Technical Paper No. 411

Whitefish and Other Nonsalmon Fish Trends in Lake Clark and Iliamna Lake, Alaska, 2012 and 2013

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September 2015

Alaska Department of Fish and Game Division of Subsistence

Symbols and Abbreviations

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Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

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September 2015

Development and publication of this manuscript were partially financed under U.S. Fish and Wildlife Service, Office of Subsistence Management Project No. 12-452.

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This document should be cited as:
Hazell, S. M., C. Welch, J. T. Ream, S. S. Evans, T. M. Krieg, H. Z. Johnson, G. Zimpelman, and C. Carty. 2015. Whitefish and Other Nonsalmon Fish Trends in Lake Clark and Iliamna Lake, Alaska, 2012 and 2013. Alaska Department of Fish and Game Division of Subsistence, Technical Paper No. 411. Anchorage.

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TABLE OF CONTENTS

Table of Contents ..... **i**

List of Tables ..... **vii**

List of Figures ..... **x**

List of Plates ..... **xv**

List of Appendices ..... **xv**

Abstract ..... **xvi**

1. Introduction **1**
- Project Background 6
- Regional Background 9
- Regulatory Context 10
- Study Objectives 11
- Descriptions of Studied Species 11
  - Whitefishes 11
    - *Humpback Whitefish* *12*
    - *Round Whitefish* *12*
    - *Least Cisco* *12*
  - Other Nonsalmon Fish 12
    - *Rainbow Trout* *12*
    - *Brook Trout and Mountain Trout* *13*
    - *Lake Trout* *13*
    - *Dolly Varden and Arctic Char* *13*
    - *Arctic Grayling* *13*
    - *Rainbow Smelt* *14*
    - *Alaska Blackfish* *14*
    - *Northern Pike* *14*
    - *Longnose Sucker* *14*
    - *Burbot* *14*
- Research Methods 15
  - Ethical Principles for the Conduct of Research 15
  - Project Planning and Approvals 15
  - Systematic Household Surveys 17
  - Mapping Locations of Subsistence Fishing Activities 18
  - Key Respondent Interviews 19
  - Household Survey Implementation 19
    - *Igiugig* *19*
    - *Iliamna* *19*
    - *Newhalen* *19*

TABLE OF CONTENTS, CONTINUED

Nondalton *20*
Pedro Bay *20*
Port Alsworth *20*
Data Analysis and Review 21
Survey Data Entry and Analysis 21
Ethnographic Analysis 22
Population Estimates and Other Demographic Information 22
Map Data Entry and Analysis 23
Community Review Meetings 23
Final Report Organization 24

2. Community Backgrounds and Demographic Results 25
Regional Settlement History 25
Igiugig 26
Population Estimates and Demographic Information 28
Iliamna 34
Population Estimates and Demographic Information 35
Newhalen 40
Population Estimates and Demographic Information 41
Nondalton 47
Population Estimates and Demographic Information 50
Pedro Bay 57
Population Estimates and Demographic Information 58
Port Alsworth 64
Population Estimates and Demographic Information 65

3. Survey Results for Study Years 2012 and 2013 72
Harvest Assessment 72
Igiugig 72
Importance of Whitefishes *72*
Fishery Participation *72*
Iliamna 74
Importance of Whitefishes *74*
Fishery Participation *74*
Newhalen 76
Importance of Whitefishes *76*
Fishery Participation *76*
Nondalton 78
Importance of Whitefishes *78*
Fishery Participation *78*
Pedro Bay 80
Importance of Whitefishes *80*

TABLE OF CONTENTS, CONTINUED

Fishery Participation *80*
Port Alsworth 82
Importance of Whitefishes *82*
Fishery Participation *82*
Whitefish Harvests 84
Igiugig 84
Iliamna 100
Newhalen 108
Nondalton 123
Pedro Bay 134
Port Alsworth 145
Other Nonsalmon Fish Harvests 159
Igiugig 159
Iliamna 170
Newhalen 179
Nondalton 190
Pedro Bay 204
Port Alsworth 218

4. Factors Shaping Harvest Efforts for Each Species Over Time 230
Seasonal Round and Importance of Whitefishes and Other Nonsalmon Fish 230
Igiugig—Seasonal Round 230
Igiugig—Resource Importance 230
Iliamna and Newhalen—Seasonal Round 230
Iliamna—Resource Importance 231
Newhalen—Resource Importance 232
Nondalton—Seasonal Round 232
Nondalton—Resource Importance 232
Pedro Bay—Seasonal Round 234
Pedro Bay—Resource Importance 234
Port Alsworth—Seasonal Round 235
Port Alsworth—Resource Importance 235
Summary of Use Patterns and Traditional Ecological Knowledge Observations by Species 236
Whitefishes 236
Humpback Whitefish *236*
Trends in Harvests or Populations Over Time *236*
Physical Characteristics and Health *239*
Spawning and Seasonal Movements *239*
Interactions with Other Species *241*
Local Taxonomies *241*
Traditional Management *242*

TABLE OF CONTENTS, CONTINUED

Preservation Methods and Consumption *243*
Round Whitefish *245*
Trends in Harvests or Populations Over Time *245*
Physical Characteristics and Health *246*
Spawning and Seasonal Movements *246*
Interactions with Other Species *246*
Local Taxonomies *246*
Traditional Management *246*
Preservation Methods and Consumption *247*
Least Cisco *247*
Trends in Harvests or Populations Over Time *247*
Spawning and Seasonal Movements *247*
Interactions with Other Species *248*
Local Taxonomies *248*
Other Nonsalmon Fish 248
Rainbow Trout *248*
Brook Trout and Mountain Trout *249*
Lake Trout *250*
Dolly Varden and Arctic Char *250*
Pedro Bay: Unspecified Trout and Char *251*
Arctic Grayling *252*
Rainbow Smelt *253*
Alaska Blackfish *254*
Northern Pike *254*
Longnose Sucker *257*
Burbot *257*

5. Factors Influencing Residents' Ability to Harvest Nonsalmon Fish 259
Harvest Factors: Port Alsworth 259
Environmental Factors: Igiugig 259
High Water 259
High Winds 259
Warmer Winters 260
Habitat Disruption and Pressure on Fish Populations 260
Environmental Factors: Iliamna 261
Water Levels 261
High Winds 261
Warmer Winters 262
Pressure on Fish Populations 262
Environmental Factors: Newhalen 263
Warmer Winters 263
Beaver Dams 264

TABLE OF CONTENTS, CONTINUED

Environmental Factors: Nondalton 264
Warmer Winters 264
Declining Fish Populations 264
Beaver Dams 264
Availability of Other Resources 265
Environmental Factors: Pedro Bay 265
Regulatory Factors: Igiugig 266
Rainbow Trout Harvest Restrictions 266
Oversight and Enforcement of the Sport Fishery 266
Regulatory Factors: Iliamna 266
Enforcement 266
Catch-and-Release Fishing 267
Regulatory Factors: Newhalen 267
Sport Fishing Regulations 267
Regulatory Factors: Nondalton 268
Catch-and-Release Fishing 268
Restrictions on “Chumming” 269
Regulatory Factors: Pedro Bay 269
Social and Cultural Factors: Igiugig 271
Generational Shifts 271
Social and Cultural Factors: Iliamna 272
Generational Shifts 272
Changes in Technology 272
Social and Cultural Factors: Newhalen 273
Generational Shifts 273
Social and Cultural Factors: Nondalton 276
Generational Shifts 276
Social and Cultural Factors: Pedro Bay 278
Generational Shifts 278
Economic Factors: Igiugig 279
Availability of Paid Employment 279
Cost of Gear 279
Cost of Groceries 279
Economic Factors: Iliamna 279
Availability of Paid Employment 279
Cost of Gear and Fuel 280
Cost of Groceries 280
Economic Factors: Newhalen 281
Cost of Gear, Fuel, and Food 281
Economic Factors: Nondalton 281
Availability of Paid Employment 281
Cost of Gear 281

TABLE OF CONTENTS, CONTINUED

Economic Factors: Pedro Bay 282

6. Discussion and Conclusions 283
Overview of Findings for Whitefishes 283
Conclusion 288
Recommendations 289

Acknowledgments 290

References 291

LIST OF TABLES

Table

1-1.–Population estimates, study communities, 2010, 2012, and 2013. 3
1-2.–Species used by study communities, 2012 and 2013. 4
1-3.–Community scoping meetings, study communities, 2013 and 2014. 15
1-4.–Project staff. 16
1-5.–Estimated households and sample achievement, study communities, 2012 and 2013. 18
1-6.–Community review meetings, study communities, 2014 and 2015. 23
2-1.–Population estimates, Igiugig, 2010, 2012, and 2013. 29
2-2.–Sample achievement, Igiugig, 2012 and 2013. 30
2-3.–Demographic characteristics, Igiugig, 2012 and 2013. 30
2-4.–Birthplaces of population, Igiugig, 2012 and 2013. 31
2-5.–Birthplaces of household heads, Igiugig, 2012 and 2013. 31
2-6.–Population profile, Igiugig, 2012. 32
2-7.–Population profile, Igiugig, 2013. 33
2-8.–Population estimates, Iliamna, 2010 and 2013. 35
2-9.–Sample achievement, Iliamna, 2013. 36
2-10.–Demographic characteristics, Iliamna, 2012 and 2013. 37
2-11.–Population profile, Iliamna, 2013. 38
2-12.–Birthplaces of household heads, Iliamna, 2013. 39
2-13.–Birthplaces of population, Iliamna, 2013. 39
2-14.–Population estimates, Newhalen, 2010, 2012, and 2013. 42
2-15.–Demographic characteristics, Newhalen, 2012 and 2013. 43
2-16.–Sample achievement, Newhalen, 2012 and 2013. 45
2-17.–Population profile, Newhalen, 2012. 45
2-18.–Population profile, Newhalen, 2013. 46
2-19.–Birthplaces of household heads, Newhalen, 2012 and 2013. 46
2-20.–Birthplaces of population, Newhalen, 2012 and 2013. 47
2-21.–Population estimates, Nondalton, 2010, 2012, and 2013. 51
2-22.–Sample achievement, Nondalton, 2012 and 2013. 52
2-23.–Demographic characteristics, Nondalton, 2012 and 2013. 52
2-24.–Birthplaces of population, Nondalton, 2012 and 2013. 53
2-25.–Birthplaces of household heads, Nondalton, 2012 and 2013. 54
2-26.–Population profile, Nondalton, 2012. 55
2-27.–Population profile, Nondalton, 2013. 56
2-28.–Population estimates, Pedro Bay, 2010, 2012, and 2013. 59

LIST OF TABLES, CONTINUED

Table

2-29.–Sample achievement, Pedro Bay, 2012 and 2013. 60
2-30.–Demographic characteristics, Pedro Bay, 2012 and 2013. 60
2-31.–Population profile, Pedro Bay, 2012. 61
2-32.–Population profile, Pedro Bay, 2013. 61
2-33.–Birthplaces of household heads, Pedro Bay, 2012 and 2013. 63
2-34.–Birthplaces of population, Pedro Bay, 2012 and 2013. 63
2-35.–Population estimates, Port Alsworth, 2010, 2012, and 2013. 66
2-36.–Sample achievement, Port Alsworth, 2012 and 2013. 67
2-37.–Demographic characteristics, Port Alsworth, 2012 and 2013. 67
2-38.–Birthplaces of population, Port Alsworth, 2012 and 2013. 68
2-39.–Birthplaces of household heads, Port Alsworth, 2012 and 2013. 69
2-40.–Population profile, Port Alsworth, 2012. 70
2-41.–Population profile, Port Alsworth, 2013. 71
3-1.–Household responses describing importance of whitefishes, Igiugig, 2012 and 2013. 73
3-2.–Household responses describing effort to harvest whitefishes, Igiugig, 2012 and 2013. 73
3-3.–Household responses reporting what they do differently if they cannot get enough whitefishes, Igiugig, 2012 and 2013. 74
3-4.–Household responses describing importance of whitefishes, Iliamna, 2013. 75
3-5.–Household responses describing effort to harvest whitefishes, Iliamna, 2013. 75
3-6.–Household responses reporting what they do differently if they cannot get enough whitefishes, Iliamna, 2013. 76
3-7.–Household responses describing importance of whitefishes, Newhalen, 2012 and 2013. 77
3-8.–Household responses describing effort to harvest whitefishes, Newhalen, 2012 and 2013. 77
3-9.–Household responses reporting what they do differently if they cannot get enough whitefishes, Newhalen, 2012 and 2013. 78
3-10.–Household responses describing importance of whitefishes, Nondalton, 2012 and 2013. 79
3-11.–Household responses describing effort to harvest whitefishes, Nondalton, 2012 and 2013. 79
3-12.–Household responses reporting what they do differently if they cannot get enough whitefishes, Nondalton, 2012 and 2013. 80
3-13.–Household responses describing importance of whitefishes, Pedro Bay, 2012 and 2013. 81
3-14.–Household responses describing effort to harvest whitefishes, Pedro Bay, 2012 and 2013. 81
3-15.–Household responses reporting what they do differently if they cannot get enough whitefishes, Pedro Bay, 2012 and 2013. 82
3-16.–Household responses describing importance of whitefishes, Port Alsworth, 2012 and 2013. 83

LIST OF TABLES, CONTINUED

Table

3-17.–Household responses describing effort to harvest whitefishes, Port Alsworth, 2012 and 2013. 83
3-18.–Household responses reporting what they do differently if they cannot get enough whitefishes, Port Alsworth, 2012 and 2013. 84
3-19.–Estimated use and harvests of nonsalmon fish resources, Igiugig, 2012. 85
3-20.–Estimated use and harvests of nonsalmon fish resources, Igiugig, 2013. 86
3-21.–Estimated harvest of nonsalmon fish by gear type, resource, Igiugig, 2012. 90
3-22.–Estimated harvest of nonsalmon fish by gear type, resource, Igiugig, 2013. 92
3-23.–Estimated harvest of whitefishes by month, Igiugig, 2012. 99
3-24.–Estimated harvest of whitefishes by month, Igiugig, 2013. 99
3-25.–Estimated use and harvests of nonsalmon fish resources, Iliamna, 2013. 101
3-26.–Estimated harvest of whitefishes by month, Iliamna, 2013. 103
3-27.–Estimated harvest of nonsalmon fish by gear type, resource, Iliamna, 2013. 103
3-28.–Estimated use and harvests of nonsalmon fish resources, Newhalen, 2012. 110
3-29.–Estimated use and harvests of nonsalmon fish resources, Newhalen, 2013. 111
3-30.–Estimated harvest of whitefishes by month, Newhalen, 2012. 113
3-31.–Estimated harvest of whitefishes by month, Newhalen, 2013. 113
3-32.–Estimated harvest of nonsalmon fish by gear type, resource, Newhalen, 2012. 114
3-33.–Estimated harvest of nonsalmon fish by gear type, resource, Newhalen, 2013. 115
3-34.–Estimated use and harvests of nonsalmon fish resources, Nondalton, 2012. 124
3-35.–Estimated use and harvests of nonsalmon fish resources, Nondalton, 2013. 125
3-36.–Estimated harvest of nonsalmon fish by gear type, resource, Nondalton, 2012. 128
3-37.–Estimated harvest of nonsalmon fish by gear type, resource, Nondalton, 2013. 130
3-38.–Estimated harvest of whitefishes by month, Nondalton, 2012. 141
3-39.–Estimated harvest of whitefishes by month, Nondalton, 2013. 141
3-40.–Estimated use and harvests of nonsalmon fish resources, Pedro Bay, 2012. 142
3-41.–Estimated use and harvests of nonsalmon fish resources, Pedro Bay, 2013. 143
3-42.–Estimated use and harvests of nonsalmon fish resources, Port Alsworth, 2012. 146
3-43.–Estimated use and harvests of nonsalmon fish resources, Port Alsworth, 2013. 147
3-44.–Estimated harvest of nonsalmon fish by gear type, resource, Port Alsworth, 2012. 150
3-45.–Estimated harvest of nonsalmon fish by gear type, resource, Port Alsworth, 2013. 152
3-46.–Estimated harvest of nonsalmon fish by gear type, resource, Pedro Bay, 2012. 208
3-47.–Estimated harvest of nonsalmon fish by gear type, resource, Pedro Bay, 2013. 210

LIST OF FIGURES

Figure

1-1.–Map of study communities, Lake Clark and Iliamna Lake areas. 2
1-2.–Estimated whitefish harvests by pounds per capita, study communities, historical estimates and 2012 and 2013. 7
1-3.–Estimated other nonsalmon fish harvests by pounds per capita, study communities, historical estimates and 2012 and 2013. 8
2-1.–Historical population estimates, Igiugig, 1960–2013. 29
2-2.–Population profile, Igiugig, 2012. 32
2-3.–Population profile, Igiugig, 2013. 33
2-4.–Historical population estimates, Iliamna, 1960–2013. 36
2-5.–Population profile, Iliamna, 2013. 38
2-6.–Historical population estimates, Newhalen, 1950–2013. 42
2-7.–Population profile, Newhalen, 2012. 44
2-8.–Population profile, Newhalen, 2013. 44
2-9.–Historical population estimates, Nondalton, 1950–2013.....51
2-10.–Population profile, Nondalton, 2012.....55
2-11.–Population profile, Nondalton, 2013. 56
2-12.–Historical population estimates, Pedro Bay, 1950–2013. 59
2-13.–Population profile, Pedro Bay, 2012. 62
2-14.–Population profile, Pedro Bay, 2013. 62
2-15.–Historical population estimates, Port Alsworth, 1980–2013. 66
2-16.–Population profile, Port Alsworth, 2012. 70
2-17.–Population profile, Port Alsworth, 2013. 71
3-1.–Composition of nonsalmon fish harvest in pounds usable weight, Igiugig, 2012. 87
3-2.–Composition of nonsalmon fish harvest in pounds usable weight, Igiugig, 2013. 87
3-3.–Estimated harvests of whitefishes by pounds per capita, Igiugig, 1974, 1983, 1992, 2003, 2005, 2012, and 2013. 88
3-4.–Nonsalmon fish harvest by gear type, Igiugig, 2012. 91
3-5.–Nonsalmon fish harvest by gear type, Igiugig, 2013. 93
3-6.–Harvest locations of humpback whitefish, Igiugig, 2012 and 2013. 94
3-7.–Harvest locations of round whitefish, Igiugig, 2012 and 2013.....95
3-8.–Fishing and harvest locations of whitefish species by gear type, Igiugig, 2012.....96
3-9.–Fishing and harvest locations of whitefish species by gear type, Igiugig, 2013.....97

LIST OF FIGURES, CONTINUED

Figure

3-10.–Households reporting timing of whitefish harvests for 2013 and 5 and 10 years prior, Igiugig. 98
3-11.–Composition of nonsalmon fish harvest in pounds usable weight, Iliamna, 2013. 100
3-12.–Estimated harvests of whitefishes by pounds per capita, Iliamna, 1974, 1983, 1991, 2004, and 2013. 102
3-13.–Nonsalmon fish harvest by gear type, Iliamna, 2013. 104
3-14.–Harvest locations of humpback whitefish, Iliamna, 2013. 105
3-15.–Fishing and harvest locations of whitefish species by gear type, Iliamna, 2013. 106
3-16.–Households reporting timing of whitefish harvests for 2013 and 5 and 10 years prior, Iliamna. 107
3-17.–Composition of nonsalmon fish harvest in pounds usable weight, Newhalen, 2012. 109
3-18.–Composition of nonsalmon fish harvest in pounds usable weight, Newhalen, 2013. 109
3-19.–Estimated harvests of whitefishes by pounds per capita, Newhalen, 1974, 1983, 1991, 2003, 2004, 2012, and 2013. 112
3-20.–Nonsalmon fish harvest by gear type, Newhalen, 2012. 116
3-21.–Nonsalmon fish harvest by gear type, Newhalen, 2013. 117
3-22.–Harvest locations of humpback whitefish, Newhalen, 2012 and 2013. 118
3-23.–Fishing and harvest locations of whitefish species by gear type, Newhalen, 2012. 119
3-24.–Harvest locations of round whitefish, Newhalen, 2012 and 2013. 120
3-25.–Fishing and harvest locations of whitefish species by gear type, Newhalen, 2013. 121
3-26.–Households reporting timing of whitefish harvests for 2013 and 5 and 10 years prior, Newhalen. 122
3-27.–Composition of nonsalmon fish harvest in pounds usable weight, Nondalton, 2012. 126
3-28.–Composition of nonsalmon fish harvest in pounds usable weight, Nondalton, 2013. 126
3-29.–Estimated harvests of whitefishes by pounds per capita, Nondalton, 1973, 1974, 1980, 1981, 2003, 2004, 2012, and 2013. 127
3-30.–Nonsalmon fish harvest by gear type, Nondalton, 2012. 129
3-31.–Nonsalmon fish harvest by gear type, Nondalton, 2013. 131
3-32.–Harvest locations of humpback whitefish, Nondalton, 2012 and 2013. 133
3-33.–Harvest locations of round whitefish, Nondalton, 2012 and 2013. 135
3-34.–Harvest locations of least cisco, Nondalton, 2012 and 2013. 136
3-35.–Harvest locations of Bering cisco, Nondalton, 2013. 137
3-36.–Fishing and harvest locations of whitefish species by gear type, Nondalton, 2012. 138
3-37.–Fishing and harvest locations of whitefish species by gear type, Nondalton, 2013. 139

LIST OF FIGURES, CONTINUED

Figure

3-38.–Households reporting timing of whitefish harvests for 2013 and 5 and 10 years prior, Nondalton. 140
3-39.–Harvest locations of least cisco, Pedro Bay, 2013. 144
3-40.–Composition of nonsalmon fish harvest in pounds usable weight, Port Alsworth, 2012. 148
3-41.–Composition of nonsalmon fish harvest in pounds usable weight, Port Alsworth, 2013. 148
3-42.–Estimated harvests of whitefishes by pounds per capita, Port Alsworth, 1983, 2004, 2012, and 2013. 149
3-43.–Nonsalmon fish harvest by gear type, Port Alsworth, 2012. 151
3-44.–Nonsalmon fish harvest by gear type, Port Alsworth, 2013. 153
3-45.–Harvest locations of humpback whitefish, Port Alsworth, 2012 and 2013. 154
3-46.–Harvest locations of round whitefish, Port Alsworth, 2012 and 2013. 155
3-47.–Fishing and harvest locations of whitefish species by gear type, Port Alsworth, 2012. 156
3-48.–Fishing and harvest locations of whitefish species by gear type, Port Alsworth, 2013. 157
3-49.–Households reporting timing of whitefish harvests for 2013 and 5 and 10 years prior, Port Alsworth. 158
3-50.–Estimated harvests of other nonsalmon fish by pounds per capita, Igiugig, 1983, 1992, 2003, 2005, 2012, and 2013. 160
3-51.–Fishing and harvest locations of other nonsalmon fish species by gear type, Igiugig, 2012. 162
3-52.–Fishing and harvest locations of other nonsalmon fish species by gear type, Igiugig, 2013. 163
3-53.–Harvest locations of rainbow trout, Igiugig, 2012 and 2013. 165
3-54.–Harvest locations of Arctic grayling, Igiugig, 2012 and 2013. 166
3-55.–Harvest locations of northern pike, Igiugig, 2012 and 2013. 167
3-56.–Harvest locations of Dolly Varden, Igiugig, 2012 and 2013. 168
3-57.–Harvest locations of longnose sucker, Igiugig, 2012. 169
3-58.–Estimated harvests of other nonsalmon fish by pounds per capita, Iliamna, 1983, 1991, 2003–2004, and 2013. 171
3-59.–Fishing and harvest locations of other nonsalmon fish species by gear type, Iliamna, 2013. 172
3-60.–Harvest locations of Dolly Varden, Iliamna, 2013. 173
3-61.–Harvest locations of rainbow trout, Iliamna, 2013. 174
3-62.–Harvest locations of northern pike, Iliamna, 2013. 175
3-63.–Harvest locations of Arctic grayling, Iliamna, 2013. 176

LIST OF FIGURES, CONTINUED

Figure

3-64.–Harvest locations of lake trout, Iliamna, 2013.....177
3-65.–Harvest locations of burbot, Iliamna, 2013. 178
3-66.–Estimated harvests of other nonsalmon fish by pounds per capita, Newhalen, 1983, 1991, 2003–2004, 2012, and 2013.....180
3-67.–Fishing and harvest locations of other nonsalmon fish species by gear type, Newhalen, 2012.....181
3-68.–Fishing and harvest locations of other nonsalmon fish species by gear type, Newhalen, 2013.....182
3-69.–Harvest locations of rainbow trout, Newhalen, 2012 and 2013. 183
3-70.–Harvest locations of Dolly Varden, Newhalen, 2012 and 2013.....184
3-71.–Harvest locations of northern pike, Newhalen, 2012 and 2013.....185
3-72.–Harvest locations of Arctic grayling, Newhalen, 2012 and 2013.....186
3-73.–Harvest locations of lake trout, Newhalen, 2012 and 2013.....187
3-74.–Harvest locations of Arctic char, Newhalen, 2012 and 2013.....188
3-75.–Harvest locations of burbot, Newhalen, 2012 and 2013.....189
3-76.–Estimated harvests of other nonsalmon fish by pounds per capita, Nondalton, 1973, 1980–1981, 1983, 2003–2004, 2012, and 2013.....191
3-77.–Fishing and harvest locations of other nonsalmon fish species by gear type, Nondalton, 2012.....194
3-78.–Fishing and harvest locations of other nonsalmon fish species by gear type, Nondalton, 2013.....195
3-79.–Harvest locations of rainbow trout, Nondalton, 2012 and 2013.....196
3-80.–Harvest locations of northern pike, Nondalton, 2012 and 2013.....197
3-81.–Harvest locations of Arctic grayling, Nondalton, 2012 and 2013. 198
3-82.–Harvest locations of lake trout, Nondalton, 2012 and 2013. 199
3-83.–Harvest locations of Dolly Varden, Nondalton, 2012 and 2013.....200
3-84.–Harvest locations of burbot, Nondalton, 2012 and 2013.....201
3-85.–Harvest locations of longnose sucker, Nondalton, 2013. 202
3-86.–Harvest locations of Arctic char, Nondalton, 2012 and 2013.....203
3-87.–Composition of nonsalmon fish harvest in pounds usable weight, Pedro Bay, 2012.....206
3-88.–Composition of nonsalmon fish harvest in pounds usable weight, Pedro Bay, 2013.....206
3-89.–Estimated harvests of other nonsalmon fish by pounds per capita, Pedro Bay, 1982, 1996, 2003–2004, 2012, and 2013.....207

LIST OF FIGURES, CONTINUED

Figure

3-90.–Nonsalmon fish harvest by gear type, Pedro Bay, 2012. 209
3-91.–Nonsalmon fish harvest by gear type, Pedro Bay, 2013. 211
3-92.–Fishing and harvest locations of other nonsalmon fish species by gear type, Pedro Bay, 2012. 212
3-93.–Fishing and harvest locations of other nonsalmon fish species by gear type, Pedro Bay, 2013. 213
3-94.–Harvest locations of rainbow trout, Pedro Bay, 2012 and 2013. 214
3-95.–Harvest locations of Arctic char, Pedro Bay, 2012. 215
3-96.–Harvest locations of Dolly Varden, Pedro Bay, 2012 and 2013. 216
3-97.–Harvest locations of lake trout, Pedro Bay, 2012 and 2013. 217
3-98.–Estimated harvests of other nonsalmon fish by pounds per capita, Port Alsworth, 1983, 2003–2004, 2012, and 2013. 219
3-99.–Nonsalmon fish harvest by gear type, Port Alsworth, 2012. 220
3-100.–Nonsalmon fish harvest by gear type, Port Alsworth, 2013. 221
3-101.–Harvest locations of lake trout, Port Alsworth, 2012 and 2013. 222
3-102.–Harvest locations of northern pike, Port Alsworth, 2012 and 2013. 223
3-103.–Harvest locations of Arctic grayling, Port Alsworth, 2012 and 2013. 224
3-104.–Harvest locations of burbot, Port Alsworth, 2012 and 2013. 225
3-105.–Harvest locations of rainbow trout, Port Alsworth, 2013. 226
3-106.–Harvest locations of longnose sucker, Port Alsworth, 2013. 227
3-107.–Harvest locations of Dolly Varden, Port Alsworth, 2012. 228
3-108.–Harvest locations of Arctic char, Port Alsworth, 2013. 229
4-1.–Seasonal round, Nondalton. 233

LIST OF PLATES

Plate

2-1.–View from the bank of the Kvichak River, Igiugig, 2014. 27
2-2.–View of Roadhouse Bay from Severson's Point, Iliamna, 2014. 34
2-3.–View from the mouth of the Newhalen River, Newhalen, 2014.....40
2-4.–Nondalton residents harvest whitefishes with a net set under the ice on Sixmile Lake off the bank bordering their community, Nondalton, April 2013.....48
2-5.–View of Pedro Bay while ice fishing, Pedro Bay, March 2013. 57
2-6.–View from Port Alsworth of Lake Clark and the Alaska Range, Port Alsworth, March 2014. 64
4-1.–Local resident ice fishing near Iliamna, 2014.....231
4-2.–Humpback whitefish harvested with a net under the ice, Nondalton, 2013. 238
4-3.–Local resident cleaning humpback whitefish, Nondalton, 2013.....244
4-4.–Two pan-size rainbow trout and a Dolly Varden harvested by ice fishing, Iliamna, March 2014. 249
4-5.–Local resident holding a "trout," Pedro Bay, March 2013. 252
4-6.–Northern pike drying on a rack on the side of a house in Newhalen.....256

LIST OF APPENDICES

Appendix

A–Nondalton Culture Week 2014 Curriculum 295
B–Cooperative Agreements 320
C–Survey Instrument 333
D–Fish Identification Guide.....341
E–Key Respondent Interview Protocol: Study Years 2012 and 2013.....346
F–Conversion Factors 356

ABSTRACT

This report presents the results of a study of whitefish and other freshwater nonsalmon fish harvest patterns and trends by communities around Lake Clark and Iliamna Lake, Alaska; the study focuses on climate change in context with harvesting patterns and trends. The study communities include: Igiugig, Iliamna, Newhalen, Nondalton, Pedro Bay, and Port Alsworth. Historically, whitefishes, as well as other nonsalmon fish (i.e., Dolly Varden, Arctic grayling, and rainbow trout), have been important subsistence resources for communities in the Lake Clark and Iliamna Lake areas. However, whitefish and other nonsalmon fish harvests have declined in recent decades in the study communities for reasons that are unclear, but possibly related to climate change. To better understand potential causes, environmental or otherwise, for the decrease in whitefish and other nonsalmon fish harvests, this project was implemented using social science methods—including harvest surveys, participant observation, and key respondent interviews—over a 2-year period. The results of this study indicate the continued significance of whitefish and other nonsalmon freshwater fish subsistence harvests to inhabitants of the study communities. Freshwater nonsalmon fish resources are particularly vital to residents in the spring and fall when salmon and other resources are not available in abundance. Additionally, local residents consistently reported a climate characterized by a warming trend in recent decades (i.e., at least 20–25 years), which has affected their ability to obtain nonsalmon fish resources.

Key words: subsistence, whitefish, nonsalmon fish, climate change, Igiugig, Iliamna, Newhalen, Nondalton, Pedro Bay, Port Alsworth, Iliamna Lake, Lake Clark

1. INTRODUCTION

This report presents the results of a study of whitefish and other freshwater nonsalmon fish harvest patterns and trends by communities around Lake Clark and Iliamna Lake, Alaska, during study years 2012 and 2013; the study focuses on climate change in context with harvesting patterns and trends (Figure 1-1). The study communities and 2013 population estimates include: Igiugig (population 61), Iliamna (population 92), Newhalen (population 139), Nondalton (population 198), Pedro Bay (population 34), and Port Alsworth (population 179); the community populations ranged from approximately 30–200 residents during the 2 study years (Table 1-1). Historically, whitefishes, as well as other nonsalmon fish (i.e., Dolly Varden, Arctic grayling, and rainbow trout, among others), have been important subsistence resources for communities in the Lake Clark and Iliamna Lake areas. However, whitefish and other nonsalmon fish harvests have declined in recent decades in the study communities for reasons that are unclear, but possibly related to climate change. To better understand potential causes, environmental or otherwise, for the decreases in whitefish and other nonsalmon fish harvests, this project was implemented using social science methods—including harvest surveys, participant observation, and key respondent interviews—over a 2-year period. Table 1-2 presents a list, including the Linnaean taxonomic names, common names, and Yup'ik and Dena'ina names, of freshwater nonsalmon fish resources used by the study communities in 2012 and 2013. The project also included an outreach component in the community of Nondalton. This program, called "Culture Week 2014," focused on presenting students with activities that highlighted the importance of different ways of knowing (e.g., traditional ecological knowledge and Western scientific knowledge) (Appendix A).

This project sought to understand whitefish harvests within broader nonsalmon fish harvest efforts. Fishing efforts mainly take place in the spring and fall and include jigging for fish through holes in the ice in the spring, or using nets in the fall (Fall et al. 2006, 2010; Holen and Lemons 2010; Holen et al. 2006; Kari 1983). In addition, whitefishes in Sixmile Lake and Lark Clark are caught in nets during the salmon harvest but identifying species is often difficult, and harvests are underreported. In order to understand contemporary harvests and reasons for change over time this research was guided by 3 research questions:

1. What are the contemporary harvest and use patterns of each whitefish species and other nonsalmon fish species used by residents of the Lake Clark and Iliamna Lake communities of Igiugig, Iliamna, Newhalen, Nondalton, Pedro Bay, and Port Alsworth?
2. What factors have shaped the harvest efforts of each whitefish and other freshwater nonsalmon fish species over time?
3. What factors are influencing residents' ability to harvest the varied species of whitefishes and other nonsalmon fish?

The results of this study indicate the continued significance of whitefish and other nonsalmon freshwater fish subsistence harvests to the residents of the Southwest Alaska communities of Igiugig, Iliamna, Newhalen, Nondalton, Pedro Bay, and Port Alsworth. Freshwater nonsalmon fish resources are particularly vital to residents in the spring and fall when salmon and other resources are not available in abundance. Many households in the study area harvested and used 1 or more nonsalmon fish species during 2012 and 2013. Community members participated widely in exchange networks to share whitefish and other nonsalmon fish resources. Additionally, local residents consistently reported a climate characterized by a warming trend in recent decades (i.e., at least 20–25 years), which has affected their ability to obtain nonsalmon fish resources.

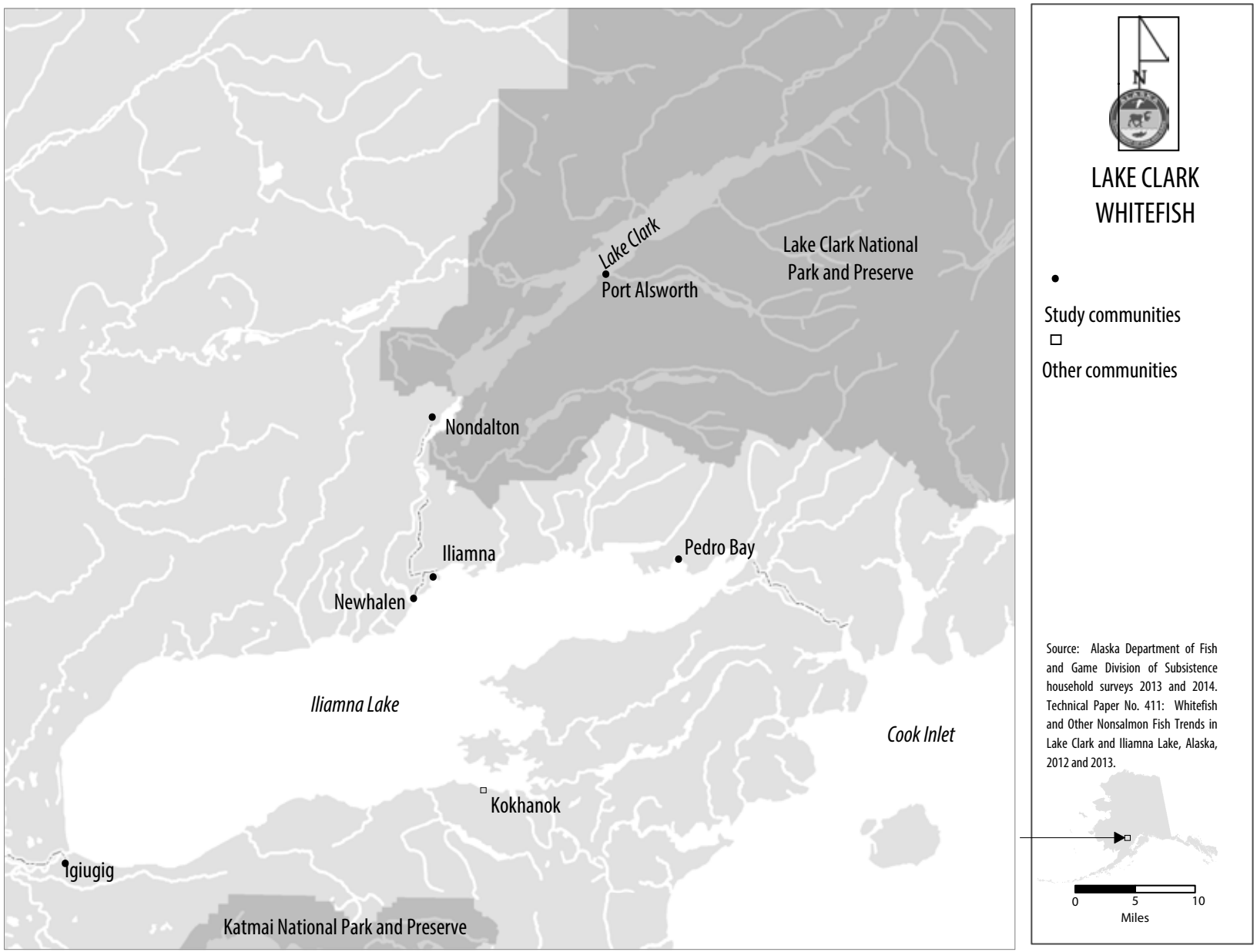

Figure 1-1.–Map of study communities, Lake Clark and Iliamna Lake areas.

Table 1-1.–Population estimates, study communities, 2010, 2012, and 2013.

	Census	This study	
Community	2010	2012	2013
Igiugig	50	54	61
Iliamna	109	ND	92
Newhalen	190	179	139
Nondalton	164	177	198
Pedro Bay	42	29	34
Port Alsworth	159	162	179

Sources U.S. Census Bureau (2011) for 2010 estimate; ADF&G Division of Subsistence household surveys, 2013, for 2012 estimate; and ADF&G Division of Subsistence household surveys, 2014, for 2013 estimate.

Note "ND" indicates data are not available; Iliamna did not participate in the study for 2012.

Table 1-2.–Species used by study communities, 2012 and 2013.

Common English name	Scientific name	Dena'ina name	Yup'ik name
Whitefish			Tupuk[n]
			Naptaq[o, p, q]
			Uraruq[r]
			Uralluq[s]
Humpback whitefish	*Coregonus pidschian*	Hulehga[a, g]	Cavirrutnaq[w, f]
		Q'untuq[b]	Cingikeggliq[t, u]
			Uraruq[r, v, y]
Round whitefish (Candlefish)	*Prosopium cylindraceum*	Hesten[c]	Cavirrutnaq[x]
			Cauirunat[t]
			Cingikeggliq[v, y]
			Uraruq[r]
Least cisco	*Coregonus sardinella*	Ghelguts'i k'una[d]	Cavirrutnaq[v, y]
			Eliuuyak[t]
			Irpayagak[u]
			Kassayak[u]
Rainbow trout	*Oncorhynchus mykiss*	Tuni[a, g]	Talaariq[t, v, y]
		Telaghi[e]	
		Shagela[f]	
Brook trout	*Salvelinus fontinalis*	Dghili juna[g, h]	Manigtacuarat
		Dghili chuna[f]	
		Dghelay tsebaya[i]	
Lake trout	*Salvelinus namaycush*	Zhuk'udghuzha[a, g]	Cikignaq[t, y]
		Bat[j]	
Dolly Varden	*Salvelinus malma*	Qak'elay[a, g]	Iqallugpik
		Qak'elvaya[f]	Iqalluapuk[s]
		Telch'eli	Yugyaq[v, y]
		Chebay[e]	Yugyat[t]
		Łiq'a k'qen[a]	
Arctic char	*Salvelinus alpinus*	Vat[g]	Yugyak[f]
Arctic grayling	*Thymallus arcticus*	Ch'dat'an[a, g]	Culugpauk[t]
		Ch'dat'ana[e]	Nakrullugpak[v, y]
Rainbow smelt	*Osmerus mordax*	Tuni[g]	Iqalluaq[v, y]
			Lituuliiyak[x]
Alaska blackfish	*Dallia pectoralis*	Huzheghi, huzhehi[g, h]	Can'giiq[w, z, q]
			Imangaq[t, v]
Northern pike	*Esox lucius*	Ghelguts'i[a, g]	Ciulek
			Cuukvak[s, y, z]
			Eleqruyak[u]
			Keggsuli[v]
			Luqruuyak[y, t]
Longnose sucker	*Catostomus catostomus*	Duch'ehdi[l, g]	Cungarteque
		Dehch'udya[m]	Cungartak[t]
		Łih[k]	Nepcaq
Burbot (Lushfish, Lingcod)	*Lota lota*	Ch'unya[a, g]	Kanayurnaq[n]
		Ch'anya[e]	Manignaq[t, u, v]
		K'ezex[b]	Muuteyak[t, s]
			Atigaq[s]
			Atriaq[s]

Sources Coffing et al. (2001), Fall et al. (2012), Jacobson (1984), Kari (2007), Krieg et al. (2005), LaVine et al. (2007), and Ray et al. (2010).

-continued-

Table 1-2.–Page 2 of 2.

a. Inland villages (Nondalton, Lime Village, and often Iliamna).

b. Kuskokwim Ingalik at Lime Village.

c. Inland villages and Talkeetna.

d. Nondalton.

e. Upper Cook Inlet villages (Tyonek, Susitna Station, Knik, and Eklutna).

f. Iliamna.

g. Nondalton.

h. Lime Village.

i. Talkeetna.

j. Susitna Station.

k. Outer Cook Inlet (Kenai and Kustatan).

l. Inland and Upper Cook Inlet villages.

m. Eklutna.

n. Northern Norton Sound.

o. Hooper Bay and Chevak.

p. Nelson Island.

q. Nunivak Island.

r. Humpback whitefish are referred to as "uraruq" in the Iliamna Lake subregion. The same term is used for round whitefish in the Togiak and Nushagak drainages.

s. Aleknagik.

t. Akiachak.

u. Eek, Tuntutuliak, Nunapitchuk.

v. Emmonak.

w. Kuskokwim and Bristol Bay.

x. Kokhanok.

y. Togiak.

z. Kuskokwim area.

Project Background

Whitefishes have been, and continue to be, part of the overall subsistence harvest pattern for communities in the Lake Clark National Park and Preserve (LACL). Division of Subsistence researcher Davin Holen was initially alerted to possible declines of whitefish and nonsalmon fish abundance, including the potential role of climate change as a causal factor, by community members of the Iliamna Lake and Lake Clark areas during his work in the area over a 10-year period beginning in 2001 (Holen field notes, Iliamna Lake and Lake Clark communities, May 2003). Residents often spoke about local declines in whitefish and nonsalmon fish abundance. Community members also reported warmer weather affecting ice conditions; if the lakes did freeze they did so late in the season and then thawed early; or, did not freeze at all (Holen field notes, Iliamna Lake and Lake Clark communities, May 2003). Additionally, residents described warmer lake temperatures and lower water levels. These observations are supported by the scientific community conducting research on the effects of climate change; scientists predict increased lake, stream, and ocean temperatures in North America (Karl et al. 2009). The predicted long-term effects of climate change on fish and wildlife include drier landscapes leading to degradation of important freshwater resources and decreased productivity in the marine environment of important stocks of salmon and other fishes that rely on saltwater for a portion of their lifecycle, such as some whitefish species. These effects will likely significantly affect the ability of rural communities to locally obtain subsistence resources like whitefishes and other nonsalmon fish. For instance, it has been documented that deteriorating sea ice has resulted in dangerous travel and hunting conditions, food insecurity, and socioeconomic and health impacts (Karl et al. 2009). Likewise, local residents reported significant changes to freshwater ice in Iliamna Lake and Lake Clark during this study, which impeded their ability to travel and obtain resources.

Local observations concerning declines in the abundance of whitefishes and other nonsalmon fish are supported by historical data collected by the Division of Subsistence, which indicate decreased harvests by local residents over time in some communities. In particular, the harvest of whitefishes has decreased by more than 30 lb per capita by Igiugig residents since 1973. In other study communities, such as Iliamna and Nondalton, whitefish harvests fluctuated over time. Past per capita whitefish harvests in the communities of Newhalen, Pedro Bay, and Port Alsworth appear more stable but were low with less than 5 lb per capita harvested per study year (Figure 1-2). Harvests of other nonsalmon fish have also fluctuated over time in the study communities, particularly at Iliamna, Pedro Bay, and Port Alsworth (Figure 1-3). For Igiugig and Nondalton, 2012 and 2013 harvests of other nonsalmon fish demonstrate a declining trend compared to the past. Newhalen exhibits the most stable pattern of other nonsalmon fish harvests over time but also with a significant decline in study year 2013.

Concerns about whitefish populations were raised at a LACL Subsistence Resource Commission meeting in Nondalton in 2008. At that time there was a lack of available long-term data that could inform about trends of fish populations and potential causes for abundance variations. At the meeting were representatives of the Nondalton Tribal Council, LACL, and the Alaska Department of Fish and Game (ADF&G), among others. These issues were discussed and identified as information priorities by the Bristol Bay Regional Advisory Council and Federal Subsistence Board and became part of the regional priority information needs in the biennial request for proposals by the federal Office of Subsistence Management (OSM) issued for 2010 and 2012.

The information priority needs listed include "patterns in whitefish harvest and use from Lake Clark communities," and "changes in subsistence fishery resources and uses, in the context of climate change where relevant, including but not limited to fishing season, species target, fishing locations, fish quality, harvest methods and means, and methods of preservation."

The project was developed through a partnership between the ADF&G Division of Subsistence, Bristol Bay Native Association (BBNA), Nondalton Tribal Council (NTC), and the LACL[1]. To investigate causes of

1. For more information about the project partners please visit the following websites:
http://www.adfg.alaska.gov/index.cfm?adfg=subsistence.main
http://www.bbna.com/
http://www.nps.gov/lacl/index.htm

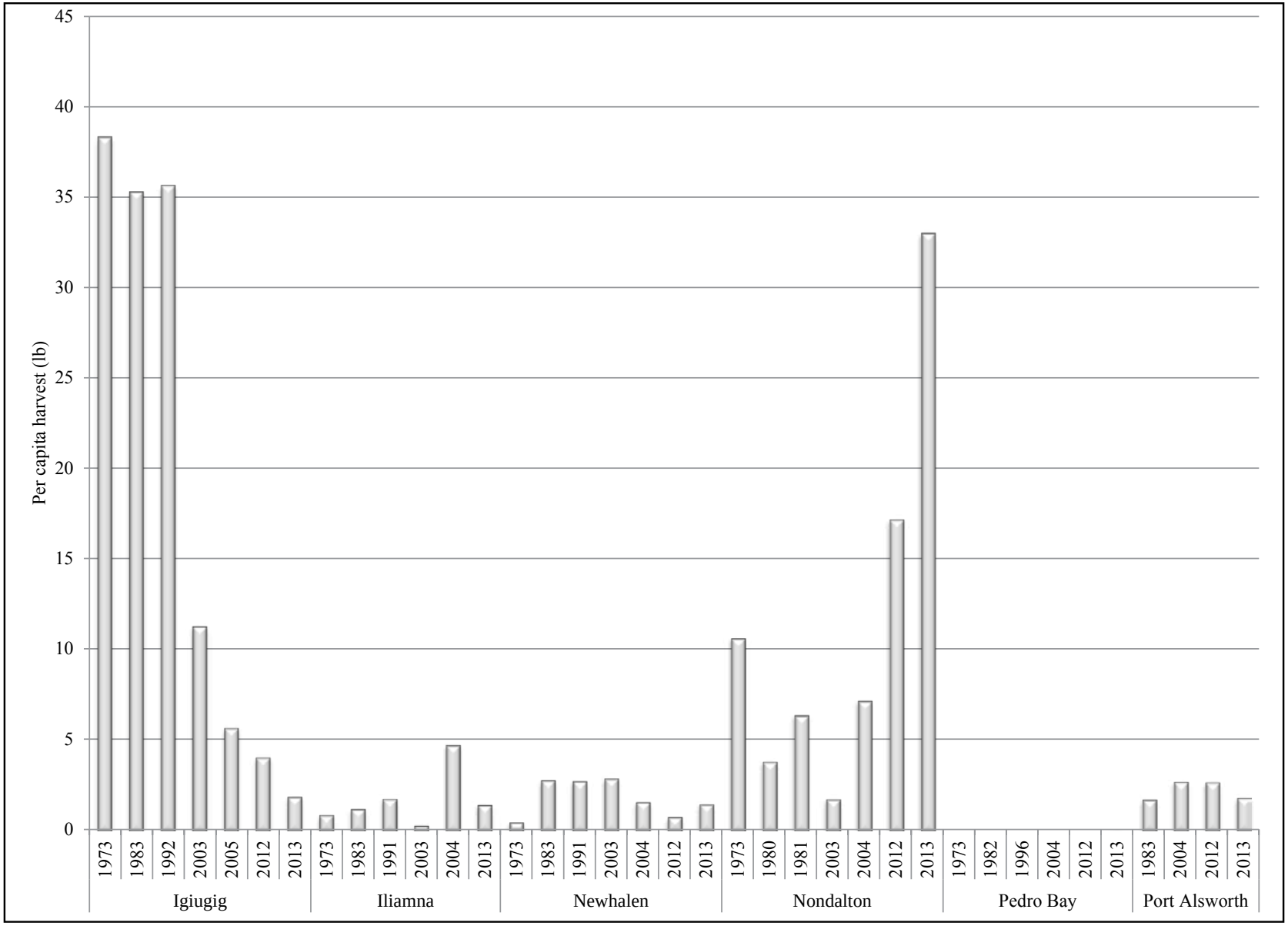

Figure 1-2.–Estimated whitefish harvests by pounds per capita, study communities, historical estimates and 2012 and 2013.

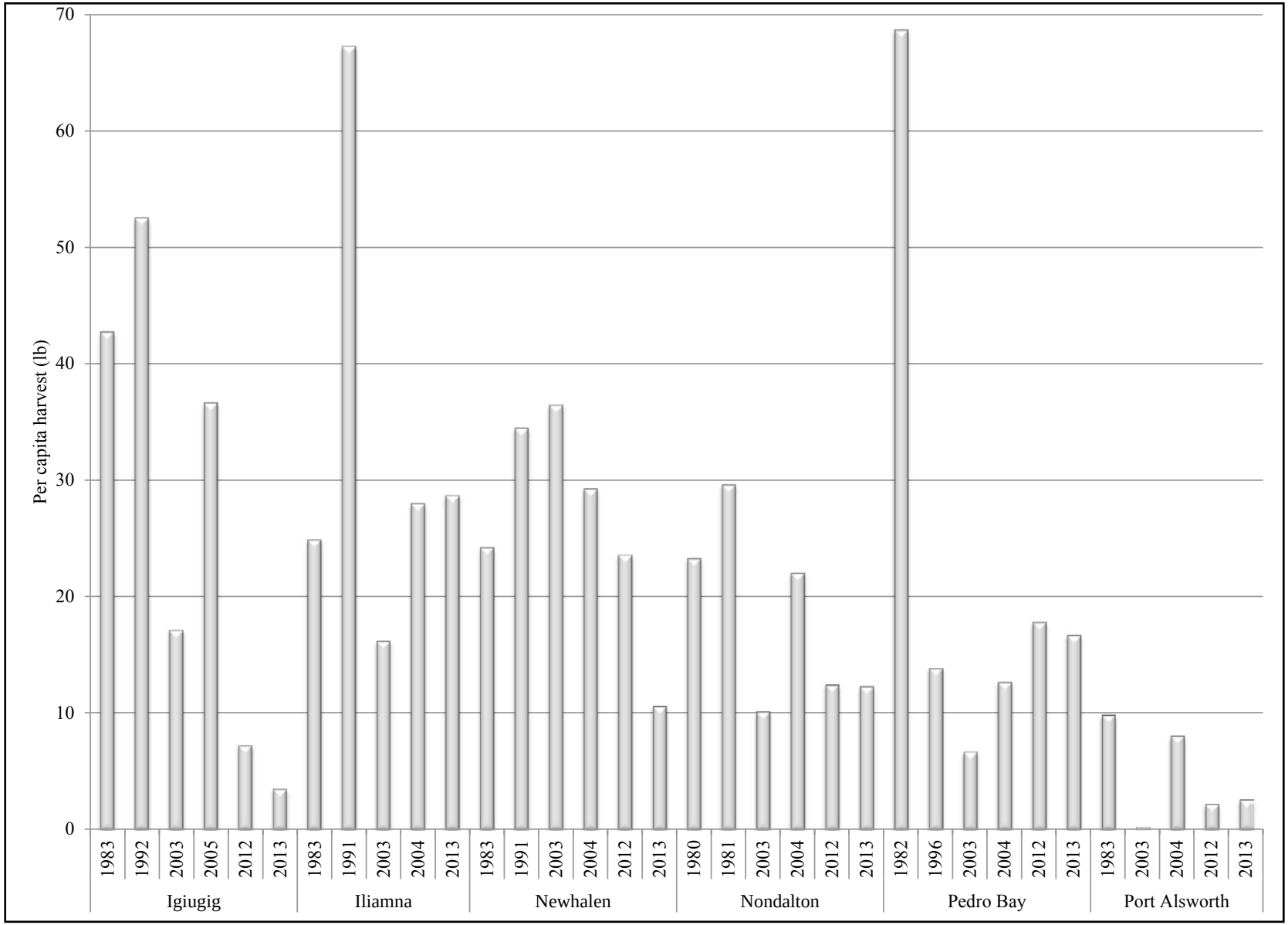

Figure 1-3.–Estimated other nonsalmon fish harvests by pounds per capita, study communities, historical estimates and 2012 and 2013.

locally observed decreases in whitefish and nonsalmon fish abundance, ADF&G coordinated with the NTC, BBNA, and LACL to understand potential factors affecting these fish populations, including the possible effects of climate change. Five[2] of the resident zone communities of LACL were selected for study based on their use of whitefishes and other nonsalmon fish: Iliamna, Newhalen, Nondalton, Port Alsworth, and Pedro Bay.[3] Igiugig, which is a resident zone community of neighboring Katmai National Park (KATM), was included in the present study at the request of Daniel Young, a fisheries biologist of the LACL who had been conducting telemetry studies of humpback whitefish in the Kvichak River watershed. Mr. Young's studies focused on elucidating basic life history characteristics of humpback whitefish that are currently little understood (Woody and Young 2006). Igiugig was incorporated into the study to obtain harvest and traditional ecological knowledge data to complement Mr. Young's telemetry study of humpback whitefish of the Kvichak River watershed. The community of Kokhanok, although a resident zone community of KATM, was not included because this study is principally concerned with resident zone communities of the LACL. Previously, communities from the Bristol Bay region, including communities located in the LACL and KATM areas, were surveyed concerning local harvest and use of freshwater fishes, among other wild resources (Fall et al. 1996, 2006; Holen and Lemons 2010; Holen et al. 2006; Krieg et al. 2005).

Whitefishes are one of the most important freshwater nonsalmon fish species for Lake Clark and Iliamna Lake communities and especially for residents of Igiugig and Nondalton. However, local harvests of whitefishes have been in decline in recent decades for unknown reasons, and very little is known about whitefish spawning and migration patterns in these watersheds. Through the application of social science methods (harvest surveys, participant observation, and recording local traditional knowledge), this project was developed and implemented to better understand the changes in whitefish harvests and whitefish spawning and migration patterns within the context of climate change. The Office of Subsistence Management provided the funding for this project (OSM #12-452).

Regional Background

The study communities included 2 incorporated cities, Newhalen and Nondalton, and 4 unincorporated census designated places (CDPs) located within the Lake and Peninsula Borough (Figure 1-1). Port Alsworth is the only community that does not have a federally recognized tribe. Igiugig, Iliamna, Newhalen, Nondalton, and Pedro Bay have tribal governments that operate independently of the corporations that were formed under the Alaska Native Claims Settlement Act (ANCSA). The communities are also classified as resident zone communities of the LACL and KATM. The collective population of these communities in 2013 was approximately 700 people (Table 1-1).

The areas surrounding the study communities have historically been occupied by the Dena'ina, a northern Athabascan group, and the Central Yup'ik. According to a knowledgeable elder, local residents consider the historical boundary between the 2 groups to be the Newhalen River (*Nughil Vetnu* [flows downstream]) on the north side of Iliamna Lake and Tommy Creek near Kokhanok on the south side of the lake (Holen field notes, Iliamna Lake and Lake Clark communities, May 2003). In the past, boundaries were more fluid as evidenced by the archaeological record and oral histories that indicate Yup'ik occupied Newhalen circa 1900, which was a former Dena'ina settlement (Gaul 2007). Over time, marriages between members of different communities and contemporary migrations of people in and out of the study communities have contributed to more ethnic diversity (i.e., Alutiiq and Euro-American). However, the communities of Iliamna, Nondalton, and Pedro Bay remain primarily Dena'ina; Igiugig and Newhalen are principally Yup'ik. The population of Port Alsworth is largely Euro-American but is also home to a number of Dena'ina families (Gaul 2007).

2. The sixth resident zone community of LACL is Lime Village. This community was surveyed as part of another project focusing on upper Kuskokwim River communities. See Technical Paper No. 407: "Whitefish Trends on the Upper Kuskokwim River: Ethnographic Overview and 2012–2013 Nonsalmon Fish Harvests, Nikolai and Lime Village, Alaska" (available online at: http://www.adfg.alaska.gov/techpap/TP407.pdf).

3. Initially, Pedro Bay was not included because the community does not usually harvest whitefishes. However, under recommendation by OSM, Pedro Bay was contacted and offered inclusion in the project because it is a resident zone community of the study area. Pedro Bay residents wanted to be a part of the project and supported their participation.

The contemporary economies of the study communities are a mixture of subsistence hunting and fishing components with involvement in the cash or wage economy.[4] Of the communities, Port Alsworth is the most heavily involved in the wage economy because of local guiding operations and employment provided by the LACL.

In general, these communities can be characterized by a seasonal round that begins in spring with the harvest of whitefishes and other freshwater nonsalmon by fishing through the ice or setting nets under the ice. Once the ice has melted and the weather becomes warmer, preparations begin for fish camp in May and June. Families travel to their fish camps to maintain and repair their cabins and to begin bringing supplies for summer salmon fishing. In this area, sockeye (or red) salmon are the mainstay of life and large quantities of fish are "put up" for the winter by smoking, drying, canning, salting, and pickling. At fish camp, migratory waterfowl and their eggs may be targeted for harvesting and berries and other plants are also collected in great quantities. Vegetation gathering continues into the late summer and fall when hunting activities replace fishing. In fall, moose and caribou hunting expeditions along rivers and surrounding lands ensue. At this time, upland game birds are also hunted. Some winter hunts for large land mammals may also occur. In late fall, before rivers and lakes freeze up, some community members set nets for whitefishes and other nonsalmon fish. In winter, residents trap locally for small mammals. Many people ice fish between January and when the ice begins to "rot" (April); these months are a good time for catching whitefishes and other nonsalmon fish.

Regulatory Context

The study area includes land owned by state, federal, and private entities. There are no bag or possession limits on subsistence-harvested freshwater nonsalmon fish in the study area, except for rainbow trout. Based upon a regulation adopted in the mid-1970s, prior to adoption of the state subsistence law in 1978, subsistence fishing for rainbow trout was prohibited throughout the state due to conservation concerns with gillnet fishing, with 2 specific location exceptions.[5] In 1993, following positive customary and traditional use determinations for rainbow trout stocks, the Board of Fisheries repealed the statewide prohibition of subsistence fishing for rainbow trout (5 AAC 01.010 (*l*)—repealed 5/15/93).

According to state regulations, rainbow trout may only be taken incidentally in subsistence nets and through the ice. State and federal regulations concerning rainbow trout differ. The federal subsistence fisheries regulations limit rainbow trout harvests to 2 per day and 2 in possession between April 10 and October 31; and 5 per day and 5 in possession between November 1 and April 9. Additionally, federal subsistence fishing for rainbow trout is restricted to rod and reel or jigging gear, but rainbow trout caught incidentally in other subsistence net fisheries, or through the ice, may be retained for subsistence purposes.[6]

The communities in this study are situated in the state-managed Bristol Bay Area. Subsistence fishing for other types of nonsalmon freshwater fish, including whitefishes, requires the use of a gillnet or beach seine. However, it is also permitted to fish through the ice for all freshwater nonsalmon fish, like Dolly Varden, Arctic grayling, and whitefishes, with a hook and line attached to a rod or pole (5 AAC 01.320). Except when fishing through the ice, rod and reel fishing is considered by the Board of Fisheries to be a sport fishing activity for which a license is required. Aside from rainbow trout, there are no designated limits for freshwater nonsalmon subsistence fishing harvests.[7]

Similar to state regulations, the study area is located within the federally designated Bristol Bay Area. Federally managed areas include the lands located within the LACL, which encompass 2 of the study

4. For more information about Alaska's economies and subsistence, please consult: http://www.adfg.alaska.gov/static/home/library/pdfs/subsistence/ak_economies_subsistence.pdf (accessed December 2014).
5. Robert Bentz (ADF&G fishery biologist) to Donald Voros (Assistant Regional Director of the U.S. Department of Wildlife of the Interior, Fish and Wildlife Service), January 25, 1991.
6. For more information about federal subsistence fishing regulations in Bristol Bay Area, please consult: http://www.doi.gov/subsistence/regulation/fish_shell/upload/Bristol.pdf (accessed May 2015).
7. For more information about state fishing regulations, please consult: http://www.adfg.alaska.gov/index.cfm?adfg=fishingsubsistence.main (accessed May 2015).

communities: Nondalton and Port Alsworth. Under federal regulations, only rural Alaska residents may subsistence fish on park lands. In several respects, the regulations overlap. For instance, similar to state regulations, federal regulations do not have a harvest limit for freshwater nonsalmon fish. One notable difference, described previously, is that the federal regulations allow for targeted retention of rainbow trout.[8]

For the purpose of this report and as summarized in the tables and figures that show harvests by gear type in chapter 3, "Survey Results for Study Years 2012 and 2013," a gillnet or seine refers to a seine or gillnet deployed in open water, but not set under the ice. Harvests with gillnets set under the ice are summarized in a separate label: "net under ice." "Ice fishing" is the use of a hook or hooks attached to a rod or pole deployed through the ice; harvests with nets are not included in the "ice fishing" category. "Jig" is a weighted hook attached to a line operated in open water. "Other method" refers to methods less commonly used, including but not limited to, spears or fyke nets (traps). "Subsistence gear, any method" summarizes all of the methods noted above, which are generally classified as subsistence fishing in regulations for the Bristol Bay Area. Rod and reel refers to a hook and line and reel attached to a rod or pole used in open water; rod and reel harvests are summarized in a separate category because they are regulated under state sport fishing regulations or federal subsistence regulations. "Any method" refers to all harvest methods used by the fishermen of the area covered by this study.

Study Objectives

The project had the following objectives:

- Estimate the harvests of nonsalmon fish by residents of Igiugig, Iliamna, Newhalen, Nondalton, Pedro Bay, and Port Alsworth in 2012 and 2013.
- Describe the harvests of nonsalmon fish in terms of species, gear, location, and timing of harvests.
- Document local traditional ecological knowledge (TEK) of each whitefish species, including harvest and population trends, physical characteristics and health, spawning and seasonal movements, interactions with other fish and wildlife, local taxonomies, traditional management systems, harvest preservation methods and preparations for consumption, and environmental and climate-related observations.
- Describe the characteristics and trends of the whitefish fishery by species.
- Identify what factors may be influencing residents' ability to harvest various whitefish species through the ice in the spring.

Descriptions of Studied Species

In this report, the term "other nonsalmon fish" refers to freshwater fish species excluding whitefishes whereas the term "nonsalmon fish" includes whitefishes with other freshwater fish. Following are descriptions of the nonsalmon fish species used in the study communities; whitefish and then other nonsalmon fish species are listed taxonomically.

Whitefishes

According to the Linnaean classification system, "whitefishes" comprise the subfamily *Coregoninae* of the biological family *Salmonidae* (Morrow 1980). North of the Alaska Range, whitefishes is the most abundant

8. For more information about federal fishing regulations, please consult: https://www.doi.gov/sites/doi.opengov.ibmcloud.com/files/uploads/Fish%20Regs%2015-17.pdf (accessed May 2015).

category of fish occurring in almost every freshwater habitat. Physical attributes of whitefishes include silver coloring, large scales, absence of teeth, fleshy dorsal and adipose fins, and the presence of a pelvic axillary process.[9] Whitefish ecotypes include lacustrine (lake resident), allacustrine (fish move between lakes and rivers), and anadromous (fish move between salt- and freshwater environments but spawn in fresh water) (Woody and Young 2006:4). In a single watershed, more than one ecotype may be evidenced. It is believed whitefishes spawn in the fall, between September and October, although some types of whitefishes have been known to spawn as late as January (Alt 1979; Morrow 1980; Reynolds 1997).

From a biological perspective, little is known about whitefishes of the LACL and KATM regions, including the waterbodies of Lake Clark, Sixmile Lake, and the Kvichak River (Woody and Young 2006). Recent investigations have focused on elucidating basic life history characteristics of humpback whitefish in the LACL (Woody and Young 2006). Results indicated rapid physical growth of humpback whitefish until 4–7 years of age when individuals become sexually mature. Analysis of humpback whitefish otoliths for anadromy suggests that the Lake Clark population is resident (Woody and Young 2006).

Humpback Whitefish

Humpback whitefish *Coregonus pidschian* were the most commonly harvested whitefish species in the study communities. The distinguishing characteristic of this type of fish is a pronounced hump behind the head in adults (Morrow 1980). Humpback whitefish have inferior located mouths adapted to bottom feeding on snails, aquatic insects, and larvae.[10] The head of the humpback whitefish is small with the body being wide from the stomach to the backbone.

Round Whitefish

Round whitefish *Prosopium cylindraceum* are commonly found in the Kvichak River drainage. Their bodies have a cigar shape, and they have a small, pointed snout. The upper jaw extends over the lower one. Round whitefish are generally small, rarely exceeding a length of 16 inches. The round whitefish is similar to the pygmy whitefish, which are also present in the Kvichak River but which were rarely mentioned by the residents that took part in this study. The pygmy whitefish is differentiated from the round whitefish primarily by size, and generally reaches about one-half the length of the round whitefish (Krieg et al. 2005:86).

Least Cisco

Least ciscoes *Coregonus sardinella,* often locally referred to as herring or freshwater herring, are similar to a marine herring in that its mouth has a lower jaw that projects past the end of the upper jaw. A mature least cisco is brown or olive green in color and has a silver-colored underbelly. Least ciscoes are found throughout the Bristol Bay drainage in lakes, streams, and estuaries. This species is a relatively small fish—usually fewer than 14 inches in length. Least ciscoes are a favorite food of both northern pike and burbot (Krieg et al. 2005:88). Biologists understand that around the ages of 4 through 6 years these fish migrate upstream in the fall to spawn (around October) in streams that have gravel bottoms (Krieg et al. 2005:88).

Other Nonsalmon Fish

Rainbow Trout

Rainbow trout *Oncorhynchus mykiss* are known to inhabit the lakes and streams of the study area. Rainbow trout are distinguished by black spots on their bodies and a reddish horizontal band midline along their sides (Morrow 1980). There are migratory and non-migratory populations of rainbow trout in the Bristol Bay drainage (Krieg et al. 2005). Rainbow trout cohabitating with sockeye salmon in the area's larger

9. Alaska Department of Fish and Game. Revised and reprinted 1994. "Whitefish species." Accessed May 2015. http://www.adfg.alaska.gov/static/education/wns/whitefish_species.pdf

10. Alaska Department of Fish and Game. Revised and reprinted 1994. "Whitefish species." Accessed May 2015. http://www.adfg.alaska.gov/static/education/wns/whitefish_species.pdf

lakes grow faster and larger than resident rainbow trout of local streams (Krieg et al. 2005:71). It should be noted that rainbow trout are the only nonsalmon fish found in the area that residents are not allowed to target under state subsistence fishing regulations—targeted effort occurs under sport fishing regulations. Incidental catch of rainbow trout in subsistence fisheries may be kept for subsistence uses.[11]

Brook Trout and Mountain Trout

Like other char, brook trout *Salvelinus fontinalis* are characterized by having a dark body with light-colored spots and small scales. Typically, brook trout have dark green or brownish backs (Morrow 1980). Brook trout are not native to Alaska and were introduced to Southeast Alaska between 1917 and 1950 (Krieg et al. 2005:79).

Lake Trout

Lake trout *Salvelinus namaycush* are the largest fish found in Alaska's fresh waters and are distinguished by dark green to grayish bodies with white or yellowish spots (Morrow 1980). They are the largest of a group of fish called char and are closely related to Dolly Varden and Arctic char, which are discussed below. Lake trout can be distinguished from these other char species primarily by their lack of pink spots and their deeply forked tail compared to other char. They are found in large, deep, and cold lakes of the Bristol Bay region. Lake trout growth is variable depending upon diet, water temperature, altitude, and genetics. They can live longer than 40 years(Krieg et al. 2005:65).

Dolly Varden and Arctic Char

Both resident (non-migratory) and anadromous populations of Dolly Varden *Salvelinus malma* are found in the Bristol Bay region. Arctic char *S. alpinus* also occur in the region and are closely related to Dolly Varden, as established by taxonomists in the 1980s (Morrow 1980:61). Both anadromous (seagoing) and non-anadromous (freshwater resident) Arctic char are found in North America and throughout polar regions; it is the most northerly distributed char.

Dolly Varden and Arctic char are characterized by having light spots (white, yellow, pink, red) on a body with a dark background.[12, 13] These colors can be highly variable, however, depending on location, time of year, and sexual development (Morrow 1980). There are some physical characteristics that may be used to differentiate between Arctic char and Dolly Varden. Arctic char often have a shorter head and snout, a trait most easily identified in spawning males. An Arctic char's tail has a slightly deeper fork when compared with a Dolly Varden's and the base of the Arctic char's tail is also narrower than that of the Dolly Varden's.

Arctic Grayling

Arctic grayling *Thymallus arcticus* are salmonids that live in cold streams and lakes of the Bristol Bay region. Arctic grayling are characterized by their enlarged fringed dorsal fin. Like the whitefish species, Arctic grayling have a small mouth and fine teeth in both jaws (Morrow 1980). Arctic grayling do not grow quickly and it takes a fish 6 or 7 years to reach 12 inches in length (Krieg et al. 2005:31). Biologists have determined that Arctic grayling spend the winter in deep water. In the spring they move upstream into tributaries to spawn. Mature grayling then swim even farther upstream to establish themselves in pools for the summer months. In September grayling start to move downstream again to spend winter in deep water.

11. Alaska Department of Fish and Game. n.d. "Bristol Bay Area: Information—Subsistence Fishing, Fishing Information, Non-Salmon Finfish." Acessed May 2015. http://www.adfg.alaska.gov/index.cfm?adfg=ByAreaSubsistenceBristolBay.fishingInfo
12. Alaska Department of Fish and Game. n.d. "Dolly Varden (Salvelinus malma) Species Profile." Accessed May 2015. http://www.adfg.alaska.gov/index.cfm?adfg=dollyvarden.main
13. Alaska Department of Fish and Game. n.d. "Arctic Char (Salvelinus alpinus) Species Profile." Accessed May 2015. http://www.adfg.alaska.gov/index.cfm?adfg=arcticchar.main

Grayling possess a tolerance for low levels of dissolved oxygen in water, which allows them to survive long winters in places where other salmonids would likely perish (Krieg et al. 2005:31).

Rainbow Smelt

Rainbow smelt *Osmerus mordax* have widespread distribution, and anadromous and lacustrine populations occur.[14] They inhabit midwaters of lakes, inshore coastal waters, rivers, and estuaries. Rainbow smelt bodies are elongate, compressed and slender and they have strong canine teeth. *O. mordax* are olive green-speckled with a white underbelly.

Alaska Blackfish

Alaska blackfish *Dallia pectoralis* inhabit ponds, rivers, and lakes rich in vegetation in the Bristol Bay region. They are small fish, typically 8 inches in length, and they grow slowly while living up to 8 years in age. These fish are bottom dwellers that feed primarily on insects. The Alaska blackfish is unique in that it has a modified esophagus allowing for absorption of gas—meaning it can process atmospheric oxygen.[15] This adaptation allows the Alaska blackfish to live in small, stagnant muskeg or tundra pools that are almost devoid of oxygen in summer. They are also able to survive in moist tundra mosses during extended periods of dryness prior to rain filling the tundra pools (Krieg et al. 2005:39).

Northern Pike

Northern pike *Esox lucius* are found in lakes, rivers, and sloughs of the study area. Northern pike are distinguished by a long, flat, "duck-billed" snout containing large and sharp teeth (Morrow 1980:165). They are typically dark grayish/green or dark brownish with yellow spots on the side of their bodies. They can grow to be very large, commonly reaching 20 lb or more. Pike aged 6 through 8 years weigh an average of around 5 lb and are greater than 2 feet long. Pike are carnivores and eat other fish, including pike, and have been known to eat small birds, rodents, and insects (Krieg et al. 2005:48).

Longnose Sucker

The longnose sucker *Catostomus catostomus* is the only species of sucker in Alaska.[16] Longnose suckers are bottom feeders characterized by a protruding toothless fleshy mouth located on the underside (Morrow 1980). Longnose suckers typically have reddish-brown, dark brassy green, and gray or black upper bodies with white bellies. Suckers are compact fish round in shape that typically weigh 3 lb or 4 lb and are deceptively heavy for their size (Krieg et al. 2005:46).

Burbot

Burbot *Lota lota* are part of the codfishes family, *Gadidae*, and common names are lingcod or lush. Burbot inhabit circumpolar freshwater streams and lakes of the northern hemisphere. Burbot are physically distinctive with a "barbel" at the top of the chin appearing like a long chin whisker (Morrow 1980:181). Burbot have large heads and wide gill openings and have coloring ranging from brown to dark olive green backs and sides mottled with pale and dark colors and yellow or white bellies. Burbot grow slowly and can reach 20 inches in length after 8 years. In the study communities, burbot are locally called "lingcod" (these are not the same as the marine species lingcod *Ophiodon elongatus*).

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14. T. A. Gotthardt and J. G. McClory, Alaska Natural Heritage Program, Environment and Natural Resources Institute, University of Alaska, Anchorage: Anchorage. Accessed May 2015.
http://www.adfg.alaska.gov/static/species/speciesinfo/_aknhp/Rainbow_smelt.pdf
15. Alaska Department of Fish and Game. Revised and reprinted 1994. "Alaska Blackfish." Accessed May 2015.
http://www.adfg.alaska.gov/static/education/wns/alaska_blackfish.pdf
16. Alaska Department of Fish and Game. 2004. "Longnose Sucker." Accessed May 2015
http://www.adfg.alaska.gov/static/education/wns/longnose_sucker.pdf

Table 1-3.–Community scoping meetings, study communities, 2013 and 2014.

Community	Date	Attendance: Community residents	Attendance: Staff
Igiugig[a]	4/10/2013	14	1
Iliamna[b]	3/17/2014	3	3
Newhalen	2/6/2013	2	2
Nondalton	2/21/2013	9	2
Pedro Bay	2/5/2013	6	2
Port Alsworth	2/6/2013	7	2

a. Due to weather conditions, the scoping meeting was postponed until survey administration in April 2013.
b. Iliamna declined to participate in the first year of the project. ADF&G Division of Subsistence and BBNA staff met with community members again in 2014 whereupon the Iliamna community decided to participate.

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*[17], by Bristol Bay Native Association's *Policy Guidelines for Research in Bristol Bay*[18], 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

As noted above, the project was developed in concert with BBNA, NTC, and LACL to understand the importance of whitefishes within the broader contexts of other freshwater nonsalmon fish harvests and climate change. Partnerships with BBNA, NTC, and LACL involved formal cooperative agreements (Appendix B). Researchers Sarah Hazell and Theodore Krieg were the main points of contact for the fieldwork concerning project partners and study communities. ADF&G staff researchers conducted scoping meetings by visiting the study communities and giving presentations about the project (Table 1-3). The harvest survey administration was mainly staffed by ADF&G researchers and graduate interns with assistance from BBNA by fisheries specialist Danielle Stickman. Culture Week 2014 activities were developed and conducted through the coordinated efforts of ADF&G, BBNA, and LACL staff. Visiting ADF&G researcher Cameron Welch coordinated with ADF&G staff researchers to write the report; however, BBNA, NTC, and LACL edited and reviewed the report documents. Table 1-4 lists project staff who planned and executed research and analysis and also wrote and reviewed this report.

17. Alaska Federation of Natives. 2013. "Alaska Federation of Natives Guidelines for Research." Alaska Native Knowledge Network. Accessed Aptil 2015. http://www.ankn.uaf.edu/IKS/afnguide.html
18. Bristol Bay Native Association. n.d. "Bristol Bay Native Association Policy Guidelines for Research in Bristol Bay," Bristol Bay Native Association.
19. National Science Foundation Interagency Social Science Task Force. 2012. "Principles for the Conduct of Research in the Arctic." Accessed April 2015. http://www.nsf.gov/od/opp/arctic/conduct.jsp

Table 1-4.–Project staff.

Task	Name	Organization
Southern Regional Program Manager	Davin Holen	ADF&G Division of Subsistence
Principal Investigator	Sarah M. Hazell	ADF&G Division of Subsistence
Alaska Department of Fish and Game Lead	Theodore M. Krieg	ADF&G Division of Subsistence
Nondalton Tribal Council Lead	Fawn Silas	NTC
Bristol Bay Native Corp. Lead	Courtenay Carty	BBNA
Lake Clark National Park and Preserve Lead	Karen Evanoff	LACL
Cultural advisors	Allen Dick	BBNA
	Helen Dick	BBNA
	Butch Hobson	BBNA
	Pauline Hobson	BBNA
Data Management Lead	David S. Koster	ADF&G Division of Subsistence
Administrative support	Maegan Smith	ADF&G Division of Subsistence
Programmer	Garrett Zimpelman	ADF&G Division of Subsistence
Data entry	Margaret Cunningham	ADF&G Division of Subsistence
	Barbara Dodson	ADF&G Division of Subsistence
	John Dwyer	ADF&G Division of Subsistence
	Nicholas Jackson	ADF&G Division of Subsistence
	Theresa M. Quiner	ADF&G Division of Subsistence
	Zayleen Kalalo	ADF&G Division of Subsistence
Data cleaning/validation	Garrett Zimpelman	ADF&G Division of Subsistence
Data analysis	David S. Koster	ADF&G Division of Subsistence
	Garrett Zimpelman	ADF&G Division of Subsistence
Cartography	Bronwyn Jones	ADF&G Division of Subsistence
Editorial Review Lead	Mary Lamb	ADF&G Division of Subsistence
Project intern	Eric Schacht	ADF&G Division of Subsistence
Project intern	Dustin Murray	ADF&G Division of Subsistence
Project intern	Jessie Merriam	ADF&G Division of Subsistence
Field research staff	Sarah Evans (Port Alsworth lead)	ADF&G Division of Subsistence
	Sarah Hazell (Iliamna and Newhalen lead)	ADF&G Division of Subsistence
	Hannah Johnson	ADF&G Division of Subsistence
	Bronwyn Jones	ADF&G Division of Subsistence
	Theodore Krieg (Iguigig and Nondalton lead)	ADF&G Division of Subsistence
	Yoko Kugo	ADF&G Division of Subsistence
	Joshua T. Ream (Pedro Bay lead)	ADF&G Division of Subsistence
	Cameron Welch	ADF&G Division of Subsistence
	Karen Evanoff	LACL
	Danielle Stickman	BBNA
	Gelsey Carmichael	BBNA
Local research assistants	Annie Wilson	Igiugig
	Sherry Nelson	Igiugig
	Tim Anelon	Iliamna
	Donna Anelon	Newhalen
	Wassie Balluta	Newhalen
	Terry Wassillie	Newhalen
	Leslie Agoney	Nondalton
	Janell Kakaruk	Nondalton
	Teresa Rickteroff	Nondalton
	Melvin Trefon	Nondalton
	Daniel Maximum	Pedro Bay
	Bianca Jensen	Pedro Bay
	Yvette Evanoff	Port Alsworth

To gain community support from the study communities, letters were sent in November 2012 to notify communities about the project and request a time for Division of Subsistence staff to give a presentation about the project. Igiugig, Newhalen, Nondalton, Port Alsworth, and Pedro Bay responded to email and telephone communications from research staff and meetings were confirmed for February 2013. Iliamna was hesitant to confirm a date for the presentation, but a February meeting was set up to discuss scheduling a community-wide presentation later. Hazell and Krieg visited 5 of the 6 communities on February 5–7 in 2013 (the Igiugig visit was canceled because of weather).

On February 5, 2013, Hazell and Krieg gave a scoping meeting presentation about the project in Pedro Bay, which was held at the local tribal office. The meeting was attended by both community members and tribal administrators. A total of 6 people attended. The tribal council provided the Division of Subsistence with a letter of support for the project.

Hazell and Krieg traveled to Port Alsworth on February 6, 2013, and held a scoping meeting that was facilitated by LACL staff at the visitor center. Several LACL employees and 2 members of the community attended the meeting (a total of 7). The project was well received and plans were made to return in March 2013 to conduct the harvest survey.

A scoping meeting was held in Nondalton on February 6, 2013, at the NTC building. The meeting was attended by 9 people. Community members expressed interest in and support of the project. NTC signed the cooperative agreement in advance of this meeting.

In the evening of February 6, 2013, Hazell and Krieg held a scoping meeting in Newhalen at the teen center. A total of 2 people attended the meeting, including the tribal council president. The project was well received and a letter of support was provided to the Division of Subsistence by the tribal council.

On February 7, 2013, Hazell and Krieg were scheduled to hold a scoping meeting to discuss the goals and procedures of this study with the residents of Igiugig. However, this meeting did not take place because of a flight cancelation due to poor weather conditions in the Igiugig area. In subsequent correspondence, the Igiugig Tribal Council was sent project overview material about the study and the council gave approval for the project to be conducted in Igiugig by signing a letter of support. It was agreed that a Microsoft PowerPoint[20] presentation describing the goals, procedures, and an overview of the project would be presented to the community when researchers arrived to conduct harvest surveys but before work commenced. This scoping meeting was on April 10, 2013, and the meeting was attended by 14 community members, including a number of students from the local school.

On February 5, 2013, Hazell and Krieg met with the Iliamna tribal administrator to attempt to schedule a time for the community-wide scoping meeting presentation. They described the project and provided project overview materials to be given to the tribal president and council. On February 7, 2013, Hazell and Krieg visited briefly with the tribal president to discuss the project. On March 6, 2013, the Division of Subsistence was emailed a letter indicating Iliamna would not be participating in the first year of the study. In November 2013, Hazell and Krieg sent a follow-up letter to Iliamna to provide a second opportunity to be involved in the project. On March 17, 2014, Hazell, Krieg, and Stickman met with the Iliamna tribal council about the project. At this scoping meeting, the tribal council decided to approve the project and recommended a local research assistant (LRA). A letter of support for the project was provided by the tribal council to the Division of Subsistence.

Systematic Household Surveys

Principally through the administration of harvest surveys, the Division of Subsistence scientifically quantifies harvests of wild resources by Alaska residents to assist the Alaska Board of Fisheries and Board of Game with making informed decisions concerning the management and conservation of fish and wildlife resources in Alaska. During the past 30 years, the Division of Subsistence has conducted harvest assessment

20. Product names are given because they are established standards for the State of Alaska or for scientific completeness; they do not constitute product endorsement.

Table 1-5.–Estimated households and sample achievement, study communities, 2012 and 2013.

	Households				
	U.S. Census	Estimated		Sample achievement	
Community	2010	2012	2013	2012	2013
Igiugig	16	20	23	17	18
Iliamna	39	ND	35	ND	29
Newhalen	50	48	44	34	33
Nondalton	57	56	64	38	45
Pedro Bay	19	13	14	13	11
Port Alsworth	44	50	55	45	51
Total	**225**	**187**	**235**	**147**	**187**

Sources U.S. Census (2011) for 2010 estimate; ADF&G Division of Subsistence households surveys, 2013 and 2014, for the 2012 and 2013 estimates.
Note "ND" indicates data are not available; Iliamna did not participate in the study for 2012.

surveys in 243 communities in Alaska (Community Subsistence Information System [CSIS]).[21] The results of harvest surveys and associated studies are available online in the CSIS and in the Division of Subsistence published technical papers series.[22]

The primary method for collecting subsistence harvest and use information in this project was a systematic household survey. Following receipt of comments at the scoping meetings, ADF&G finalized the survey instrument in March 2012. A key goal was to structure the survey instrument to collect demographic and resource harvest and use data that are comparable with information collected in other household surveys in the study communities and with data in the CSIS. Appendix C is an example of the survey instrument used in this project. Appendix D is the fish identification guide that was provided to survey respondents to aid with reporting harvests during the survey.

The project study areas follow city limit and CDP boundaries designated by the U.S. Census Bureau. The objective was to survey every household in each of the communities (i.e., a census goal) for both study years. Table 1-5 shows the original community household estimates based on 2010 census data, and also the number of households that were estimated after ground truthing to determine occupied households as well as the number of surveyed households (i.e., sample achievement) for study years 2012 and 2013.

Mapping Locations of Subsistence Fishing Activities

During household interviews, the researchers asked respondents to indicate the locations of fishing activities during the study year. In addition, interviewers asked the respondents to mark on the maps the sites of each harvest, the species harvested, the amounts harvested, and the months of harvest. ADF&G staff established a standard mapping method. Points were used to mark harvest locations and polygons (circled areas) were used to indicate harvest effort areas. Some lines were also drawn when the harvesting activity did not occur at a specific point; for example, lines were used to depict nets or fishing lines under the ice.

The maps used in each community consisted of a set of 3 paper maps: 1) a map covering the larger area at a scale of 1:750,000; 2) a map covering the general area around the community at 1:500,000; and 3) a map covering the immediate area around the community at a scale of 1:250,000. The maps were produced by Division of Subsistence staff using ArcGIS 10.2 software on 11-inch by 17-inch paper and displayed a U.S. Geological Survey (USGS) topographic relief. Each surveyed household recorded subsistence activities for 2012 and 2013 onto 1 or more of the selected maps based on location(s) and intensity of fishing activities

21. ADF&G CSIS: http://www.adfg.alaska.gov/sb/CSIS/ (hereinafter cited as CSIS).
22. ADF&G technical papers can be accessed at: http://www.adfg.alaska.gov/sf/publications/

(i.e., close to or far from the community, many fishing trips or only 1 trip). Maps were organized by writing the community identification number, the household's identification number, the survey date, and the interviewer's initials on each map. For the most part, ADF&G and BBNA researchers conducted all the mapping portions of the interviews. Division of Subsistence staff checked all maps for consistency by matching them to the survey forms at the end of each day.

Key Respondent Interviews

While researchers were in the study communities they consulted with tribal governments, community councils, and LRAs to identify key respondents to interview. The purpose of the key respondent interviews was to provide additional context for the quantitative data. The number of key respondent interviews varied among communities. Key respondent interviews were semi-structured and directed by a key respondent interview protocol designed by ADF&G researchers Holen, Hazell, and James Van Lanen. This protocol was updated for study year 2; both key respondent interview protocols are available in Appendix E. In addition to gathering qualitative data through the key respondent interview protocol, ADF&G staff took notes during interviews to provide additional context for this report. Researchers analyzed key respondent interviews and interview notes in preparation for this report. Key respondents were informed that, to maintain anonymity, their names would not be included in this report.

Household Survey Implementation

Igiugig

Household surveys and key respondent interviews for the 2012 study year were conducted by researcher Krieg. During the first year of the study, Krieg was assisted by an LRA, Annie Wilson, who is a long-time resident of the community. Wilson received survey training on April 10, 2013, and the surveys were conducted April 10–14, 2013.

The following year, Krieg returned to Igiugig with visiting researcher Welch. Wilson returned as an LRA and an additional LRA was contracted, Sherry Nelson, to conduct the second year of surveys (March 18–20, 2014). Survey training was conducted with the LRAs on March 18, 2014. The 2014 survey period was punctuated by local excitement surrounding the Alaska high school state basketball championship, which some members of the Igiugig community attended in Anchorage. The Newhalen School girls' team played in the tournament, which created an additional level of excitement for the tightly-knit Iliamna Lake community of friends and relatives. Attendance at the basketball tournament may help to explain the slight reduction in the percentage of households that were surveyed in Igiugig for study year 2013 in comparison to the previous year (Table 1-5).

Iliamna

Hazell conducted the household surveys in Iliamna with LRA Tim Anelon, vice president of the tribal council at that time. Survey training took place on March 18, 2014, and surveys were administered until March 20. Iliamna is the neighboring road-connected community to Newhalen and some residents were out of town supporting their children who were participating in the Newhalen School girls' basketball team championship in Anchorage, which contributed to the number of "no contacts."[23]

Newhalen

ADF&G staff Hazell and Krieg, ADF&G interns Hannah Johnson and Yoko Kugo, and BBNA staffer Stickman conducted surveys in Newhalen from March 11–14, 2013. Terry Wassillie was the LRA and he

23. If researchers were initially unsuccessful at making contact, the household was contacted a minimum of 3 different occasions. When a reasonable effort was made to survey the household and no contact could be made, this household was assigned a "no contact" disposition.

was trained on March 10, 2013. Researchers had an opportunity to conduct participant observation of ice fishing activities with local residents during this time.

The second year of survey administration included ADF&G staff Sarah Evans, Bronwyn Jones, Krieg, and Welch and BBNA staffer Stickman (March 18–11, 2014). Two LRAs (Wassie Balluta and Donna Anelon) were contract hired and trained on March 18. A number of families were out of town to support the Newhalen School girls' basketball team, which decreased the number of households that could be contacted and surveyed.

Nondalton

For the 2012 study year, household surveys were conducted by ADF&G staff Krieg and Evans and BBNA staffer Stickman. ADF&G staff were assisted by 2 LRAs who were trained on April 5, 2013. Surveys were conducted in Nondalton on April 5–9, 2013. During this time, staff worked with LACL cultural anthropologist Karen Evanoff, who was responsible for conducting key respondent interviews with Nondalton community members. Also, ADF&G, BBNA, and LACL staff had an opportunity to participate in and observe activities involving the harvest and use of whitefishes.

In 2014, Krieg and Evans returned to Nondalton for the second year of surveys with Welch. They conducted surveys on April 27–May 3, 2014. Survey training took place on April 27, 2014, with 2 LRAs. The 2014 survey period corresponded with Culture Week 2014—a week of activities taking place in and around the school in Nondalton. Widespread interest and participation in Culture Week 2014 activities by schoolchildren and their family members could help to explain the higher percentage of households that were surveyed during Culture Week 2014 activities compared to the previous year (Table 1-5).

Pedro Bay

ADF&G interns Johnson and Kugo arrived in Pedro Bay on April 4, 2013. The first day included training with the LRA, Daniel Maximum. The interns conducted surveys and key respondent interviews in the community until April 7, 2013.

In 2014, Bianca Jensen was hired by BBNA as a short-term employee to assist with survey implementation. ADF&G researcher Joshua Ream traveled to Pedro Bay on March 19, 2014. He trained Jensen to administer surveys, which occurred until March 22, 2014. Most surveys were completed during this period, though 2 households were surveyed by Jensen a week later due to household members being out of town during the initial survey effort.

Port Alsworth

ADF&G staffer Evans and BBNA staffer Stickman arrived in Port Alsworth on April 10, 2013. The first day included training with the LRA, Yvette Evanoff. Afterward, Evanoff started setting up interview times with local residents and survey administration commenced. Over the next 3 days, 45 surveys were completed by research staff and Evanoff. Five households were out of town and no households refused to be surveyed.

For project year 2, Evans coordinated with the community of Port Alsworth and BBNA to arrange the second year of surveys in the community. Again, Evanoff was hired as an LRA. Training and survey implementation occurred March 20–22, 2014. Many surveys were completed during this time and 1 key respondent interview. When the researchers left the community, the remaining surveys were left with the LRA to complete over a period of 1 week; the completed surveys were sent through the mail back to Anchorage.

Data Analysis and Review

Survey Data Entry and Analysis

All data were coded for data entry by Division of Subsistence staff in Anchorage. Household surveys were reviewed and coded 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 1 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.

Once data were entered and confirmed, information was processed with the use of Statistical Package for the Social Sciences (SPSS) software, version 20. 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 fish were converted to pounds usable weight using standard factors (see Appendix F 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 "non-response" 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

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

where:

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

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

$\bar{h}_i =$ the mean harvest per returned survey,

$h_i =$ 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 constant for 95% confidence limits is 1.96. Though there are numerous ways to express the formula below, it contains the components of a SD, V, and SE:

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

where:

$s =$ sample standard deviation,

$n =$ sample size,

$N =$ population size,

$t_{\alpha/2} =$ Student's t statistic for alpha level (α=.95) with n–1 degrees of freedom, and

$\bar{x} =$ sample mean.

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 will be added to the Division of Subsistence CSIS. This publicly-accessible database includes community-level study findings.

Ethnographic Analysis

Field notes and audio recorded interviews based on participant observation and key respondent interviews were transcribed upon return from the study communities. The key respondent interviews were coded with NVivo 10 software, which is a qualitative data analysis software. This software was used to allow for easy access to the transcription documents and searches for subject matter during the research and draft report development phase of the project. NVivo 10 is used to organize data, facilitate collaboration among researchers, and assist with data analysis and the formulation of conclusions. With NVivo 10, information collected was coded according to more than 1 node allowing for rapid retrieval of relevant data concerning broad and specific types of information (i.e., nonsalmon–whitefish–weather–spawning). Materials were archived according to division guidelines.

Population Estimates and Other Demographic Information

As noted above, a goal of the research was to collect demographic information for all year-round households in each study community. For this study, "year-round" was defined as being domiciled in the community when the surveys took place and for at least 3 months in the study year with the intent to be a resident during the study years 2012 and 2013. Because not all households were interviewed, population estimates for each community were calculated by multiplying the average household size of interviewed households by the total number of year-round households, as identified by Division of Subsistence researchers in consultation with community officials and other knowledgeable respondents.

There may be several reasons for the differences among the population estimates for each community generated from the division's surveys and other demographic data developed by the 2010 federal census (U.S. Census Bureau 2011), the U.S. Census Bureau's American Community Survey (U.S. Census Bureau n.d.), and the Alaska Department of Labor and Workforce Development (Alaska Department of Labor and Workforce Development 2014). Sampling of households, timing for when surveys are conducted, or

Table 1-6.–Community review meetings, study communities, 2014 and 2015.

Community	Date	Attendance: Community residents	Attendance: Staff
Igiugig	10/16/2014	16	Krieg/Welch
Iliamna	10/15/2014	5	Krieg/Welch
Newhalen	10/15/2014	8	Krieg/Welch
Nondalton	10/14/2015	12	Krieg/Welch
Pedro Bay	10/15/2014	22	Krieg/Welch
Port Alsworth	10/14/2014	1	Krieg/Welch

eligibility criteria for inclusion in the survey may explain differences in the population estimates by these various organizations.

Other factors specifically relevant to the surveyed region might have contributed to differences in population estimates and population changes between the first and second study years. For example, surveys were administered in winter 2013 and 2014, which is a time of year when most residents were in or around the village. The U.S. Census Bureau American Community Survey gathers population data in September through December when residents are away to engage in subsistence activities such as hunting or pursuing other seasonal employment (U.S. Census Bureau 2014). Additionally, relocation to neighboring communities or outmigration to urban areas are plausible reasons for population changes between study years. Also, during 2013, the Pebble mine project, which was a significant source of local employment opportunities, scaled down research and exploration activities in the region and a byproduct of that change might be relocations due to job loss. There is evidence that some population change between study years occurred due to new households moving to a study community, or reduction of household size, rather than entire households moving away.

Map Data Entry and Analysis

As discussed above, maps were generated based on data collected on 11-inch by 17-inch paper maps. 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 researchers from the server and maps showing harvest locations for each species created in ArcGIS 10.2 using a standard template for reports. Maps show harvest locations for fish species, and maps were reviewed at a community review meeting to ensure accuracy as well identify any data the community wanted to keep confidential.

Community Review Meetings

ADF&G staff presented preliminary survey findings and associated search area and harvest maps at a meeting in each community. This review process is part of the Division of Subsistence's policy to provide opportunities to comment on study findings by participants and community members. Table 1-6 shows when a community review meeting occurred in each study community and how many community residents attended. Krieg communicated with all of the local governments of the study communities to arrange for reviews of the findings to occur October 14–17, 2014, with the exception of Port Alsworth, for which LACL acted as the point of contact. Local advertisements of the meetings were provided. Following are brief summaries of the meetings. Additional details conveyed by community members at the meetings about particular resources are included in chapter 5, "Factors Influencing Residents' Ability to Harvest Nonsalmon Fish."

The review meeting in Port Alsworth occurred at the LACL visitor's center on October 14, 2014. Only 1 person attended the meeting. Fortunately, the community member that attended is a long-time resident and very knowledgeable about whitefishes and other nonsalmon fish species. Concerns were expressed to

ADF&G staff about global warming and the information collected for this study; these are discussed in more detail in the community concerns section for Port Alsworth.

In Nondalton, a community review meeting was held at the NTC building on October 14, 2014. The meeting was attended by 12 people, including elders and tribal council and community members. Research findings were discussed with the community and residents provided valuable insight into a number of outstanding questions and helped to improve harvest maps. One community member provided ADF&G staff with a sample of what she called a mountain trout in an effort to clarify some questions related to locally used fish names and biological taxonomies.

On October 15, 2014, Krieg and Welch gave a presentation to the Newhalen Tribal Council at the tribal office. Council members verified the information they received and were thankful to ADF&G staff for providing an opportunity to comment on the study results. The council members indicated they would contact staff if they had any questions and looked forward to production of the final report.

The community review meeting for Pedro Bay took place on October 15, 2014, at the Pedro Bay Village Council building. A total of 22 community members attended the meeting and offered insightful and positive feedback on the data that were presented. While attendees agreed that the data appeared accurate, some offered additional contextual information, particularly in reference to local ways of identifying individual trout and char species.

The Iliamna community review meeting was held on October 15, 2014, at the tribal office. Two tribal council members and 3 elders attended the meeting. The meeting was extremely informative and participants were very interested in the results.

In Igiugig, a community review meeting was conducted on October 16, 2014. The meeting was held in the community building with 16 community members in attendance. A number of those in attendance were secondary school students. Community members were positive about the study and provided information about particular weather events that affected villagers' ability to harvest whitefishes in 2013. Participants pointed out that people put more effort into whitefish harvesting in the past when they had dogs to feed. Generally, the findings of the study were verified by community members.

Final Report Organization

This report summarizes the results of systematic household surveys and mapping interviews conducted by staff from ADF&G, BBNA, NTC, and LACL, as well as LRAs, and the report also summarizes resident feedback provided at community review meetings. The next chapter of this report provides community background information for the study communities. Additional chapters present research findings that are organized by study objective.

2. COMMUNITY BACKGROUNDS AND DEMOGRAPHIC RESULTS

This chapter begins with a regionwide historical settlement description of the Lake Clark and Iliamna Lake areas where the study communities are located. Alaska Native and Euro-American relationships and activities in the region influenced early development of the contemporary communities, as well as trade and economy. Following this broad overview are accounts for how each specific study community site was settled along with community descriptions. Following the topic of present-day community infrastructure and characteristics are survey results for population and demographic characteristics of each community. The following regional settlement history overview is based on Burns et al. (2013).

Regional Settlement History

Iliamna Lake is the largest lake in Alaska measuring 60 miles long by 20 miles wide. Surrounding the lake are snowcapped mountains that produce glacial melt in summer that flow down into valleys of low-lying brush and trees. The boreal forest environment is dominated by spruce and deciduous trees in the east of the area, which meets flat lowland tundra characteristic of southwestern Alaska to the west. Glacial waters carved granite valleys through 2 main lakes, Lake Clark and Sixmile Lake, which flow into the Newhalen River, then Iliamna Lake and the Kvichak River, and terminate in Bristol Bay (Figure 1-1).

Originally, Iliamna Lake was settled by people of the Ocean Bay Tradition dating between 5600 to 2000 B.C. who were known to use marine-oriented slate tools in non-marine contexts (Gaul 2007). There are 2 major village sites located on the eastern portion of Iliamna Lake: Pedro Bay and Old Iliamna. Pedro Bay has the longest documented history of occupation of any site in the region that is represented by a series of occupations by different groups dating as far back as 2500 B.C. (Reger et al. 2005). At the time of the Ocean Bay Tradition, Iliamna Lake was larger with water levels 25 feet higher than today (Reger et al. 2005). Subsequent to the Ocean Bay Tradition, people of the Arctic Small Tool Tradition (ASTt) (1000 B.C.) and the Norton Tradition (500 B.C. to A.D. 500) thrived in the region (Reger et al. 2005).

After A.D. 500, occupation of the area is not well documented archaeologically, and Pedro Bay remained unoccupied until approximately A.D. 1750 when Dena'ina peoples moved to the area (Reger et al. 2005). Dena'ina are an Athabascan group organized by a matrilineal clan-based kinship system (Ellanna and Balluta 1992:100). Traditionally, the Dena'ina spoke 4 distinct language dialects that have boundaries that extend to the west, north, and east around the Cook Inlet Basin (Kari and Fall 2003). These language areas are designated the Inland, Upper Inlet, Outer Inland, and Iliamna dialect groups. The Dena'ina of the Lake Clark and Iliamna Lake areas are part of the Inland grouping, along with the contemporary community of Lime Village.

The Central Yup'ik population of Iliamna Lake consists of 2 separate groups: the *Aglurmiut* and the *Kiatagmiut*. The Aglurmiut are associated with territory including most of the Alaska Peninsula and the western two-thirds of Iliamna Lake (VanStone 1967). Central Yup'ik peoples of the Nushagak River refer to themselves as "Kiatagmiut." This subgroup of Central Yup'ik speakers occupied the entire Nushagak River and maintained territory on the upper Kvichak River and probably the lower end of Iliamna Lake (VanStone 1984). Historically, movements of Yup'ik groups throughout the region in response to European contact and activities resulted in the frequent comingling of Yup'ik subgroups (VanStone 1984).

Iliamna Lake is considered to be part of the Bristol Bay region both geographically and culturally. Access to the Iliamna Lake area was facilitated by the establishment of the trading post of Aleksandrovski Redoubt at "Nushagak" near the confluence of the Nushagak and Wood rivers (VanStone 1971). Nushagak became a trading center and a staging area for exploration in inland areas. The first Russian exploration of the area was military in nature in 1791, followed by Russian efforts to establish relationships for potential fur trading (Zagoskin 1967). The rival Russian companies of Shelikhov and Lebedev-Lastochkin competed for control

over the region and the latter plundered the villages of Iliamna and Nushagak in 1792, which allowed it to establish a company trading post (VanStone and Townsend 1970). After long-term mistreatment by the Russians, the Dena'ina massacred the Russians stationed at the post in 1797. It was only in 1821 that the Dena'ina permitted the Russians to re-establish a trading post among them (VanStone and Townsend 1970).

Trading of traditional goods occurred between the Iliamna Lake area Dena'ina and the Bristol Bay Yup'ik populations during the Russian period: "the Dena'ina supplying moose and wolverine skins for seal skins for example, while the Lake Clark, Mulchatna, and Stony River Dena'ina maintained trade with the *Kuskowagamiut* [Yup'ik]" (Osgood 1937).

The Iliamna Portage (*Tus Nuch'elyasht* "pass where we bring things back") is a centuries-old trail spanning approximately 22 miles and extending from the mouth of the Iliamna River through the mountains to the head of Iliamna Bay. The first Europeans to use the pass were likely the Russian explorer Peter Korsakovsky and his party who were guided by Dena'ina over this portage in 1818 to assess fur trade potential in the Iliamna Lake region (Unrau 1994). Eventually, this trail became the main route for transporting furs from the areas around Lake Clark to Cook Inlet. After the United States purchased Alaska in1867, trading posts transferred from Russian control to the Alaska Commercial Company (ACC). The ACC had a trading post on Iliamna Lake and a satellite station at the head of Iliamna Bay during the latter part of the 19th century at a site called AC Point, which was managed by John W. Clark, for whom Lake Clark is named (Unrau 1994).

Late in the 19th century, commercial salmon fishing in Bristol Bay gained importance and many residents in the area became involved in the industry. Ten canneries were opened between 1883 and 1903 at various locations on Nushagak Bay. Initially, canneries discriminated against hiring local Yup'ik who traveled to the area specifically for employment; it took at least a decade before a moderate number of Yup'ik were working in the canneries (VanStone 1971). In general, this work tended to be seasonal, and, just as now, cannery workers typically relocated temporarily to fishing hubs like Dillingham for the summer only.

In the 20th century, the commercial fishing industry, in addition to other Euro-American economic activities in the region, continued to be important for Dena'ina and Yup'ik people. However, most people living in the Iliamna Lake and Lake Clark areas relied heavily on the harvest of seasonally available subsistence foods for their nutritional and cultural well-being. Over time, local people have complemented their subsistence activities with employment in the wage economy, which is known in Alaska as a "mixed, subsistence-market" economy (Fall 2014). For communities in this study, subsistence continues to play important roles in the social, economic, and cultural lives of the households examined in this study.

Igiugig

The contemporary community of Igiugig is located on the southern bank of the Kvichak River at its confluence with Iliamna Lake. The waters of the Kvichak River are part of the Bristol Bay watershed, which hosts one of Alaska's most important populations of sockeye salmon (Krieg et al. 2005:31). As mentioned previously, the residents of the western and southern shores of Iliamna Lake and the Nushagak and Kvichak river watersheds once consisted of 2 distinct Central Yup'ik groups: the Kiatagmiut and the Aglurmiut. According to VanStone (1984:224–225), the diversity of intra-Yup'ik ethnicity became blurred with European contact "as epidemic diseases, the establishment of schools and missions, and particularly the emergence of the fur trade and an important commercial salmon-fishing industry in Bristol Bay resulted in considerable movement of Eskimos throughout the region, the coalescence of some populations and the dispersal of others." Igiugig resident, leader, and scholar AlexAnna Salmon explained how the period encompassing Russian contact through the Alaska Purchase until the 1930s was one of change among residents of the area with the introduction of Christianity, new technologies, and disease. She also demonstrated that the people of the area historically used and maintained a traditional land use system that remains largely intact. Historical and contemporary residents occupied and "… claimed places as they followed changing patterns of subsistence" (Salmon 2008:62).

The predecessor to the community of Igiugig was the Yup'ik community of *Qinuyang* (most commonly referred to now in English as Old Igiugig), which was located near Kaskanak Creek approximately 7 miles

Photo by Theodore M. Krieg, staff, ADF&G Division of Subsistence

Plate 2-1.–View from the bank of the Kvichak River, Igiugig, 2014.

downriver from the current site of Igiugig. Local history holds that Qinuyang was abandoned in 1919 in the aftermath of a flu epidemic. Area residents maintained ties to the Qinuyang area, however, due to the establishment of reindeer stations in the vicinity of the old community between the 1920s and early 1940s (Salmon 2008:84–86). The community of Igiugig was established at its current location by the start of the 1920s. In 1922, a trading post was built by a non-Native trapper across the Kvichak River from Igiugig. In 1947, this trading post was purchased by a game warden who was also a pilot and who introduced air travel to the people of Igiugig. Residents of Igiugig witnessed the establishment of a Distant Early Warning (DEW) station built on Big Mountain near Igiugig in the mid-1950s. The DEW station brought with it an airfield and a road, and employed around 10 men until its closure in the early 1970s (Morris 1986:37). By 1960, the community included a landing strip, a post office, and a Russian Orthodox Church. The opening of a school in 1967 attracted people to settle in the community thus resulting in the growth of the population.

Also during the 1960s, the Igiugig Village Council (IVC) became formalized. This development was followed in 1989 by the creation of a tribal membership registry, based on residence in Igiugig, which satisfied a federal policy for determining health, education, and social funding for the community. IVC manages most of the community's infrastructure and daily operations, including the sewer and water system, electrical and fuel services, as well as house rentals, the community preschool, library and computer lab, environmental programs, greenhouse, and other social services (Lochner 2008; Salmon 2008:124).[1] The Igiugig Native Corporation (INC) was created in 1974 under ANCSA. INC is the for-profit village

1. See also Igiugig Village Council. 2015. "Tribal government," Village of Igiugig website. Accessed January 7, 2015. http://www.igiugig.com/tribal-government

corporation serving Igiugig residents, and it manages corporation-owned land on behalf of shareholders (Salmon 2008:118–124). In addition to local affiliations with village and regional corporations, residents of Igiugig are also served by BBNA. This association was established to meet educational, social, and cultural needs of area residents and serves most of the communities in the Lake Clark and Iliamna Lake areas (Gaul 2007:52). The local medical clinic is operated by the Bristol Bay Area Health Corporation.[2] Igiugig is in the Lake and Peninsula Borough, and its residents are served by the Lake and Peninsula School District. The trading post from the past has been replaced by a small store that sells basic food products and household supplies. Many local residents now have non-subsistence food and goods flown into the community. There are several seasonal sport hunting and fishing lodges, primarily on a number of islands across the Kvichak River from Igiugig. Visitors can find accommodations in a locally run bunkhouse.

Many Igiugig residents enjoy familial, cultural, social, religious, and economic ties with residents of the other communities in the Iliamna Lake and Lake Clark areas. It is not uncommon for residents of Igiugig to travel in order to conduct subsistence activities with friends or relatives in other communities in the area. Igiugig residents noted during interviews their practice of going to Levelock to fish for whitefishes as an example of regional mobility. Historically, ancestors of current residents of Igiugig joined neighboring populations for Yup'ik winter carnivals, traveling significant distances by dogsled or by foot. Today Igiugig residents travel by boat, all-terrain vehicle (ATV), snowmachine, and airplane to visit friends and relatives in the region, Alaska urban centers, and beyond. Igiugig is serviced by several passenger and cargo air companies operating in the community of Iliamna, which has emerged as a regional transportation hub. During Russian Orthodox Christmas, or *Selaviq,* many residents of Igiugig coordinate with residents of the communities of Newhalen, Iliamna, Kokhanok, Levelock, and occasionally the people of Naknek, to visit one another to celebrate the holiday; this includes giving and receiving food items, especially subsistence foods. One scholar has argued that some of the customs, such as the consumption and exchange of subsistence foods associated with Selaviq, are rooted in the much older local tradition of the Yup'ik winter festivals or carnivals (Oleksa 1992:192).

Another recent technological development—locally available high-speed Internet connections—now allows Igiugig residents to maintain ties with nonresident family and friends, as well as people and organizations across the globe. The Internet has not only provided the opportunity for residents of Igiugig to maintain a global awareness and presence, but also has allowed those community residents to participate in post-secondary education via webcasts among other activities.

Population Estimates and Demographic Information

Based on household surveys, Igiugig's resident population was estimated to be 54 in 2012 and 61 in 2013 (Table 2-1). These estimates are slightly higher than U.S. Census Bureau findings; the federal census estimated a population of 50 in 2010 and the American Community Survey 5-year estimate covering 2008–2012 was 48 persons. The higher population estimates generated by this study may be explained by the timing of the household surveys and the seasonal round of subsistence activities in which Igiugig residents engage. Surveys were administered in winter 2013 and 2014, which is a time of year when most residents of Igiugig were in or around the community. The percentage of the population self-identifying as Alaska Native has remained approximately 75% in recent years (Table 2-1). Population estimates indicate a general trend of modest population increase in recent history (Figure 2-1).

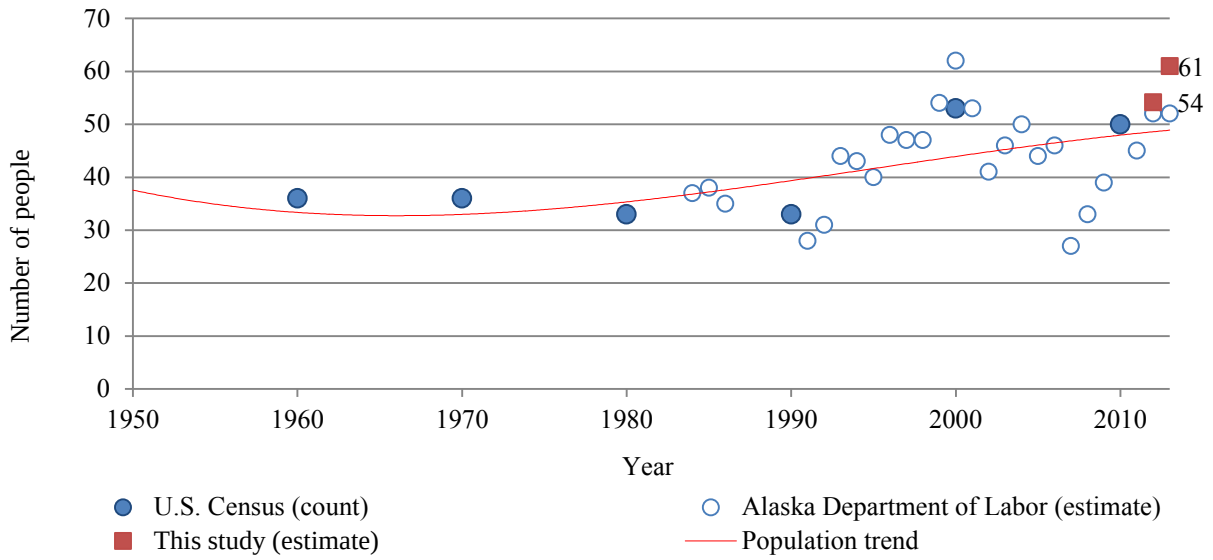
There were an estimated 20 year-round households in Igiugig in 2012 and 23 in 2013 (Table 2-2). Of those households, 17 (85%) were interviewed in the first year of the study and 18 (78%) were interviewed in the second year of the study. The mean length of residency in Igiugig was 17 years in 2013 (Table 2-3). For both study years, approximately 30% of residents were born in Igiugig (Table 2-4). Many residents born outside of Igiugig were born in neighboring communities around Iliamna Lake and Lake Clark while approximately 13% of the population of Igiugig was born outside of Alaska. The same proportions generally hold for the

2. Bristol Bay Area Health Corporation. 2014. "Igiugig." Bristol Bay Area Health Corporation website. Accessed January 7, 2015.
http://www.bbahc.org/index.asp?SEC={F44B7D81-7715-49E6-8325-AC896384EDC4}&Type=B_BASIC&persistdesign=none

Table 2-1.–Population estimates, Igiugig, 2010, 2012, and 2013.

	Census (2010)	5-Year American Community Survey (2008–2012)	This study (2012)	This study (2013)
Total population				
Households	16.0	22.0	20.0	23.0
Population	50.0	48.0	54.1	61.3
Alaska Native				
Population	35.0	36.0	43.5	46.0
Percentage	70.0%	75.0%	80.4%	75.0%

Sources U.S. Census Bureau (2011) for 2010 estimate; U.S. Census Bureau (2013) for 5-year survey estimate; and ADF&G Division of Subsistence household surveys, 2013, for 2012 estimate and 2014, for 2013 estimate.



Note Population data for this community are not available prior to 1960.

Figure 2-1.–Historical population estimates, Igiugig, 1960–2013.

birthplaces of household heads, although closer to 25% of household heads were born outside Alaska (Table 2-5). In both study years, the mean household size was 2.7 people while the largest household in Igiugig comprised 5 people (Table 2-3). The relatively small household size in Igiugig can perhaps be attributed to the predominately adult population and limited housing availability, but the IVC is making efforts to provide an appropriate amount of housing for the resident population.

In 2012, 67% of the population was under the age of 35 (Table 2-6; Figure 2-2). In 2013, the largest age cohorts for males were ages 20–24 and 25–29 (each cohort was 15% of the population) (Table 2-7). The largest age cohort for females was ages 5–9, representing approximately 18% of the population (Figure 2-3). Igiugig's adult population is young and productive with almost 30% of the population in its twenties and approximately 63% of the population under 35 years of age.

Table 2-2.–Sample achievement, Igiugig, 2012 and 2013.

	2012	2013
Number of dwelling units	20	23
Interview goal	20	23
Households interviewed	17	18
Households failed to contact	2	4
Households declined to be interviewed	1	1
Households moved or nonresident	0	0
Total households attempted to interview	18	23
Refusal rate	5.6%	5.3%
Final estimate of permanent households	20	23
Percentage of total households interviewed	85.0%	78.3%
Interview weighting factor	1.2	1.3
Sampled population	46	48
Estimated population	54.1	61.3

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.

Table 2-3.–Demographic characteristics, Igiugig, 2012 and 2013.

	Igiugig	
Characteristics	2012	2013
Household size		
Mean	2.7	2.7
Minimum	1	1
Maximum	5	5
Age		
Mean	28.8	31.7
Minimum[a]	0	1
Maximum	81	81
Median	24	27
Length of residency		
Total population		
Mean	14.6	16.9
Minimum[a]	1	1
Maximum	59	63
Heads of household		
Mean	21.6	22.6
Minimum[a]	1	1
Maximum	59	63
Alaska Native households[b]		
Number	17.6	19.2
Percentage	88%	83%

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.

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.

Table 2-4.–Birthplaces of population, Igiugig, 2012 and 2013.

Birthplace	Percentage 2012	Percentage 2013
Anchorage	10.9%	10.4%
Aniak	0.0%	2.1%
Fairbanks	6.5%	4.2%
Goodnews Bay	4.3%	4.2%
Hoonah	2.2%	0.0%
Igiugig	28.3%	31.3%
Iliamna	4.3%	2.1%
Kokhanok	6.5%	12.5%
Levelock	6.5%	8.3%
Naknek	4.3%	2.1%
Newhalen	2.2%	2.1%
Nondalton	0.0%	2.1%
Kukaklek Lake	4.3%	4.2%
Lockanok	2.2%	2.1%
Other Alaska	4.3%	0.0%
Other U.S.	13.0%	10.4%
Foreign	0.0%	2.1%

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.
Note "Birthplace" means the place of residence of the parents of the individual when the individual was born.

Table 2-5.–Birthplaces of household heads, Igiugig, 2012 and 2013.

Birthplace	Percentage 2012	Percentage 2013
Anchorage	3.8%	3.6%
Aniak	0.0%	3.6%
Fairbanks	3.8%	3.6%
Igiugig	26.9%	25.0%
Iliamna	3.8%	3.6%
Kokhanok	11.5%	17.9%
Levelock	3.8%	3.6%
Naknek	3.8%	3.6%
Newhalen	3.8%	0.0%
Nondalton	0.0%	3.6%
Kukaklek Lake	7.7%	7.1%
Lockanok	3.8%	3.6%
Other Alaska	7.7%	0.0%
Other U.S.	19.2%	17.9%
Foreign	0.0%	3.6%

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.
Note "Birthplace" means the place of residence of the parents of the individual when the individual was born.

Table 2-6.–Population profile, Igiugig, 2012.

	Male			Female			Total		
Age	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage
0–4	2.4	10.5%	10.5%	3.5	11.1%	11.1%	5.9	10.9%	10.9%
5–9	3.5	15.8%	26.3%	4.7	14.8%	25.9%	8.2	15.2%	26.1%
10–14	1.2	5.3%	31.6%	2.4	7.4%	33.3%	3.5	6.5%	32.6%
15–19	1.2	5.3%	36.8%	2.4	7.4%	40.7%	3.5	6.5%	39.1%
20–24	2.4	10.5%	47.4%	3.5	11.1%	51.9%	5.9	10.9%	50.0%
25–29	3.5	15.8%	63.2%	5.9	18.5%	70.4%	9.4	17.4%	67.4%
30–34	0.0	0.0%	63.2%	0.0	0.0%	70.4%	0.0	0.0%	67.4%
35–39	1.2	5.3%	68.4%	1.2	3.7%	74.1%	2.4	4.3%	71.7%
40–44	1.2	5.3%	73.7%	1.2	3.7%	77.8%	2.4	4.3%	76.1%
45–49	0.0	0.0%	73.7%	0.0	0.0%	77.8%	0.0	0.0%	76.1%
50–54	1.2	5.3%	78.9%	1.2	3.7%	81.5%	2.4	4.3%	80.4%
55–59	2.4	10.5%	89.5%	2.4	7.4%	88.9%	4.7	8.7%	89.1%
60–64	0.0	0.0%	89.5%	0.0	0.0%	88.9%	0.0	0.0%	89.1%
65–69	0.0	0.0%	89.5%	2.4	7.4%	96.3%	2.4	4.3%	93.5%
70–74	0.0	0.0%	89.5%	0.0	0.0%	96.3%	0.0	0.0%	93.5%
75–79	2.4	10.5%	100.0%	0.0	0.0%	96.3%	2.4	4.3%	97.8%
80–84	0.0	0.0%	100.0%	1.2	3.7%	100.0%	1.2	2.2%	100.0%
85–89	0.0	0.0%	100.0%	0.0	0.0%	100.0%	0.0	0.0%	100.0%
90–94	0.0	0.0%	100.0%	0.0	0.0%	100.0%	0.0	0.0%	100.0%
95–99	0.0	0.0%	100.0%	0.0	0.0%	100.0%	0.0	0.0%	100.0%
100–104	0.0	0.0%	100.0%	0.0	0.0%	100.0%	0.0	0.0%	100.0%
Missing	0.0	0.0%	100.0%	0.0	0.0%	100.0%	0.0	0.0%	100.0%
Total	**22.4**	**100.0%**	**100.0%**	**31.8**	**100.0%**	**100.0%**	**54.1**	**100.0%**	**100.0%**

Source ADF&G Division of Subsistence household surveys, 2013.

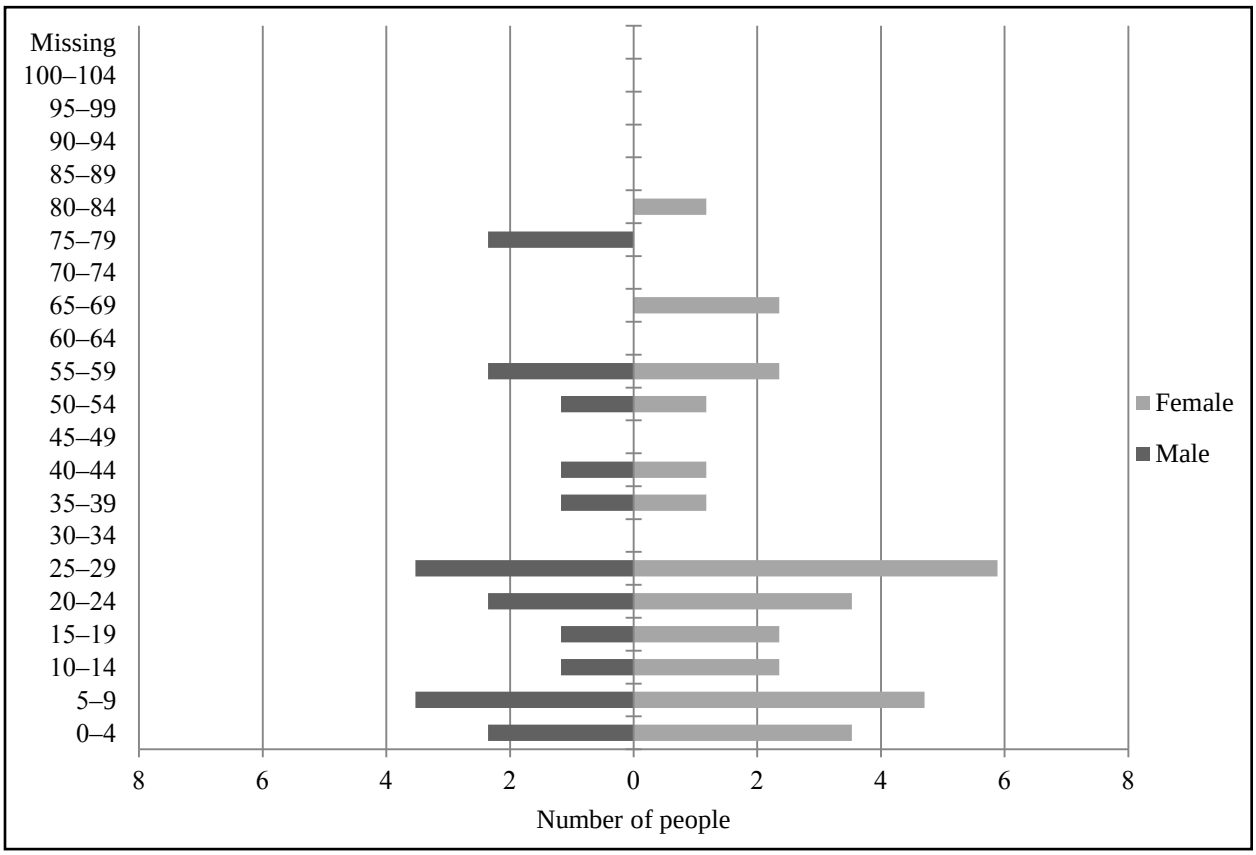


Figure 2-2.–Population profile, Igiugig, 2012.

Table 2-7.–Population profile, Igiugig, 2013.

	Male			Female			Total		
Age	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage
0–4	2.6	10.0%	10.0%	2.6	7.1%	7.1%	5.1	8.3%	8.3%
5–9	2.6	10.0%	20.0%	6.4	17.9%	25.0%	8.9	14.6%	22.9%
10–14	1.3	5.0%	25.0%	0.0	0.0%	25.0%	1.3	2.1%	25.0%
15–19	0.0	0.0%	25.0%	3.8	10.7%	35.7%	3.8	6.3%	31.3%
20–24	3.8	15.0%	40.0%	3.8	10.7%	46.4%	7.7	12.5%	43.8%
25–29	3.8	15.0%	55.0%	5.1	14.3%	60.7%	8.9	14.6%	58.3%
30–34	2.6	10.0%	65.0%	0.0	0.0%	60.7%	2.6	4.2%	62.5%
35–39	1.3	5.0%	70.0%	2.6	7.1%	67.9%	3.8	6.3%	68.8%
40–44	1.3	5.0%	75.0%	1.3	3.6%	71.4%	2.6	4.2%	72.9%
45–49	0.0	0.0%	75.0%	1.3	3.6%	75.0%	1.3	2.1%	75.0%
50–54	1.3	5.0%	80.0%	1.3	3.6%	78.6%	2.6	4.2%	79.2%
55–59	2.6	10.0%	90.0%	2.6	7.1%	85.7%	5.1	8.3%	87.5%
60–64	0.0	0.0%	90.0%	0.0	0.0%	85.7%	0.0	0.0%	87.5%
65–69	0.0	0.0%	90.0%	2.6	7.1%	92.9%	2.6	4.2%	91.7%
70–74	0.0	0.0%	90.0%	0.0	0.0%	92.9%	0.0	0.0%	91.7%
75–79	2.6	10.0%	100.0%	0.0	0.0%	92.9%	2.6	4.2%	95.8%
80–84	0.0	0.0%	100.0%	2.6	7.1%	100.0%	2.6	4.2%	100.0%
85–89	0.0	0.0%	100.0%	0.0	0.0%	100.0%	0.0	0.0%	100.0%
90–94	0.0	0.0%	100.0%	0.0	0.0%	100.0%	0.0	0.0%	100.0%
95–99	0.0	0.0%	100.0%	0.0	0.0%	100.0%	0.0	0.0%	100.0%
100–104	0.0	0.0%	100.0%	0.0	0.0%	100.0%	0.0	0.0%	100.0%
Missing	0.0	0.0%	100.0%	0.0	0.0%	100.0%	0.0	0.0%	100.0%
Total	**25.6**	**100.0%**	**100.0%**	**35.8**	**100.0%**	**100.0%**	**61.3**	**100.0%**	**100.0%**

Source ADF&G Division of Subsistence household surveys, 2014.

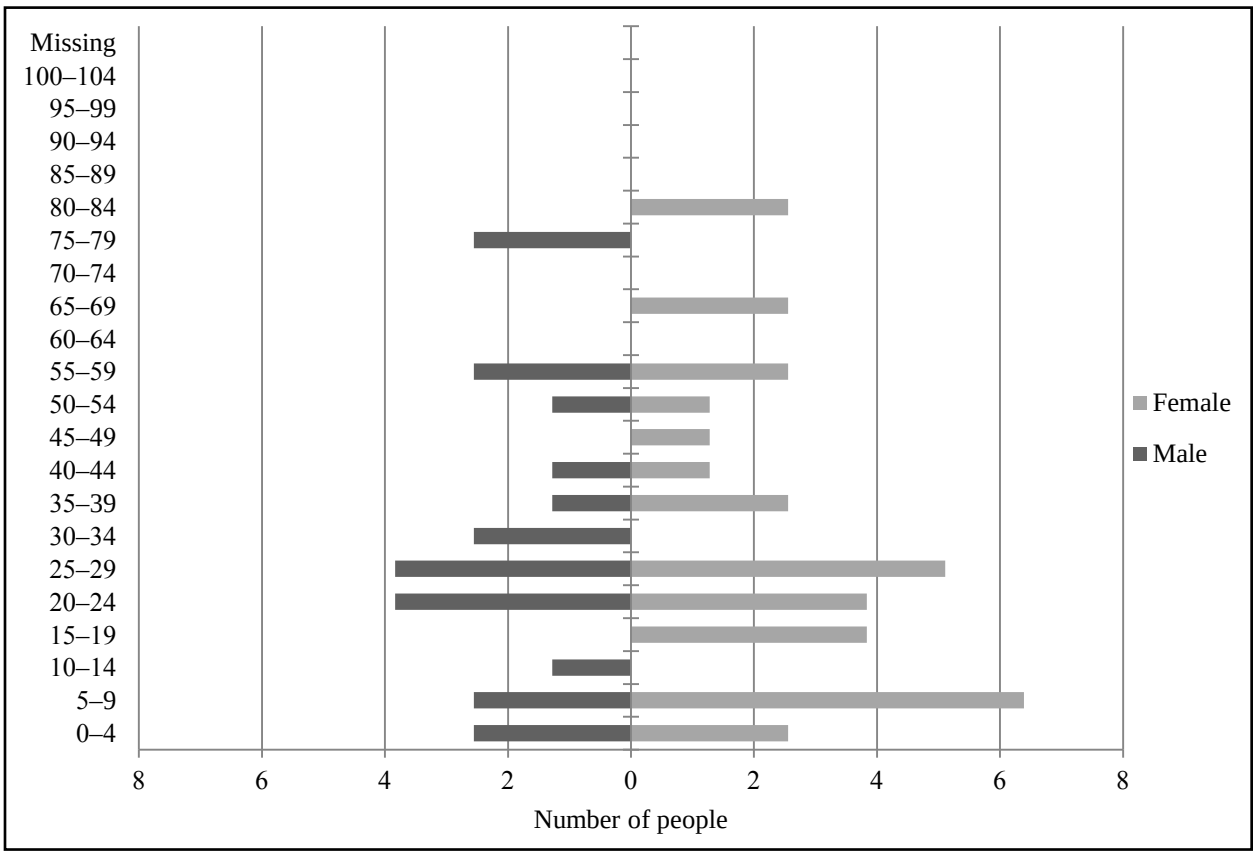


Figure 2-3.–Population profile, Igiugig, 2013.

Iliamna

A Dena'ina community called Old Iliamna (*Nuch'ak'dalitnu* [flows out river] or *Ch'ak'alitnu*) once existed on the far eastern shore of Iliamna Lake on Pile Bay (Gaul 2007). Inhabitants of Old Iliamna eventually relocated to the communities of Pedro Bay and Pile Bay due to a combination of disease and increased ability to access natural resources (i.e., fish) early in the 20th century. While it is possible some Dena'ina from Old Iliamna relocated to the eastern lake community of Iliamna, the connection between these 2 places is mostly by name, brought about by the transfer of the post office from Old Iliamna to Iliamna in 1935 (Morris 1986).

Environmentally, Iliamna is characterized by a mix of tundra, spruce forest, and Arctic willow. The area is home to a diverse array of fish and wildlife species. Salmon, in particular, are important to inhabitants, as are moose, caribou, nonsalmon fish, lake seals, ptarmigan, and a number of berry species.

In the early 1900s, the community of Iliamna originated with the establishment of a store followed by a roadhouse in 1913 (Morris 1986). These facilities provided essential goods for local Dena'ina people, as well as trappers and prospectors, and in the early 20th century attracted both Alaska Natives and Euro-Americans to the area. During this time, some inhabitants of Iliamna Lake were seasonally involved with the Bristol Bay commercial fishing industry via working in canneries (Gaul 2007). Circa World War II, men from the region also began working on fishing boats.

The contemporary community of Iliamna is made up of people from a variety of ethnic backgrounds including Dena'ina, Yup'ik, and Euro-American, among others. The community of Iliamna is located on

Photo by Sarah M. Hazell, staff, ADF&G Division of Subsistence

Plate 2-2.–View of Roadhouse Bay from Severson's Point, Iliamna, 2014.

Iliamna Lake, the largest lake in Alaska, measuring approximately 60 miles long by 20 miles wide. In addition to Iliamna Lake, the community is also bordered by the community of Newhalen to the south, the Newhalen River to the west, a place local residents call "Landing" on the Newhalen River in the north (from which boats can be launched), and Roadhouse Creek on the eastern side. A prominent feature for communities in this area to the northeast is Roadhouse Mountain.

The airstrip has transformed Iliamna into a subregional center for other communities in the Iliamna Lake–Lake Clark area (Morris 1986). Iliamna has also become a center and springboard for guided rainbow trout fishing in the region. The community today is home to 2 grocery stores (one a corporation-owned store), post office, health clinic, Baptist church, air taxi business, and the Iliamna tribal government and corporation. During the past decade, Iliamna has also been the staging ground for the Pebble mine project, a proposed mining operation for gold, copper, and molybdenum. However, at the time of this study in 2013 and 2014, exploration activities of the proposed Pebble mining site(s) had decreased.

Population Estimates and Demographic Information

For study year 2013, the estimated population of Iliamna was 92 residents composed of approximately 35 households (Table 2-8). This is approximately 15% fewer residents than the 2010 census estimate, which was 109 community members. However, the 5-year (2008–2012) American Community Survey household estimate for Iliamna was 35 households, which indicates a stable trend over time. Figure 2-4 shows historical population estimates for Iliamna.

Of the estimated households (35), a total of 29 were surveyed (83%) (Table 2-9). The average household size was 2.6 residents and the average length of residency was 25 years (Table 2-10). The mean age of Iliamna residents was 39. Youths under the age of 15 only made up 14% of the population in 2013 (Table 2-11). The cohorts for ages 15–64 were similarly populated, with 8 of the 10 cohorts comprising approximately 6 individuals. The population was fairly equal between males (47) and females (42) (Figure 2-5).

Many household heads were from Iliamna (27%) and Newhalen (10%) (Table 2-12). This proportion is also reflected by the general population, with 33% of residents being from Iliamna and 8% being from Newhalen (Table 2-13). Most other residents originated in neighboring communities like Nondalton, Kokhanok, Pedro Bay, New Stuyahok, and Koliganek.

Table 2-8.–Population estimates, Iliamna, 2010 and 2013.

	Census (2010)	5-Year American Community Survey (2008–2012)	This study (2013)
Total population			
Households	39.0	35.0	35.0
Population	109.0	80.0	91.7
Alaska Native			
Population	71.0	56.0	53.1
Percentage	65.1%	70.0%	57.9%

Sources U.S. Census Bureau (2011) for 2010 estimate; U.S. Census Bureau (2013) for 5-year survey estimate; and ADF&G Division of Subsistence household surveys, 2014, for 2013 estimate.
Note No surveys were conducted in Iliamna in 2013. Consequently, no data are available for 2012.

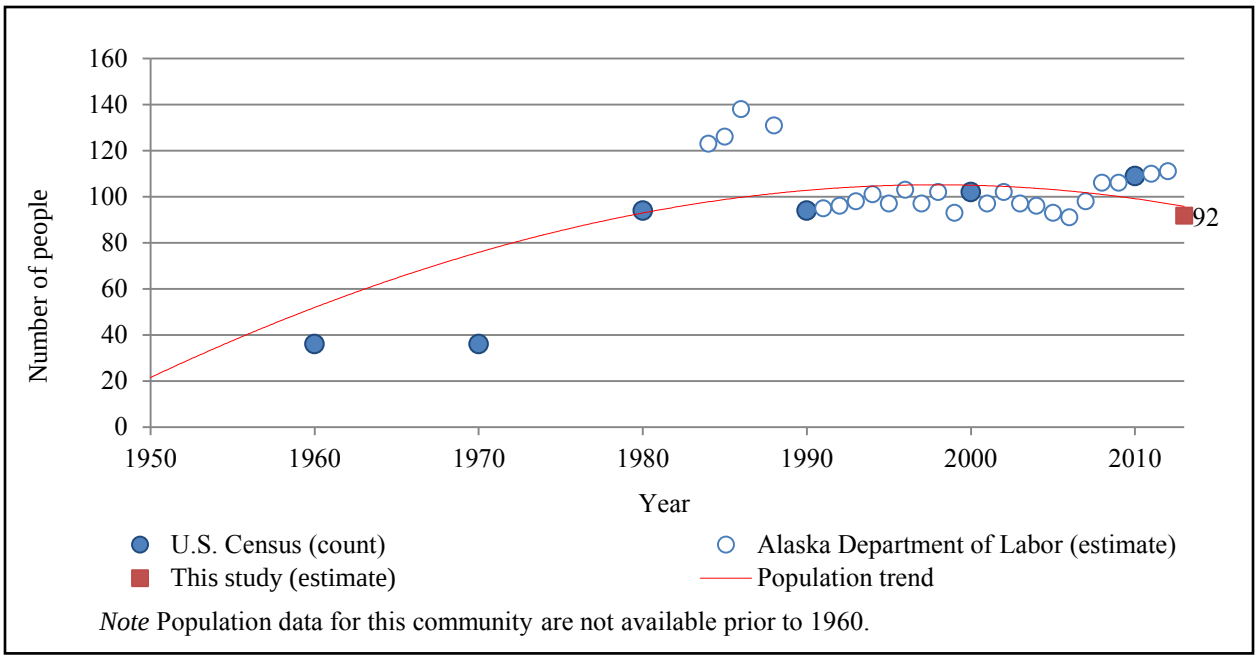


Figure 2-4.–Historical population estimates, Iliamna, 1960–2013.

Table 2-9.–Sample achievement, Iliamna, 2013.

Number of dwelling units	35
Interview goal	35
Households interviewed	29
Households failed to contact	6
Households declined to be interviewed	0
Households moved or nonresident	0
Total households attempted to interview	35
Refusal rate	0.0%
Final estimate of permanent households	35
Percentage of total households interviewed	82.9%
Interview weighting factor	1.2
Sampled population	76
Estimated population	91.7

Source ADF&G Division of Subsistence household surveys, 2014.
Note Data for 2012 were not collected.

Table 2-10.–Demographic characteristics, Iliamna, 2012 and 2013.

Characteristics	Iliamna 2012[c]	Iliamna 2013
Household size		
Mean		2.6
Minimum		1
Maximum		7
Age		
Mean		39.2
Minimum[a]		1
Maximum		86
Median		39.5
Length of residency		
Total population		
Mean		24.7
Minimum[a]		2
Maximum		82
Heads of household		
Mean		28.5
Minimum[a]		2
Maximum		82
Alaska Native households[b]		
Number		24.1
Percentage		69.0%

Source ADF&G Division of Subsistence household surveys, 2014.

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.

c. Surveys were not conducted in Iliamna in 2013. Consequently, no data are available for 2012.

Table 2-11.–Population profile, Iliamna, 2013.

	Male			Female			Total		
Age	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage
0–4	2.4	5.1%	5.1%	2.4	5.7%	5.7%	4.8	5.4%	5.4%
5–9	0.0	0.0%	5.1%	2.4	5.7%	11.4%	2.4	2.7%	8.1%
10–14	2.4	5.1%	10.3%	2.4	5.7%	17.1%	4.8	5.4%	13.5%
15–19	2.4	5.1%	15.4%	3.6	8.6%	25.7%	6.0	6.8%	20.3%
20–24	4.8	10.3%	25.6%	1.2	2.9%	28.6%	6.0	6.8%	27.0%
25–29	4.8	10.3%	35.9%	1.2	2.9%	31.4%	6.0	6.8%	33.8%
30–34	1.2	2.6%	38.5%	4.8	11.4%	42.9%	6.0	6.8%	40.5%
35–39	3.6	7.7%	46.2%	2.4	5.7%	48.6%	6.0	6.8%	47.3%
40–44	3.6	7.7%	53.8%	2.4	5.7%	54.3%	6.0	6.8%	54.1%
45–49	3.6	7.7%	61.5%	1.2	2.9%	57.1%	4.8	5.4%	59.5%
50–54	4.8	10.3%	71.8%	3.6	8.6%	65.7%	8.4	9.5%	68.9%
55–59	2.4	5.1%	76.9%	3.6	8.6%	74.3%	6.0	6.8%	75.7%
60–64	1.2	2.6%	79.5%	4.8	11.4%	85.7%	6.0	6.8%	82.4%
65–69	4.8	10.3%	89.7%	2.4	5.7%	91.4%	7.2	8.1%	90.5%
70–74	1.2	2.6%	92.3%	0.0	0.0%	91.4%	1.2	1.4%	91.9%
75–79	0.0	0.0%	92.3%	0.0	0.0%	91.4%	0.0	0.0%	91.9%
80–84	0.0	0.0%	92.3%	1.2	2.9%	94.3%	1.2	1.4%	93.2%
85–89	0.0	0.0%	92.3%	1.2	2.9%	97.1%	1.2	1.4%	94.6%
90–94	0.0	0.0%	92.3%	0.0	0.0%	97.1%	0.0	0.0%	94.6%
95–99	0.0	0.0%	92.3%	0.0	0.0%	97.1%	0.0	0.0%	94.6%
100–104	0.0	0.0%	92.3%	0.0	0.0%	97.1%	0.0	0.0%	94.6%
Missing	3.6	7.7%	100.0%	1.2	2.9%	100.0%	4.8	5.4%	100.0%
Total	**47.1**	**100.0%**	**100.0%**	**42.2**	**100.0%**	**100.0%**	**89.3**	**100.0%**	**100.0%**

Source ADF&G Division of Subsistence household surveys, 2014.

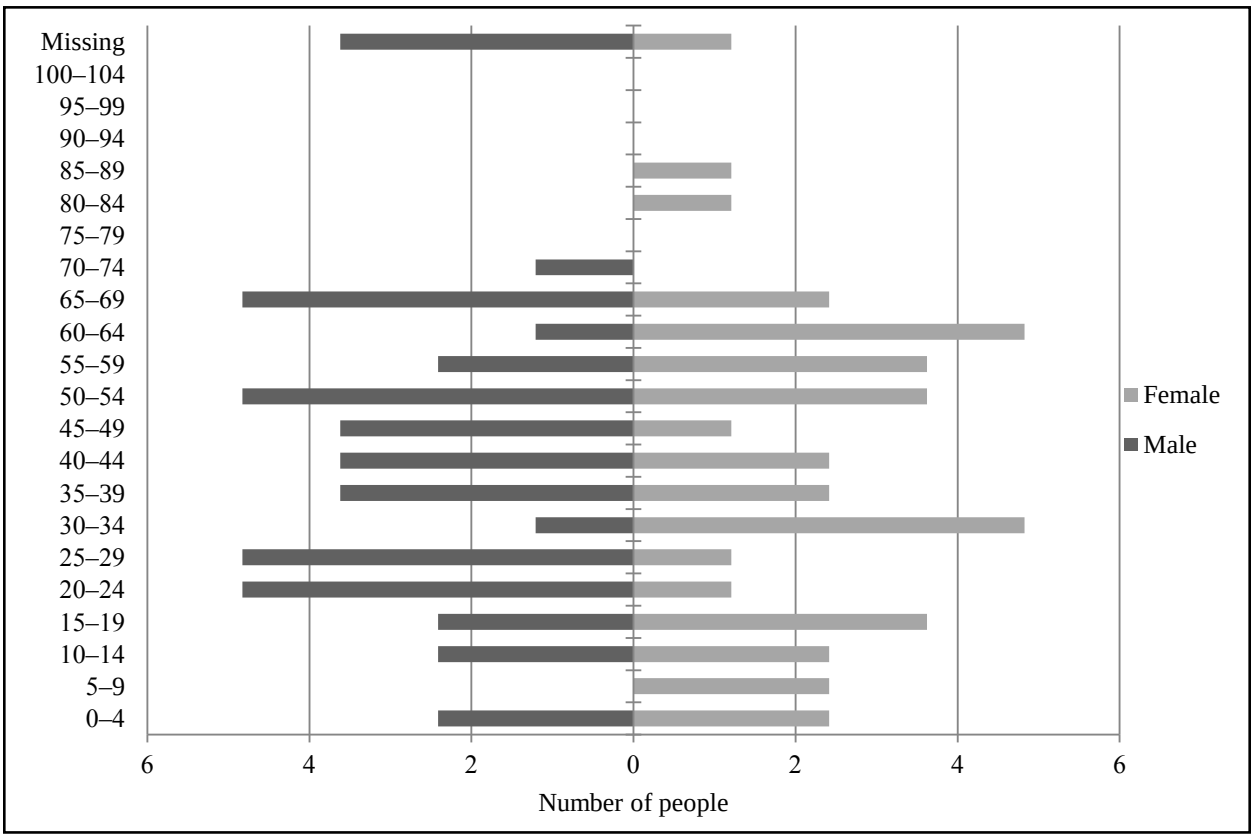


Figure 2-5.–Population profile, Iliamna, 2013.

Table 2-12.–Birthplaces of household heads, Iliamna, 2013.

Birthplace	Percentage
Dillingham	2.0%
Iliamna	26.5%
Kokhanok	2.0%
Koliganek	2.0%
New Stuyahok	2.0%
Newhalen	10.2%
Nondalton	4.1%
Palmer	2.0%
Pedro Bay	2.0%
Sand Point	2.0%
Allakaket	2.0%
Kvichak/Naknek	2.0%
Missing	4.1%

Source ADF&G Division of Subsistence household surveys, 2014.
Note "Birthplace" means the place of residence of the parents of the individual when the individual was born.

Table 2-13.–Birthplaces of population, Iliamna, 2013.

Birthplace	Percentage
Dillingham	1.3%
Iliamna	32.9%
Kokhanok	1.3%
Koliganek	1.3%
New Stuyahok	1.3%
Newhalen	7.9%
Nondalton	2.6%
Palmer	1.3%
Pedro Bay	1.3%
Sand Point	1.3%
Allakaket	1.3%
Kvichak/Naknek	1.3%
Chekok	1.3%
Other U.S.	30.3%
Missing	10.5%

Source ADF&G Division of Subsistence household surveys, 2014.
Note "Birthplace" means the place of residence of the parents of the individual when the individual was born.

Photo by Sarah M. Hazell, staff, ADF&G Division of Subsistence

Plate 2-3.–View from the mouth of the Newhalen River, Newhalen, 2014.

Newhalen

The Yup'ik name for Newhalen is *Nuurileng* (the Dena'ina term for Newhalen is *Nughil Hdakaq* [water running down]) and it is located on the eastern side of the mouth of the Newhalen River on Iliamna Lake (Gaul 2007). The Newhalen River provides a natural boundary or territorial marker, and in the past, on the northern side of Iliamna Lake, this was considered the traditional border between Yup'ik and Dena'ina groups (Gaul 2007; Tenenbaum 2006). The area to the east of the river was occupied by the Dena'ina, but late in the 19th century Yup'ik Alaska Natives migrated across the river to establish a settlement at Newhalen. Evidence of this migration was documented in 1890 by the census agent Ivan Petroff who documented 16 residents living there who called themselves *Noghelingamiut*, a Yup'ik term for "people of the Nughil Hdakaq" (Gaul 2007; Petroff 1892). Townsend (1970) noted it is difficult to establish the cultural affiliation of archaeological sites because of the frequent adoption and adaptation of technologies and material culture between Yup'ik and Dena'ina groups; consequently it is difficult to ascertain chronologically the occupation of sites in the area. The location of Newhalen has changed a number of times during the century before the community settled at its current position; "Old Newhalen" can be seen from the current location (Gaul 2007; Morris 1986).

Like the neighboring community of Iliamna, located 5 miles away by road, Newhalen is characterized by a mixed tundra, spruce, and Arctic willow environment. The Newhalen River is fed by Sixmile Lake and Lake Clark; all are important spawning grounds for returning runs of sockeye salmon that provide significant subsistence resources to residents of the area. In addition to salmon, a diverse array of fish and

wildlife species are available locally: moose, caribou, nonsalmon fish, lake seals, ptarmigan, and a number of berry species.

As in Iliamna, Newhalen residents are involved in the commercial fishing industry and it remains one of the principal sources of income for residents. A number of residents hold commercial fishing permits for Bristol Bay[3] while others work as crew members on fishing boats.

Subsistence fishing is also a significant seasonal activity for Newhalen residents in addition to providing important food resources. In the last harvest survey involving salmon conducted in Newhalen, for instance, the harvest of sockeye salmon was estimated to be 192 lb per person[4] for 2008 (CSIS).

Newhalen is a second-class city that was incorporated in 1971 (Morris 1986). The city has a Russian Orthodox church, firehouse, community center, city office, small medical clinic, and the Iliamna Newhalen Nondalton Electric Cooperative, Inc. (INNEC). The local K–12 school is also in Newhalen, which serves both the communities of Newhalen and Iliamna. In addition to educational purposes, the school is an important venue for social gatherings and interactions. At lunchtime, elders are encouraged to visit and are provided lunch. The gymnasium is used for a variety of social purposes including televising sporting events involving former Newhalen and Iliamna residents located in other communities.

Population Estimates and Demographic Information

The estimated population of Newhalen was 179 in 2012 and 139 in 2013 (Table 2-14). In comparison to the 5-year (2008–2012) American Community Survey estimate (230 residents), these survey estimates reflect a general trend over time of a decrease in the population in Newhalen (Table 2-14; Figure 2-6). The decline between 2012 and 2013 in the number of households between the 2 study years was not as steep. For instance, it was estimated that 48 households resided in Newhalen in 2012 and 44 in 2013 (Table 2-14). It appears that the population decline stems largely from a decrease in average household size, from 3.7 persons in 2012 to 3 in 2013 (Table 2-15). The population profile indicates a significant decrease of children ages 10–14 (Figure 2-7; Figure 2-8).

Of the estimated households (48), a total of 34 were surveyed (71%) in 2012 and a total of 33 households of the 44 identified households (75%) were interviewed in 2013 (Table 2-16). The average resident age increased slightly from 28 years to 31 years of age (Table 2-15). The average length of residency was 20 years in 2012 and 22 years in 2013. The population of males was higher in 2012 and it is estimated that in 2013 the same number of females and males were residents of Newhalen (Table 2-17; Table 2-18).

Most household heads are originally from Newhalen (Table 2-19). It is interesting to note that not a single person claimed as a birthplace the neighboring community of Iliamna—neither household heads nor the general population (Table 2-19; Table 2-20). In 2012, Kokhanok was the Alaska community second to Newhalen as the place of origin of household heads and the general population; for 2013, Koliganek (on the Nushagak River) was the second most frequently cited Alaska community birthplace for household heads and the overall population. Most other residents originated in the Yup'ik communities of Igiugig, New Stuyahok, and Russian Mission or from outside Alaska.

3. Commercial Fisheries Entry Commission. n.d. "2013 Permit Fishing Activity by Year, State, Census Area, or City: Newhalen." Accessed January 2015. http://www.cfec.state.ak.us/gpbycen/2013/164300.htm#footn3

4. An estimated 1% of the total individual sockeye salmon harvest in 2008 were caught using rod and reel (Fall et al. 2010:66).

Table 2-14.–Population estimates, Newhalen, 2010, 2012, and 2013.

	Census (2010)	5-Year American Community Survey (2008–2012)	This study (2012)	This study (2013)
Total population				
Households	50.0	55.0	48.0	44.0
Population	190.0	230.0	179.3	138.7
Alaska Native				
Population	175.0	183.0	159.5	118.7
Percentage	92.1%	79.6%	89.0%	85.6%

Sources U.S. Census Bureau (2011) for 2010 estimate; U.S. Census Bureau (2013) for 5-year survey estimate; and ADF&G Division of Subsistence household surveys, 2013, for 2012 estimate and 2014, for 2013 estimate.

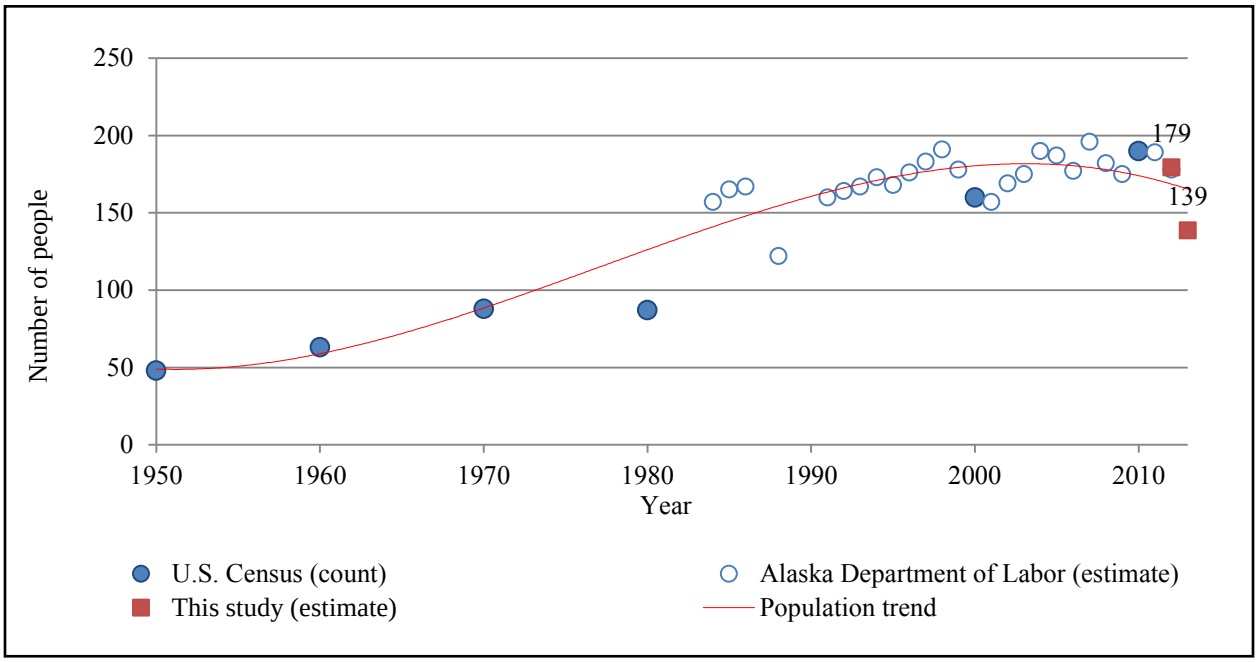


Figure 2-6.–Historical population estimates, Newhalen, 1950–2013.

Table 2-15.–Demographic characteristics, Newhalen, 2012 and 2013.

Characteristics	Newhalen 2012	Newhalen 2013
Household size		
Mean	3.7	3.0
Minimum	1	1
Maximum	8	7
Age		
Mean	27.9	31.0
Minimum[a]	0	0
Maximum	75	85
Median	25	26
Length of residency		
Total population		
Mean	20.1	22.2
Minimum[a]	0	0
Maximum	76	86
Heads of household		
Mean	29.7	29.7
Minimum[a]	0	0
Maximum	71	86
Alaska Native households[b]		
Number	43.8	37.3
Percentage	91.2%	84.8%

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.

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.

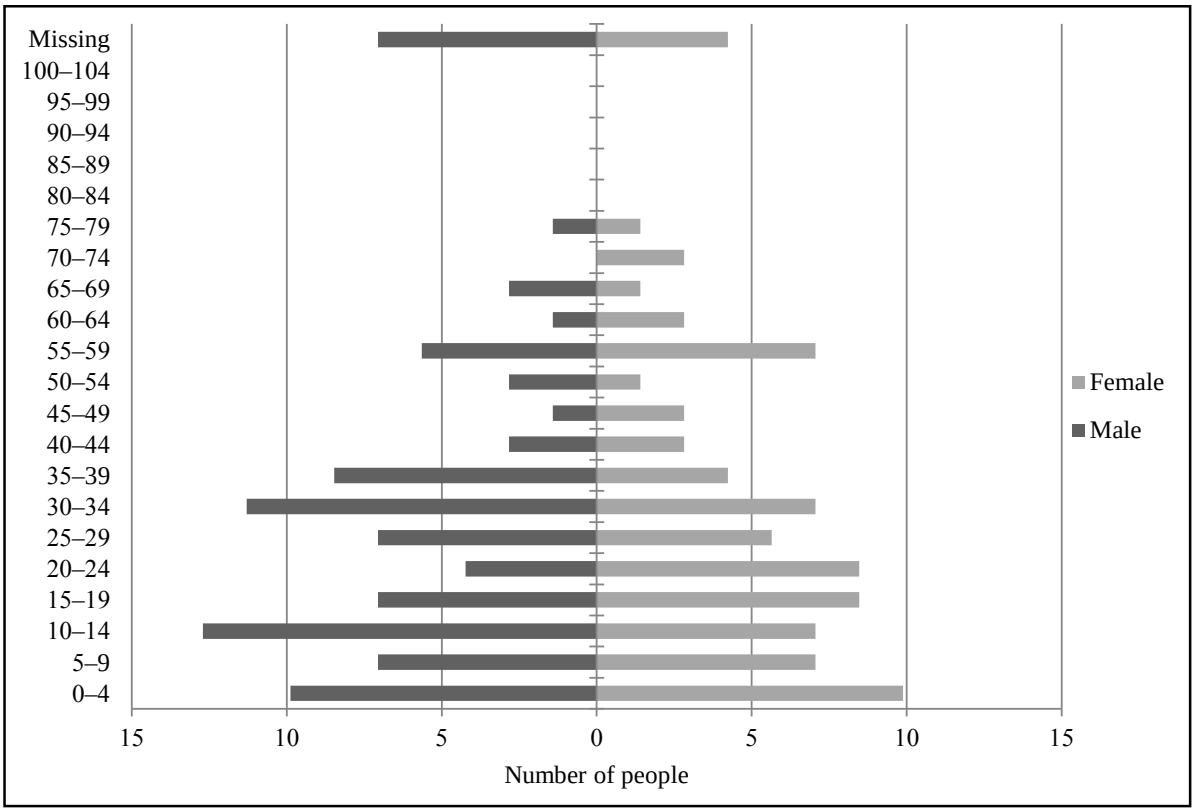


Figure 2-7.–Population profile, Newhalen, 2012.

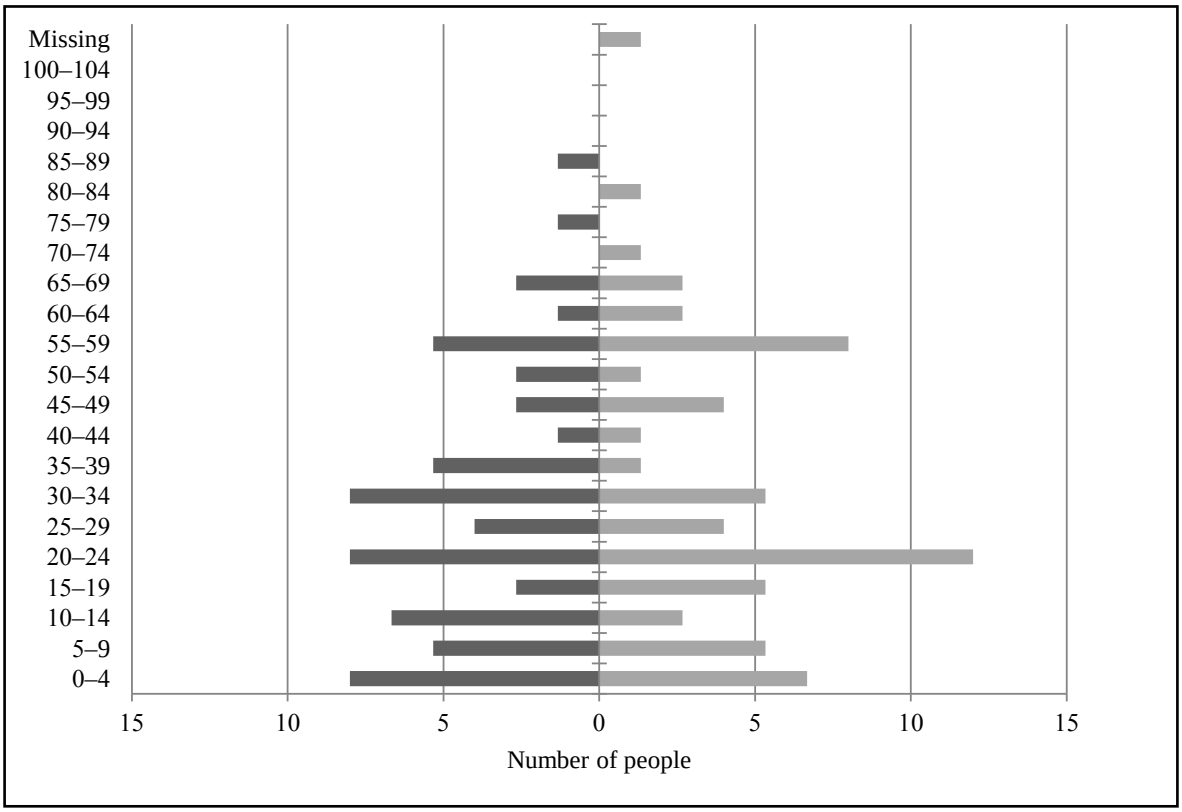


Figure 2-8.–Population profile, Newhalen, 2013.

Table 2-16.–Sample achievement, Newhalen, 2012 and 2013.

	2012	2013
Number of dwelling units	48	44
Interview goal	48	44
Households interviewed	34	33
Households failed to contact	10	6
Households declined to be interviewed	4	5
Households moved or nonresident	0	0
Total households attempted to interview	38	44
Refusal rate	10.5%	13.2%
Final estimate of permanent households	48	44
Percentage of total households interviewed	70.8%	75.0%
Interview weighting factor	1.4	1.3
Sampled population	127	104
Estimated population	179.3	138.7

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.

Table 2-17.–Population profile, Newhalen, 2012.

	Male			Female			Total		
Age	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage
0–4	9.9	10.6%	10.6%	9.9	11.7%	11.7%	19.8	11.1%	11.1%
5–9	7.1	7.6%	18.2%	7.1	8.3%	20.0%	14.1	7.9%	19.0%
10–14	12.7	13.6%	31.8%	7.1	8.3%	28.3%	19.8	11.1%	30.2%
15–19	7.1	7.6%	39.4%	8.5	10.0%	38.3%	15.5	8.7%	38.9%
20–24	4.2	4.5%	43.9%	8.5	10.0%	48.3%	12.7	7.1%	46.0%
25–29	7.1	7.6%	51.5%	5.6	6.7%	55.0%	12.7	7.1%	53.2%
30–34	11.3	12.1%	63.6%	7.1	8.3%	63.3%	18.4	10.3%	63.5%
35–39	8.5	9.1%	72.7%	4.2	5.0%	68.3%	12.7	7.1%	70.6%
40–44	2.8	3.0%	75.8%	2.8	3.3%	71.7%	5.6	3.2%	73.8%
45–49	1.4	1.5%	77.3%	2.8	3.3%	75.0%	4.2	2.4%	76.2%
50–54	2.8	3.0%	80.3%	1.4	1.7%	76.7%	4.2	2.4%	78.6%
55–59	5.6	6.1%	86.4%	7.1	8.3%	85.0%	12.7	7.1%	85.7%
60–64	1.4	1.5%	87.9%	2.8	3.3%	88.3%	4.2	2.4%	88.1%
65–69	2.8	3.0%	90.9%	1.4	1.7%	90.0%	4.2	2.4%	90.5%
70–74	0.0	0.0%	90.9%	2.8	3.3%	93.3%	2.8	1.6%	92.1%
75–79	1.4	1.5%	92.4%	1.4	1.7%	95.0%	2.8	1.6%	93.7%
80–84	0.0	0.0%	92.4%	0.0	0.0%	95.0%	0.0	0.0%	93.7%
85–89	0.0	0.0%	92.4%	0.0	0.0%	95.0%	0.0	0.0%	93.7%
90–94	0.0	0.0%	92.4%	0.0	0.0%	95.0%	0.0	0.0%	93.7%
95–99	0.0	0.0%	92.4%	0.0	0.0%	95.0%	0.0	0.0%	93.7%
100–104	0.0	0.0%	92.4%	0.0	0.0%	95.0%	0.0	0.0%	93.7%
Missing	7.1	7.6%	100.0%	4.2	5.0%	100.0%	11.3	6.3%	100.0%
Total	**93.2**	**100.0%**	**100.0%**	**84.7**	**100.0%**	**100.0%**	**177.9**	**100.0%**	**100.0%**

Source ADF&G Division of Subsistence household surveys, 2013.

Table 2-18.–Population profile, Newhalen, 2013.

	Male			Female			Total		
Age	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage
0–4	8.0	12.0%	12.0%	6.7	10.0%	10.0%	14.7	11.0%	11.0%
5–9	5.3	8.0%	20.0%	5.3	8.0%	18.0%	10.7	8.0%	19.0%
10–14	6.7	10.0%	30.0%	2.7	4.0%	22.0%	9.3	7.0%	26.0%
15–19	2.7	4.0%	34.0%	5.3	8.0%	30.0%	8.0	6.0%	32.0%
20–24	8.0	12.0%	46.0%	12.0	18.0%	48.0%	20.0	15.0%	47.0%
25–29	4.0	6.0%	52.0%	4.0	6.0%	54.0%	8.0	6.0%	53.0%
30–34	8.0	12.0%	64.0%	5.3	8.0%	62.0%	13.3	10.0%	63.0%
35–39	5.3	8.0%	72.0%	1.3	2.0%	64.0%	6.7	5.0%	68.0%
40–44	1.3	2.0%	74.0%	1.3	2.0%	66.0%	2.7	2.0%	70.0%
45–49	2.7	4.0%	78.0%	4.0	6.0%	72.0%	6.7	5.0%	75.0%
50–54	2.7	4.0%	82.0%	1.3	2.0%	74.0%	4.0	3.0%	78.0%
55–59	5.3	8.0%	90.0%	8.0	12.0%	86.0%	13.3	10.0%	88.0%
60–64	1.3	2.0%	92.0%	2.7	4.0%	90.0%	4.0	3.0%	91.0%
65–69	2.7	4.0%	96.0%	2.7	4.0%	94.0%	5.3	4.0%	95.0%
70–74	0.0	0.0%	96.0%	1.3	2.0%	96.0%	1.3	1.0%	96.0%
75–79	1.3	2.0%	98.0%	0.0	0.0%	96.0%	1.3	1.0%	97.0%
80–84	0.0	0.0%	98.0%	1.3	2.0%	98.0%	1.3	1.0%	98.0%
85–89	1.3	2.0%	100.0%	0.0	0.0%	98.0%	1.3	1.0%	99.0%
90–94	0.0	0.0%	100.0%	0.0	0.0%	98.0%	0.0	0.0%	99.0%
95–99	0.0	0.0%	100.0%	0.0	0.0%	98.0%	0.0	0.0%	99.0%
100–104	0.0	0.0%	100.0%	0.0	0.0%	98.0%	0.0	0.0%	99.0%
Missing	0.0	0.0%	100.0%	1.3	2.0%	100.0%	1.3	1.0%	100.0%
Total	**66.7**	**100.0%**	**100.0%**	**66.7**	**100.0%**	**100.0%**	**133.3**	**100.0%**	**100.0%**

Source ADF&G Division of Subsistence household surveys, 2014.

Table 2-19.–Birthplaces of household heads, Newhalen, 2012 and 2013.

	Percentage	
Birthplace	2012	2013
Anchorage	1.9%	1.9%
Chuathbaluk	1.9%	0.0%
Igiugig	5.6%	3.8%
Kokhanok	13.0%	5.8%
Koliganek	3.7%	7.7%
Levelock	1.9%	0.0%
New Stuyahok	3.7%	3.8%
Newhalen	37.0%	44.2%
Nondalton	1.9%	1.9%
Pedro Bay	0.0%	1.9%
Russian Mission	3.7%	3.8%
Saint Marys (Andreafsky)	0.0%	1.9%
Teller	1.9%	0.0%
Igushik	0.0%	1.9%
Kwigak	1.9%	0.0%
Other U.S.	0.0%	19.2%
Foreign	0.0%	1.9%
Outside Alaska	18.5%	0.0%
Missing	3.7%	0.0%

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.

Note "Birthplace" means the place of residence of the parents of the individual when the individual was born.

Table 2-20.–Birthplaces of population, Newhalen, 2012 and 2013.

Birthplace	Percentage 2012	Percentage 2013
Anchorage	3.9%	5.8%
Brevig Mission	0.8%	0.0%
Chuathbaluk	0.8%	0.0%
Dillingham	0.8%	1.0%
Igiugig	3.1%	1.9%
Kokhanok	8.7%	2.9%
Koliganek	2.4%	8.7%
Levelock	0.8%	0.0%
New Stuyahok	2.4%	1.9%
Newhalen	54.3%	56.7%
Nondalton	0.8%	1.0%
Pedro Bay	0.0%	1.0%
Russian Mission	1.6%	1.9%
Saint Marys (Andreafsky)	0.0%	1.0%
Teller	0.8%	0.0%
Toksook Bay	0.8%	0.0%
Igushik	0.0%	1.0%
Kwigak	0.8%	0.0%
Other U.S.	0.0%	10.6%
Foreign	0.0%	1.0%
Outside Alaska	11.0%	0.0%
Missing	5.5%	0.0%

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.
Note "Birthplace" means the place of residence of the parents of the individual when the individual was born.

NONDALTON

Nondalton (*Nundaltin,* or *Nuvendaltin*) is located on the western shore of Sixmile Lake (*Nundaltin Vena* in the local Dena'ina dialect), and is approximately 15 miles north of Iliamna in southwestern Alaska (Gaul 2007:62; Evanoff 2010:124). It is the most populous community included in this study. Residents of Nondalton benefit from the community's strategic location in proximity to Sixmile Lake, the upper Newhalen River that drains Sixmile Lake into Iliamna Lake, Lake Clark (*Qizhjeh Vena*), Little Lake Clark, the Tlikakila River, and the Chulitna River. Just across Sixmile Lake from the current community site, the Tazimina River drains into Sixmile Lake. These waterways and associated valleys provide a wide variety of habitats—including lakes, rivers, spruce–birch forests, and mountains, as well as open dry tundra—that host a number of fish and wildlife populations (Behnke 1982:5).

The people of Nondalton are primarily Dena'ina, a northern Athabascan group. Traditionally, the Dena'ina spoke 4 distinct language dialects that have boundaries that extend to the west, north, and east around the Cook Inlet Basin (Kari and Fall 2003). These language areas are designated the Inland, Upper Inlet, Outer Inland, and Iliamna dialect groups. The Dena'ina of Nondalton are part of the Inland grouping, along with the contemporary community of Lime Village.

Prior to Russian contact, Inland Dena'ina traded with Cook Inlet Dena'ina (Outer and Upper Inlet Dena'ina) (Kari and Fall 2003) and other cultural groups such as the Ahtna Athabascans of the Copper River, and the

Photo by Theodore M. Krieg, staff, ADF&G Division of Subsistence

Plate 2-4.–Nondalton residents harvest whitefishes with a net set under the ice on Sixmile Lake off the bank bordering their community, Nondalton, April 2013.

Yup'ik and Alutiiq of southwestern Alaska, Kodiak Island, and Prince William Sound (Ellanna and Balluta 1992:59). In 1778, Captain James Cook was the first documented European to explore the inlet that was later officially named in his honor. During his visit, Cook observed that the coastal Dena'ina were already in possession of trade beads and iron (Ellanna and Balluta 1992:58–60). Through relations with coastal groups, Inland Dena'ina were aware of Russian trade goods and presumably interacted with Russian fur traders when Russian settlements were established on Cook Inlet by the Lebedev-Lastochkin Company in 1787. Soon after, the Lebedev-Lastochkin Company moved inland and traded with groups on the shores of Iliamna Lake. In the following decades, Russian explorers and company employees were guided by some Dena'ina to explore inland regions along Iliamna Lake and the Mulchatna River—areas north of Bristol Bay (Ellanna and Balluta 1992:61).

After the United States purchased Alaska from Russia, Euro-American contact in the area was minimal, although the Russian Orthodox church maintained a presence (Ellanna and Balluta 1992:63). The Precious and Life-Giving Cross chapel was constructed at Kijik in 1889 (Balluta 2008). In 1891, John W. Clark of the Alaska Commercial Company and A. B. Schanz, a reporter and enumerator for the U.S. Eleventh Census, visited the area to gather economic information and census data (Ellanna and Balluta 1992:63). *Qizhjeh Vena*, meaning "a place where people gathered lake" in Dena'ina, was renamed Lake Clark after John W. Clark by Schanz in the same year (Branson 2012:75). In 1900, Hans Severson built a trading post at the site of present-day Iliamna, which renewed a trade presence in the area (Ellanna and Balluta 1992:63).

Commercial salmon fishing interests moved into the Bristol Bay area in the 1880s. The industry caused shortages of salmon in drainages that fed into Bristol Bay in the early 1900s. At the same time, participation in employment at salmon canneries in the area provided Dena'ina access to cash and trade goods (Ellanna and Balluta 1992:63–77). Likewise, mining-related activities started to affect Inland Dena'ina in the late 1800s and the first gold mining claim on Lake Clark was issued in 1911. Mining, commercial fishing, and commercial trading opportunities brought many non-Natives, mostly men, into the area and resulted in Inland Dena'ina women marrying non-Native men as early as 1906 in Kijik (Ellanna and Balluta 1992:77–79).

Kijik was an early Dena'ina community established in the late 1700s. It is located at the outlet of the Kijik River on the northwestern shore of Lake Clark approximately 31 miles northeast of the current location of Nondalton. Kijik was inhabited by the ancestors of Nondalton until shortly after the influenza epidemic of 1901–1902 when community members started to move to the site of Old Nondalton. By 1909, the last inhabitants had moved from Kijik (Ellanna and Balluta 1992:64). Old Nondalton was also located on the northwestern shore of Sixmile Lake, approximately 2 miles to the northeast of Nondalton. Due to the formation of a gravel bar in front of Old Nondalton that made landing boats at the site impossible (Branson 2014:121), and also depletion of firewood, the community was moved to present-day Nondalton. The current location of the community of Nondalton was established in the late 1930s (Ellanna and Balluta 1992:80). There is a graveyard at Old Nondalton and the remains of several log cabins. During the last few years prior to the study culture camps have been held at the site.

The local government in Nondalton comprises 2 entities: municipal and tribal. Nondalton was incorporated as a city in 1971 under state law and has a 7-member city council and a mayor. Nondalton Village is a federally recognized tribe and is governed by the 7-member Nondalton Tribal Council (NTC). The municipal government is responsible for the physical operation of the city, such as sewer and water purification utilities, as well as the local fire department and the distribution of home heating fuel. NTC is primarily responsible for environmental and social programs, in addition to housing and roads.

The Kijik Corporation is the for-profit village corporation of which many Nondalton residents are shareholders. Many Nondalton residents are also shareholders in the regional Bristol Bay Native Corporation. Native allotments for Nondalton residents include some 89,954 acres—most are located along the shores of Lake Clark (Gaul 2007:64). There are 2 lodges owned by non-Native local residents in the community. Another small store selling soda and snacks is operated by the student council at the school. At the time of the community review meeting for preliminary study results in early October 2014, a store selling groceries was open to serve residents. Local people rely on groceries and supplies that are shipped into the community by plane to complement subsistence harvests of fish, game, and vegetation. The community also has a medical clinic. Nondalton is located in the Lake and Peninsula Borough and its people are served by the Lake and Peninsula School District. The school in Nondalton educates schoolchildren from kindergarten through grade 12. The city manages mail delivery and internet connections. Many of the residents have internet connections in their homes and additional service is available primarily at the school and in tribal council buildings.

Many residents of Nondalton share familial, cultural, and religious ties to other villages in the area. Residents of Nondalton also travel throughout the region (including around Lake Clark and Iliamna Lake) to fish for nonsalmon fish and practice other subsistence harvest activities. Cultural ties are strongest with other Athabascan communities such as Lime Village and Stony River. Religious ties between some Nondalton residents exist with neighboring community residents due to practicing and the sharing of the Russian Orthodox faith. The people of Nondalton are also connected to other communities through the regional transportation hub Iliamna (Behnke 1982:12). Additionally, a road was started to connect Nondalton to Iliamna and, by extension, Newhalen, but remained unfinished at the time fieldwork occurred. The road was approved in the 2002 Southwest Alaska Transportation Plan, but a legal decision required the Alaska Department of Transportation and Public Facilities to halt work on the Iliamna–Nondalton road and bridge spanning the Newhalen River (PB Consult, Inc. 2004). There is no bridge linking the partially paved roads leading from both Nondalton and Iliamna. As such, during fieldwork in winter 2014, research staff traveled

by pickup truck from Nondalton to Newhalen using the partially finished roads and crossed the Newhalen River over the ice. Method of travel between Nondalton and Iliamna or Newhalen varies depending on the time of year; when the river is ice-free Nondalton residents use a boat or plane to travel to neighboring communities.

Local participation in seasonal firefighting employment for the National Park Service or the Bureau of Land Management has provided some local residents with the opportunity to travel out of the community (Behnke 1982:15); during the recent survey effort, study participants talked about firefighting as a source of pride and a shared multi-generational profession. Participants have the opportunity to forge connections with people and communities they meet while firefighting across the state. Internet access and cellular phone service allow Nondalton's population to maintain global links with friends and family in the state of Alaska and beyond.

Population Estimates and Demographic Information

Household surveys conducted for this study estimate Nondalton's population was approximately 177 people in 2012 and 198 in 2013 (Table 2-21). These estimates are slightly higher than the federal census of 164 people in 2010 and less than the American Community Survey 5-year (2008–2012) average of 208 people. The rise in population between study years may be explained by the movement of 5 households into the community in 2013.

The majority of the population of Nondalton self-identifies as Alaska Native. For both study years, it was estimated approximately 90% of the community was Alaska Native. Figure 2-9 depicts population estimates as well as the population trend for Nondalton. This figure suggests a gradual decline in population during the past 10 years.

Surveys conducted by Division of Subsistence staff in Nondalton estimated approximately 56 year-round households in Nondalton in 2012 and 64 in 2013 (Table 2-22). Thirty-eight, or 68%, of households were interviewed during the first year of the study and 45, or 74%, of households were interviewed during the second year of the study. The mean length of residency in Nondalton was approximately 26 years for both study years (Table 2-23).

Approximately two-thirds of the residents of Nondalton reported being born to parents living in Nondalton (Table 2-24). Many residents born outside of Nondalton were from neighboring communities around Iliamna Lake and Lake Clark. Between 8% and 11% of Nondalton's population was born outside of Alaska. A very small percentage of Nondalton's population was born outside of the U.S. The same patterns generally hold for household heads (Table 2-25). The majority of household heads during both study years were born in Nondalton: 60% in 2012 and 53% in 2013. The percentage of household heads born outside of Alaska was slightly higher than the general population with 14% in 2012 and 18% in 2013 born outside of the state. The mean household size was 3 people in both study years (Table 2-23). The largest household in Nondalton was composed of 7 people.

Nondalton's population is not as young as some of the other communities covered by this study. The largest population group of males in Nondalton during 2012 was between the ages of 50 and 54 (21% of the male population) (Table 2-26; Figure 2-10). During the same year, 11% of females were between 60 and 64 years old. The largest population group of males during 2013 was aged 20–24 (16% of males) (Table 2-27; Figure 2-11). The largest age cohort of the female population during 2013 was aged 5–9 (15% of the female population).

Table 2-21.–Population estimates, Nondalton, 2010, 2012, and 2013.

	Census (2010)	5-Year American Community Survey (2008–2012)	This study (2012)	This study (2013)
Total population				
Households	57.0	53.0	56.0	61.0
Population	164.0	208.0	176.8	197.9
Alaska Native				
Population	137.0	154.0	165.1	174.9
Percentage	83.5%	74.0%	93.3%	88.4%

Sources U.S. Census Bureau (2011) for 2010 estimate; U.S. Census Bureau (2013) for 5-year survey estimate; and ADF&G Division of Subsistence household surveys, 2013, for 2012 estimate and 2014, for 2013 estimate.

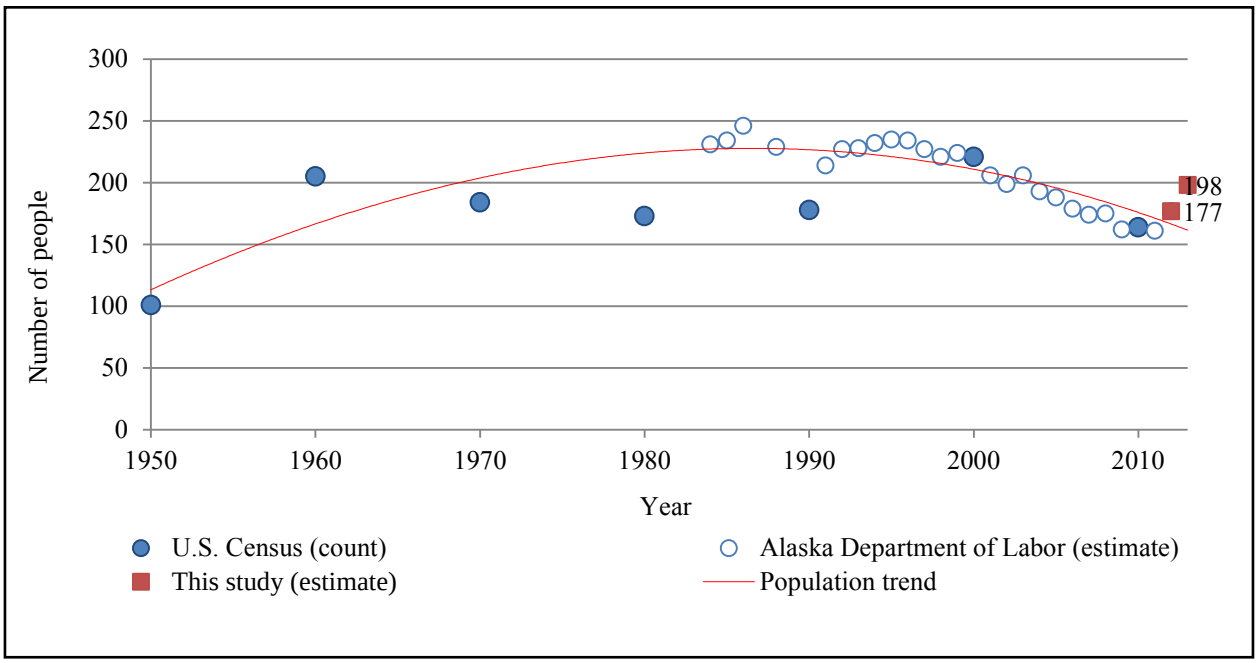


Figure 2-9.–Historical population estimates, Nondalton, 1950–2013.

Table 2-22.–Sample achievement, Nondalton, 2012 and 2013.

	2012	2013
Number of dwelling units	56	64
Interview goal	56	64
Households interviewed	38	45
Households failed to contact	8	16
Households declined to be interviewed	10	0
Households moved or nonresident	0	0
Total households attempted to interview	48	64
Refusal rate	20.8%	0.0%
Final estimate of permanent households	56	61
Percentage of total households interviewed	67.9%	73.8%
Interview weighting factor	1.5	1.4
Sampled population	120	146
Estimated population	176.8	197.9

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.

Table 2-23.–Demographic characteristics, Nondalton, 2012 and 2013.

	Nondalton	
Characteristics	2012	2013
Household size		
Mean	3.2	3.2
Minimum	1	1
Maximum	7	7
Age		
Mean	34.1	32.4
Minimum[a]	0	0
Maximum	90	96
Median	30	27
Length of residency		
Total population		
Mean	27.4	25.8
Minimum[a]	0	1
Maximum	91	91
Heads of household		
Mean	36.3	33.4
Minimum[a]	1	1
Maximum	91	91
Alaska Native households[b]		
Number	53.1	51.5
Percentage	94.7%	84.4%

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.

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.

Table 2-24.–Birthplaces of population, Nondalton, 2012 and 2013.

Birthplace	Percentage 2012	Percentage 2013
Anchorage	5.8%	6.8%
Dillingham	0.0%	1.4%
Ekwok	0.0%	0.7%
Fairbanks	0.8%	0.7%
Kenai	0.0%	0.7%
Kokhanok	0.8%	0.7%
Lime Village	1.7%	1.4%
Naknek	0.8%	0.0%
Nenana	0.8%	0.7%
New Stuyahok	0.8%	0.7%
Newhalen	0.8%	1.4%
Nondalton	74.2%	65.8%
Pedro Bay	2.5%	0.7%
Perryville	0.8%	0.0%
Sitka	0.0%	0.7%
Soldotna	0.0%	1.4%
South Naknek	0.0%	0.7%
Stony River	0.0%	0.7%
Telida	0.8%	0.7%
Wasilla	0.0%	0.7%
Kijik	0.8%	0.0%
Eagle Bay	0.0%	0.7%
Upper Talarik	0.8%	0.0%
Mulchatna/Tikchik River	0.0%	0.7%
Old Iliamna	0.0%	0.7%
Other U.S.	5.0%	9.6%
Foreign	0.0%	0.7%
Outside Alaska	2.5%	0.0%

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.
Note "Birthplace" means the place of residence of the parents of the individual when the individual was born.

Table 2-25.–Birthplaces of household heads, Nondalton, 2012 and 2013.

Birthplace	Percentage 2012	Percentage 2013
Anchorage	3.2%	4.1%
Dillingham	0.0%	1.4%
Ekwok	0.0%	1.4%
Fairbanks	1.6%	1.4%
Kokhanok	1.6%	1.4%
Lime Village	3.2%	1.4%
Naknek	1.6%	0.0%
Nenana	1.6%	1.4%
New Stuyahok	1.6%	1.4%
Newhalen	1.6%	2.7%
Nondalton	60.3%	52.7%
Pedro Bay	4.8%	1.4%
Sitka	0.0%	1.4%
South Naknek	0.0%	1.4%
Stony River	0.0%	1.4%
Telida	1.6%	1.4%
Wasilla	0.0%	1.4%
Kijik	1.6%	0.0%
Eagle Bay	0.0%	1.4%
Upper Talarik	1.6%	0.0%
Mulchatna/Tikchik River	0.0%	1.4%
Old Iliamna	0.0%	1.4%
Other U.S.	9.5%	17.6%
Foreign	0.0%	1.4%
Outside Alaska	4.8%	0.0%

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.

Note "Birthplace" means the place of residence of the parents of the individual when the individual was born.

Table 2-26.–Population profile, Nondalton, 2012.

	Male			Female			Total		
Age	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage
0–4	4.4	5.3%	5.3%	7.4	7.9%	7.9%	11.8	6.7%	6.7%
5–9	5.9	7.0%	12.3%	11.8	12.7%	20.6%	17.7	10.0%	16.7%
10–14	5.9	7.0%	19.3%	10.3	11.1%	31.7%	16.2	9.2%	25.8%
15–19	2.9	3.5%	22.8%	5.9	6.3%	38.1%	8.8	5.0%	30.8%
20–24	7.4	8.8%	31.6%	5.9	6.3%	44.4%	13.3	7.5%	38.3%
25–29	8.8	10.5%	42.1%	8.8	9.5%	54.0%	17.7	10.0%	48.3%
30–34	5.9	7.0%	49.1%	7.4	7.9%	61.9%	13.3	7.5%	55.8%
35–39	2.9	3.5%	52.6%	2.9	3.2%	65.1%	5.9	3.3%	59.2%
40–44	1.5	1.8%	54.4%	4.4	4.8%	69.8%	5.9	3.3%	62.5%
45–49	0.0	0.0%	54.4%	4.4	4.8%	74.6%	4.4	2.5%	65.0%
50–54	17.7	21.1%	75.4%	4.4	4.8%	79.4%	22.1	12.5%	77.5%
55–59	10.3	12.3%	87.7%	4.4	4.8%	84.1%	14.7	8.3%	85.8%
60–64	4.4	5.3%	93.0%	10.3	11.1%	95.2%	14.7	8.3%	94.2%
65–69	2.9	3.5%	96.5%	0.0	0.0%	95.2%	2.9	1.7%	95.8%
70–74	0.0	0.0%	96.5%	1.5	1.6%	96.8%	1.5	0.8%	96.7%
75–79	0.0	0.0%	96.5%	1.5	1.6%	98.4%	1.5	0.8%	97.5%
80–84	1.5	1.8%	98.2%	1.5	1.6%	100.0%	2.9	1.7%	99.2%
85–89	0.0	0.0%	98.2%	0.0	0.0%	100.0%	0.0	0.0%	99.2%
90–94	1.5	1.8%	100.0%	0.0	0.0%	100.0%	1.5	0.8%	100.0%
95–99	0.0	0.0%	100.0%	0.0	0.0%	100.0%	0.0	0.0%	100.0%
100–104	0.0	0.0%	100.0%	0.0	0.0%	100.0%	0.0	0.0%	100.0%
Missing	0.0	0.0%	100.0%	0.0	0.0%	100.0%	0.0	0.0%	100.0%
Total	**84.0**	**100.0%**	**100.0%**	**92.8**	**100.0%**	**100.0%**	**176.8**	**100.0%**	**100.0%**

Source ADF&G Division of Subsistence household surveys, 2013.

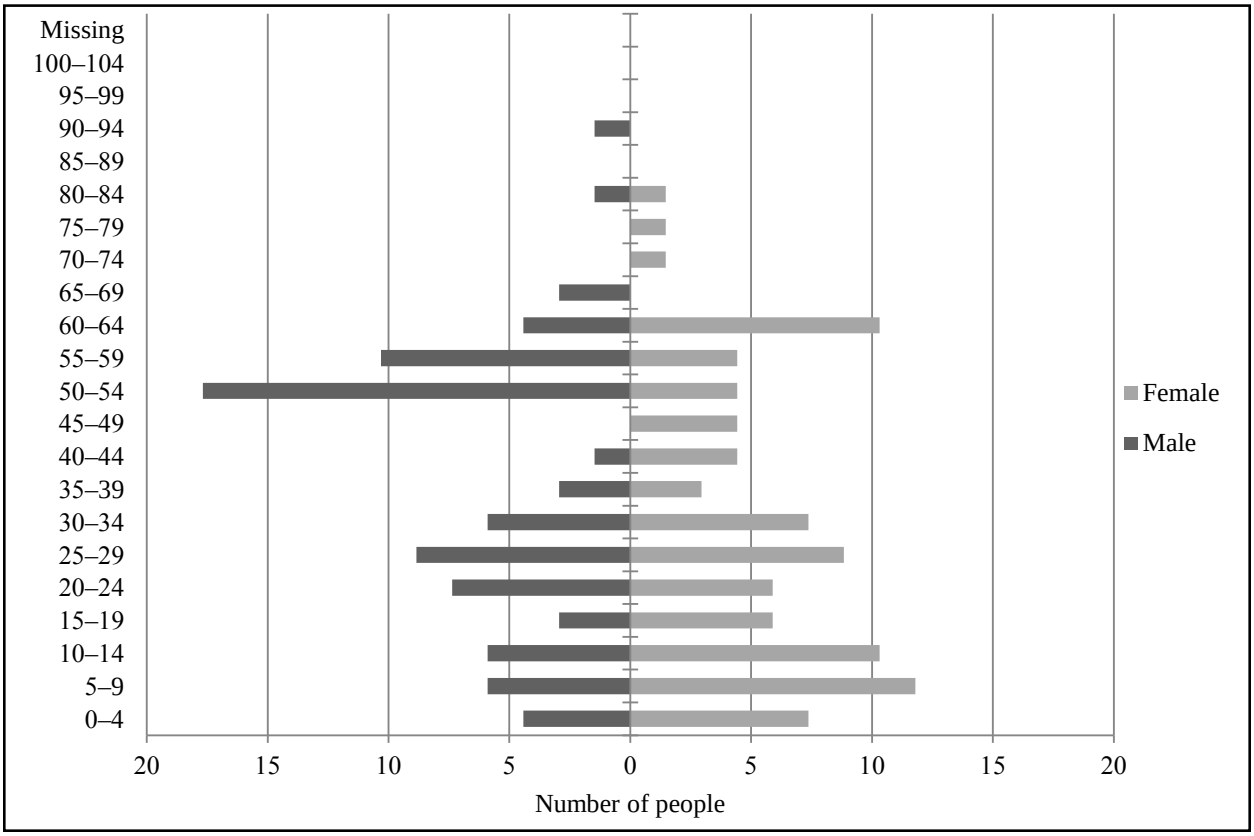


Figure 2-10.–Population profile, Nondalton, 2012.

Table 2-27.–Population profile, Nondalton, 2013.

	Male			Female			Total		
Age	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage
0–4	4.1	4.4%	4.4%	6.8	6.6%	6.6%	10.8	5.6%	5.6%
5–9	4.1	4.4%	8.8%	14.9	14.5%	21.1%	19.0	9.7%	15.3%
10–14	6.8	7.4%	16.2%	9.5	9.2%	30.3%	16.3	8.3%	23.6%
15–19	6.8	7.4%	23.5%	8.1	7.9%	38.2%	14.9	7.6%	31.3%
20–24	14.9	16.2%	39.7%	10.8	10.5%	48.7%	25.8	13.2%	44.4%
25–29	10.8	11.8%	51.5%	9.5	9.2%	57.9%	20.3	10.4%	54.9%
30–34	5.4	5.9%	57.4%	6.8	6.6%	64.5%	12.2	6.3%	61.1%
35–39	1.4	1.5%	58.8%	5.4	5.3%	69.7%	6.8	3.5%	64.6%
40–44	1.4	1.5%	60.3%	2.7	2.6%	72.4%	4.1	2.1%	66.7%
45–49	6.8	7.4%	67.6%	2.7	2.6%	75.0%	9.5	4.9%	71.5%
50–54	13.6	14.7%	82.4%	5.4	5.3%	80.3%	19.0	9.7%	81.3%
55–59	8.1	8.8%	91.2%	6.8	6.6%	86.8%	14.9	7.6%	88.9%
60–64	2.7	2.9%	94.1%	8.1	7.9%	94.7%	10.8	5.6%	94.4%
65–69	2.7	2.9%	97.1%	0.0	0.0%	94.7%	2.7	1.4%	95.8%
70–74	0.0	0.0%	97.1%	1.4	1.3%	96.1%	1.4	0.7%	96.5%
75–79	0.0	0.0%	97.1%	1.4	1.3%	97.4%	1.4	0.7%	97.2%
80–84	1.4	1.5%	98.5%	1.4	1.3%	98.7%	2.7	1.4%	98.6%
85–89	0.0	0.0%	98.5%	0.0	0.0%	98.7%	0.0	0.0%	98.6%
90–94	1.4	1.5%	100.0%	0.0	0.0%	98.7%	1.4	0.7%	99.3%
95–99	0.0	0.0%	100.0%	1.4	1.3%	100.0%	1.4	0.7%	100.0%
100–104	0.0	0.0%	100.0%	0.0	0.0%	100.0%	0.0	0.0%	100.0%
Missing	0.0	0.0%	100.0%	0.0	0.0%	100.0%	0.0	0.0%	100.0%
Total	**92.2**	**100.0%**	**100.0%**	**103.0**	**100.0%**	**100.0%**	**195.2**	**100.0%**	**100.0%**

Source ADF&G Division of Subsistence household surveys, 2014.

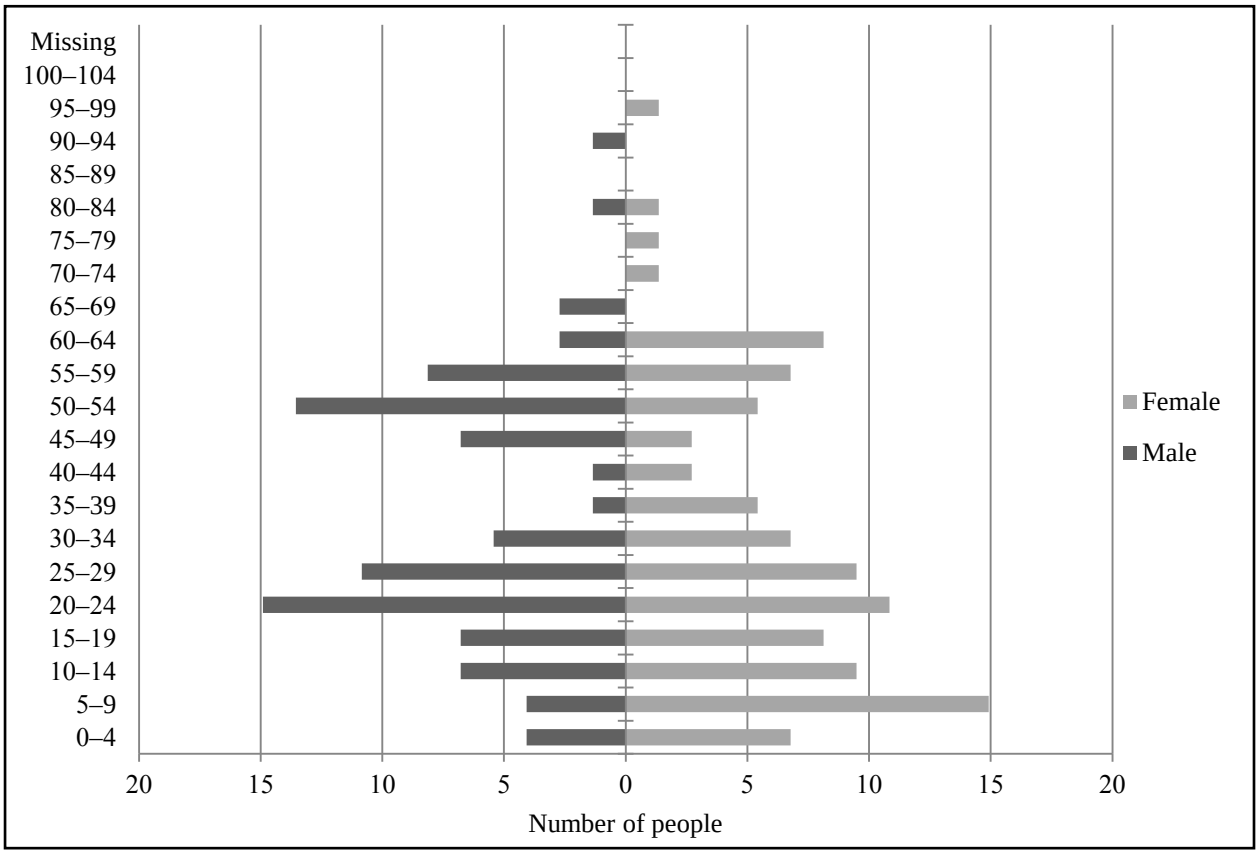


Figure 2-11.–Population profile, Nondalton, 2013.

Photo by Yoko Kugo, intern, ADF&G Division of Subsistence

Plate 2-5.–View of Pedro Bay while ice fishing, Pedro Bay, March 2013.

Pedro Bay

Pedro Bay (*Hduvunu Vena*) is located on the northeast shore of Iliamna Lake. It is approximately 176 air miles southwest of Anchorage. The community sits on a small peninsula that juts out into the lake, with Pedro Bay to its south and Knutson Bay to its north. There is also a series of islands off the town's coast, providing a unique ecology for the lake that includes a large year-round habitat for freshwater seals. The northeastern side of the community is adjacent to parts of the Aleutian Range. The western skyline is dominated by Pedro Mountain.

Ecologically, Pedro Bay lies in a transitional climatic zone. The landscape is a scenic decoration of birch, cottonwood, alder, willow, and white spruce trees. The climate is influenced both by marine and continental climate zones. Climate classifications identify the transition zone as a maritime subarctic climate (McVehil-Monnett Associates, Inc. 2006). This climate exhibits moderate winds, moderate or high humidity, heavy fog, and average temperatures between 20 °F to 64 °F with strong maritime influences. Pedro Bay's climate falls closely within these parameters. Average summer temperatures range from 42 °F to 62 °F with 26 inches of rainfall and winter temperatures range from 6 °F to 30 °F with 64 inches of snowfall.[5]

Various factors and events, including disease, Russian occupation and commercial fur trading, mining interests, missionary schools, and commercial salmon fishing, reorganized communities in eastern Iliamna Lake, which led to the relocation and concentration of people into certain areas. The community of Pedro Bay is representative of this type of reorganization, with people moving from and to the community from nearby Old Iliamna. Old Iliamna is situated approximately 300 yards from modern-day Pedro Bay (Townsend 1970). Sitting at the head of the trading road, Old Iliamna acted as a main trading post for those crossing over the Iliamna portage, both before and after the arrival of Euro-Americans. By the late 1800s, Old Iliamna was one of the most accessible non-Native settlements first established in the region. In 1903, the first store was opened. The following year another store opened in the community, and a school was

5. 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 August 2014. http://commerce.state.ak.us/cra/DCRAExternal/community/Details/783cae27-a2c6-4965-8fb0-64c858305d5b

founded in 1908 (Townsend 1965; Gaul 2007). The build-up of goods and services in Old Iliamna attracted people from all over Iliamna Lake, including from nearby communities Pedro Bay and Pile Bay. By 1906, the once-concentrated community of Pedro Bay had only 1 remaining resident, Old Pedro (Pedtrushko), after whom the current community was named (Atwater 2014). Old Iliamna was abandoned due to the same pressures that depleted Pedro Bay—mainly, the concentration of goods and services moved out of the area and into nearby locations. Completed road construction in 1937 extended the Iliamna portage to Pile Bay, negating the need to traverse the Iliamna River. This served to focus goods and services away from Old Iliamna, and many of the households relocated to Pile Bay, Pedro Bay, and Iliamna (present-day location). By the 1940s the last households in Old Iliamna moved out (Atwater 2014). At that time, the siltation of Iliamna River made it difficult to fish, which pushed people out of the community and back into Pedro Bay (Townsend 1965:68). Most of the families that live in Pedro Bay today have relatives who lived in Old Iliamna or previously lived there themselves.

As its past indicates, today Pedro Bay comprises mainly people who identify as Dena'ina. Pedro Bay currently has 2 stores that people operate from their houses that provide some nonperishable items. The Pedro Bay school closed in 2012 when enrollment dropped to fewer than 10 students, which is the minimum amount of students required for a school to receive state operational funding (AS 14.17.905).[6] Students who live in the community today either participate in the Lake and Peninsula School District homeschool program or live in other communities (such as Anchorage) during the school year. Year-round economic opportunities are scarce in Pedro Bay. Many people work seasonally during the summer in the tourism industry or in the Bristol Bay fishery. High costs of living and the draw of full-time employment outside the community have made it difficult for residents to remain in the community year-round. People depend on subsistence in Pedro Bay; not just for food security but as a way of life.

Population Estimates and Demographic Information

The population of Pedro Bay fluctuated by approximately 5 people between the 2012 and 2013 study years (Table 2-28). The 2012 study estimated 13 households with a population of 29 people. In the 2013 study year, the population grew to 34 people and 14 households. This increase was the result of community members returning to Pedro Bay as full-time residents. People fluctuating between full-time and seasonal residency could also be the cause for the population and household estimate variations between this study and the U.S. Census Bureau data for 2010. The year-round population of Pedro Bay has been on the decline since the 1970s (Figure 2-12). Population estimates from the 1990s seem to show a relatively stable trend. However, these estimates do not reflect the reality of an overall decline in permanent residency.[7] In a previous study, community members identified lack of access to funding, lack of infrastructure, and the high cost of living as factors that make it difficult for residents to obtain full-time employment within the community.[8]

One hundred percent of households were interviewed in 2012 and approximately 79% of households in 2013 (Table 2-29). The majority of the population identified as Alaska Native in 2012 (93%) and in 2013 (90%) (Table 2-28). Households had on average 2.2 people in 2012; average household size rose to 2.5 people in 2013 (Table 2-30). The average age for Pedro Bay residents in 2012 was 37. The minimum age was an infant younger than 1 and the maximum age was 80. In 2013, the average age of residents was 42, with the oldest resident being 84 and the youngest being 18. The distribution of men and women was almost equal in both years with men outnumbering women by 1 individual for both years (Table 2-31; Table 2-32). No children or youth under the age of 15 resided in Pedro Bay in 2013. For 2013, most of the population (74%) derived from cohorts spanning ages 15–34 (48% of the population) and the single cohort of 50–54

6. Alex DeMarban, "Dwindling Students Mean Four More Rural Alaska Schools Will Close," *Anchorage Daily News*, June 5, 2012. http://www.adn.com/article/dwindling-students-mean-four-more-rural-alaska-schools-will-close

7. Lake and Peninsula Borough. n.d. "Lake and Peninsula Borough Comprehensive Plan: Pedro Bay Community Action Plan." Page 1. Accessed August 2014. http://www.lakeandpen.com/vertical/sites/%7B0B64B15E-4D75-4DD6-ACBB-14563D943AB9%7D/uploads/PedroBay_CommunityPlan_9-17-12.pdf

8. Bristol Bay Regional Vision. 2011. "Pedro Bay Round II Consensor Results." Question 18. Accessed August 2014. http://www.bristolbayvision.org/downloads/

Table 2-28.–Population estimates, Pedro Bay, 2010, 2012, and 2013.

	Census (2010)	5-Year American Community Survey (2008–2012)	This study (2012)	This study (2013)
Total population				
Households	19.0	15.0	13.0	14.0
Population	42.0	26.0	29.0	34.4
Alaska Native				
Population	30.0	16.0	27.0	30.5
Percentage	71.4%	61.5%	93.1%	88.9%

Sources U.S. Census Bureau (2011) for 2010 estimate; U.S. Census Bureau (2013) for 5-year survey estimate; and ADF&G Division of Subsistence household surveys, 2013, for 2012 estimate and 2014, for 2013 estimate.

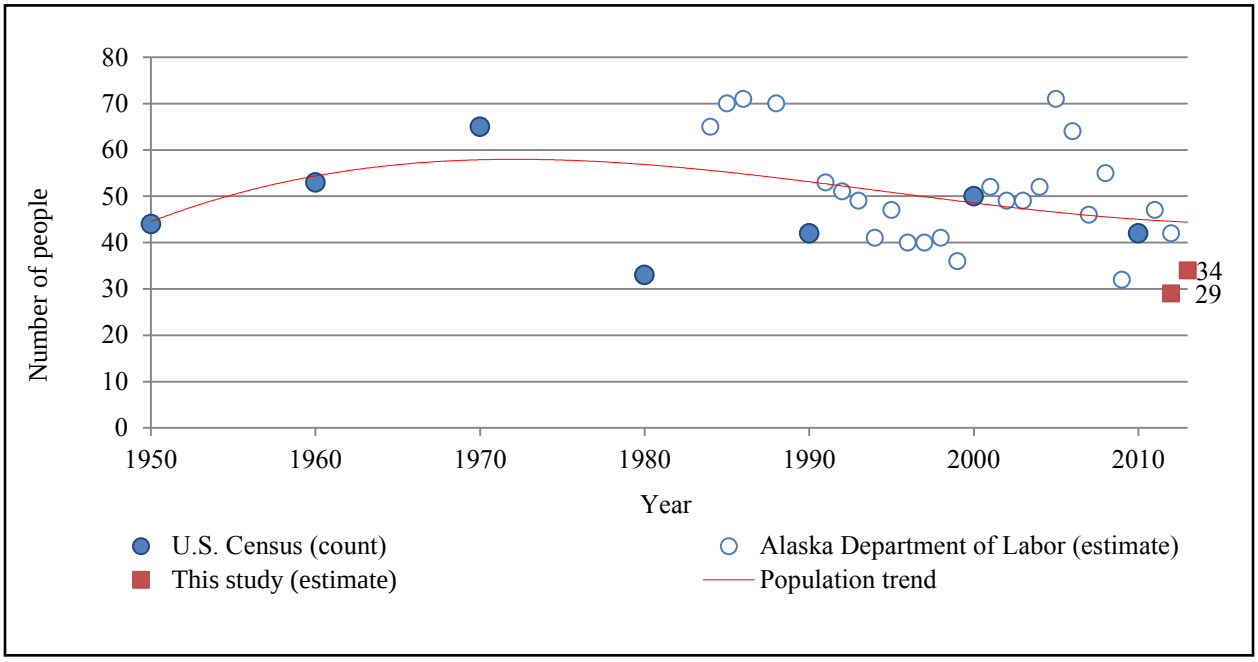


Figure 2-12.–Historical population estimates, Pedro Bay, 1950–2013.

(26% of the population) (Figure 2-13; Figure 2-14). The average length of residency in the community was 23 years in 2012 and 29 years in 2013 (Table 2-30).

The birthplace of the most heads of households and the overall population was Pedro Bay for both years (39% in 2012 and 44% in 2013 for household heads and 55% in 2012 and 48% in 2013 for the population) (Table 2-33). Notably, 11% of household heads in 2012 and 19% in 2013 originated in U.S. states outside of Alaska (rather than other Alaska communities).

Table 2-29.–Sample achievement, Pedro Bay, 2012 and 2013.

	2012	2013
Number of dwelling units	13	14
Interview goal	13	14
Households interviewed	13	11
Households failed to contact	0	2
Households declined to be interviewed	0	0
Households moved or nonresident	0	0
Total households attempted to interview	13	12
Refusal rate	0.0%	0.0%
Final estimate of permanent households	13	14
Percentage of total households interviewed	100.0%	78.6%
Interview weighting factor	1.0	1.3
Sampled population	29	27
Estimated population	29.0	34.4

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.

Table 2-30.–Demographic characteristics, Pedro Bay, 2012 and 2013.

	Pedro Bay	
Characteristics	2012	2013
Household size		
Mean	2.2	2.5
Minimum	1	1
Maximum	5	6
Age		
Mean	37.2	41.5
Minimum[a]	0	18
Maximum	80	84
Median	34	33
Length of residency		
Total population		
Mean	22.9	28.7
Minimum[a]	1	1
Maximum	80	82
Heads of household		
Mean	28.5	33.4
Minimum[a]	1	1
Maximum	80	82
Alaska Native households[b]		
Number	12.0	12.7
Percentage	92.3%	90.9%

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.

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.

Table 2-31.–Population profile, Pedro Bay, 2012.

	Male			Female			Total		
Age	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage
0–4	1.0	6.7%	6.7%	0.0	0.0%	0.0%	1.0	3.4%	3.4%
5–9	1.0	6.7%	13.3%	0.0	0.0%	0.0%	1.0	3.4%	6.9%
10–14	1.0	6.7%	20.0%	1.0	7.1%	7.1%	2.0	6.9%	13.8%
15–19	0.0	0.0%	20.0%	2.0	14.3%	21.4%	2.0	6.9%	20.7%
20–24	1.0	6.7%	26.7%	2.0	14.3%	35.7%	3.0	10.3%	31.0%
25–29	1.0	6.7%	33.3%	2.0	14.3%	50.0%	3.0	10.3%	41.4%
30–34	2.0	13.3%	46.7%	0.0	0.0%	50.0%	2.0	6.9%	48.3%
35–39	0.0	0.0%	46.7%	1.0	7.1%	57.1%	1.0	3.4%	51.7%
40–44	0.0	0.0%	46.7%	0.0	0.0%	57.1%	0.0	0.0%	51.7%
45–49	2.0	13.3%	60.0%	0.0	0.0%	57.1%	2.0	6.9%	58.6%
50–54	2.0	13.3%	73.3%	5.0	35.7%	92.9%	7.0	24.1%	82.8%
55–59	0.0	0.0%	73.3%	0.0	0.0%	92.9%	0.0	0.0%	82.8%
60–64	2.0	13.3%	86.7%	0.0	0.0%	92.9%	2.0	6.9%	89.7%
65–69	1.0	6.7%	93.3%	0.0	0.0%	92.9%	1.0	3.4%	93.1%
70–74	0.0	0.0%	93.3%	0.0	0.0%	92.9%	0.0	0.0%	93.1%
75–79	0.0	0.0%	93.3%	0.0	0.0%	92.9%	0.0	0.0%	93.1%
80–84	1.0	6.7%	100.0%	0.0	0.0%	92.9%	1.0	3.4%	96.6%
85–89	0.0	0.0%	100.0%	0.0	0.0%	92.9%	0.0	0.0%	96.6%
90–94	0.0	0.0%	100.0%	0.0	0.0%	92.9%	0.0	0.0%	96.6%
95–99	0.0	0.0%	100.0%	0.0	0.0%	92.9%	0.0	0.0%	96.6%
100–104	0.0	0.0%	100.0%	0.0	0.0%	92.9%	0.0	0.0%	96.6%
Missing	0.0	0.0%	100.0%	1.0	7.1%	100.0%	1.0	3.4%	100.0%
Total	**15.0**	**100.0%**	**100.0%**	**14.0**	**100.0%**	**100.0%**	**29.0**	**100.0%**	**100.0%**

Source ADF&G Division of Subsistence household surveys, 2013.

Table 2-32.–Population profile, Pedro Bay, 2013.

	Male			Female			Total		
Age	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage
0–4	0.0	0.0%	0.0%	0.0	0.0%	0.0%	0.0	0.0%	0.0%
5–9	0.0	0.0%	0.0%	0.0	0.0%	0.0%	0.0	0.0%	0.0%
10–14	0.0	0.0%	0.0%	0.0	0.0%	0.0%	0.0	0.0%	0.0%
15–19	1.3	7.1%	7.1%	0.0	0.0%	0.0%	1.3	3.7%	3.7%
20–24	1.3	7.1%	14.3%	6.4	38.5%	38.5%	7.6	22.2%	25.9%
25–29	2.5	14.3%	28.6%	2.5	15.4%	53.8%	5.1	14.8%	40.7%
30–34	2.5	14.3%	42.9%	0.0	0.0%	53.8%	2.5	7.4%	48.1%
35–39	0.0	0.0%	42.9%	0.0	0.0%	53.8%	0.0	0.0%	48.1%
40–44	0.0	0.0%	42.9%	0.0	0.0%	53.8%	0.0	0.0%	48.1%
45–49	1.3	7.1%	50.0%	0.0	0.0%	53.8%	1.3	3.7%	51.9%
50–54	3.8	21.4%	71.4%	5.1	30.8%	84.6%	8.9	25.9%	77.8%
55–59	0.0	0.0%	71.4%	0.0	0.0%	84.6%	0.0	0.0%	77.8%
60–64	1.3	7.1%	78.6%	0.0	0.0%	84.6%	1.3	3.7%	81.5%
65–69	0.0	0.0%	78.6%	0.0	0.0%	84.6%	0.0	0.0%	81.5%
70–74	0.0	0.0%	78.6%	0.0	0.0%	84.6%	0.0	0.0%	81.5%
75–79	0.0	0.0%	78.6%	1.3	7.7%	92.3%	1.3	3.7%	85.2%
80–84	2.5	14.3%	92.9%	0.0	0.0%	92.3%	2.5	7.4%	92.6%
85–89	0.0	0.0%	92.9%	0.0	0.0%	92.3%	0.0	0.0%	92.6%
90–94	0.0	0.0%	92.9%	0.0	0.0%	92.3%	0.0	0.0%	92.6%
95–99	0.0	0.0%	92.9%	0.0	0.0%	92.3%	0.0	0.0%	92.6%
100–104	0.0	0.0%	92.9%	0.0	0.0%	92.3%	0.0	0.0%	92.6%
Missing	1.3	7.1%	100.0%	1.3	7.7%	100.0%	2.5	7.4%	100.0%
Total	**17.8**	**100.0%**	**100.0%**	**16.5**	**100.0%**	**100.0%**	**34.4**	**100.0%**	**100.0%**

Source ADF&G Division of Subsistence household surveys, 2014.

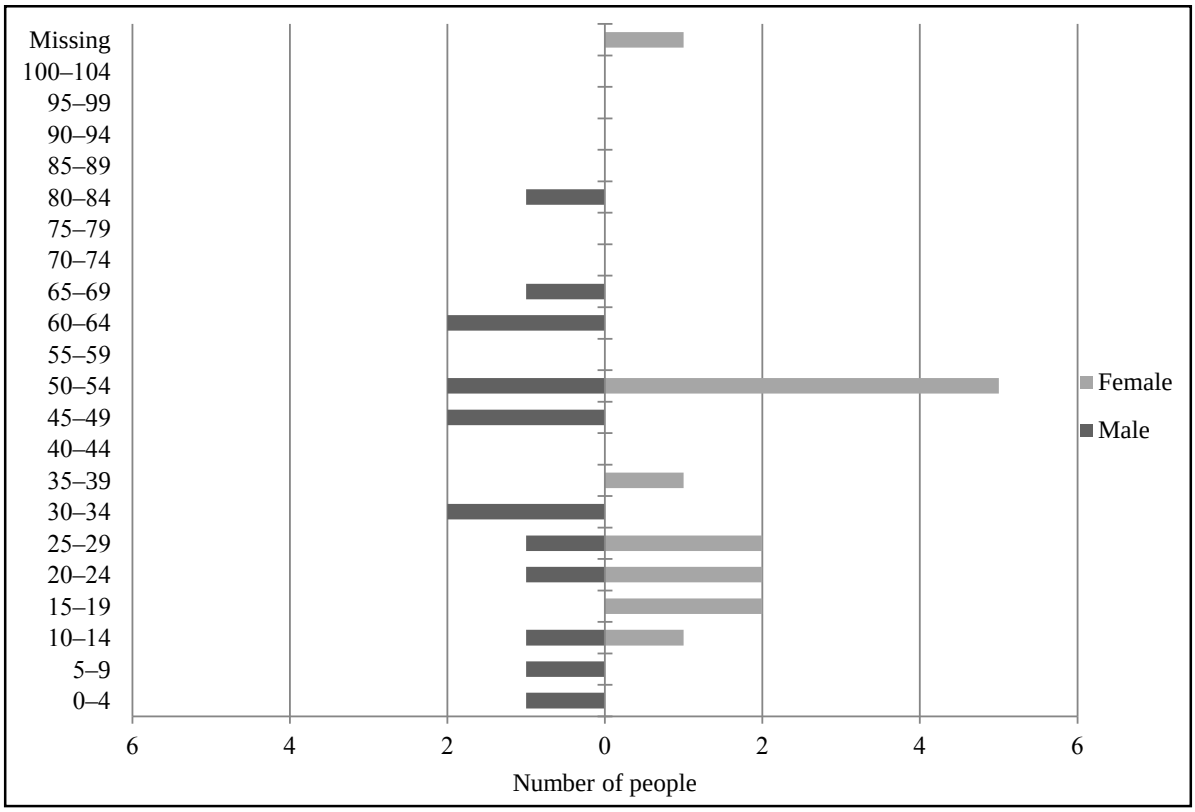


Figure 2-13.–Population profile, Pedro Bay, 2012.

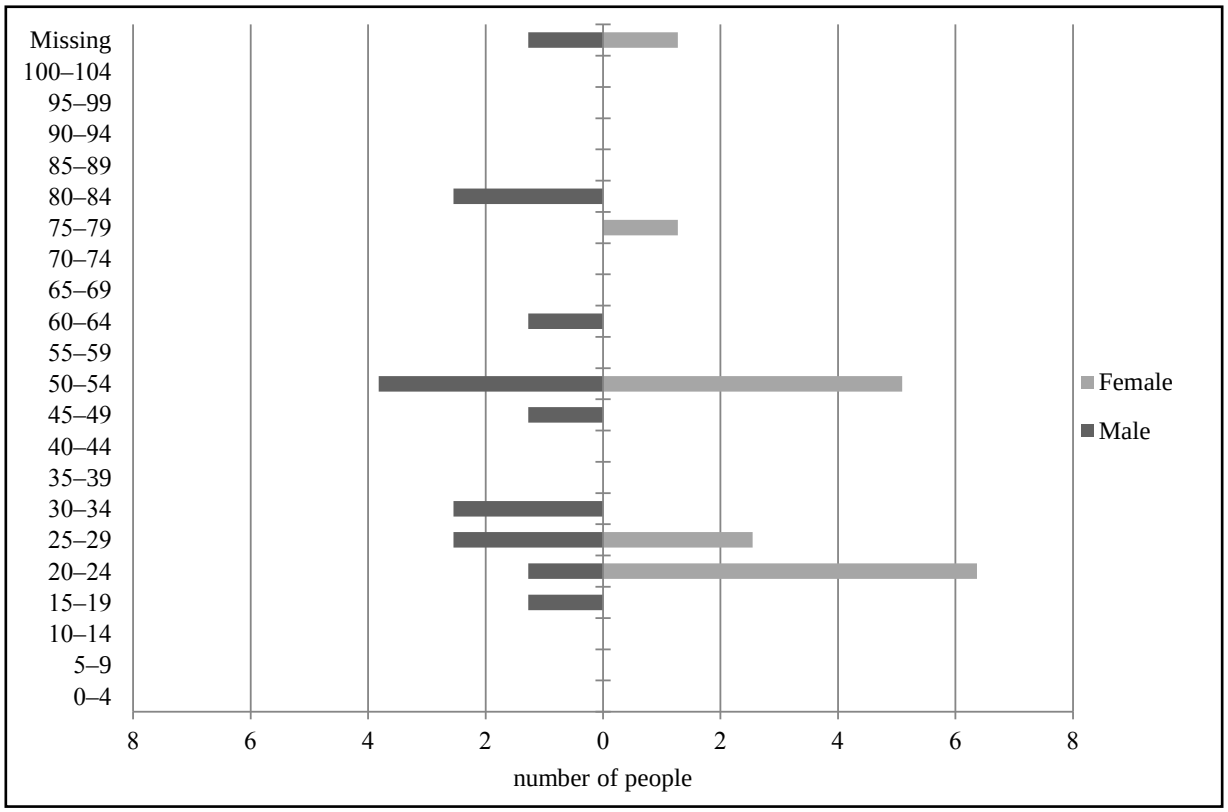


Figure 2-14.–Population profile, Pedro Bay, 2013.

Table 2-33.–Birthplaces of household heads, Pedro Bay, 2012 and 2013.

Birthplace	Percentage 2012	Percentage 2013
Anchorage	11.1%	0.0%
Dillingham	5.6%	0.0%
Ivanof Bay	5.6%	6.3%
Kotzebue	5.6%	0.0%
Nondalton	5.6%	12.5%
Old Harbor	11.1%	6.3%
Pedro Bay	38.9%	43.8%
Old Iliamna	0.0%	6.3%
Other U.S.	11.1%	18.8%
Missing	5.6%	6.3%

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.
Note "Birthplace" means the place of residence of the parents of the individual when the individual was born.

Table 2-34.–Birthplaces of population, Pedro Bay, 2012 and 2013.

Birthplace	Percentage 2012	Percentage 2013
Anchorage	6.9%	7.4%
Dillingham	3.4%	0.0%
Ivanof Bay	10.3%	11.1%
Kotzebue	3.4%	0.0%
Nondalton	3.4%	7.4%
Old Harbor	6.9%	3.7%
Pedro Bay	55.2%	48.1%
Wasilla	0.0%	3.7%
Old Iliamna	0.0%	3.7%
Other U.S.	6.9%	11.1%
Missing	3.4%	3.7%

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.
Note "Birthplace" means the place of residence of the parents of the individual when the individual was born.

Photo by Sarah S. Evans, staff, ADF&G Division of Subsistence

Plate 2-6.–View from Port Alsworth of Lake Clark and the Alaska Range, Port Alsworth, March 2014.

Port Alsworth

Port Alsworth is a small community located in southwestern Alaska on the eastern shore of Lake Clark. The site is also called Tanalian Point. Port Alsworth is surrounded by large mountains and rolling tundra as far at the eye can see. Lake Clark is a 40-mile long lake that is home to multiple fish species and a variety of wildlife.

Prior to 1944, very little human development had occurred at the site now known as the community of Port Alsworth. There is evidence that Dena'ina people from nearby Kijik camped on the eastern shore of Lake Clark, and there are some remains of camps at Hardenburg Bay, which the community of Port Alsworth surrounds, dating to 2000 B.C. to 1800 B.C. (Branson 2014). In 1944, Babe and Mary Alsworth moved into Hardenburg Bay to establish a homestead (Branson 2014:139). Babe Alsworth was well known for his love of aviation and started Lake Clark Air at the site. He built a 4,000-foot runway near Hardenburg Bay. Lake Clark Air maintains a busy aviation service for those who live in the Lake Clark region.

After the passage of ANILCA in November 1980, the new Lake Clark National Park and Preserve was established and Port Alsworth became the site of the National Park Service headquarters for the park. Port Alsworth today caters to adventure tourists who come to explore this remote national park, and sport hunters and anglers who use the many guide services headquartered at Port Alsworth (Fall et al. 2006:129).

Port Alsworth is home to multiple air charter companies, guiding services, lodges, and National Park Service visitor services. There are both year-round and seasonal employment opportunities for local residents. The community is also home to the Tanalian Bible Camp that operates during the summer and is attended

by many children from the Bristol Bay area. Port Alsworth is a tight-knit community whose members participate in the activities centered around the local school. There is a K–12 school in Port Alsworth belonging to the Lake and Peninsula Borough School District. Port Alsworth is not governed by a local tribal council, but rather by the Lake and Peninsula Borough, which is made up of a 7-member assembly that acts as the legislative body for the borough. There are no grocery stores or shops in Port Alsworth, but one of the local air taxis will shop for groceries in Anchorage and ship them out to Port Alsworth residents for a fee. Residents also take advantage of the natural resources surrounding them in Lake Clark National Park. Following federal regulations, Port Alsworth residents are able to harvest subsistence resources throughout the park.

Population Estimates and Demographic Information

Household surveys conducted for this study found Port Alsworth's resident population to be 162 people in 2012 and 179 in 2013 (Table 2-35). These numbers are very similar to the federal census numbers for 2010 (population of 159) and to the findings of the U.S. Census Bureau 5-Year American Community Survey covering 2008–2012 that estimated Port Alsworth's population at 158 persons. The percentage of the population identifying as Alaska Native was 19% in 2012, but decreased to 13% in 2013. Data gathered for this study found a small proportion of Alaska Natives in Port Alsworth's population, unlike the other study communities where 70% or more of the population were Alaska Native. Figure 2-15 shows historical population estimates for Port Alsworth. Available population data indicate an upward population trend beginning with the first census in 1980 and the opening of Lake Clark National Park and Preserve visitor center in Port Alsworth.

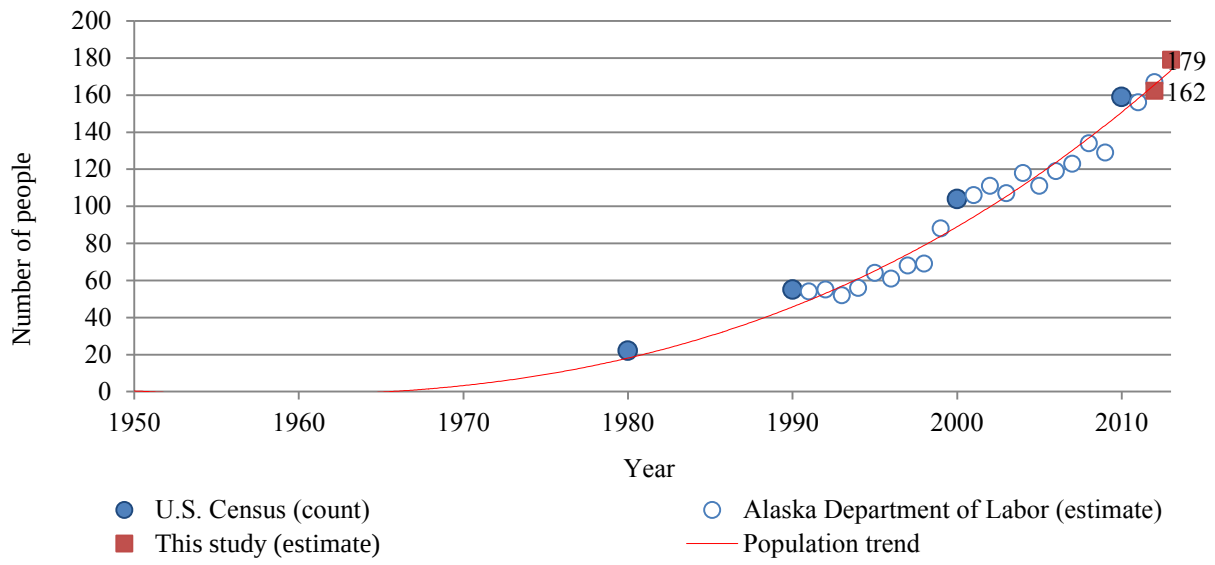
The survey found an estimated 50 year-round households in Port Alsworth in 2012 and 55 in 2013 (Table 2-36). Of these households, 45 were interviewed in the first year of the study (90%) and 51 were interviewed in the second year of the study (93%). The mean length of residency in Port Alsworth was 11 years in both 2012 and 2013 (Table 2-37). The percentage of residents born in Port Alsworth dropped from 25% in 2012 to 19% in 2013 (Table 2-38). Most of the residents were born elsewhere in the U.S.; 48% in 2012 and 45% in 2013. In both study years, around 4% of the population was born in foreign countries. For the most part, the rest of the community was born in larger communities on the road system within Alaska such as Anchorage and Palmer, or they were born in the neighboring villages of Nondalton, Egegik, or Iliamna. Household heads were generally from Anchorage or outside of Alaska (Table 2-39).

The mean household size in 2012 was 3.2 people, but decreased to 3.1 in 2013 (Table 2-37). The largest household in Port Alsworth contained 8 people in 2012, and increased to a household of 10 in 2013. In 2012, the largest age cohort for males was ages 10–14 (14% of the male population) (Table 2-40; Figure 2-16). The largest age cohorts for females were ages 15–19, 20–24 and 25–29, which, combined, represented approximately 33% of the female population. In 2013, the largest cohort for males was again ages 10–14 (16% of the male population) (Table 2-41; Figure 2-17). For females the largest cohort was for ages 10–14, or 18% of the female population.

Table 2-35.–Population estimates, Port Alsworth, 2010, 2012, and 2013.

	Census (2010)	5-Year American Community Survey (2008–2012)	This study (2012)	This study (2013)
Total population				
Households	44.0	60.0	50.0	55.0
Population	159.0	158.0	162.2	179.0
Alaska Native				
Population	42.0	21.0	30.0	23.7
Percentage	26.4%	13.3%	18.5%	13.3%

Sources U.S. Census Bureau (2011) for 2010 estimate; U.S. Census Bureau (2013) for 5-year survey estimate; and ADF&G Division of Subsistence household surveys, 2013, for 2012 estimate and 2014, for 2013 estimate.



Note Population data for this community are not available prior to 1980.

Figure 2-15.–Historical population estimates, Port Alsworth, 1980–2013.

Table 2-36.–Sample achievement, Port Alsworth, 2012 and 2013.

	2012	2013
Number of dwelling units	50	55
Interview goal	50	55
Households interviewed	45	51
Households failed to contact	5	1
Households declined to be interviewed	0	3
Households moved or nonresident	0	0
Total households attempted to interview	45	51
Refusal rate	0.0%	5.6%
Final estimate of permanent households	50	55
Percentage of total households interviewed	90.0%	92.7%
Interview weighting factor	1.1	1.1
Sampled population	146	166
Estimated population	162.2	179.0

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.

Table 2-37.–Demographic characteristics, Port Alsworth, 2012 and 2013.

	Port Alsworth	
Characteristics	2012	2013
Household size		
Mean	3.2	3.1
Minimum	1	1
Maximum	8	10
Age		
Mean	28.0	27.3
Minimum[a]	0	0
Maximum	81	81
Median	26	24
Length of residency		
Total population		
Mean	10.8	11.0
Minimum[a]	1	0
Maximum	49	60
Heads of household		
Mean	13.7	14.1
Minimum[a]	1	1
Maximum	49	60
Alaska Native households[b]		
Number	8.9	9.7
Percentage	17.8%	17.6%

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.
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.

Table 2-38.–Birthplaces of population, Port Alsworth, 2012 and 2013.

Birthplace	Percentage 2012	Percentage 2013
Anchorage	2.7%	7.8%
Dillingham	2.7%	0.0%
Eek	0.7%	0.0%
Egegik	2.7%	4.2%
Fairbanks	0.0%	1.2%
Gakona	0.7%	0.0%
Galena	0.7%	0.0%
Glennallen	0.0%	0.6%
Iliamna	0.7%	0.0%
Ivanof Bay	0.7%	0.0%
Manokotak	0.7%	0.0%
Nondalton	2.7%	3.0%
Palmer	1.4%	1.8%
Port Alsworth	25.3%	19.3%
Wasilla	0.0%	1.2%
Girdwood	0.0%	0.6%
Miller Landing	0.0%	0.6%
Other Alaska	2.1%	7.2%
Other U.S.	47.9%	45.2%
Foreign	4.1%	3.6%
Missing	4.1%	0.0%

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.
Note "Birthplace" means the place of residence of the parents of the individual when the individual was born.

Table 2-39.–Birthplaces of household heads, Port Alsworth, 2012 and 2013.

Birthplace	Percentage 2012	Percentage 2013
Anchorage	2.5%	6.9%
Eek	1.3%	0.0%
Egegik	1.3%	1.1%
Fairbanks	0.0%	2.3%
Galena	1.3%	0.0%
Glennallen	0.0%	1.1%
Iliamna	1.3%	0.0%
Ivanof Bay	1.3%	0.0%
Nondalton	2.5%	2.3%
Palmer	2.5%	3.4%
Port Alsworth	2.5%	1.1%
Wasilla	0.0%	1.1%
Girdwood	0.0%	1.1%
Miller Landing	0.0%	1.1%
Other Alaska	2.5%	8.0%
Other U.S.	72.2%	65.5%
Foreign	6.3%	4.6%
Missing	2.5%	0.0%

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.

Note "Birthplace" means the place of residence of the parents of the individual when the individual was born.

Table 2-40.–Population profile, Port Alsworth, 2012.

	Male			Female			Total		
Age	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage
0–4	8.9	10.8%	10.8%	5.6	6.9%	6.9%	14.4	8.9%	8.9%
5–9	6.7	8.1%	18.9%	6.7	8.3%	15.3%	13.3	8.2%	17.1%
10–14	11.1	13.5%	32.4%	7.8	9.7%	25.0%	18.9	11.6%	28.8%
15–19	6.7	8.1%	40.5%	8.9	11.1%	36.1%	15.6	9.6%	38.4%
20–24	4.4	5.4%	45.9%	8.9	11.1%	47.2%	13.3	8.2%	46.6%
25–29	7.8	9.5%	55.4%	8.9	11.1%	58.3%	16.7	10.3%	56.8%
30–34	8.9	10.8%	66.2%	6.7	8.3%	66.7%	15.6	9.6%	66.4%
35–39	6.7	8.1%	74.3%	6.7	8.3%	75.0%	13.3	8.2%	74.7%
40–44	4.4	5.4%	79.7%	5.6	6.9%	81.9%	10.0	6.2%	80.8%
45–49	2.2	2.7%	82.4%	2.2	2.8%	84.7%	4.4	2.7%	83.6%
50–54	5.6	6.8%	89.2%	0.0	0.0%	84.7%	5.6	3.4%	87.0%
55–59	1.1	1.4%	90.5%	4.4	5.6%	90.3%	5.6	3.4%	90.4%
60–64	2.2	2.7%	93.2%	2.2	2.8%	93.1%	4.4	2.7%	93.2%
65–69	1.1	1.4%	94.6%	0.0	0.0%	93.1%	1.1	0.7%	93.8%
70–74	2.2	2.7%	97.3%	2.2	2.8%	95.8%	4.4	2.7%	96.6%
75–79	0.0	0.0%	97.3%	0.0	0.0%	95.8%	0.0	0.0%	96.6%
80–84	1.1	1.4%	98.6%	1.1	1.4%	97.2%	2.2	1.4%	97.9%
85–89	0.0	0.0%	98.6%	0.0	0.0%	97.2%	0.0	0.0%	97.9%
90–94	0.0	0.0%	98.6%	0.0	0.0%	97.2%	0.0	0.0%	97.9%
95–99	0.0	0.0%	98.6%	0.0	0.0%	97.2%	0.0	0.0%	97.9%
100–104	0.0	0.0%	98.6%	0.0	0.0%	97.2%	0.0	0.0%	97.9%
Missing	1.1	1.4%	100.0%	2.2	2.8%	100.0%	3.3	2.1%	100.0%
Total	**82.2**	**100.0%**	**100.0%**	**80.0**	**100.0%**	**100.0%**	**162.2**	**100.0%**	**100.0%**

Source ADF&G Division of Subsistence household surveys, 2013.

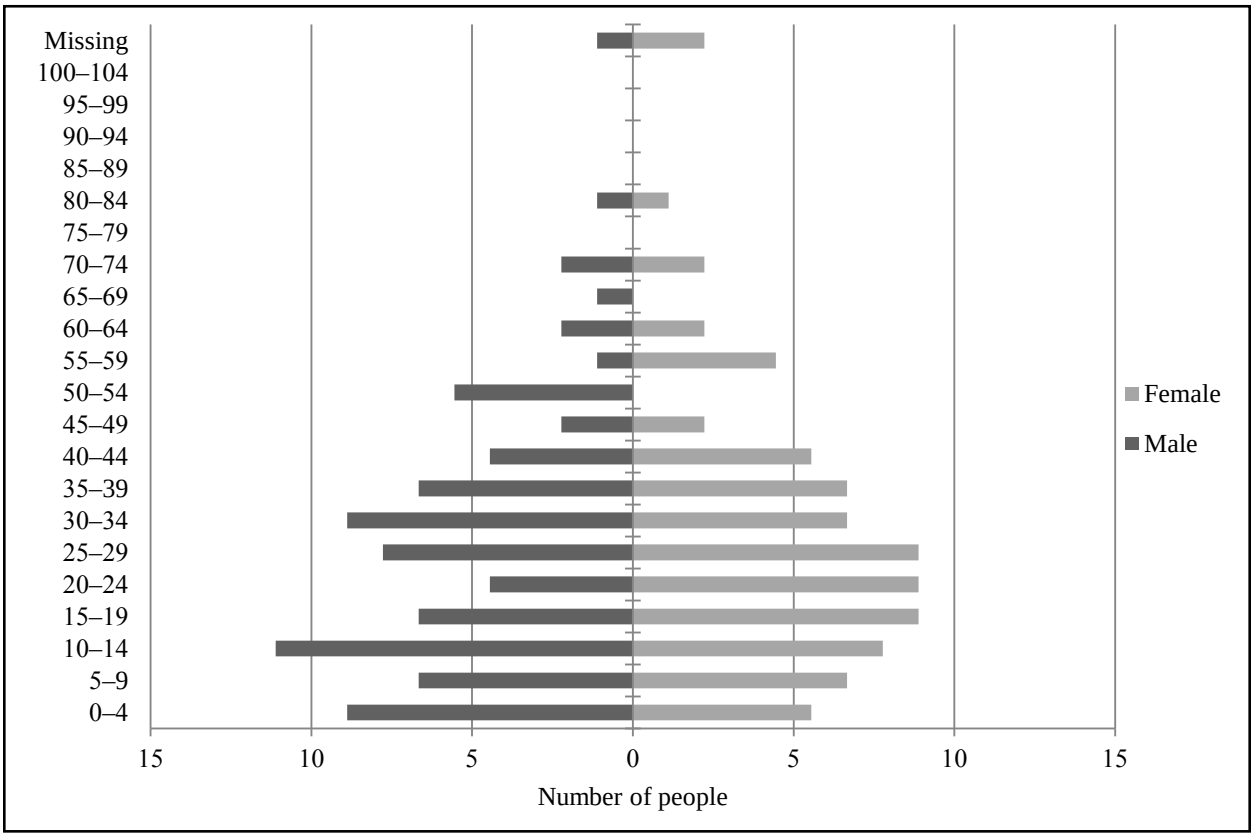


Figure 2-16.–Population profile, Port Alsworth, 2012.

Table 2-41.–Population profile, Port Alsworth, 2013.

	Male			Female			Total		
Age	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage	Number	Percentage	Cumulative percentage
0–4	11.9	12.5%	12.5%	0.0	0.0%	0.0%	11.9	6.9%	6.9%
5–9	8.6	9.1%	21.6%	10.8	13.9%	13.9%	19.4	11.3%	18.1%
10–14	15.1	15.9%	37.5%	14.0	18.1%	31.9%	29.1	16.9%	35.0%
15–19	9.7	10.2%	47.7%	4.3	5.6%	37.5%	14.0	8.1%	43.1%
20–24	8.6	9.1%	56.8%	5.4	6.9%	44.4%	14.0	8.1%	51.3%
25–29	5.4	5.7%	62.5%	9.7	12.5%	56.9%	15.1	8.8%	60.0%
30–34	8.6	9.1%	71.6%	7.5	9.7%	66.7%	16.2	9.4%	69.4%
35–39	6.5	6.8%	78.4%	6.5	8.3%	75.0%	12.9	7.5%	76.9%
40–44	2.2	2.3%	80.7%	5.4	6.9%	81.9%	7.5	4.4%	81.3%
45–49	4.3	4.5%	85.2%	2.2	2.8%	84.7%	6.5	3.8%	85.0%
50–54	4.3	4.5%	89.8%	1.1	1.4%	86.1%	5.4	3.1%	88.1%
55–59	2.2	2.3%	92.0%	5.4	6.9%	93.1%	7.5	4.4%	92.5%
60–64	2.2	2.3%	94.3%	1.1	1.4%	94.4%	3.2	1.9%	94.4%
65–69	1.1	1.1%	95.5%	1.1	1.4%	95.8%	2.2	1.3%	95.6%
70–74	3.2	3.4%	98.9%	2.2	2.8%	98.6%	5.4	3.1%	98.8%
75–79	0.0	0.0%	98.9%	0.0	0.0%	98.6%	0.0	0.0%	98.8%
80–84	1.1	1.1%	100.0%	1.1	1.4%	100.0%	2.2	1.3%	100.0%
85–89	0.0	0.0%	100.0%	0.0	0.0%	100.0%	0.0	0.0%	100.0%
90–94	0.0	0.0%	100.0%	0.0	0.0%	100.0%	0.0	0.0%	100.0%
95–99	0.0	0.0%	100.0%	0.0	0.0%	100.0%	0.0	0.0%	100.0%
100–104	0.0	0.0%	100.0%	0.0	0.0%	100.0%	0.0	0.0%	100.0%
Missing	0.0	0.0%	100.0%	0.0	0.0%	100.0%	0.0	0.0%	100.0%
Total	**94.9**	**100.0%**	**100.0%**	**77.6**	**100.0%**	**100.0%**	**172.5**	**100.0%**	**100.0%**

Source ADF&G Division of Subsistence household surveys, 2014.

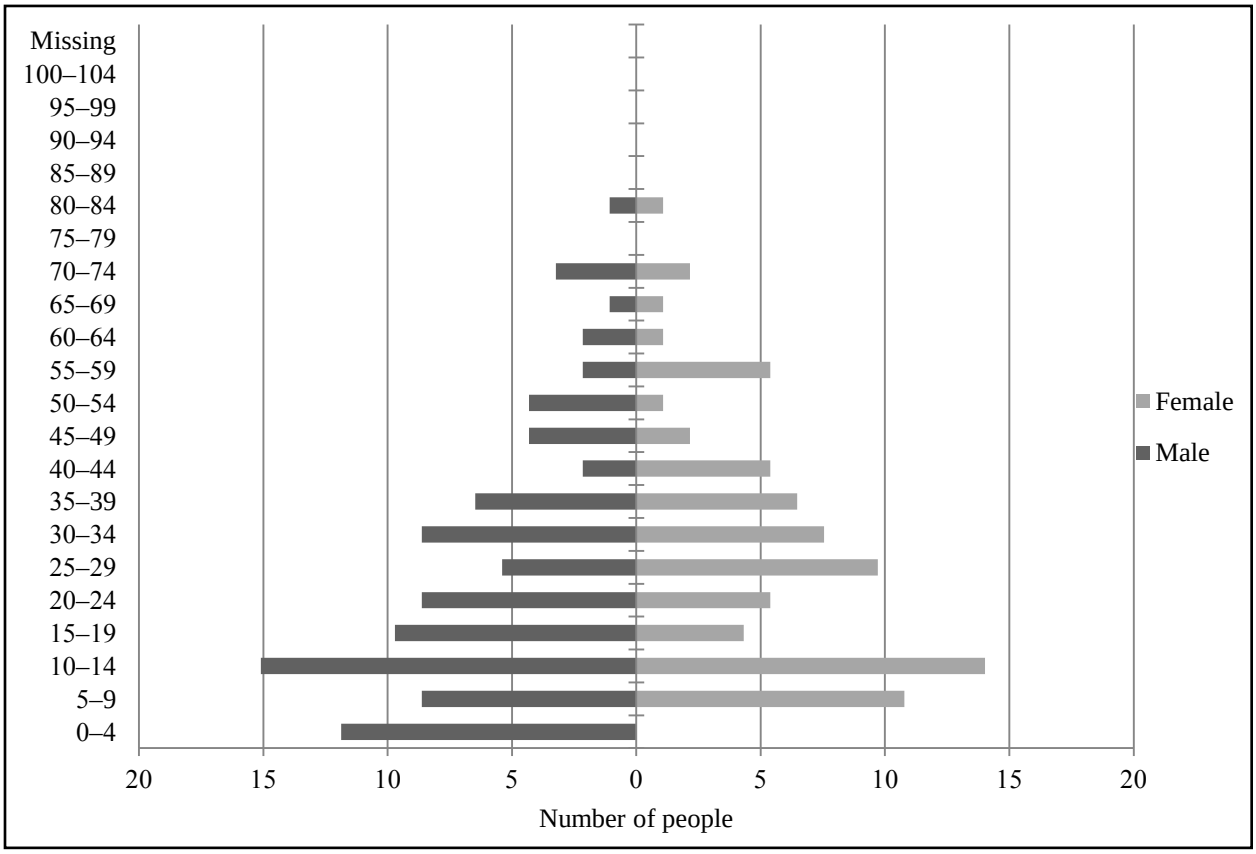


Figure 2-17.–Population profile, Port Alsworth, 2013.

3. SURVEY RESULTS FOR STUDY YEARS 2012 AND 2013

Harvest Assessment

Systematic households surveys were administered in each of the study communities (Appendix C). The following discussion presents the results of the harvest assessments and is organized by community. Respondents answered questions about their subsistence harvests of whitefishes and other nonsalmon freshwater fish in 2012 and 2013. Community members were also asked about the importance of whitefishes to their households, the effort expended by households to harvest whitefishes, and decisions concerning instances when households could not harvest enough whitefishes. Descriptions of the study species, regulatory context, and gear types are available in chapter 1, "Introduction."

Igiugig

Importance of Whitefishes

Residents of Igiugig reported that use of whitefishes was important historically and this sentiment continues today. In 2012, approximately 59% of surveyed Igiugig households reported typically using whitefishes (Table 3-1). This percentage increased to 67% for 2013. As estimated by an earlier Alaska Department of Fish and Game Division of Subsistence study, 64% of households used at least 1 species of whitefish in 2003; the percentage of households using whitefishes in 2003 is similar to those reporting that they typically use whitefishes during this study (Krieg et al. 2005:149; Table 3-1). Of the surveyed households in Igiugig, 59% in 2012 and 44% in 2013 reported the use of the various whitefish species as important (24% and 22% in 2012 and 2013, respectively) or very important (35% and 22%, respectively) to them. Residents said the resource was important for food security, as well as the general physical and cultural well-being of the community. They also reported that giving and receiving whitefishes helped to maintain social ties between their village and others and were an important component in religious holidays.

Fishery Participation

Table 3-2 presents reported harvest efforts for whitefishes during the 2 study years. The differences between the percentages of households that were successful in harvesting whitefishes and those households that reported using whitefishes is indicative of widespread sharing of the resources from harvesting households to those that did not harvest. An estimated 41% of households in Igiugig harvested whitefishes in 2012; an estimated 59% of households used whitefishes. In 2013, a smaller proportion of community households harvested whitefishes (28%) but nearly the same percentage of Igiugig households used whitefishes in 2013 as in 2012 (50% and 59%, respectively).

According to key respondents, harvesting and processing of whitefishes remains a multigenerational effort. Some local elders lament what appears to them as a waning interest in fishing for whitefishes among the younger generations (see "Social and Cultural Factors: Igiugig" in chapter 5, "Factors Influencing Residents' Ability to Harvest Nonsalmon Fish"). When asked what they would do differently if they could not get enough whitefishes to fulfill their needs, the majority of respondents in Igiugig stated that they would attempt to fill the gap with other subsistence foods (Table 3-3). For study year 2012, only 10% of responding households reported they would rely on store-bought foods to replace whitefishes in their diets. None of the responding households reported that they would purchase more food at a store if they did not have access to enough whitefishes for the 2013 study year.

Table 3-1.–Household responses describing importance of whitefishes, Igiugig, 2012 and 2013.

	2012		2013	
	Using	Total	Using	Total
Percentage of households **usually** using whitefishes	100%	59%	100%	67%
Importance of whitefishes to households today				
(Percentage of households)				
No response	0%	0%	0%	0%
Not important	0%	0%	33%	22%
Important	40%	24%	33%	22%
Very important	60%	35%	33%	22%
Importance of whitefishes to households in the past				
(Percentage of households)				
No response	0%	0%	0%	0%
Not important	10%	6%	42%	28%
Important	40%	24%	8%	6%
Very important	50%	29%	50%	33%
Households responding whitefishes **less** important today	0%	0%	25%	17%
Households responding whitefishes **more** important today	20%	12%	17%	11%
Households responding whitefishes as important today as in the past	80%	47%	58%	39%

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.
Note All percentages are based upon the number of households responding "yes" to using whitefishes.

Table 3-2.–Household responses describing effort to harvest whitefishes, Igiugig, 2012 and 2013.

	2012	2013
Percentage of households …		
using whitefishes	59%	50%
attempting to harvest whitefishes	53%	33%
harvesting whitefishes	41%	28%
Harvest effort compared with …		
(Percentage of households) [a]		
5 years ago		
No response	10%	25%
Less effort	10%	50%
Same effort	40%	17%
More effort	40%	8%
10 years ago		
No response	10%	25%
Less effort	0%	42%
Same effort	50%	17%
More effort	30%	17%

Source ADF&G Division of subsistence household surveys, 2013 and 2014.
a. Percentages based only upon households reporting use of whitefishes.

Table 3-3.–Household responses reporting what they do differently if they cannot get enough whitefishes, Igiugig, 2012 and 2013.

	2012	2013
Households providing a response	10	11
Percentage of households reporting that they would …		
buy subsistence foods	10%	9%
buy store foods	10%	0%
use other subsistence resources	70%	73%
ask others for help	0%	18%
make do with what they did get	10%	0%
increase effort	10%	0%
work more	0%	0%
use other foods (unspecified)	0%	0%
public assistance	0%	0%
other	0%	0%

Source ADF&G Division of subsistence household surveys, 2013 and 2014.

Iliamna

Importance of Whitefishes

While whitefishes are not widely abundant in the vicinity of Iliamna, residents reported receiving whitefishes from family and friends, or, residents said, they traveled to Sixmile Lake or Igiugig to harvest them (community scoping meeting, Iliamna, February 2014). A total of 55% of surveyed Iliamna households said they typically use whitefishes (Table 3-4). Of the households reporting use of whitefishes, 56% indicated whitefishes are important today and 44% indicated these species were important in the past. Overall, 88% of surveyed households that usually use whitefishes said these species are as important today as in the past.

Fishery Participation

In 2013, 34% of Iliamna households used whitefishes and 21% of households harvested whitefishes (Table 3-5). Responses to survey questions indicate residents believe fishing effort has decreased compared to 10 years ago. Specifically, 31% of households that reported using whitefishes in 2013 indicated residents expended less effort than in the past to harvest whitefishes. These observations are supported when comparing results from a previous study conducted by the Division of Subsistence for 2004, which estimated 39% of the community households used whitefishes and 23% harvested these species; however, the changes are moderate (Fall et al. 2006:45).

When asked what households would do differently if they could not get enough whitefishes, 92% of respondents to this question said they would use other subsistence resources and 8% of respondents said they would ask others for help (Table 3-6). No respondents indicated that they would buy store-bought foods to replace whitefishes.

Table 3-4.–Household responses describing importance of whitefishes, Iliamna, 2013.

	2013	
	Using	Total
Percentage of households **usually** using whitefishes	100%	55%
Importance of whitefishes to households today		
(Percentage of households)		
No response	0%	0%
Not important	6%	3%
Important	56%	31%
Very important	38%	21%
Importance of whitefishes to households in the past		
(Percentage of households)		
No response	0%	0%
Not important	13%	7%
Important	44%	24%
Very important	44%	24%
Households responding whitefishes **less** important today	6%	3%
Households responding whitefishes **more** important today	6%	3%
Households responding whitefishes as important today as in the past	88%	48%

Source ADF&G Division of Subsistence household surveys, 2014.
Note All percentages are based upon the number of households respondinng "yes" to using whitefishes.

Table 3-5.–Household responses describing effort to harvest whitefishes, Iliamna, 2013.

	2013
Percentage of households …	
using whitefishes	34%
attempting to harvest whitefishes	21%
harvesting whitefishes	21%
Harvest effort compared with …	
(Percentage of households) [a]	
5 years ago	
No response	63%
Less effort	25%
Same effort	0%
More effort	13%
10 years ago	
No response	63%
Less effort	31%
Same effort	0%
More effort	6%

Source ADF&G Division of Subsistence household surveys, 2014.
a. Percentages based only upon households reporting use of whitefishes.

Table 3-6.–Household responses reporting what they do differently if they cannot get enough whitefishes, Iliamna, 2013.

	2013
Households providing a response	12
Percentage of households reporting that they would …	
buy subsistence foods	0%
buy store foods	0%
use other subsistence resources	92%
ask others for help	8%
make do with what they did get	0%
increase effort	0%
work more	0%
use other foods (unspecified)	0%
public assistance	0%
other	0%

Source ADF&G Division of subsistence household surveys, 2014.

Newhalen

Importance of Whitefishes

Despite whitefishes not being widely available locally (similar to Iliamna), a high number of community members said they typically use whitefishes: 74% of households in 2012 and 85% in 2013 (Table 3-7). More than one-half of resident users indicated whitefishes were very important to households in 2012 (52%). While respondents who believed whitefishes were very important declined in 2013, it is estimated that more than one-third of households that usually use whitefishes (36%) still considered this resource to be very important. Of all the surveyed households, 65% in 2012 and 64% in 2013 indicated that whitefishes are as important today to Newhalen community members as in the past.

Fishery Participation

In 2012 and 2013, 21% and 27% of Newhalen households using whitefishes, respectively, harvested whitefishes, despite their not being locally abundant (Table 3-8). This increase between years is also reflected in the number of households using whitefishes in both years, which increased from 41% in 2012 to 64% in 2013. In 2012, more than 50% of respondents indicated harvest effort in the community is the same compared to 5 and 10 years ago. In 2013, the amount of respondents who thought harvest effort was the same for past years decreased significantly, but more households indicated harvest effort has increased when compared to responses from 2012. The difference between years may be the result of an increase in nonresponse rates to this question for 2013.

The majority of households reporting about what they would do differently if they could not get enough whitefishes said that they would use other subsistence resources (68% in 2012 and 67% in 2013) (Table 3-9). Households also said that they would ask others for help, buy store-bought foods, buy subsistence foods, use other foods, or make do with what they harvested/received.

Table 3-7.–Household responses describing importance of whitefishes, Newhalen, 2012 and 2013.

	2012		2013	
	Used	Total	Used	Total
Percent of households **usually** using whitefishes	100%	74%	100%	85%
Importance of whitefishes to households today				
(Percentage of households)				
No response	0%	0%	0%	0%
Not important	16%	12%	25%	21%
Important	32%	24%	39%	33%
Very important	52%	38%	36%	30%
Importance of whitefishes to households in the past				
(Percentage of households)				
No response	0%	0%	4%	3%
Not important	8%	6%	18%	15%
Important	36%	26%	29%	24%
Very important	56%	41%	50%	42%
Households responding whitefishes **less** important today	12%	9%	21%	18%
Households responding whitefishes **more** important today	0%	0%	4%	3%
Households responding whitefishes as important today as in the past	88%	65%	75%	64%

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.
Note All percentages are based upon the number of households responding "yes" to using whitefishes.

Table 3-8.–Household responses describing effort to harvest whitefishes, Newhalen, 2012 and 2013.

	2012	2013
Percentage of households …		
using whitefishes	41%	64%
attempting to harvest whitefishes	21%	30%
harvesting whitefishes	21%	27%
Harvest effort compared with …		
(Percentage of households) [a]		
5 years ago		
No response	8%	36%
Less effort	28%	18%
Same effort	56%	29%
More effort	8%	11%
10 years ago		
No response	8%	36%
Less effort	24%	11%
Same effort	52%	29%
More effort	16%	18%

Source ADF&G Division of subsistence household surveys, 2013 and 2014.
a. Percentages based only upon households reporting use of whitefishes.

Table 3-9.–Household responses reporting what they do differently if they cannot get enough whitefishes, Newhalen, 2012 and 2013.

	2012	2013
Households providing a response	25	27
Percentage of households reporting that they would …		
buy subsistence foods	4%	4%
buy store foods	8%	7%
use other subsistence resources	68%	67%
ask others for help	24%	11%
make do with what they did get	4%	0%
increase effort	0%	4%
work more	0%	0%
use other foods (unspecified)	0%	7%
public assistance	0%	0%
other	0%	4%

Source ADF&G Division of subsistence household surveys, 2013 and 2014.

Nondalton

Importance of Whitefishes

The importance of whitefishes to the people of Nondalton is evidenced by the large percentage of households who identified their members as users of the various species of whitefishes available in the area. For example, in 2012, approximately 92% of Nondalton's surveyed households said they used 1 or more whitefish species and the percentage of surveyed households typically using whitefishes dropped to approximately 82% in 2013 (Table 3-10). Of the surveyed Nondalton households, the vast majority, approximately 92% in 2012 and 80% in 2013, stated that whitefishes are important (34% and 29% in 2012 and 2013, respectively) or very important (58% and 51%, respectively) to their households today. For both study years, 80% or more of the households that used whitefishes responded that whitefishes are as important today as in the past.

Fishery Participation

When asked to compare current levels of harvest effort with those of the past, the majority of surveyed households during both study years said that about the same level of effort or more effort was exerted to harvest whitefishes than in the past (Table 3-11). According to key respondents, harvesting, processing, and consumption of whitefishes remain a multigenerational effort with many adult harvesters reporting that their children participated in harvesting, or at least processing fish harvested. Data collected for this study suggest that the percentage of households in Nondalton harvesting whitefishes has increased in recent survey years, from 53% in 2003 and 55% in 2004 to 82% and 69% of surveyed households using whitefishes in 2012 and 2013, respectively (Fall et al. 2006:194; Krieg et al. 2005:154).

Table 3-12 presents responses to the question asking what residents do differently if they cannot get enough whitefishes. In both study years, the most common answer was to use other subsistence resources (76% in 2012 and 84% in 2013). Asking others for help was also a common response in both years, thus underscoring the nutritional, social, and cultural importance of sharing whitefishes and other subsistence resources in the community of Nondalton. During 2012, only around 10% of respondents suggested that they would attempt to fill the gap with the purchase of foodstuffs from a store for cash or credit.

Table 3-10.–Household responses describing importance of whitefishes, Nondalton, 2012 and 2013.

	2012		2013	
	Used	Total	Used	Total
Percentage of households **usually** using whitefishes	100%	92%	100%	82%
Importance of whitefishes to households today				
(Percentage of households)				
No response	0%	0%	0%	0%
Not important	0%	0%	3%	2%
Important	37%	34%	35%	29%
Very important	63%	58%	62%	51%
Importance of whitefishes to households in the past				
(Percentage of households)				
No response	0%	0%	0%	0%
Not important	9%	8%	3%	2%
Important	17%	16%	32%	27%
Very important	74%	68%	65%	53%
Households responding whitefishes **less** important today	11%	11%	3%	2%
Households responding whitefishes **more** important today	9%	8%	0%	0%
Households responding whitefishes as important today as in the past	80%	74%	97%	80%

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.
Note All percentages are based upon the number of households responding "yes" to using whitefishes.

Table 3-11.–Household responses describing effort to harvest whitefishes, Nondalton, 2012 and 2013.

	2012	2013
Percentage of households …		
using whitefishes	89%	80%
attempting to harvest whitefishes	82%	69%
harvesting whitefishes	82%	69%
Harvest effort compared with …		
(Percentage of households) [a]		
5 years ago		
No response	6%	5%
Less effort	31%	32%
Same effort	37%	57%
More effort	26%	5%
10 years ago		
No response	6%	11%
Less effort	17%	41%
Same effort	37%	41%
More effort	40%	8%

Source ADF&G Division of subsistence household surveys, 2013 and 2014.
a. Percentages based only upon households reporting use of whitefishes.

Table 3-12.–Household responses reporting what they do differently if they cannot get enough whitefishes, Nondalton, 2012 and 2013.

	2012	2013
Households providing a response	34	31
Percentage of households reporting that they would …		
buy subsistence foods	3%	0%
buy store foods	12%	3%
use other subsistence resources	76%	84%
ask others for help	9%	6%
make do with what they did get	3%	0%
increase effort	0%	3%
work more	0%	0%
use other foods (unspecified)	0%	0%
public assistance	0%	0%
other	0%	3%

Source ADF&G Division of subsistence household surveys, 2013 and 2014.

Pedro Bay

Importance of Whitefishes

Whitefish use is extremely limited in Pedro Bay. In 2012, 15% of surveyed households indicated use of whitefish species was typical (Table 3-13). In 2013, the percentage of surveyed households reporting usually using whitefishes was only slightly higher at 18%. A household reporting use of whitefishes in 2013 said whitefishes were not targeted; these species were not commonly harvested by the household and the least cisco harvested was considered unpalatable.

Fishery Participation

Whitefishes are not known to have historical or contemporary significance for the community of Pedro Bay. If whitefishes did have significance in the past, it is no longer in living memory. Unlike other nonsalmon fish in the area, whitefishes do not comprise a multigenerational fishery for residents. Whitefishes are not targeted by residents of this community. A commonly provided explanation for lack of use is that whitefish species rarely occur in the vicinity. None of the key respondents remember whitefishes being important to the community. Only 1 resident remembers eating whitefishes as a child in the now-abandoned Old Iliamna village. According to this respondent, their father would sometimes be given whitefishes in Nondalton that he would bring home. Because no households reported whitefish fishing over time in Pedro Bay, there was no change in harvest effort in the last 5 or 10 years (Table 3-14). Similarly, no households reported engaging in alternative activities if not enough whitefishes were harvested (Table 3-15).

Table 3-13.–Household responses describing importance of whitefishes, Pedro Bay, 2012 and 2013.

	2012		2013	
	Using	Total	Using	Total
Percentage of households **usually** using whitefishes	100%	15%	100%	18%
Importance of whitefishes to households today				
(Percentage of households)				
No response	0%	0%	0%	0%
Not important	50%	8%	50%	9%
Important	50%	8%	50%	9%
Very important	0%	0%	0%	0%
Importance of whitefishes to households in the past				
(Percentage of households)				
No response	0%	0%	0%	0%
Not important	100%	15%	50%	9%
Important	0%	0%	0%	0%
Very important	0%	0%	50%	9%
Households responding whitefishes **less** important today	0%	0%	50%	9%
Households responding whitefishes **more** important today	50%	8%	0%	0%
Households responding whitefishes as important today as in the past	50%	8%	50%	9%

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.
Note All percentages are based upon the number of households respondinng "yes" to using whitefishes.

Table 3-14.–Household responses describing effort to harvest whitefishes, Pedro Bay, 2012 and 2013.

	2012	2013
Percentage of households …		
using whitefishes	0%	9%
attempting to harvest whitefishes	0%	9%
harvesting whitefishes	0%	9%
Harvest effort compared with …		
(Percentage of households) [a]		
5 years ago		
No response	100%	50%
Less effort	0%	50%
Same effort	0%	0%
More effort	0%	0%
10 years ago		
No response	100%	50%
Less effort	0%	50%
Same effort	0%	0%
More effort	0%	0%

Source ADF&G Division of subsistence household surveys, 2013 and 2014.
a. Percentages based only upon households reporting use of whitefishes.

Table 3-15.–Household responses reporting what they do differently if they cannot get enough whitefishes, Pedro Bay, 2012 and 2013.

	2012	2013
Households providing a response	2	0
Percentage of households reporting that they would …		
buy subsistence foods	0.0%	0.0%
buy store foods	0.0%	0.0%
use other subsistence resources	100.0%	0.0%
ask others for help	0.0%	0.0%
make do with what they did get	0.0%	0.0%
increase effort	0.0%	0.0%
work more	0.0%	0.0%
use other foods (unspecified)	0.0%	0.0%
public assistance	0.0%	0.0%
other	0.0%	0.0%

Source ADF&G Division of subsistence household surveys, 2013 and 2014.

Port Alsworth

Importance of Whitefishes

The residents of Port Alsworth did not have a high percentage of households using whitefishes historically; during this study common use of whitefishes was low compared to the other study communities. In 2012, approximately 27% of surveyed Port Alsworth households reported usually using whitefishes; this percentage dropped to 20% for 2013 (Table 3-16). These percentages were very different compared to data collected in Port Alsworth by the Alaska Department of Fish and Game Division of Subsistence for study year 2004 when 46% of households used at least 1 whitefish species (Fall et al. 2006:150). Of the surveyed households that used whitefishes, 92% of households in 2012 and 90% of households in 2013 responded that they believe whitefishes are as important today as in the past.

Fishery Participation

Approximately 15% to 30% of households in Port Alsworth fished for and harvested whitefishes (Table 3-17). For 2012, respondents who used whitefishes generally indicated that harvest effort was the same or less than from 5 and 10 years ago. Compared to 2012, more of the households using whitefishes in 2013 said that more effort was expended on fishing for these species. When asked what they would do differently if they cannot get enough whitefishes to fulfill their needs, the majority of respondents in Port Alsworth stated that they would attempt to fill the gap with other subsistence foods (Table 3-18). For study year 2012, only 11% of responding households reported that they would rely on store-bought foods to replace whitefishes in their diets. However, in 2013, 25% of responding households reported that they would rely on store-bought foods to replace whitefishes.

Table 3-16.–Household responses describing importance of whitefishes, Port Alsworth, 2012 and 2013.

	2012		2013	
	Using	Total	Using	Total
Percentage of households **usually** using whitefishes	100%	27%	100%	20%
Importance of whitefishes to households today				
(Percentage of households)				
No response	17%	4%	0%	0%
Not important	25%	7%	30%	6%
Important	50%	13%	60%	12%
Very important	8%	2%	10%	2%
Importance of whitefishes to households in the past				
(Percentage of households)				
No response	17%	4%	0%	0%
Not important	25%	7%	40%	8%
Important	42%	11%	50%	10%
Very important	17%	4%	10%	2%
Households responding whitefishes **less** important today	8%	2%	0%	0%
Households responding whitefishes **more** important today	0%	0%	10%	2%
Households responding whitefishes as important today as in the past	92%	24%	90%	18%

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.
Note All percentages are based upon the number of households responding "yes" to using whitefishes.

Table 3-17.–Household responses describing effort to harvest whitefishes, Port Alsworth, 2012 and 2013.

	2012	2013
Percentage of households …		
using whitefishes	29%	14%
attempting to harvest whitefishes	29%	16%
harvesting whitefishes	29%	14%
Harvest effort compared with …		
(Percentage of households) [a]		
5 years ago		
No response	42%	10%
Less effort	17%	30%
Same effort	33%	30%
More effort	8%	20%
10 years ago		
No response	50%	10%
Less effort	17%	30%
Same effort	17%	20%
More effort	17%	30%

Source ADF&G Division of subsistence household surveys, 2013 and 2014.
a. Percentages based only upon households reporting use of whitefishes.

Table 3-18.–Household responses reporting what they do differently if they cannot get enough whitefishes, Port Alsworth, 2012 and 2013.

	2012	2013
Households providing a response	9	8
Percentage of households reporting that they would …		
buy subsistence foods	11%	0%
buy store foods	11%	25%
use other subsistence resources	56%	88%
ask others for help	0%	0%
make do with what they did get	22%	0%
increase effort	0%	0%
work more	0%	0%
use other foods (unspecified)	0%	0%
public assistance	0%	0%
other	0%	0%

Source ADF&G Division of Subsistence household surveys, 2013 and 2014.

Whitefish Harvests

For each study community, survey results of estimated household uses and harvests of whitefishes are presented for each study year. The tables are organized by nonsalmon fish species and all edible resources are reported in pounds usable weight (see Appendix E for conversion factors). The "harvest" category includes resources harvested by any member of the surveyed households during the study year. The "use" category includes all resources taken, given away, or used by a household, and resources acquired from other harvesters either as gifts, by barter or trade, or through fishing partnerships. Differences between household harvest and use percentages reflect sharing among households within the study community or with households from other communities in the region and across the state.

Additional topics discussed for each community include comparisons with historical harvest estimates, fishing locations and gear used to harvest whitefishes, and the timing of whitefish harvests. See the regulatory context discussion in chapter 1, "Introduction," for descriptions of gear types.

Igiugig

In 2012, approximately 53% of households used humpback whitefish while 12% used round whitefish (locally referred to as "candlefish" [Stickman et al. 2003:55]) (Table 3-19). No other species of whitefish was harvested, but in 2012 an estimated 18% of households used sheefish that were given to them. In 2013, 44% of households used humpback whitefish and approximately 17% used round whitefish (Table 3-20). This represents a reduction from 2005, when 58% of households used humpback whitefish (Krieg et al. 2009:40).

The majority of the harvest weight of whitefishes was from humpback whitefish in both 2012 (96%) and 2013 (97%), while approximately 4% of the whitefish harvest was round whitefish (Table 3-19; Table 3-20). Humpback whitefish made up 34% of the total harvest of nonsalmon fish by Igiugig residents in 2012 and 33% of the nonsalmon fish harvest in 2013 (Figure 3-1; Figure 3-2).

In 2012, an estimated 208 lb, or 4 lb per capita, of humpback whitefish were harvested. This harvest decreased by about one-half to 107 lb, or 2 lb per capita, in 2013. The decrease in the harvest of humpback whitefish was accompanied by a similar decrease in the harvest of round whitefish. Despite its continued importance, harvests of whitefishes have been declining in Igiugig since the 1970s (Figure 3-3). While harvests are still

Table 3-19.–Estimated use and harvests of nonsalmon fish resources, Igiugig, 2012.

	Percentage of households					Harvest weight (lb)			Harvest amount			95%
Resource	Use %	Attempt %	Harvest %	Receive %	Give %	Total	Mean household	Per capita	Total	Unit	Mean household	confidence limit (±)
Nonsalmon fish	**88.2**	**88.2**	**76.5**	**58.8**	**70.6**	**610.6**	**30.5**	**11.3**				**32.2**
Rainbow smelt	17.6	5.9	5.9	11.8	17.6	21.2	1.1	0.4	3.5	gal	0.2	82.1
Arctic lamprey	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	5.9	5.9	5.9	0.0	0.0	3.5	0.2	0.1	3.5	lb	0.2	82.1
Burbot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Arctic char	5.9	5.9	5.9	0.0	0.0	4.9	0.2	0.1	3.5	ind	0.2	82.1
Dolly Varden–freshwater	23.5	17.6	17.6	5.9	11.8	39.5	2.0	0.7	28.2	ind	1.4	55.1
Dolly Varden–fingerling	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Lake trout	5.9	5.9	5.9	0.0	0.0	4.9	0.2	0.1	3.5	ind	0.2	82.1
Unknown char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Arctic grayling	35.3	29.4	29.4	5.9	17.6	32.1	1.6	0.6	45.9	ind	2.3	38.8
Northern pike	52.9	35.3	29.4	29.4	17.6	115.3	5.8	2.1	41.2	ind	2.1	39.5
Longnose sucker	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	64.7	70.6	58.8	11.8	35.3	172.9	8.6	3.2	123.5	ind	6.2	39.5
Unknown trout	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Sheefish	17.6	0.0	0.0	17.6	11.8	0.0	0.0	0.0	0.0	ind	0.0	0.0
Broad whitefish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Bering cisco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Humpback whitefish	52.9	47.1	35.3	35.3	35.3	207.9	10.4	3.8	118.8	ind	5.9	41.3
Round whitefish	11.8	11.8	11.8	0.0	0.0	8.2	0.4	0.2	8.2	ind	0.4	61.8
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

Source ADF&G Division of Subsistence household surveys, 2013.

Note Where the percentage of households using a resource is greater than the combined receiving and harvesting households indicates use of resources obtained during a previous year.

Table 3-20.–Estimated use and harvests of nonsalmon fish resources, Igiugig, 2013.

	Percentage of households					Harvest weight (lb)			Harvest amount			95%
Resource	Use %	Attempt %	Harvest %	Receive %	Give %	Total	Mean household	Per capita	Total	Unit	Mean household	confidence limit (±)
Nonsalmon fish	**94.4**	**77.8**	**61.1**	**83.3**	**61.1**	**328.5**	**14.3**	**5.4**				**30.9**
Rainbow smelt	22.2	11.1	11.1	16.7	16.7	7.7	0.4	0.1	39.6	gal	1.7	95.6
Arctic lamprey	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	5.6	0.0	0.0	5.6	5.6	0.0	0.0	0.0	0.0	lb	0.0	0.0
Burbot	5.6	5.6	0.0	5.6	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Arctic char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Dolly Varden–freshwater	38.9	27.8	22.2	27.8	11.1	42.9	1.9	0.7	30.7	ind	1.3	73.8
Lake trout	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Unknown char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Arctic grayling	27.8	33.3	27.8	5.6	11.1	31.3	1.4	0.5	44.7	ind	1.9	49.2
Northern pike	50.0	38.9	22.2	27.8	11.1	55.5	2.4	0.9	19.8	ind	0.9	56.1
Longnose sucker	11.1	11.1	11.1	0.0	5.6	19.2	0.8	0.3	12.8	ind	0.6	67.5
Rainbow trout	55.6	44.4	38.9	27.8	16.7	60.8	2.6	1.0	43.4	ind	1.9	34.7
Unknown trout	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	ind	0.0	0.0
Broad whitefish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Bering cisco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Least cisco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Humpback whitefish	44.4	27.8	22.2	27.8	27.8	107.3	4.7	1.8	61.3	ind	2.7	53.7
Round whitefish	16.7	16.7	11.1	5.6	11.1	3.8	0.2	0.1	3.8	ind	0.2	71.6

Source ADF&G Division of Subsistence household surveys, 2014.

Note Where the percentage of households using a resource is greater than the combined receiving and harvesting households indicates use of resources obtained during a previous year.

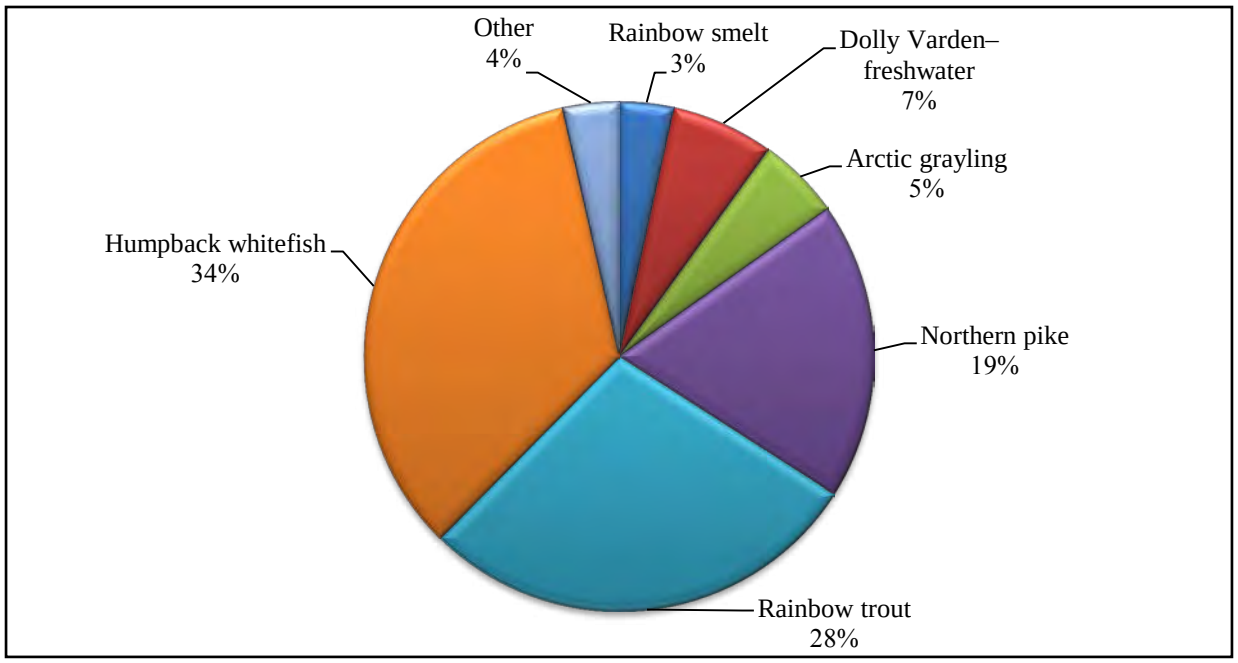


Figure 3-1.–Composition of nonsalmon fish harvest in pounds usable weight, Igiugig, 2012.

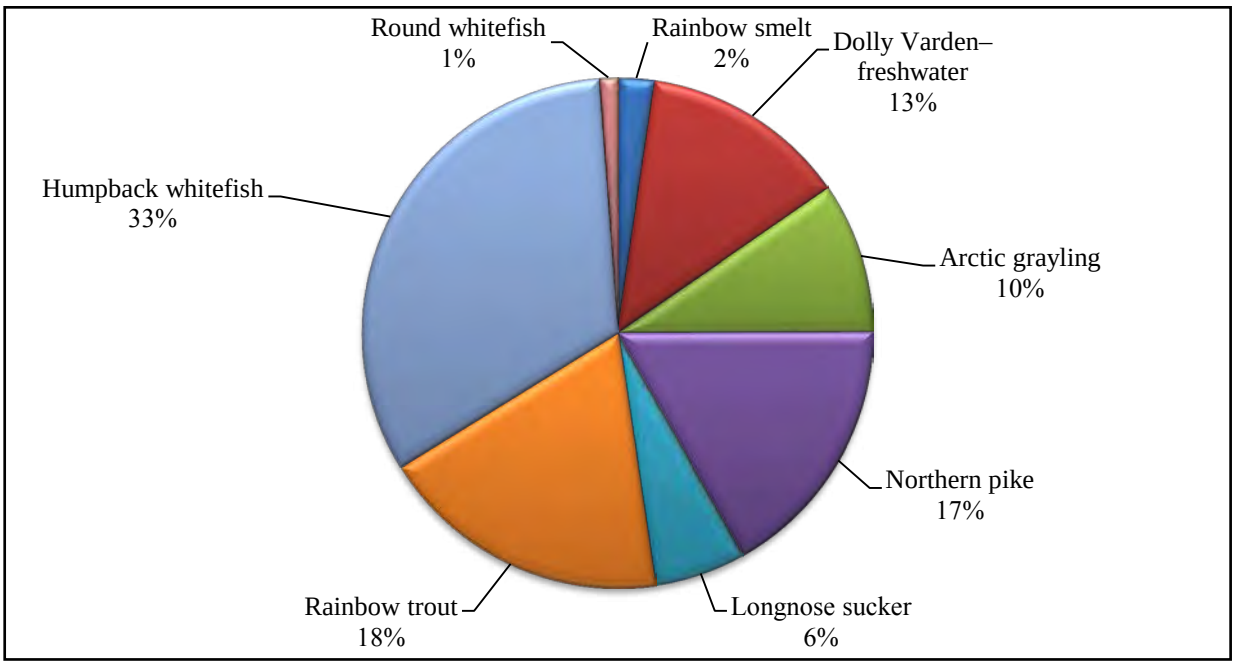
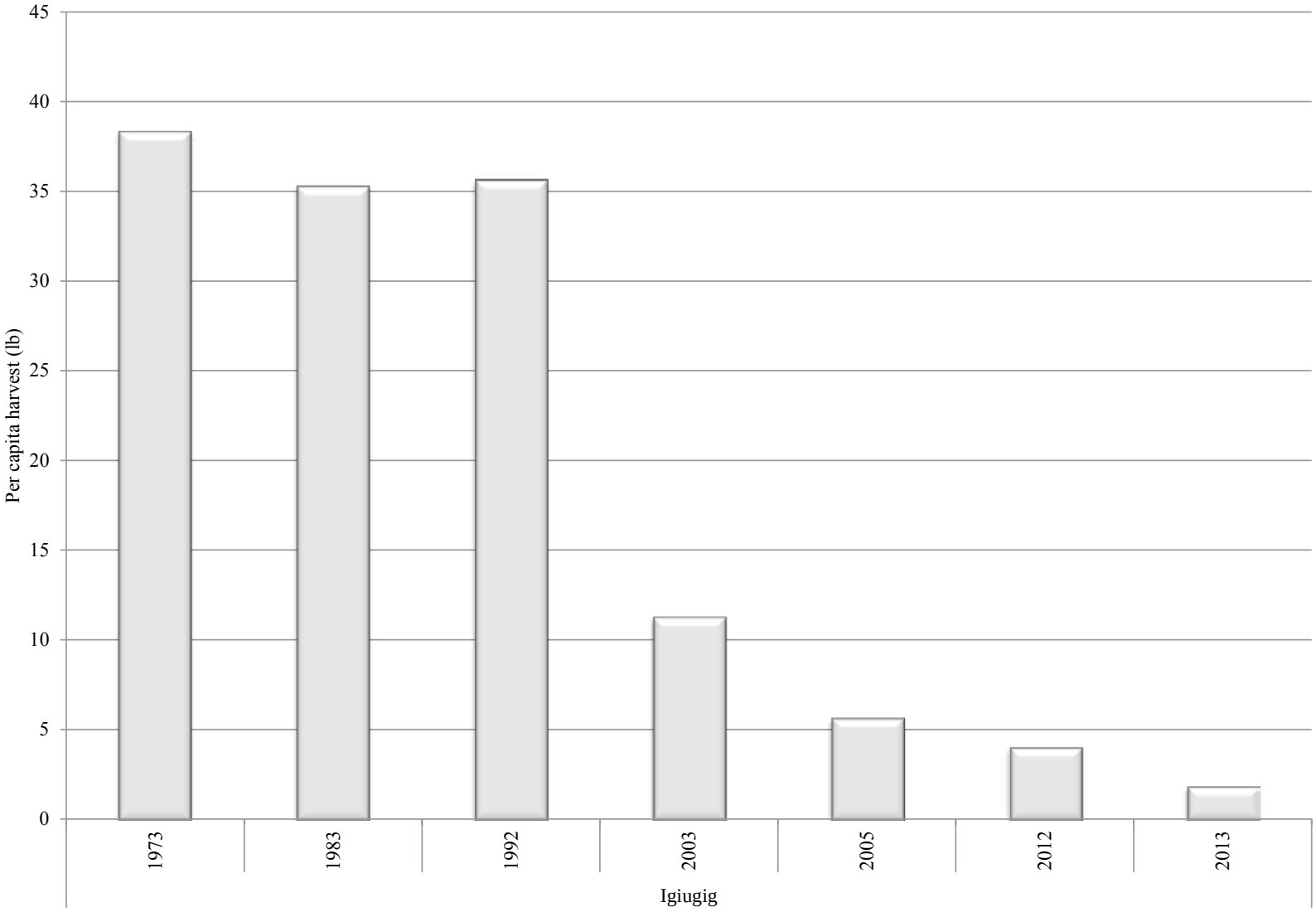


Figure 3-2.–Composition of nonsalmon fish harvest in pounds usable weight, Igiugig, 2013.

on the decline, the per capita harvest of whitefishes has remained more stable since 2005. The 111 lb of whitefishes harvested from an estimated 65 individual whitefishes (both humpback and round) in 2013 is less than 5% of the 1973–1974 harvest of 1,480 individual fish (Krieg et al. 2005:143; Table 3-20).

The almost 50% decrease in the total pounds of whitefishes harvested and the decrease in the percentage of households fishing for humpback whitefish between 2012 and 2013 was primarily attributed by local



Note For all study years, sheefish harvests were included in the estimated harvest of whitefishes.

Figure 3-3.–Estimated harvests of whitefishes by pounds per capita, Igiugig, 1974, 1983, 1992, 2003, 2005, 2012, and 2013.

residents to various personal reasons and local weather conditions. The decreased harvests of whitefishes were consistent with a similar decrease in the total harvest of all nonsalmon fish (611 lb and 329 lb of nonsalmon fish harvested in 2012 and 2013, respectively) (Table 3-19; Table 3-20). However, while harvests of whitefishes have declined over time, the relative importance of whitefishes to the people of Igiugig is illustrated by the harvest of whitefishes as a percentage of the total nonsalmon fish harvest during 2012 (35% of total nonsalmon fish harvest by weight) and 2013 (34%), which was more than 3 times higher than that estimated by ADF&G for 2005 when whitefishes made up just 10% of the nonsalmon fish harvest (Krieg et al. 2009:50).

Harvests of whitefishes by gear type has remained generally the same based on comparing this study's results to results for a survey from 10 years ago (Krieg et al. 2005:184). In 2012, an estimated 127 whitefishes (216 lb) were taken using subsistence gear, and no whitefishes were harvested using rod and reel (Table 3-21). Figure 3-4 is a visual representation of whitefishes harvested by total pounds and by gear type for 2012. Ninety-eight percent of the whitefish harvest was caught using a subsistence net in open water: 100% of the humpback whitefish harvested and 72% of the round whitefish harvested. The remainder of the round whitefish were taken while ice fishing.

In 2013, an estimated 65 whitefishes (111 lb) were taken using subsistence methods, and no whitefishes were harvested using rod and reel (Table 3-22). Figure 3-5 is a visual representation of whitefishes harvested by total pounds and by gear type for 2013. The highest numbers of fish were again caught using a subsistence net: 100% of humpback whitefish and 94% of the entire whitefish harvest. All of the round whitefish harvested by residents of Igiugig were taken while ice fishing with a hook under the ice.

Figure 3-6 represents harvest locations for humpback whitefish. The harvests of humpback whitefish were accomplished in 2012 and 2013 by setting a net upstream from the village site on the Kvichak River, and around the mouths of Ole, Pecks, and Kaskanak creeks. One household indicated during the 2013 survey that very high water in fall 2013, accompanied by high winds, affected fishing for whitefishes. These adverse conditions likely focused the fishing effort in 2013 at Kaskanak Creek, a location that was said by active fishers and village elders to be the most productive place to harvest whitefishes over the years.

Round whitefish was the only whitefish species harvested by ice fishing by Igiugig households during 2012 and 2013 (Table 3-21; Table 3-22). This method was used during the months after freeze-up and prior to breakup when ice conditions allowed. Figure 3-7 illustrates the harvest locations of round whitefish during 2012 and 2013. Ice fishing generally took place close to the village or on Iliamna Lake.

During fieldwork in winter 2014, survey staff observed that there were several ice fishing holes used by Igiugig residents in a slough off the Kvichak River near the south end of the Igiugig airport runway. These holes were covered with spruce boughs to denote their location and were spaced approximately 50 meters apart. The holes were drilled in 1 to 2 feet of water that was above a sand- and gravel-laden river bed. The current flowing under the ice pulled the fishing line downstream. Someone had left a bait can with preserved salmon eggs and a small folding chair beside the holes indicating that people intended to return consistently to the same holes to fish through the ice. Figures 3-8 and 3-9 represent fishing locations by gear type for 2012 and 2013, respectively.

Harvest timing has generally remained the same over the past 10 years in Igiugig (Figure 3-10). During 2012 and 2013, whitefish harvests were concentrated in the fall with fewer harvests occurring in late spring and summer, primarily during the periods of September through November and April through July (Table 3-23; Table 3-24). One household indicated that humpback whitefish run into Kaskanak Creek in the fall and spring. The harvest of whitefishes in the late spring along with the harvest of other nonsalmon fish provides an important food source during the seasonal round of the village when households' supplies of salmon may be low. Study participants and key respondents stated that although the general timing of whitefish fishing has remained the same in recent memory, changes in the climate have resulted in ice fishing for whitefishes starting later in the year and therefore for a shorter period of time. The observed warming of the climate has truncated the periods of time during which the river and lake are frozen to an extent that allows fishing through the ice.

Table 3-21.–Estimated harvest of nonsalmon fish by gear type, resource, Igiugig, 2012.

	Subsistence methods															
	Gillnet or seine		Ice fishing (hook under ice)		Net under ice		Jig		Other method		Subsistence gear, any method		Rod and reel		Any method	
Resource	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds
Nonsalmon fish	**198.8**	**320.9**	**138.8**	**220.8**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**337.6**	**541.7**	**42.4**	**68.9**	**380.0**	**610.6**
Rainbow smelt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	21.2	3.5	21.2
Arctic lamprey	0.0	0.0	0.0	0.0	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	0.0	0.0	3.5	3.5	0.0	0.0	0.0	0.0	0.0	0.0	3.5	3.5	0.0	0.0	3.5	3.5
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
Arctic char	3.5	4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.5	4.9	0.0	0.0	3.5	4.9
Dolly Varden–freshwater	0.0	0.0	28.2	39.5	0.0	0.0	0.0	0.0	0.0	0.0	28.2	39.5	0.0	0.0	28.2	39.5
Dolly Varden–fingerling	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lake trout	0.0	0.0	3.5	4.9	0.0	0.0	0.0	0.0	0.0	0.0	3.5	4.9	0.0	0.0	3.5	4.9
Unknown char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arctic grayling	0.0	0.0	36.5	25.5	0.0	0.0	0.0	0.0	0.0	0.0	36.5	25.5	9.4	6.6	45.9	32.1
Northern pike	2.4	6.6	38.8	108.7	0.0	0.0	0.0	0.0	0.0	0.0	41.2	115.3	0.0	0.0	41.2	115.3
Longnose sucker	0.0	0.0	0.0	0.0	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	68.2	95.5	25.9	36.2	0.0	0.0	0.0	0.0	0.0	0.0	94.1	131.8	29.4	41.2	123.5	172.9
Unknown trout	0.0	0.0	0.0	0.0	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
Broad 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
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
Least 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
Humpback whitefish	118.8	207.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	118.8	207.9	0.0	0.0	118.8	207.9
Round whitefish	5.9	5.9	2.4	2.4	0.0	0.0	0.0	0.0	0.0	0.0	8.2	8.2	0.0	0.0	8.2	8.2
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

Source ADF&G Division of Subsistence household surveys, 2013.

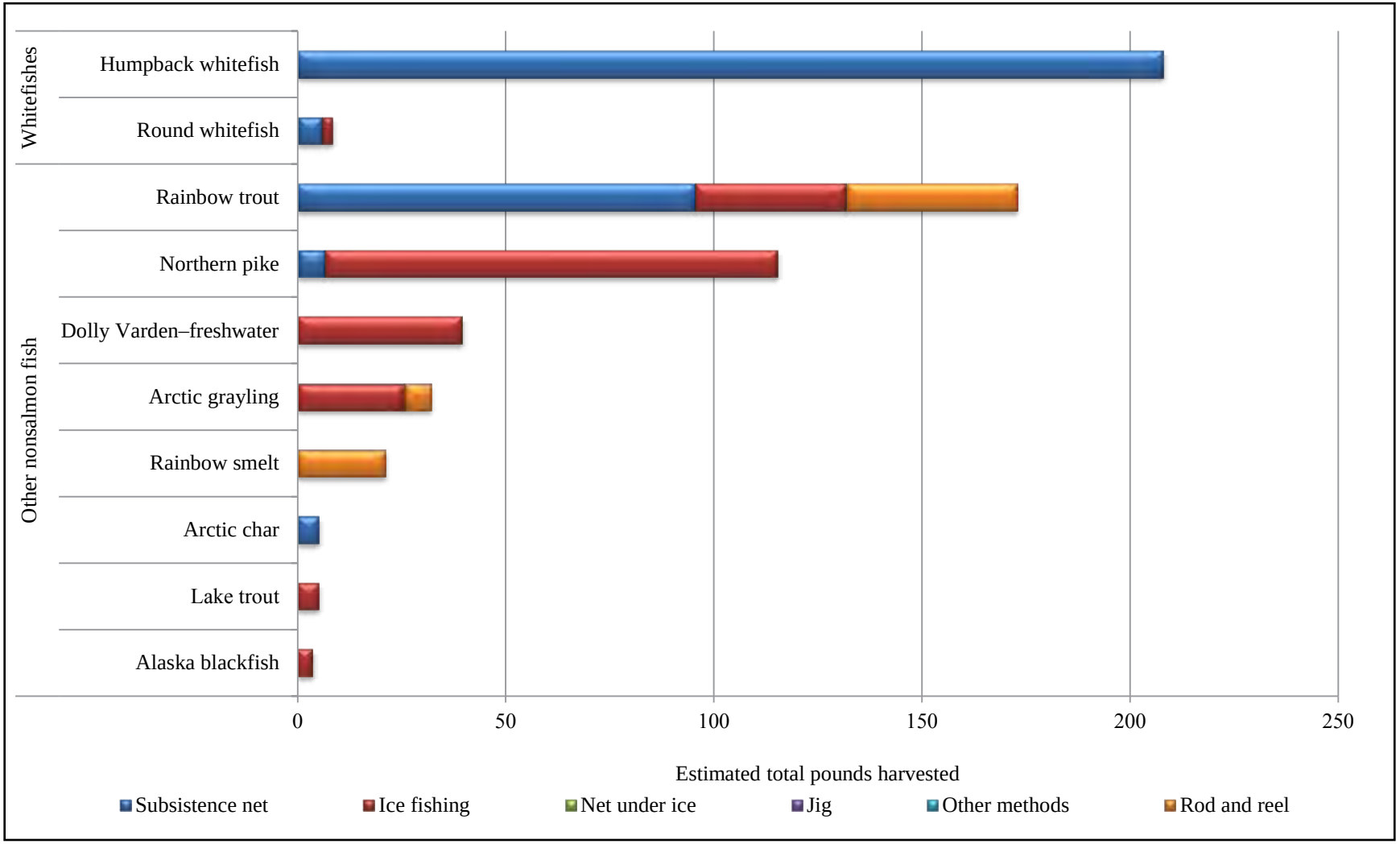


Figure 3-4.–Nonsalmon fish harvest by gear type, Igiugig, 2012.

Table 3-22.–Estimated harvest of nonsalmon fish by gear type, resource, Igiugig, 2013.

	Subsistence methods															
	Gillnet or seine		Ice fishing (hook under ice)		Net under ice		Jig		Other method		Subsistence gear, any method		Rod and reel		Any method	
Resource	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds
Nonsalmon fish	**92.0**	**160.5**	**132.3**	**117.9**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**224.3**	**278.4**	**31.9**	**50.1**	**256.2**	**328.5**
Rainbow smelt	0.0	0.0	39.6	7.7	0.0	0.0	0.0	0.0	0.0	0.0	39.6	7.7	0.0	0.0	39.6	7.7
Arctic lamprey	0.0	0.0	0.0	0.0	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	0.0	0.0	0.0	0.0	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
Arctic char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dolly Varden–freshwater	0.0	0.0	30.7	42.9	0.0	0.0	0.0	0.0	0.0	0.0	30.7	42.9	0.0	0.0	30.7	42.9
Lake trout	0.0	0.0	0.0	0.0	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 char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arctic grayling	0.0	0.0	31.9	22.4	0.0	0.0	0.0	0.0	0.0	0.0	31.9	22.4	12.8	8.9	44.7	31.3
Northern pike	6.4	17.9	3.2	8.9	0.0	0.0	0.0	0.0	0.0	0.0	9.6	26.8	10.2	28.6	19.8	55.5
Longnose sucker	12.8	19.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.8	19.2	0.0	0.0	12.8	19.2
Rainbow trout	11.5	16.1	23.0	32.2	0.0	0.0	0.0	0.0	0.0	0.0	34.5	48.3	8.9	12.5	43.4	60.8
Unknown trout	0.0	0.0	0.0	0.0	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
Broad 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
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
Least 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
Humpback whitefish	61.3	107.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	61.3	107.3	0.0	0.0	61.3	107.3
Round whitefish	0.0	0.0	3.8	3.8	0.0	0.0	0.0	0.0	0.0	0.0	3.8	3.8	0.0	0.0	3.8	3.8

Source ADF&G Division of Subsistence household surveys, 2014.

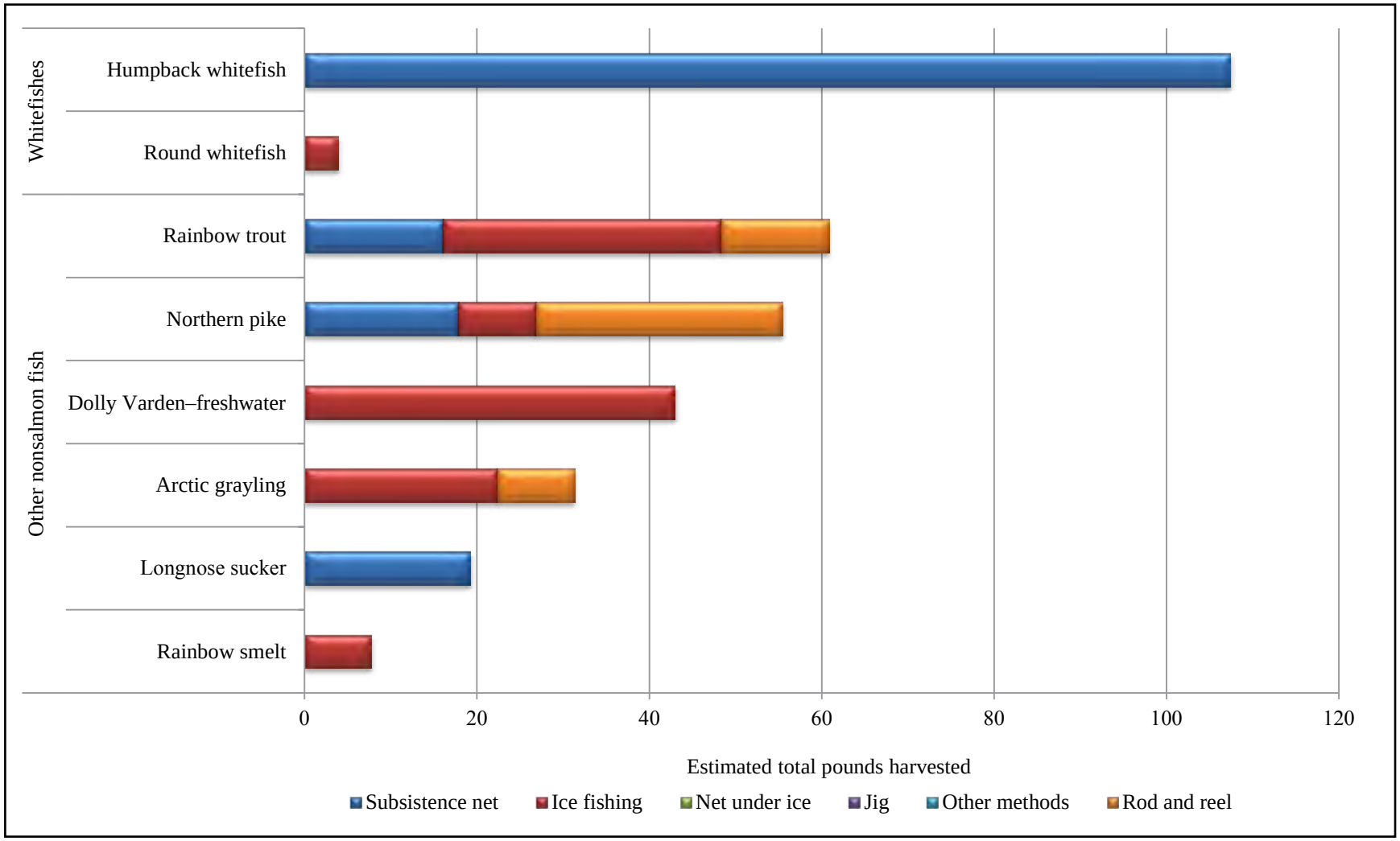


Figure 3-5.–Nonsalmon fish harvest by gear type, Igiugig, 2013.

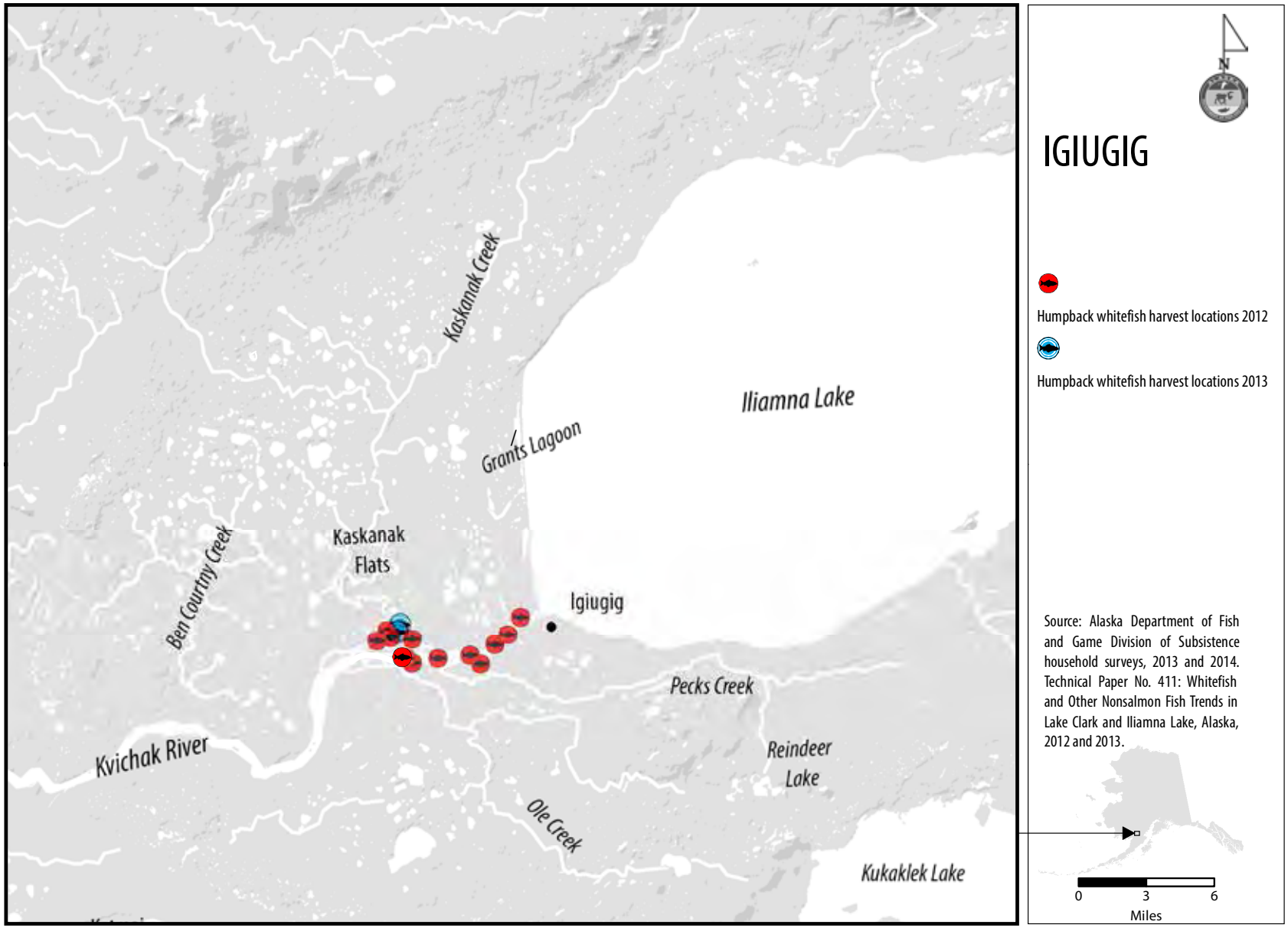


Figure 3-6.–Harvest locations of humpback whitefish, Igiugig, 2012 and 2013.

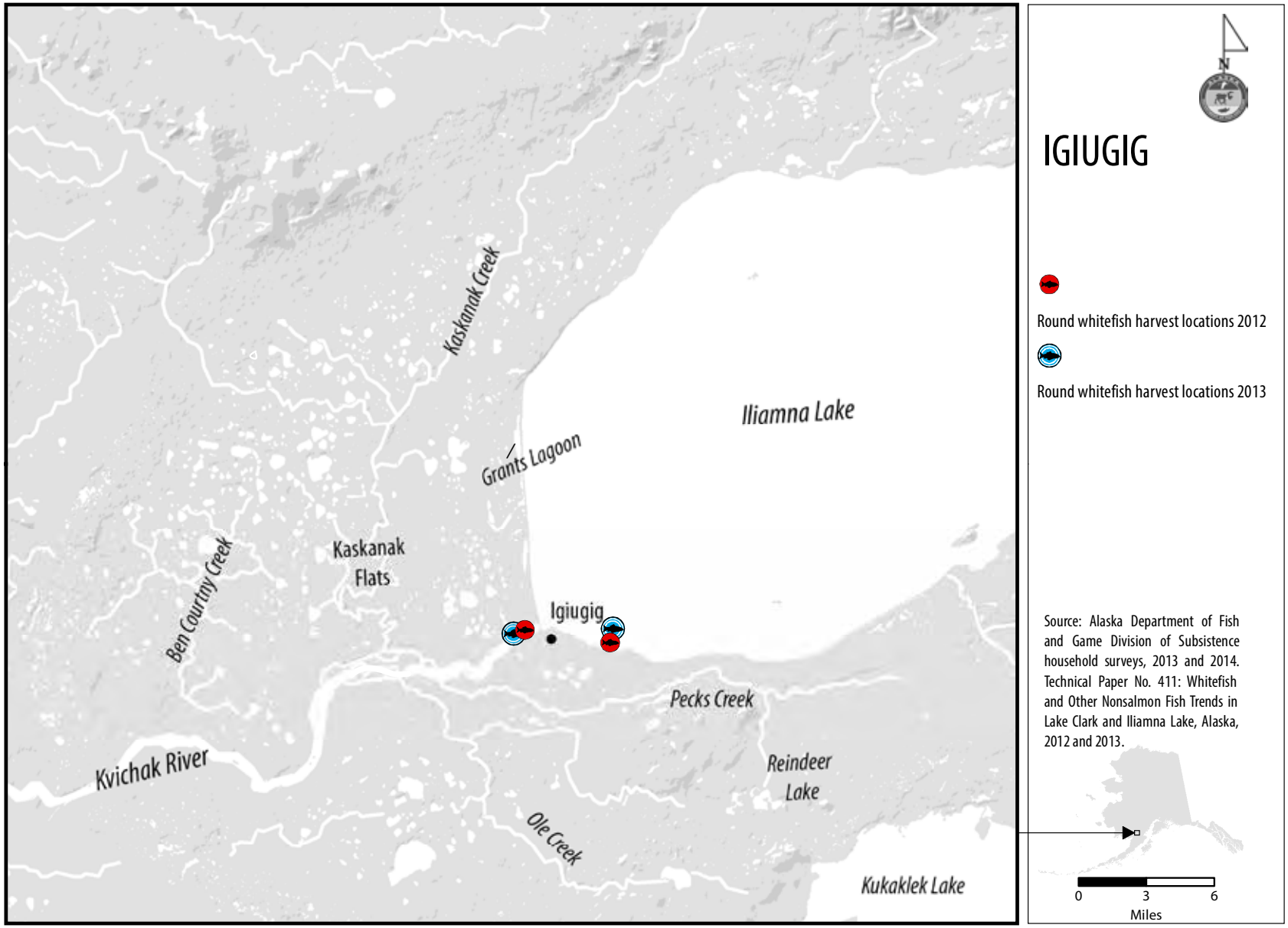


Figure 3-7.–Harvest locations of round whitefish, Igiugig, 2012 and 2013.

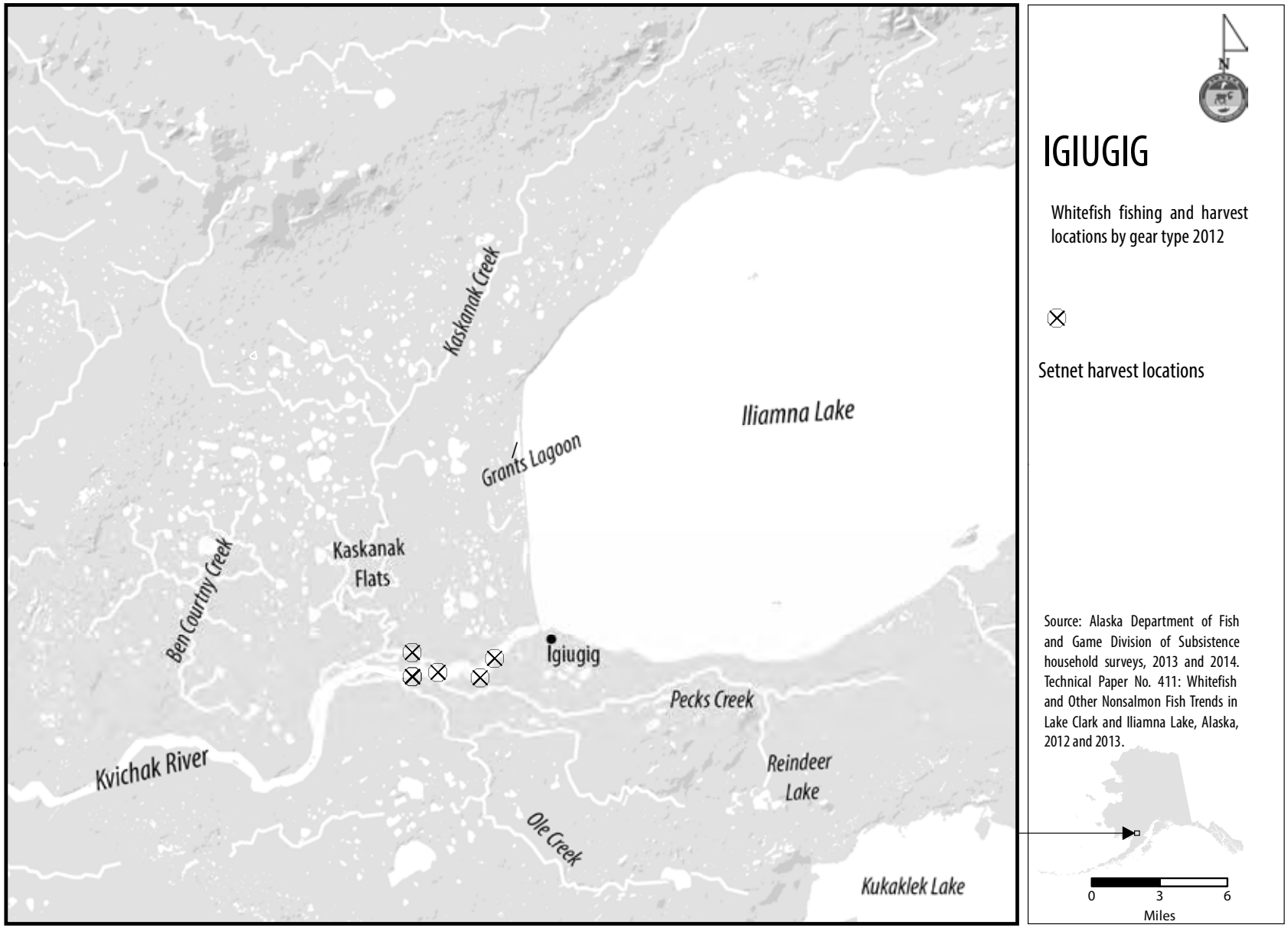


Figure 3-8.–Fishing and harvest locations of whitefish species by gear type, Igiugig, 2012.

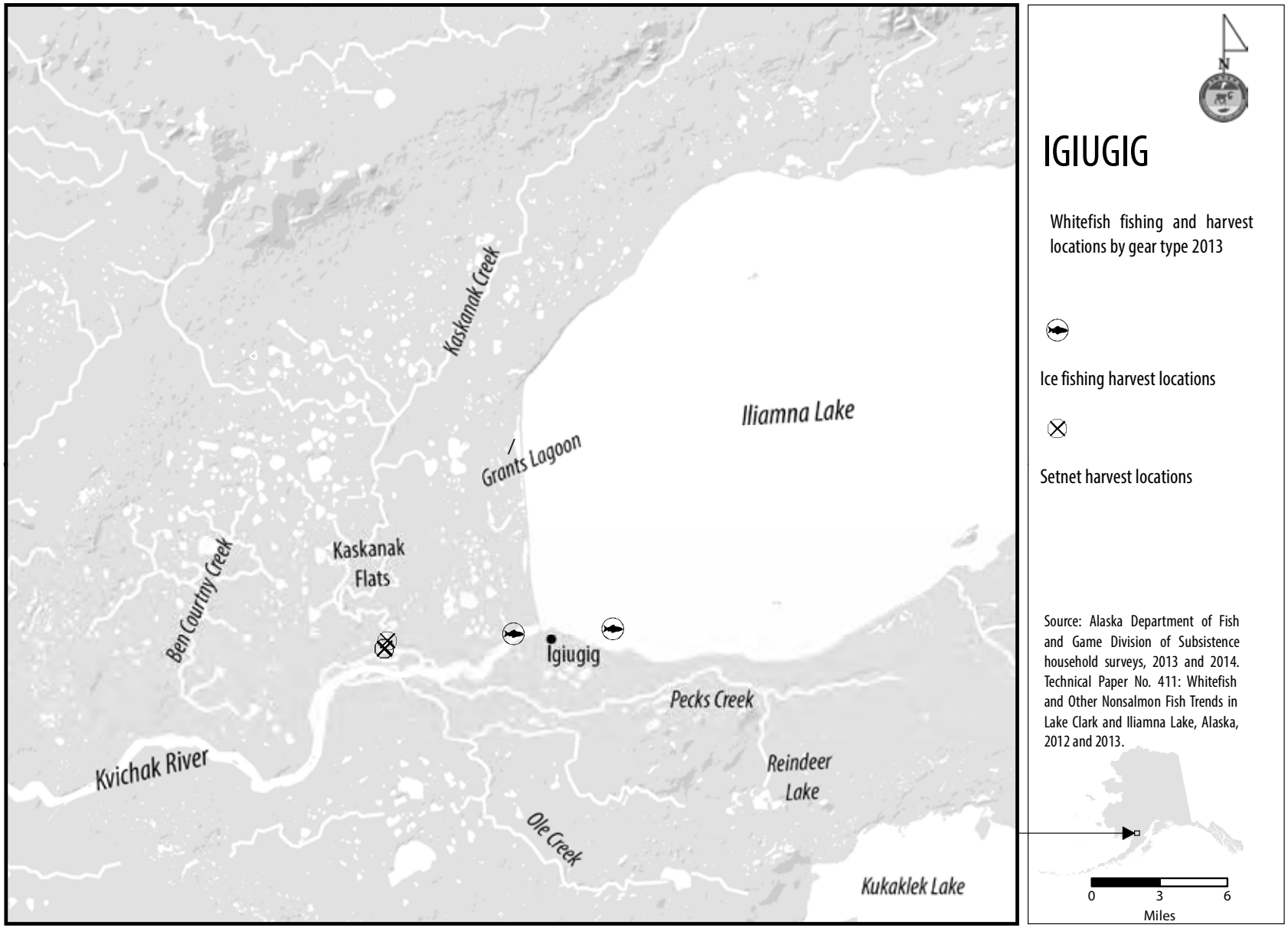
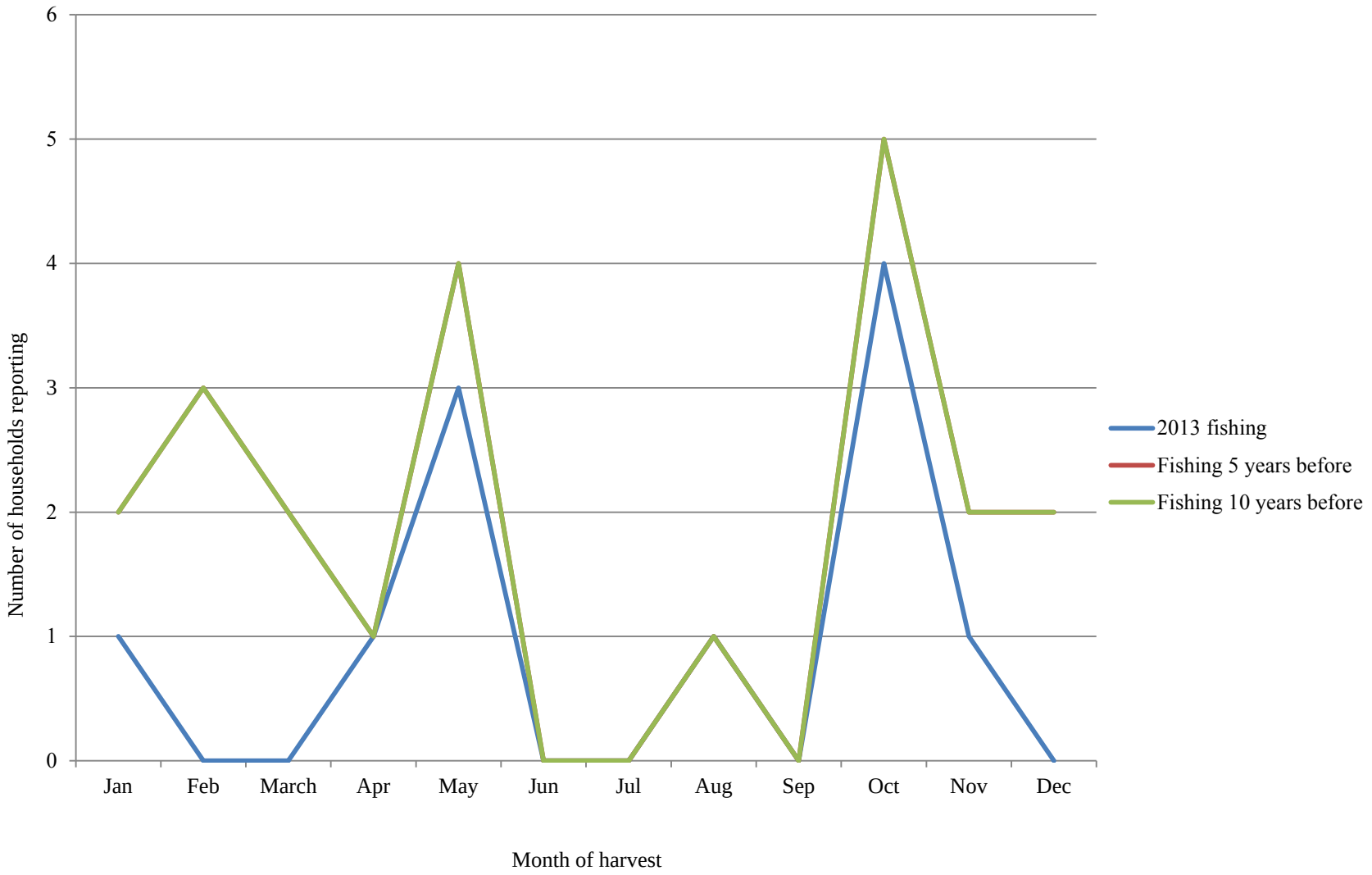


Figure 3-9.–Fishing and harvest locations of whitefish species by gear type, Igiugig, 2013.



Note Where fewer than 3 lines appear it indicates that the fishing pattern was identical for more than one timeline. For example, the fishing pattern for 5 years ago was identical to the fishing pattern for 10 years ago.

Figure 3-10.–Households reporting timing of whitefish harvests for 2013 and 5 and 10 years prior, Igiugig.

Table 3-23.–Estimated harvest of whitefishes by month, Igiugig, 2012.

	Estimated harvest of whitefishes by month													
Resource	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Unk	**Total**
Whitefishes	**0.0**	**0.0**	**0.0**	**0.0**	**1.2**	**1.2**	**0.0**	**0.0**	**20.0**	**23.5**	**72.9**	**0.0**	**0.0**	**118.8**
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**
Broad 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**
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**
Least 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**
Humpback whitefish	0.0	0.0	0.0	0.0	1.2	1.2	0.0	0.0	20.0	23.5	72.9	0.0	0.0	**118.8**
Round whitefish	0.0	0.0	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	5.9	0.0	0.0	**8.2**

Source ADF&G Division of Subsistence household surveys, 2013.

Table 3-24.–Estimated harvest of whitefishes by month, Igiugig, 2013.

	Estimated harvest of whitefishes by month													
Resource	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Unk	**Total**
Whitefishes	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**10.2**	**0.0**	**12.8**	**38.3**	**0.0**	**0.0**	**0.0**	**61.3**
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**
Broad 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**
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**
Least 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**
Humpback whitefish	0.0	0.0	0.0	0.0	0.0	0.0	10.2	0.0	12.8	38.3	0.0	0.0	0.0	**61.3**
Round whitefish	2.6	0.0	0.0	1.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**3.8**

Source ADF&G Division of Subsistence household surveys, 2014.

Iliamna

The harvests of whitefishes were composed of a limited amount of humpback whitefish, least cisco, and sheefish for the community of Iliamna in the single study year of 2013. Humpback whitefish composed 4% of the total harvest of nonsalmon fish while least cisco and sheefish each made up less than 1% of the estimated nonsalmon fish harvest (Figure 3-11). Approximately 93 lb (1 lb per capita) of humpback whitefish were harvested in 2013 (Table 3-25). These values are consistent with historical records documenting the harvest of whitefishes and local residents' testimony that whitefishes are not locally available. In general, the estimated harvest of whitefishes by Iliamna residents has historically been between 1–2 lb per capita, with the exception of 2004 where the per capita harvest was 5 lb (Figure 3-12).

More than one-third of the community used humpback whitefish in 2013 (35%) (Table 3-25). Access to this whitefish species likely occurred through the sharing of humpback whitefish by neighboring communities and family members. This is supported by the high level of community households that were estimated as receiving humpback whitefish (31%); note that the rate of receiving households was much higher for humpback whitefish than any other nonsalmon fish.

Humpback whitefish were harvested by Iliamna residents in the spring, summer, and early fall (Table 3-26). Some humpback whitefish were harvested in gillnets under the ice and by use of rod and reel while ice fishing (Table 3-27); however, the majority (70 lb) were obtained by rod and reel during the summer (Figure 3-13; Table 3-26). The harvest of humpback whitefish by Iliamna households only occurred in Sixmile Lake (Figure 3-14). Iliamna residents ice fished for least cisco in Sixmile Lake in March (Figure 3-15; Table 3-26). Sheefish were harvested in June with rod and reel on the lower Yukon River (Table 3-26; Figure 3-13).

The harvest timing of whitefish over the past 5 and 10 years has not changed significantly (Figure 3-16). Whitefishes are harvested mostly in the spring and summer between February and August with a hiatus in the early fall and minimal harvests in late fall and winter.

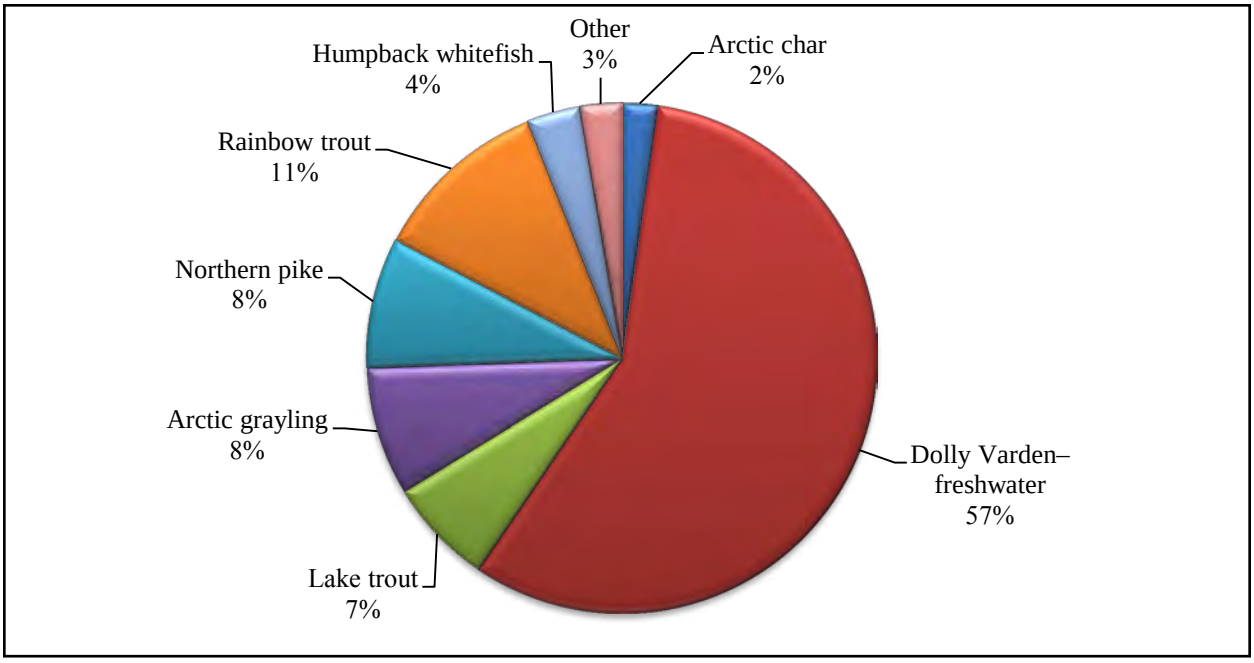


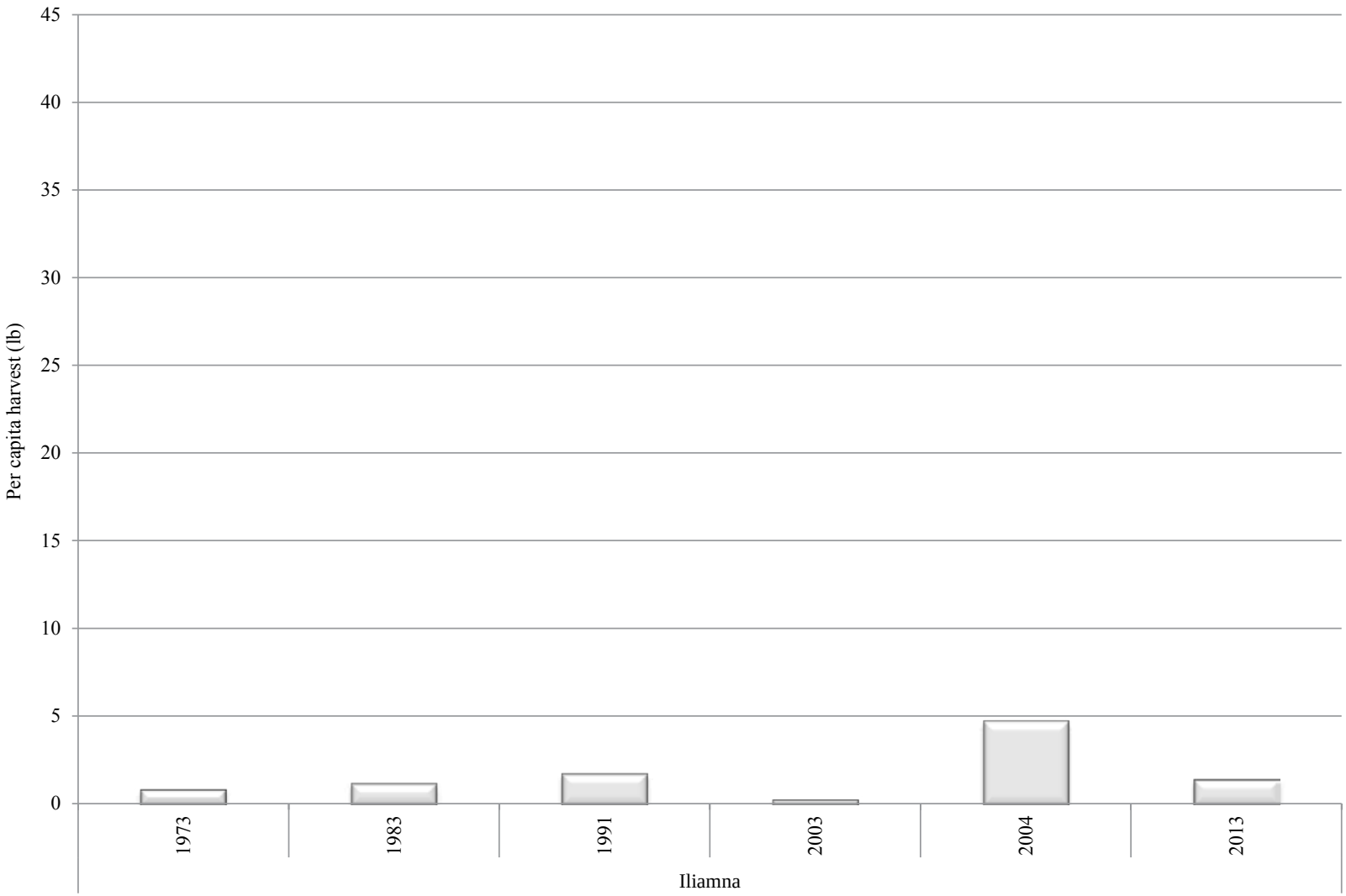
Figure 3-11.–Composition of nonsalmon fish harvest in pounds usable weight, Iliamna, 2013.

Table 3-25.–Estimated use and harvests of nonsalmon fish resources, Iliamna, 2013.

	Percentage of households					Harvest weight (lb)			Harvest amount			95%
Resource	Use %	Attempt %	Harvest %	Receive %	Give %	Total	Mean household	Per capita	Total	Unit	Mean household	confidence limit (±)
Nonsalmon fish	**79.3**	**69.0**	**69.0**	**58.6**	**31.0**	**2,766.2**	**79.0**	**30.2**				**21.9**
Rainbow smelt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	gal	0.0	0.0
Arctic lamprey	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	lb	0.0	0.0
Burbot	10.3	10.3	6.9	3.4	3.4	4.8	0.1	0.1	4.8	ind	0.1	66.3
Arctic char	6.9	6.9	6.9	3.4	6.9	62.5	1.8	0.7	44.7	ind	1.3	62.7
Dolly Varden–freshwater	58.6	51.7	51.7	17.2	24.1	1,583.2	45.2	17.3	1,130.9	ind	32.3	32.3
Lake trout	24.1	20.7	20.7	6.9	6.9	187.6	5.4	2.0	134.0	ind	3.8	45.4
Unknown char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Arctic grayling	48.3	48.3	48.3	3.4	13.8	225.6	6.4	2.5	322.2	ind	9.2	33.4
Northern pike	44.8	34.5	34.5	13.8	6.9	228.3	6.5	2.5	81.6	ind	2.3	28.7
Longnose sucker	3.4	3.4	3.4	0.0	0.0	36.2	1.0	0.4	24.1	ind	0.7	84.8
Rainbow trout	55.2	48.3	48.3	20.7	13.8	312.6	8.9	3.4	223.3	ind	6.4	24.7
Unknown trout	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Sheefish	3.4	3.4	3.4	3.4	0.0	19.9	0.6	0.2	3.6	ind	0.1	84.8
Broad whitefish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Bering cisco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Least cisco	3.4	3.4	3.4	0.0	3.4	12.6	0.4	0.1	31.4	ind	0.9	84.8
Humpback whitefish	34.5	17.2	17.2	31.0	6.9	92.9	2.7	1.0	53.1	ind	1.5	48.7
Round whitefish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0

Source ADF&G Division of Subsistence household surveys, 2014.

Note Where the percentage of households using a resource is greater than the combined receiving and harvesting households indicates use of resources obtained during a previous year.



Note For all study years, sheefish harvests were included in the estimated harvest of whitefishes.

Figure 3-12.–Estimated harvests of whitefishes by pounds per capita, Iliamna, 1974, 1983, 1991, 2004, and 2013.

Table 3-26.–Estimated harvest of whitefishes by month, Iliamna, 2013.

Resource	Estimated harvest of whitefishes by month													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Unk	**Total**
Whitefishes	**0.0**	**0.0**	**33.8**	**1.2**	**0.0**	**32.6**	**9.7**	**6.0**	**4.8**	**0.0**	**0.0**	**0.0**	**0.0**	**88.1**
Sheefish	0.0	0.0	0.0	0.0	0.0	3.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**3.6**
Broad 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**
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**
Least cisco	0.0	0.0	31.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**31.4**
Humpback whitefish	0.0	0.0	2.4	1.2	0.0	29.0	9.7	6.0	4.8	0.0	0.0	0.0	0.0	**53.1**
Round 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**

Source ADF&G Division of Subsistence household surveys, 2014.

Table 3-27.–Estimated harvest of nonsalmon fish by gear type, resource, Iliamna, 2013.

Resource	Subsistence methods															
	Gillnet or seine		Ice fishing (hook under ice)		Net under ice		Jig		Other method		Subsistence gear, any method		Rod and reel		Any method	
	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds
Nonsalmon fish	**12.1**	**20.3**	**1,414.3**	**1,962.8**	**16.9**	**6.8**	**0.0**	**0.0**	**0.0**	**0.0**	**1,443.3**	**1,989.9**	**610.3**	**776.3**	**2,053.6**	**2,766.2**
Rainbow smelt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arctic lamprey	0.0	0.0	0.0	0.0	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	0.0	0.0	0.0	0.0	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	4.8	4.8	0.0	0.0	0.0	0.0	0.0	0.0	4.8	4.8	0.0	0.0	4.8	4.8
Arctic char	0.0	0.0	21.7	30.4	0.0	0.0	0.0	0.0	0.0	0.0	21.7	30.4	22.9	32.1	44.7	62.5
Dolly Varden–freshwater	0.0	0.0	1,016.2	1,422.7	0.0	0.0	0.0	0.0	0.0	0.0	1,016.2	1,422.7	114.7	160.5	1,130.9	1,583.2
Lake trout	2.4	3.4	27.8	38.9	0.0	0.0	0.0	0.0	0.0	0.0	30.2	42.2	103.8	145.3	134.0	187.6
Unknown char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arctic grayling	0.0	0.0	109.8	76.9	0.0	0.0	0.0	0.0	0.0	0.0	109.8	76.9	212.4	148.7	322.2	225.6
Northern pike	0.0	0.0	51.7	144.8	0.0	0.0	0.0	0.0	0.0	0.0	51.7	144.8	29.8	83.5	81.6	228.3
Longnose sucker	0.0	0.0	24.1	36.2	0.0	0.0	0.0	0.0	0.0	0.0	24.1	36.2	0.0	0.0	24.1	36.2
Rainbow trout	0.0	0.0	140.0	196.0	0.0	0.0	0.0	0.0	0.0	0.0	140.0	196.0	83.3	116.6	223.3	312.6
Unknown trout	0.0	0.0	0.0	0.0	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	3.6	19.9	3.6	19.9
Broad 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
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
Least cisco	0.0	0.0	14.5	5.8	16.9	6.8	0.0	0.0	0.0	0.0	31.4	12.6	0.0	0.0	31.4	12.6
Humpback whitefish	9.7	16.9	3.6	6.3	0.0	0.0	0.0	0.0	0.0	0.0	13.3	23.2	39.8	69.7	53.1	92.9
Round 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

Source ADF&G Division of Subsistence household surveys, 2014.

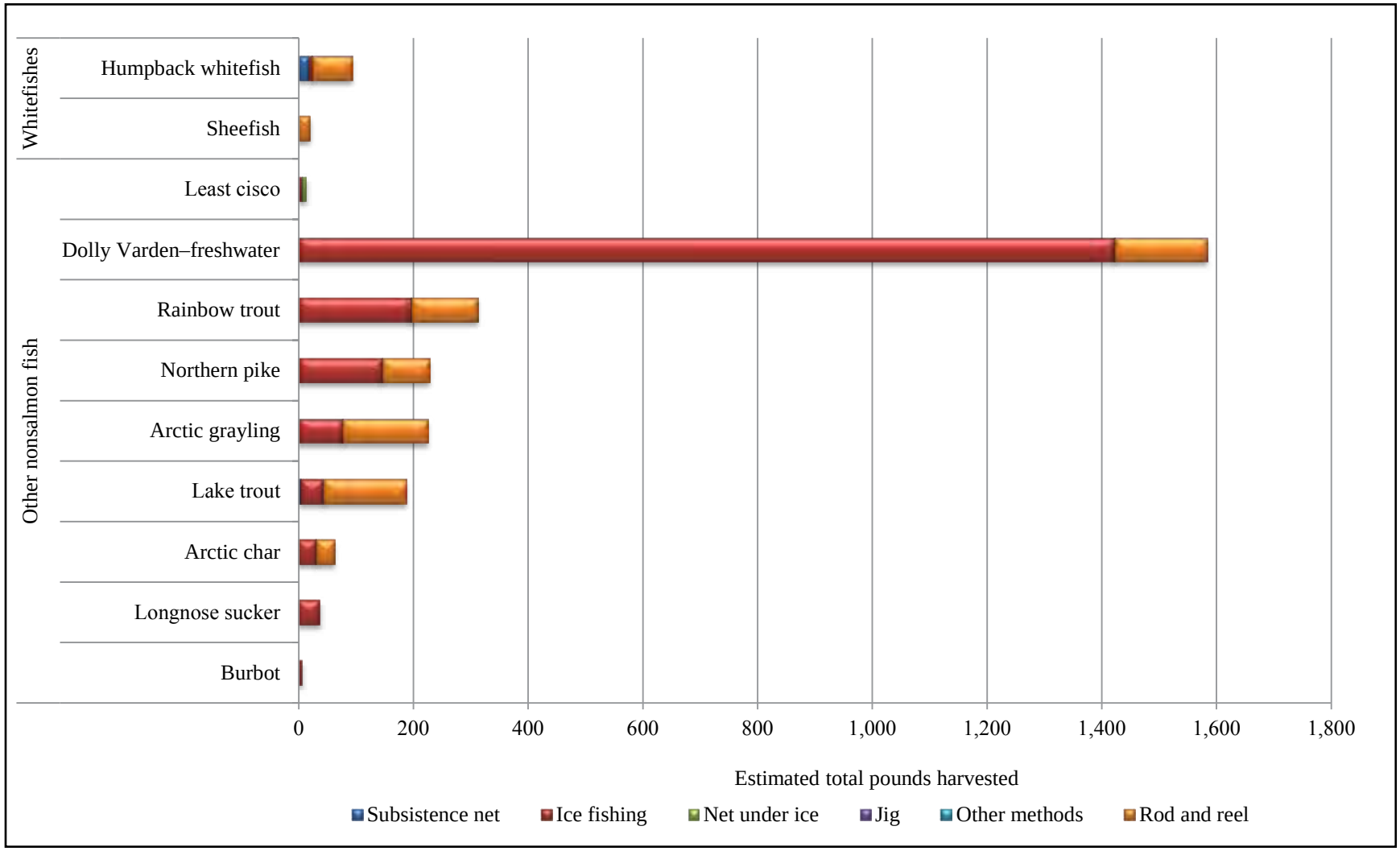


Figure 3-13.–Nonsalmon fish harvest by gear type, Iliamna, 2013.

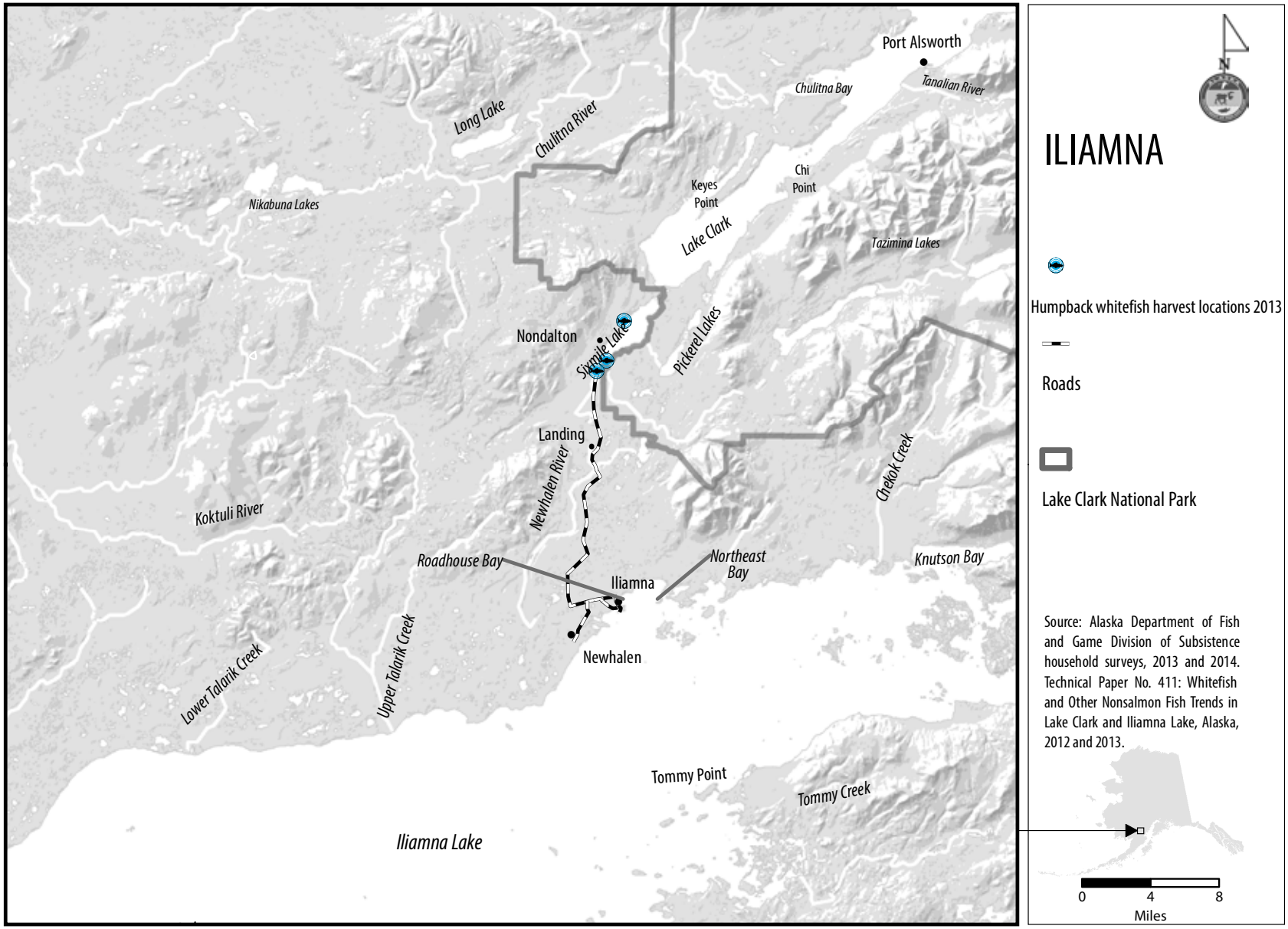


Figure 3-14.–Harvest locations of humpback whitefish, Iliamna, 2013.

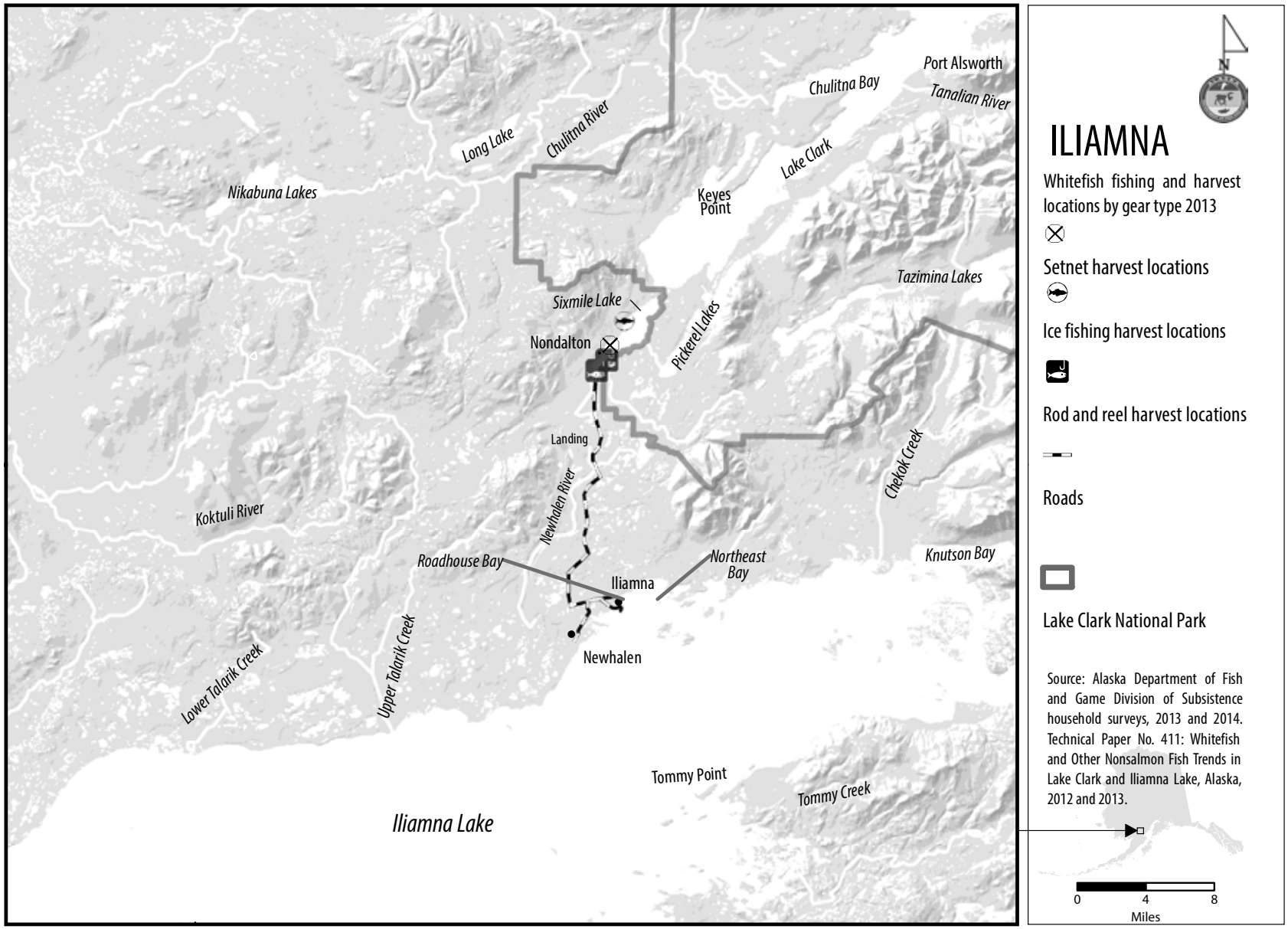
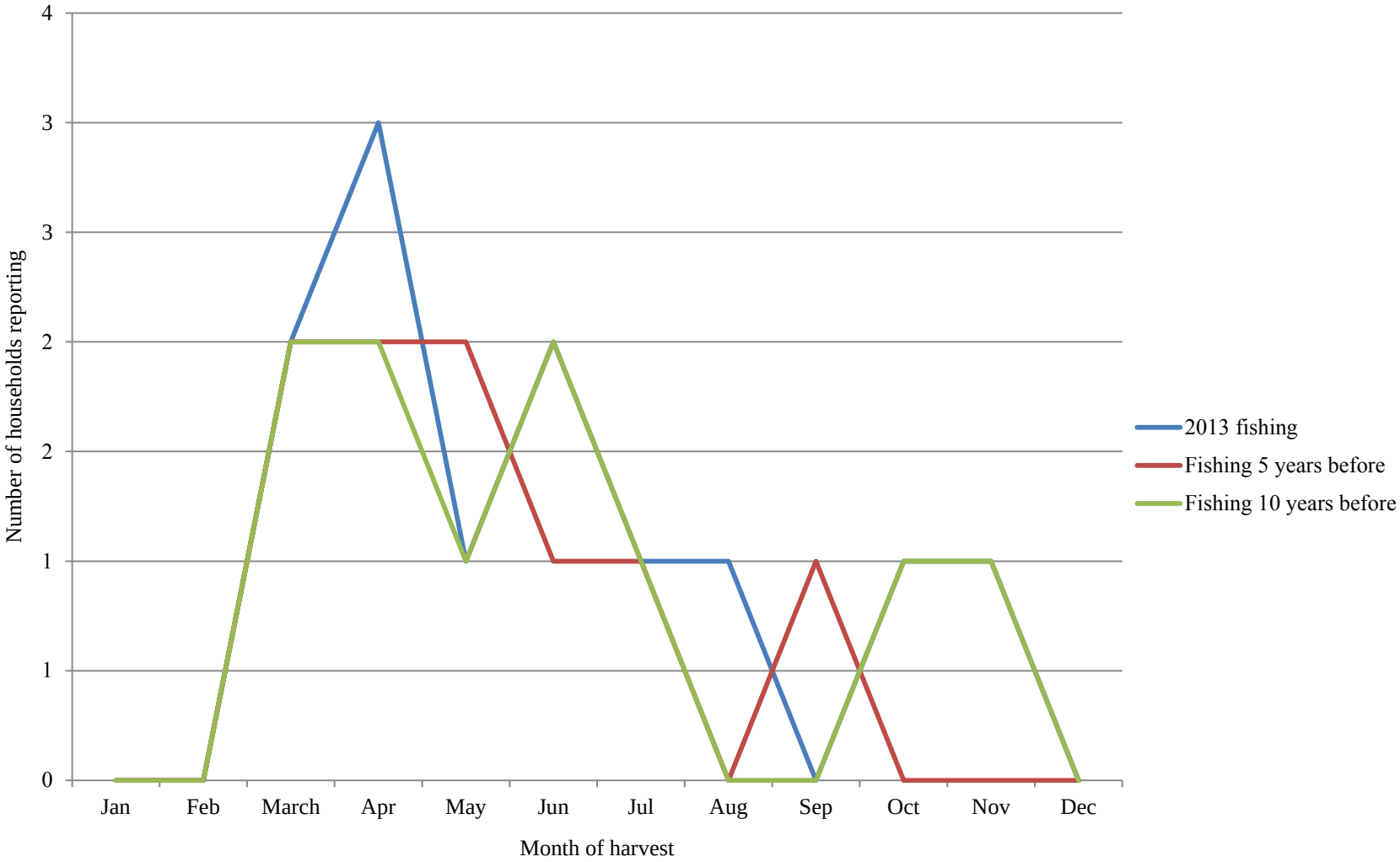


Figure 3-15.–Fishing and harvest locations of whitefish species by gear type, Iliamna, 2013.



Note Where fewer than 3 lines appear it indicates that the fishing pattern was identical for more than one timeline. For example, the fishing pattern for all 3 timelines was identical for January through March.

Figure 3-16.–Households reporting timing of whitefish harvests for 2013 and 5 and 10 years prior, Iliamna.

Newhalen

In 2012 and 2013, humpback and round whitefish were the most commonly harvested whitefishes by Newhalen residents, but the harvests were small in comparison to other types of nonsalmon fish (figures 3-17 and 3-18; tables 3-28 and 3-29). The only other whitefish species harvested was in 2013 when sheefish were harvested on the Yukon River by a single household and when broad whitefish were harvested (21 lb total) (Table 3-29). In both 2012 and 2013, Newhalen households harvested an estimated 1 lb per capita of humpback whitefish and less than 1 lb per capita of round whitefish. These estimates are comparable to most historical harvests, which document past estimated harvests of whitefishes as between 1–3 lb per capita from the 1980s (Figure 3-19).

Humpback whitefish were generally harvested between March and October of both study years (tables 3-30 and 3-31). Humpback whitefish were harvested with a variety of methods including gillnet, ice fishing, and rod and reel during the open water season (tables 3-32 and 3-33; figures 3-20 and 3-21). In 2012 and 2013, humpback whitefish were harvested in a variety of locations including at the mouth of the Newhalen River, Roadhouse Bay, Landing, and in Sixmile Lake (Figure 3-22; Figure 3-23). In contrast, round whitefish were only harvested by Newhalen households at the mouth of the Newhalen River in both study years with rod and reel and also by ice fishing in 2013 (Figure 3-24; Figure 3-25). In 2012, round whitefish were harvested between July and October and in January, March, and October in 2013 (Table 3-30; Table 3-31).

The timing of whitefish harvests by Newhalen residents has remained similar over the past 10 years between January and June (Figure 3-26). However, significant changes have occurred in the timing of whitefish harvests between July and December. In fact, fishing in 2013 exhibited the exact opposite pattern of harvesting compared to 5 and 10 years ago. For example, harvests in 2013 gradually decline after May whereas past harvests drop entirely in July and then gradually rise again over the late summer and fall.

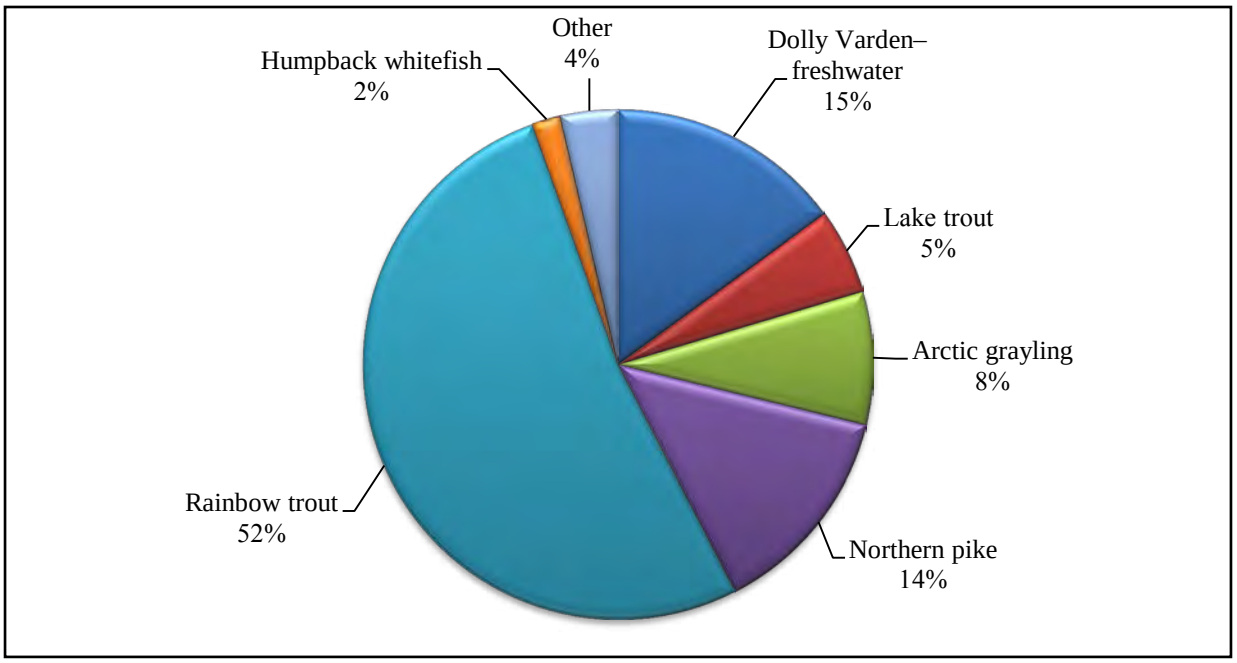


Figure 3-17.–Composition of nonsalmon fish harvest in pounds usable weight, Newhalen, 2012.

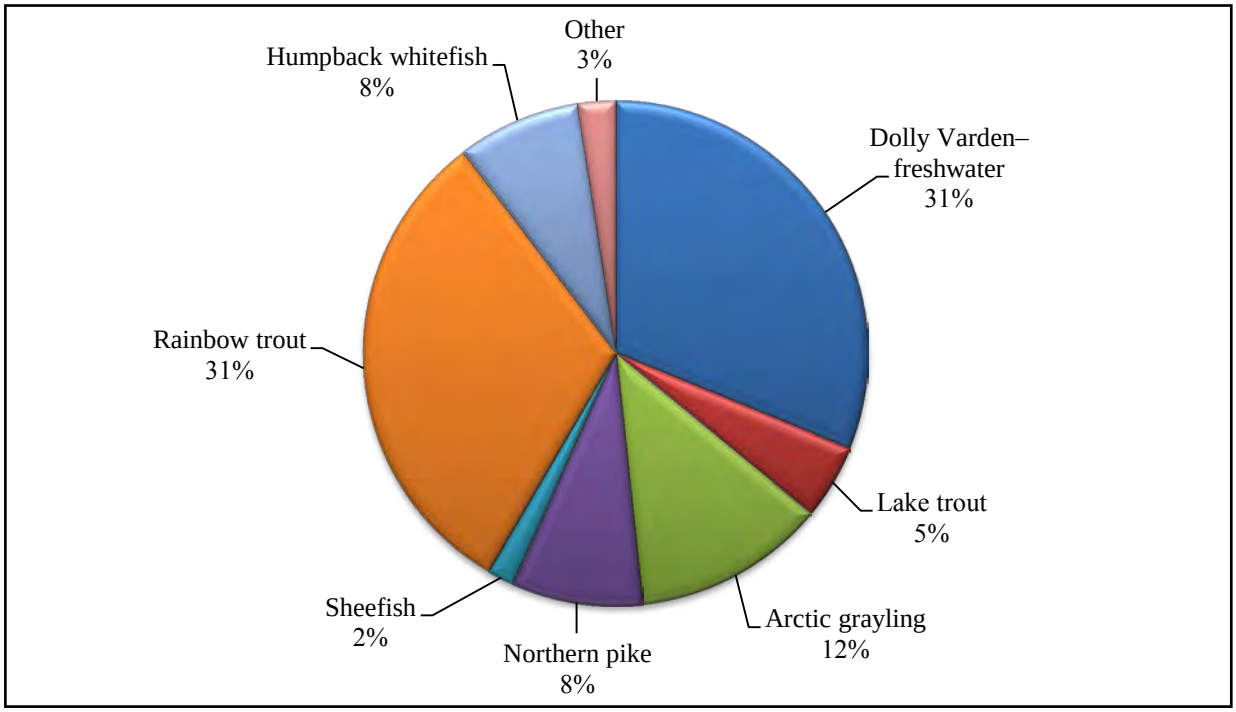


Figure 3-18.–Composition of nonsalmon fish harvest in pounds usable weight, Newhalen, 2013.

Table 3-28.–Estimated use and harvests of nonsalmon fish resources, Newhalen, 2012.

	Percentage of households					Harvest weight (lb)			Harvest amount			95%
Resource	Use %	Attempt %	Harvest %	Receive %	Give %	Total	Mean household	Per capita	Total	Unit	Mean household	confidence limit (±)
Nonsalmon fish	**94.1**	**76.5**	**70.6**	**64.7**	**58.8**	**4,372.2**	**91.1**	**24.4**				**40.6**
Rainbow smelt	2.9	0.0	0.0	2.9	0.0	0.0	0.0	0.0	0.0	gal	0.0	0.0
Arctic lamprey	2.9	0.0	0.0	2.9	2.9	0.0	0.0	0.0	0.0	ind	0.0	0.0
Alaska blackfish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	lb	0.0	0.0
Burbot	8.8	5.9	5.9	2.9	5.9	9.9	0.2	0.1	9.9	ind	0.2	95.0
Arctic char	2.9	2.9	2.9	0.0	2.9	59.3	1.2	0.3	42.4	ind	0.9	109.9
Dolly Varden–freshwater	61.8	55.9	52.9	14.7	23.5	654.2	13.6	3.6	467.3	ind	9.7	38.7
Dolly Varden–fingerling	2.9	2.9	2.9	0.0	2.9	33.9	0.7	0.2	564.7	ind	11.8	109.9
Lake trout	35.3	38.2	32.4	0.0	11.8	237.2	4.9	1.3	169.4	ind	3.5	53.7
Unknown char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Arctic grayling	67.6	55.9	50.0	17.6	20.6	368.6	7.7	2.1	526.6	ind	11.0	35.4
Northern pike	61.8	52.9	47.1	20.6	23.5	594.4	12.4	3.3	212.3	ind	4.4	33.6
Longnose sucker	2.9	2.9	2.9	0.0	0.0	2.1	0.0	0.0	1.4	ind	0.0	109.9
Rainbow trout	58.8	58.8	52.9	11.8	26.5	2,278.9	47.5	12.7	1,627.8	ind	33.9	59.9
Unknown trout	2.9	2.9	2.9	0.0	0.0	9.9	0.2	0.1	7.1	ind	0.1	109.9
Sheefish	14.7	0.0	0.0	14.7	11.8	0.0	0.0	0.0	0.0	ind	0.0	0.0
Broad whitefish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Bering cisco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Least cisco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Humpback whitefish	35.3	20.6	17.6	29.4	14.7	81.5	1.7	0.5	46.6	ind	1.0	46.9
Round whitefish	8.8	5.9	2.9	2.9	2.9	42.4	0.9	0.2	42.4	ind	0.9	109.9
Unknown nonsalmon fish	5.9	0.0	0.0	5.9	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0

Source ADF&G Division of Subsistence household surveys, 2013.

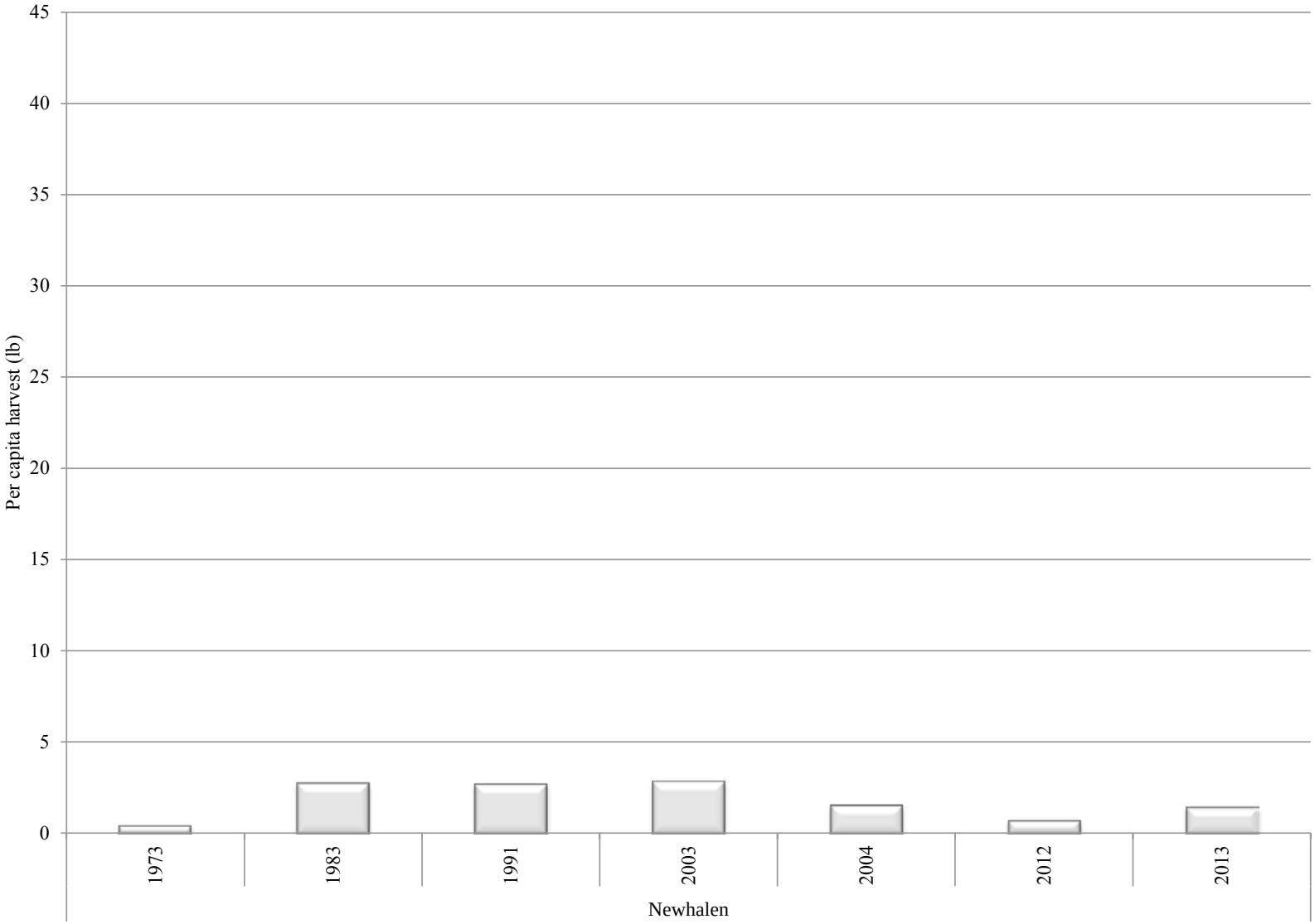
Note Where the percentage of households using a resource is greater than the combined receiving and harvesting households indicates use from resources obtained during a previous year.

Table 3-29.–Estimated use and harvests of nonsalmon fish resources, Newhalen, 2013.

	Percentage of households					Harvest weight (lb)			Harvest amount			95%
Resource	Use %	Attempt %	Harvest %	Receive %	Give %	Total	Mean household	Per capita	Total	Unit	Mean household	confidence limit (±)
Nonsalmon fish	**87.9**	**69.7**	**66.7**	**72.7**	**33.3**	**1,677.0**	**38.1**	**12.1**				**23.3**
Rainbow smelt	6.1	0.0	0.0	6.1	0.0	0.0	0.0	0.0	0.0	gal	0.0	0.0
Arctic lamprey	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	lb	0.0	0.0
Burbot	9.1	6.1	3.0	6.1	0.0	2.7	0.1	0.0	2.7	ind	0.1	101.8
Arctic char	3.0	3.0	3.0	0.0	0.0	5.6	0.1	0.0	4.0	ind	0.1	101.8
Dolly Varden–freshwater	60.6	45.5	45.5	24.2	9.1	522.7	11.9	3.8	373.3	ind	8.5	27.3
Lake trout	36.4	30.3	30.3	9.1	6.1	80.3	1.8	0.6	57.3	ind	1.3	35.8
Unknown char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Arctic grayling	60.6	48.5	48.5	18.2	15.2	207.2	4.7	1.5	296.0	ind	6.7	33.5
Northern pike	48.5	33.3	24.2	21.2	15.2	139.7	3.2	1.0	49.9	ind	1.1	56.6
Longnose sucker	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	63.6	54.5	54.5	9.1	9.1	524.5	11.9	3.8	374.7	ind	8.5	26.7
Unknown trout	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Sheefish	6.1	3.0	3.0	6.1	0.0	29.3	0.7	0.2	5.3	ind	0.1	101.8
Broad whitefish	6.1	6.1	3.0	6.1	0.0	21.3	0.5	0.2	5.3	ind	0.1	101.8
Bering cisco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Least cisco	3.0	0.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Humpback whitefish	54.5	24.2	18.2	39.4	12.1	133.0	3.0	1.0	76.0	ind	1.7	41.6
Round whitefish	27.3	9.1	9.1	18.2	3.0	10.7	0.2	0.1	10.7	ind	0.2	57.9

Source ADF&G Division of Subsistence household surveys, 2014.

Note Where the percentage of households using a resource is greater than the combined receiving and harvesting households indicates use from resources obtained during a previous year.



Note For all study years, sheefish harvests were included in the estimated harvest of whitefishes.

Figure 3-19.–Estimated harvests of whitefishes by pounds per capita, Newhalen, 1974, 1983, 1991, 2003, 2004, 2012, and 2013.

Table 3-30.–Estimated harvest of whitefishes by month, Newhalen, 2012.

	Estimated harvest of whitefishes by month													
Resource	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Unk	**Total**
Whitefishes	**0.0**	**0.0**	**9.9**	**2.8**	**0.0**	**11.3**	**11.3**	**5.6**	**0.0**	**5.6**	**0.0**	**0.0**	**0.0**	**46.6**
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**
Broad 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**
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**
Least 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**
Humpback whitefish	0.0	0.0	9.9	2.8	0.0	11.3	11.3	5.6	0.0	5.6	0.0	0.0	0.0	**46.6**
Round whitefish	0.0	0.0	0.0	0.0	0.0	0.0	9.9	9.9	11.3	11.3	0.0	0.0	0.0	**42.4**

Source ADF&G Division of Subsistence household surveys, 2013.

Table 3-31.–Estimated harvest of whitefishes by month, Newhalen, 2013.

	Estimated harvest of whitefishes by month													
Resource	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Unk	**Total**
Whitefishes	**0.0**	**0.0**	**44.0**	**8.0**	**9.3**	**5.3**	**12.0**	**4.0**	**4.0**	**0.0**	**0.0**	**0.0**	**0.0**	**86.7**
Sheefish	0.0	0.0	0.0	5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**5.3**
Broad whitefish	0.0	0.0	0.0	0.0	0.0	5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**5.3**
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**
Least 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**
Humpback whitefish	0.0	0.0	44.0	2.7	9.3	0.0	12.0	4.0	4.0	0.0	0.0	0.0	0.0	**76.0**
Round whitefish	2.7	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	**10.7**

Source ADF&G Division of Subsistence household surveys, 2014.

Table 3-32.–Estimated harvest of nonsalmon fish by gear type, resource, Newhalen, 2012.

	Subsistence methods															
	Gillnet or seine		Ice fishing (hook under ice)		Net under ice		Jig		Other method		Subsistence gear, any method		Rod and reel		Any method	
Resource	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds
Nonsalmon fish	**19.8**	**34.6**	**2,294.9**	**3,154.2**	**0.0**	**0.0**	**595.8**	**74.5**	**0.0**	**0.0**	**2,910.5**	**3,263.4**	**807.2**	**1,108.8**	**3,717.7**	**4,372.2**
Rainbow smelt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arctic lamprey	0.0	0.0	0.0	0.0	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	0.0	0.0	0.0	0.0	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	9.9	9.9	0.0	0.0	0.0	0.0	0.0	0.0	9.9	9.9	0.0	0.0	9.9	9.9
Arctic char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	42.4	59.3	42.4	59.3
Dolly Varden–freshwater	0.0	0.0	443.3	620.6	0.0	0.0	0.0	0.0	0.0	0.0	443.3	620.6	24.0	33.6	467.3	654.2
Dolly Varden–fingerling	0.0	0.0	0.0	0.0	0.0	0.0	564.7	33.9	0.0	0.0	564.7	33.9	0.0	0.0	564.7	33.9
Lake trout	0.0	0.0	151.1	211.5	0.0	0.0	0.0	0.0	0.0	0.0	151.1	211.5	18.4	25.7	169.4	237.2
Unknown char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arctic grayling	0.0	0.0	436.2	305.4	0.0	0.0	4.2	3.0	0.0	0.0	440.5	308.3	86.1	60.3	526.6	368.6
Northern pike	0.0	0.0	175.9	492.4	0.0	0.0	0.0	0.0	0.0	0.0	175.9	492.4	36.4	101.9	212.3	594.4
Longnose sucker	0.0	0.0	0.0	0.0	0.0	0.0	1.4	2.1	0.0	0.0	1.4	2.1	0.0	0.0	1.4	2.1
Rainbow trout	0.0	0.0	1,058.8	1,482.4	0.0	0.0	25.4	35.6	0.0	0.0	1,084.2	1,517.9	543.5	760.9	1,627.8	2,278.9
Unknown trout	0.0	0.0	7.1	9.9	0.0	0.0	0.0	0.0	0.0	0.0	7.1	9.9	0.0	0.0	7.1	9.9
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
Broad 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
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
Least 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
Humpback whitefish	19.8	34.6	12.7	22.2	0.0	0.0	0.0	0.0	0.0	0.0	32.5	56.8	14.1	24.7	46.6	81.5
Round 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	42.4	42.4	42.4	42.4
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

Source ADF&G Division of Subsistence household surveys, 2013.

Table 3-33.–Estimated harvest of nonsalmon fish by gear type, resource, Newhalen, 2013.

	Subsistence methods															
	Gillnet or seine		Ice fishing (hook under ice)		Net under ice		Jig		Other method		Subsistence gear, any method		Rod and reel		Any method	
Resource	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds
Nonsalmon fish	**21.3**	**48.4**	**784.0**	**1,041.1**	**0.0**	**0.0**	**0.0**	**0.0**	**53.3**	**74.7**	**858.7**	**1,164.2**	**396.6**	**512.8**	**1,255.2**	**1,677.0**
Rainbow smelt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arctic lamprey	0.0	0.0	0.0	0.0	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	0.0	0.0	0.0	0.0	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	2.7	2.7	0.0	0.0	0.0	0.0	0.0	0.0	2.7	2.7	0.0	0.0	2.7	2.7
Arctic char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	5.6	4.0	5.6
Dolly Varden–freshwater	2.7	3.7	237.3	332.3	0.0	0.0	0.0	0.0	26.7	37.3	266.7	373.3	106.7	149.3	373.3	522.7
Lake trout	0.0	0.0	28.0	39.2	0.0	0.0	0.0	0.0	0.0	0.0	28.0	39.2	29.3	41.1	57.3	80.3
Unknown char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arctic grayling	0.0	0.0	194.7	136.3	0.0	0.0	0.0	0.0	0.0	0.0	194.7	136.3	101.3	70.9	296.0	207.2
Northern pike	0.0	0.0	48.0	134.4	0.0	0.0	0.0	0.0	0.0	0.0	48.0	134.4	1.9	5.3	49.9	139.7
Longnose sucker	0.0	0.0	0.0	0.0	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	220.0	308.0	0.0	0.0	0.0	0.0	26.7	37.3	246.7	345.3	128.0	179.2	374.7	524.5
Unknown trout	0.0	0.0	0.0	0.0	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	5.3	29.3	5.3	29.3
Broad whitefish	5.3	21.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.3	21.3	0.0	0.0	5.3	21.3
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
Least 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
Humpback whitefish	13.3	23.3	46.7	81.7	0.0	0.0	0.0	0.0	0.0	0.0	60.0	105.0	16.0	28.0	76.0	133.0
Round whitefish	0.0	0.0	6.7	6.7	0.0	0.0	0.0	0.0	0.0	0.0	6.7	6.7	4.0	4.0	10.7	10.7

Source ADF&G Division of Subsistence household surveys, 2014.

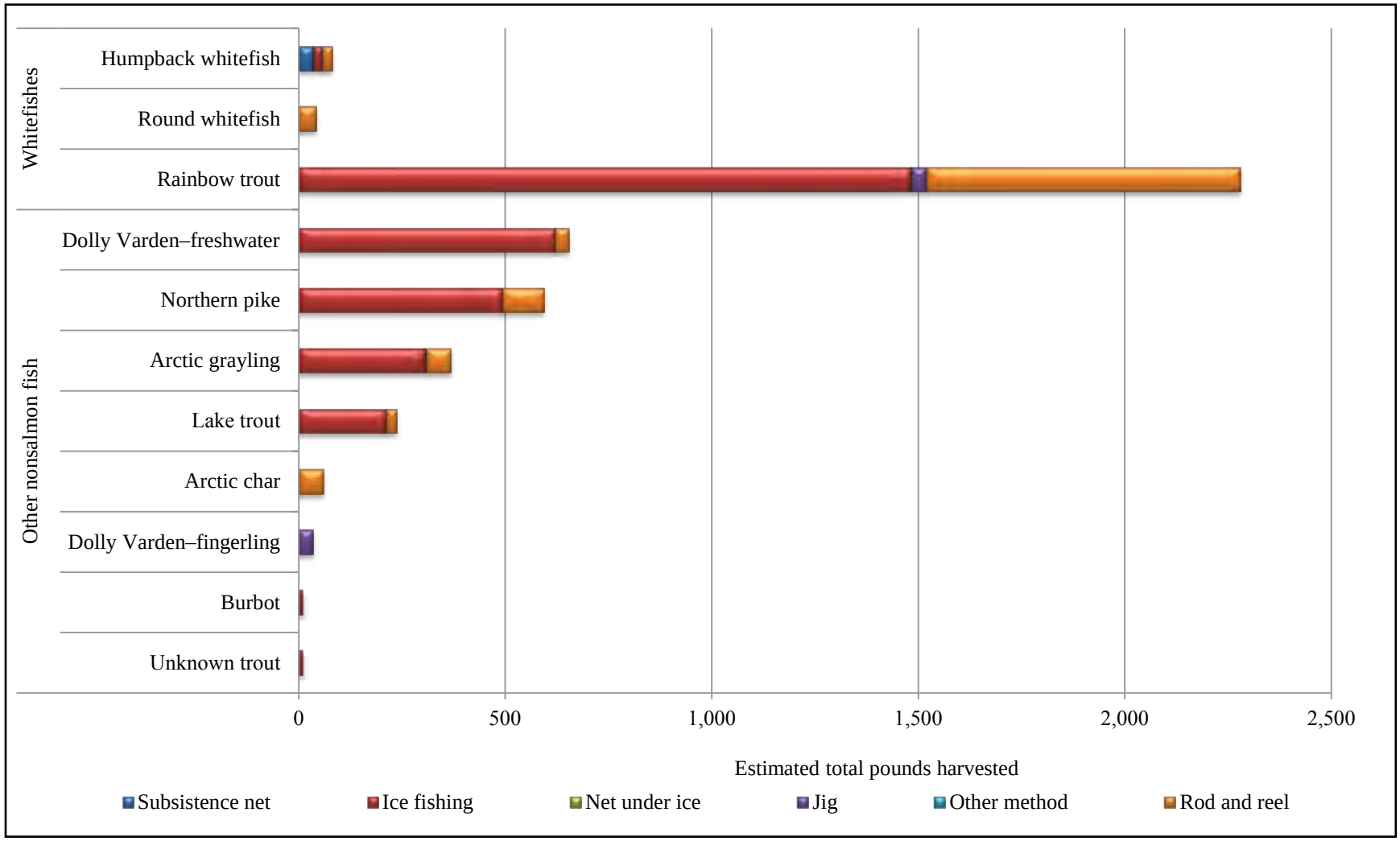


Figure 3-20.–Nonsalmon fish harvest by gear type, Newhalen, 2012.

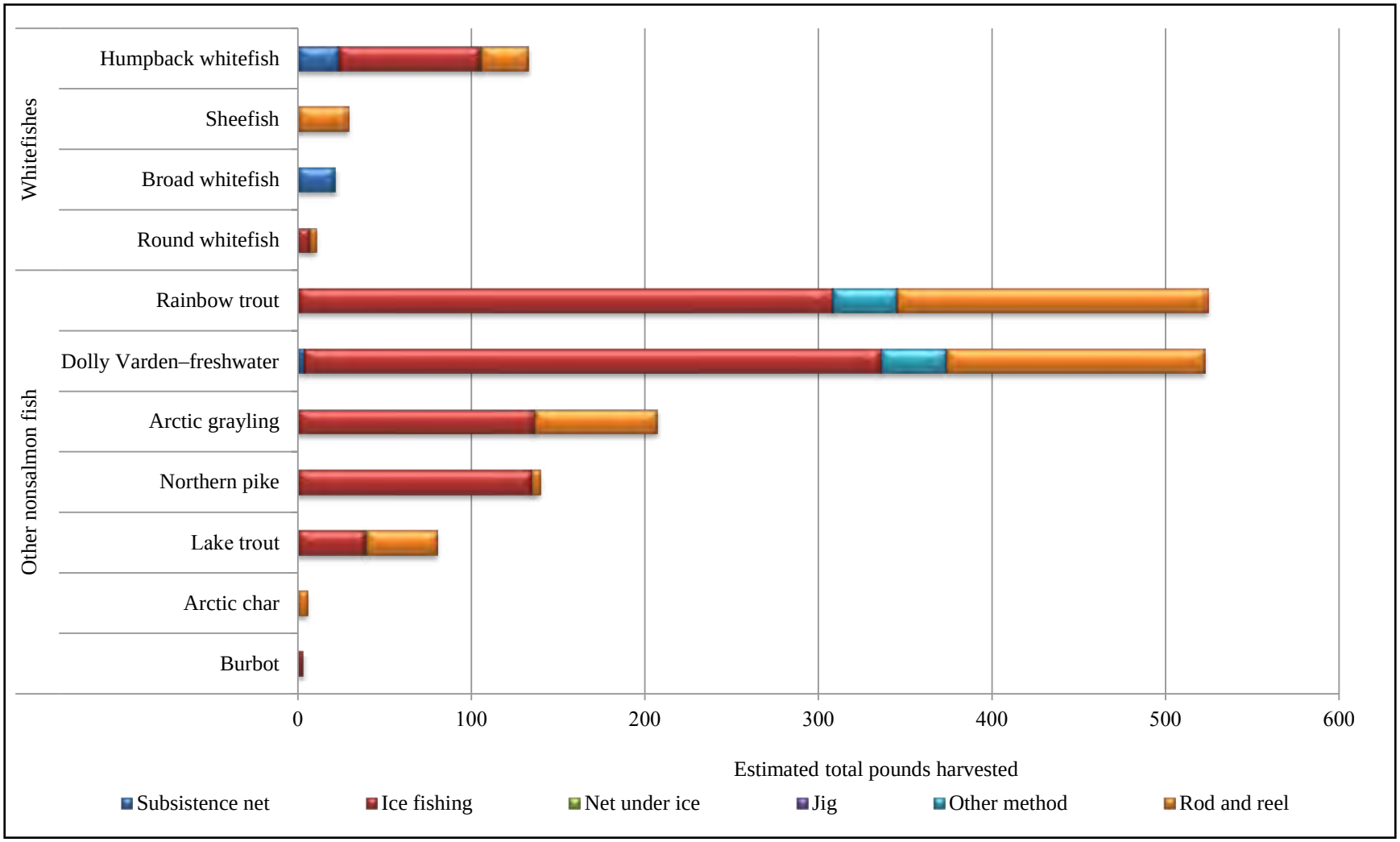


Figure 3-21.–Nonsalmon fish harvest by gear type, Newhalen, 2013.

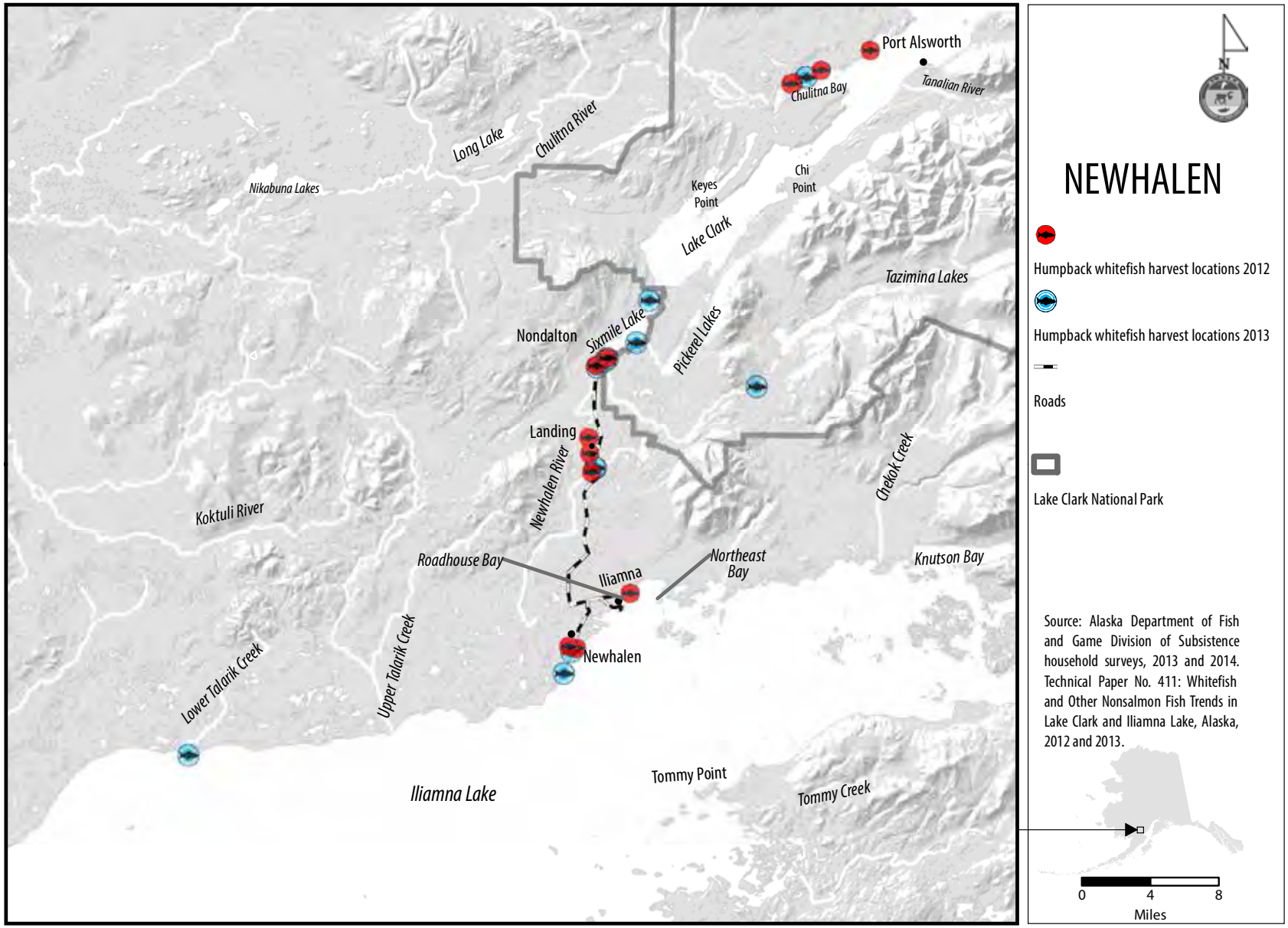


Figure 3-22.–Harvest locations of humpback whitefish, Newhalen, 2012 and 2013.

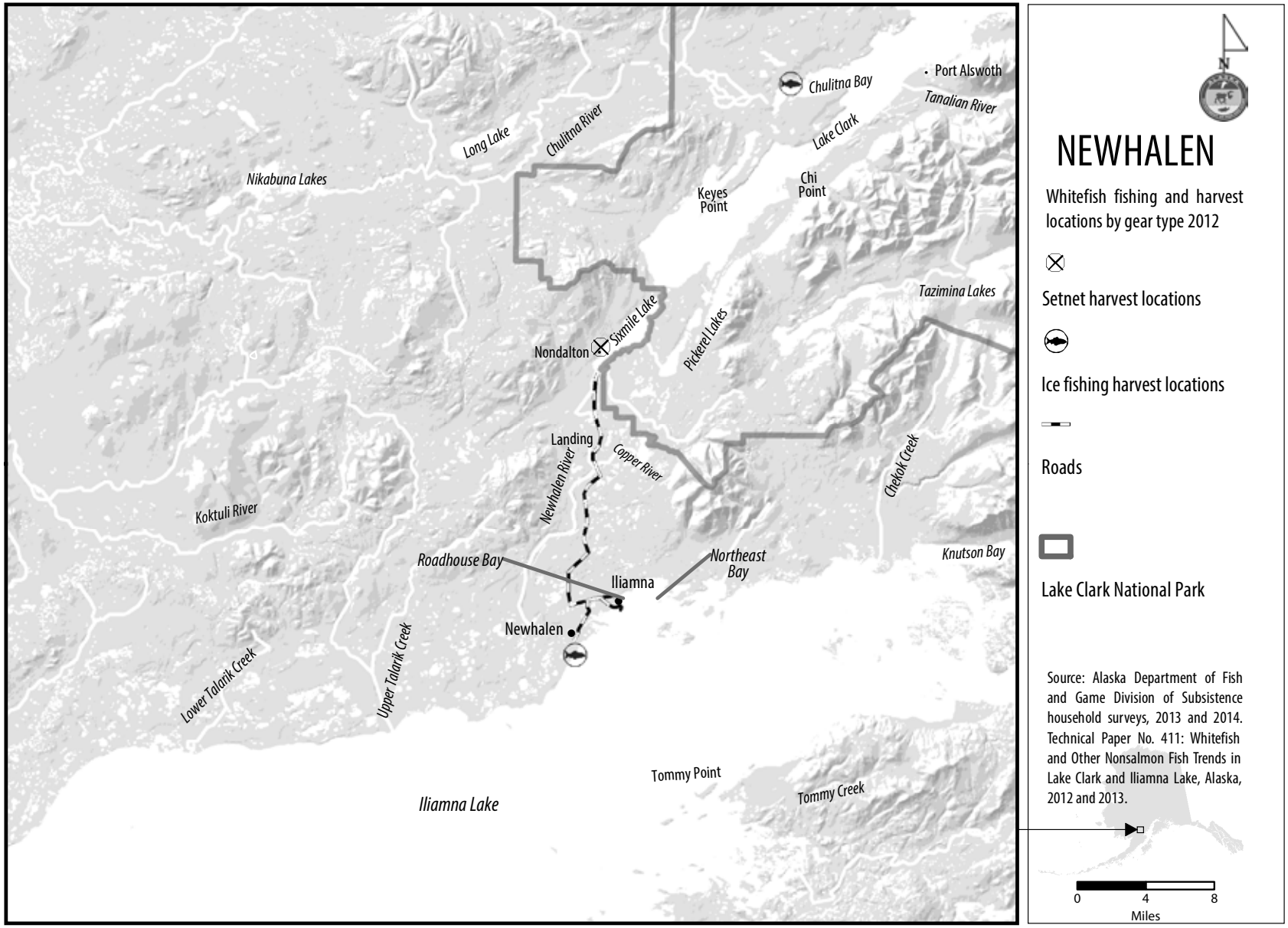


Figure 3-23.–Fishing and harvest locations of whitefish species by gear type, Newhalen, 2012.

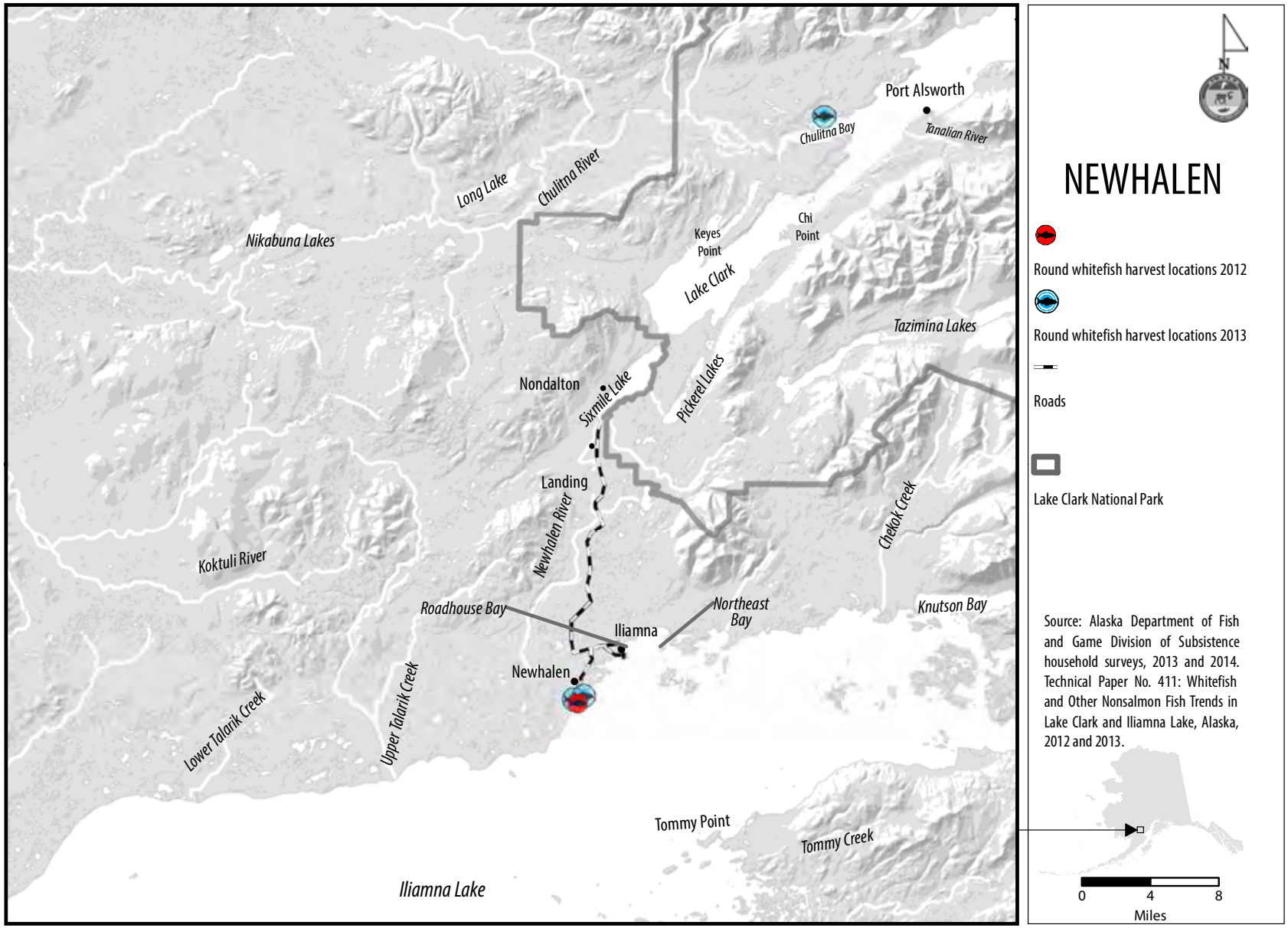


Figure 3-24.–Harvest locations of round whitefish, Newhalen, 2012 and 2013.

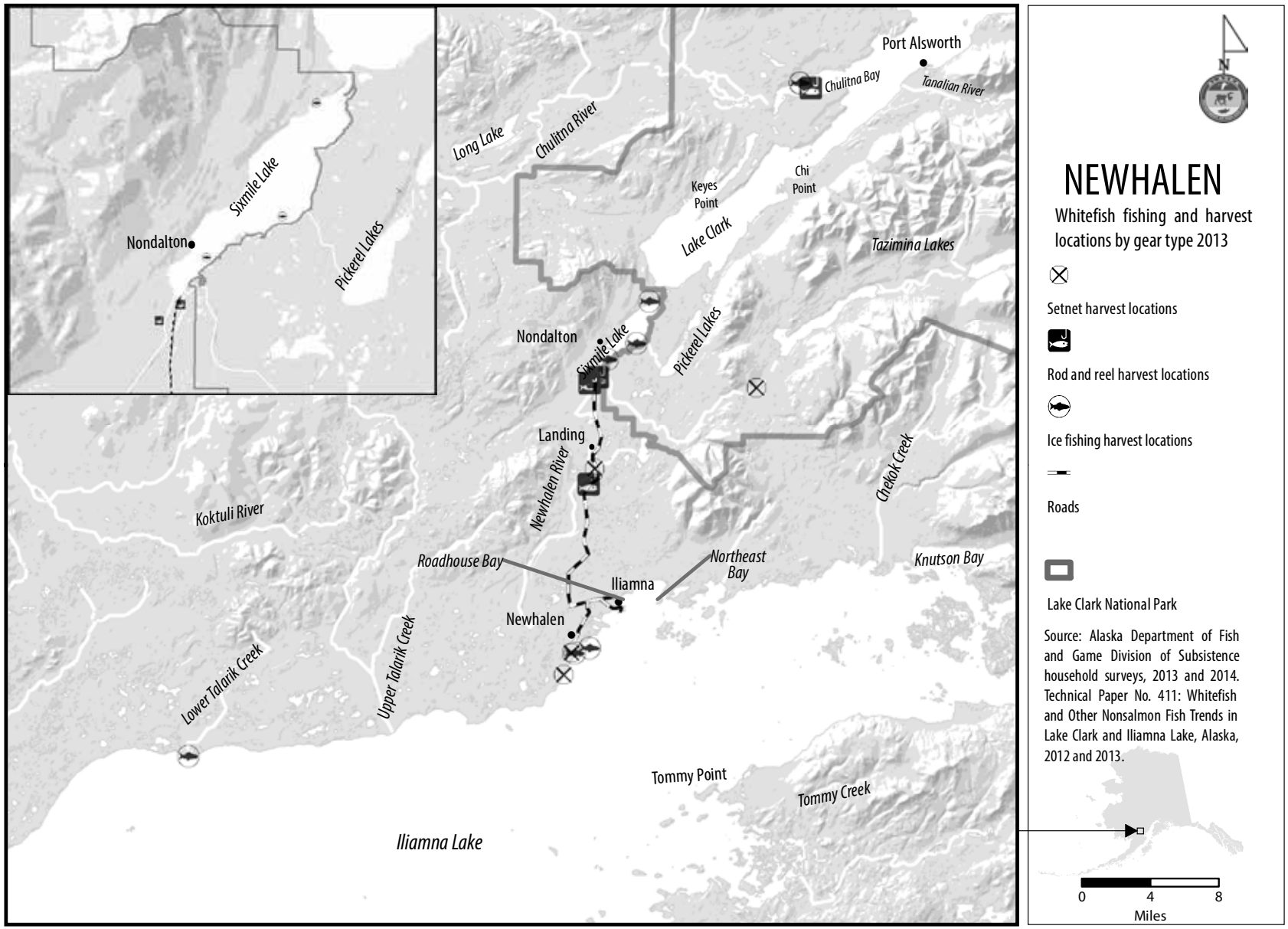
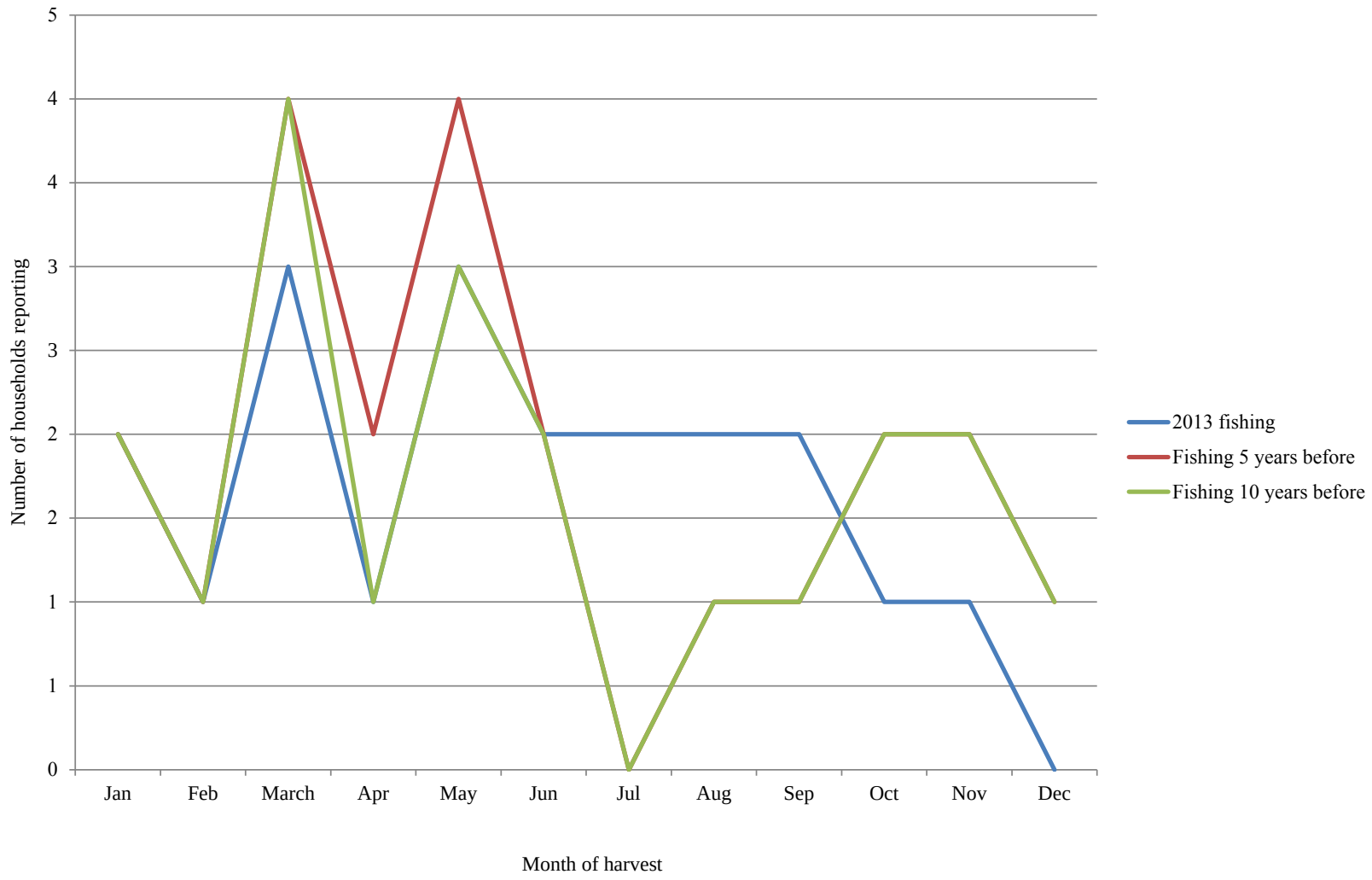


Figure 3-25.–Fishing and harvest locations of whitefish species by gear type, Newhalen, 2013.



Note Where fewer than 3 lines appear it indicates that the fishing pattern was identical for more than one timeline. For example, the fishing pattern for 5 years ago was identical to the fishing pattern for 10 years ago for July through December.

Figure 3-26.–Households reporting timing of whitefish harvests for 2013 and 5 and 10 years prior, Newhalen.

Nondalton

During both study years humpback whitefish was the most commonly used nonsalmon fish species in Nondalton (Table 3-34; Table 3-35). In 2012, approximately 90% of households used humpback whitefish (Table 3-34). During the same year, 32% of households used round whitefish, 8% used least cisco, 3% used Bering cisco, and 3% of households used broad whitefish that were received through a sharing network rather than harvested by community households. In 2013, 80% of households used humpback whitefish while 13% used round whitefish; 2% of households used least cisco and Bering cisco, and 4% of households used broad whitefish that were not harvested by Nondalton community members but were shared with them (Table 3-35).

Humpback whitefish made up more than one-half (53%) of the total nonsalmon fish harvest by the residents of Nondalton during 2012 and almost three-quarters (72%) of the nonsalmon fish harvest in 2013 (Figure 3-27; Figure 3-28). In 2012, an estimated 2,757 lb of humpback whitefish were harvested from 1,575 individual fish resulting in a per capita harvest of 16 lb (Table 3-34). While in 2013 almost 10% fewer households used humpback whitefish compared to 2012, the harvested weight more than doubled to 6,486 lb from 3,706 individual fish (Table 3-34). Accordingly, the per capita harvest also doubled to 33 lb.

The decrease in percentage of households using humpback whitefish during 2013, despite the increased harvest of the species, can be explained by a corresponding decrease in the percentage of households that chose to share this resource (Table 3-34; Table 3-35). Nondalton residents did not offer any specific reasons as to why the sharing of humpback whitefish declined between the 2 study years. However, when reflecting on decreases in resource use during 2004 as part of a previous study, residents of Nondalton provided many reasons for a decrease in use of subsistence resources. Variations in wild resource populations, as well as personal reasons and poor weather, were the most commonly cited reasons for less use of at least 1 resource category by Nondalton residents in 2004 (Fall et al. 2006:175). While available data do not provide a definitive answer, it is possible to attribute the decrease in the number of households using humpback whitefish during 2013 compared to 2012 to one or more of the reasons for less resource use that were provided by the people of Nondalton in the past.

As the harvest of humpback whitefish increased between the 2 study years, the harvest of round whitefish decreased from 237 lb in 2012 to just 41 lb in 2013 (Table 3-34; Table 3-35). Limited harvests of least cisco and Bering cisco during 2012 were nonexistent in 2013. The estimated per capita harvests for humpback whitefish during this study (17 lb in 2012 and 33 lb in 2013) far exceed historical harvest estimates for per capita whitefish harvests in Nondalton (Figure 3-29). It is clear whitefishes continue to be an important species of fish for the people of Nondalton today.

In the past, residents of Nondalton fished for whitefishes and other nonsalmon fish, such as northern pike and Arctic grayling, using *taz'in* (fish traps) or gillnets set at the mouths of creeks, at lake outlets, or other places where the water was open in the early spring. Prior to the introduction of cotton nets locally, an area of 15 to 20 square feet in a creek would be fenced off with wooden stakes forming a type of weir. Doors of a funnel shape were placed at the end of the weir. Trapped fish were taken from shallow water with dip nets (*ech'equyi*). The harvested fish were then strung through the gills and taken back to camp for consumption as whole, fresh fish or were cut and hung to dry for future use (Ellanna and Balluta 1992:145).

In 2012, an estimated 1,242 whitefishes (2,000 lb) were taken using subsistence gear while utilizing any method and about one-half as many, or 662 whitefishes (1,036 lb) were taken using rod and reel (Table 3-36). Figure 3-30 is a representation of whitefishes harvested by total pounds and by gear type for 2012. For humpback whitefish, the most commonly used gear type was ice fishing (37%, or 582 fish), followed by rod and reel, which accounted for about one-third of the humpback whitefish harvest. Humpback whitefish was the only species of whitefish harvested with a net set under the ice in 2012, accounting for 14% of the humpback whitefish harvest. The remainder of the 2012 humpback whitefish harvest was accomplished with a gillnet or seine. The majority of the round whitefish harvested by the people of Nondalton were harvested with a rod and reel (67%, or 158 fish, of the round whitefish harvest), followed by ice fishing (27%, or 65 fish). The remainder of the round whitefish harvest was done with a gillnet or seine. The least

Table 3-34.–Estimated use and harvests of nonsalmon fish resources, Nondalton, 2012.

	Percentage of households					Harvest weight (lb)			Harvest amount			95%
Resource	Use %	Attempt %	Harvest %	Receive %	Give %	Total	Mean household	Per capita	Total	Unit	Mean household	confidence limit (±)
Nonsalmon fish	**97.4**	**89.5**	**89.5**	**63.2**	**63.2**	**5,252.3**	**93.8**	**29.7**				**17.2**
Rainbow smelt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	gal	0.0	0.0
Arctic lamprey	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	lb	0.0	0.0
Burbot	15.8	15.8	15.8	0.0	5.3	45.7	0.8	0.3	45.7	ind	0.8	76.0
Arctic char	5.3	5.3	5.3	0.0	0.0	14.4	0.3	0.1	10.3	ind	0.2	87.5
Dolly Varden–freshwater	21.1	18.4	18.4	5.3	7.9	115.5	2.1	0.7	82.5	ind	1.5	59.8
Dolly Varden–fingerling	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Lake trout	57.9	44.7	44.7	21.1	21.1	336.3	6.0	1.9	240.2	ind	4.3	37.4
Unknown char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Arctic grayling	52.6	42.1	42.1	18.4	13.2	457.0	8.2	2.6	652.8	ind	11.7	34.4
Northern pike	31.6	28.9	28.9	7.9	15.8	540.5	9.7	3.1	193.1	ind	3.4	48.0
Longnose sucker	5.3	5.3	5.3	2.6	2.6	22.7	0.4	0.1	15.1	ind	0.3	113.4
Rainbow trout	65.8	47.4	47.4	26.3	26.3	685.0	12.2	3.9	489.3	ind	8.7	44.7
Unknown trout	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	ind	0.0	0.0
Broad whitefish	2.6	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Bering cisco	2.6	2.6	2.6	0.0	0.0	6.2	0.1	0.0	4.4	ind	0.1	114.9
Least cisco	7.9	7.9	7.9	5.3	2.6	34.8	0.6	0.2	86.9	ind	1.6	90.0
Humpback whitefish	89.5	78.9	78.9	55.3	55.3	2,756.9	49.2	15.6	1,575.4	ind	28.1	19.6
Round whitefish	31.6	28.9	28.9	7.9	2.6	237.3	4.2	1.3	237.3	ind	4.2	54.3
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

Source ADF&G Division of Subsistence household surveys, 2013.

Note Where the percentage of households using a resource is greater than the combined receiving and harvesting households indicates use from resources obtained during a previous year.

Table 3-35.–Estimated use and harvests of nonsalmon fish resources, Nondalton, 2013.

	Percentage of households					Harvest weight (lb)			Harvest amount			95%
Resource	Use %	Attempt %	Harvest %	Receive %	Give %	Total	Mean household	Per capita	Total	Unit	Mean household	confidence limit (±)
Nonsalmon fish	**84.4**	**73.3**	**73.3**	**62.2**	**60.0**	**8,978.5**	**147.2**	**45.4**				**24.0**
Rainbow smelt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	gal	0.0	0.0
Arctic lamprey	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	lb	0.0	0.0
Burbot	20.0	17.8	17.8	4.4	8.9	109.8	1.8	0.6	109.8	ind	1.8	53.8
Arctic char	4.4	2.2	2.2	2.2	2.2	1.9	0.0	0.0	1.4	ind	0.0	103.2
Dolly Varden–freshwater	17.8	17.8	17.8	6.7	6.7	187.9	3.1	0.9	134.2	ind	2.2	48.4
Lake trout	51.1	42.2	42.2	22.2	15.6	316.9	5.2	1.6	226.4	ind	3.7	24.1
Unknown char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Arctic grayling	44.4	44.4	42.2	13.3	17.8	467.8	7.7	2.4	668.3	ind	11.0	23.7
Northern pike	35.6	35.6	33.3	8.9	15.6	623.8	10.2	3.2	222.8	ind	3.7	36.3
Longnose sucker	6.7	6.7	6.7	0.0	4.4	59.0	1.0	0.3	39.3	ind	0.6	64.6
Rainbow trout	64.4	48.9	48.9	31.1	28.9	685.1	11.2	3.5	489.4	ind	8.0	23.6
Unknown trout	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	ind	0.0	0.0
Broad whitefish	4.4	0.0	0.0	4.4	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Bering cisco	2.2	2.2	0.0	2.2	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Least cisco	2.2	0.0	0.0	2.2	2.2	0.0	0.0	0.0	0.0	ind	0.0	0.0
Humpback whitefish	80.0	68.9	68.9	44.4	44.4	6,485.7	106.3	32.8	3,706.1	ind	60.8	30.6
Round whitefish	13.3	8.9	8.9	4.4	2.2	40.7	0.7	0.2	40.7	ind	0.7	53.0

Source ADF&G Division of Subsistence household surveys, 2014.

Note Where the percentage of households using a resource is greater than the combined receiving and harvesting households indicates use from resources obtained during a previous year.

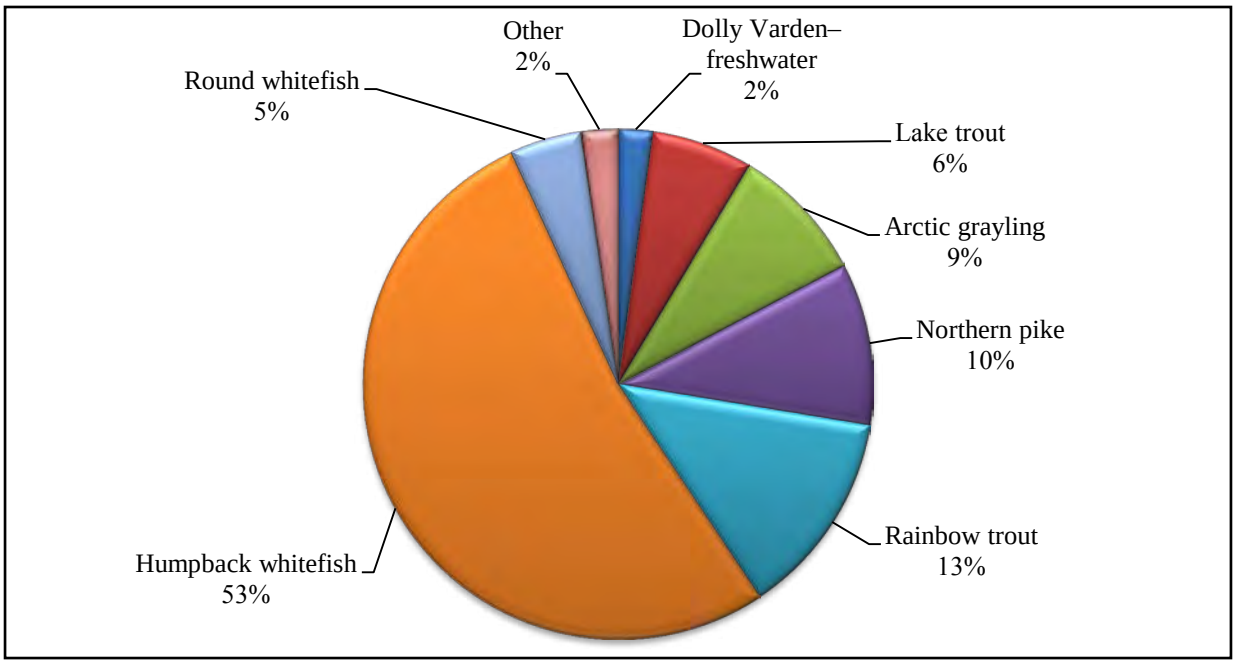


Figure 3-27.–Composition of nonsalmon fish harvest in pounds usable weight, Nondalton, 2012.

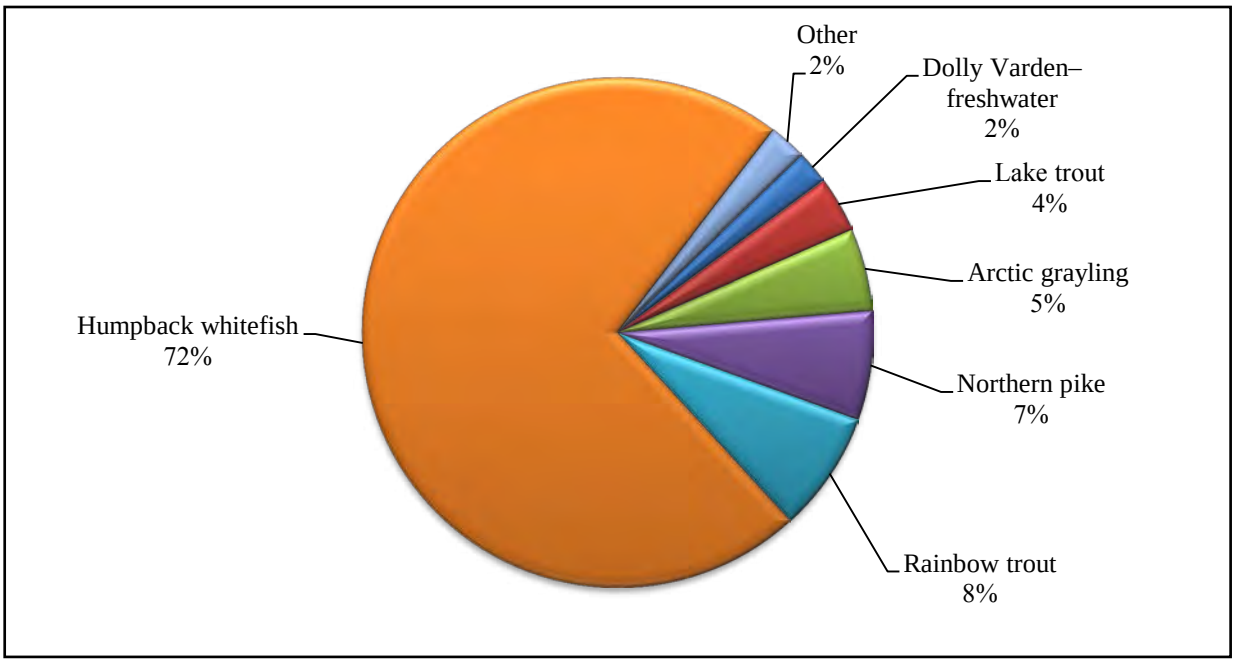
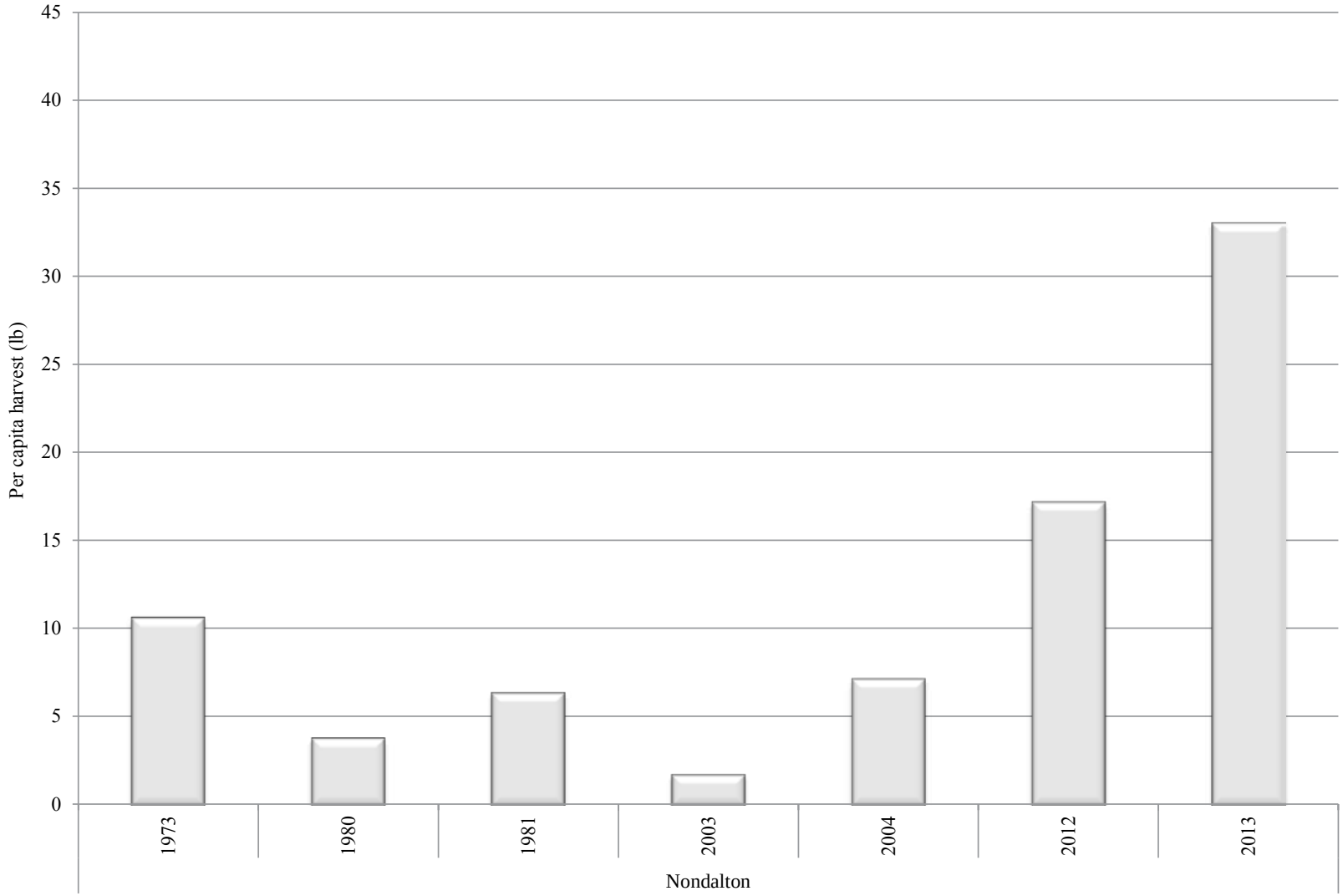


Figure 3-28.–Composition of nonsalmon fish harvest in pounds usable weight, Nondalton, 2013.



Note For all study years, sheefish harvests were included in the estimated harvest of whitefishes.
Note Harvest data for Nondalton for 1983 are not included because the relatively small sample size and difference in sampling method for that survey year render the data incompatible for the purpose of comparative analysis. Data for this community are still available in the CSIS.

Figure 3-29.–Estimated harvests of whitefishes by pounds per capita, Nondalton, 1973, 1974, 1980, 1981, 2003, 2004, 2012, and 2013.

Table 3-36.–Estimated harvest of nonsalmon fish by gear type, resource, Nondalton, 2012.

	Subsistence methods															
	Gillnet or seine		Ice fishing (hook under ice)		Net under ice		Jig		Other method		Subsistence gear, any method		Rod and reel		Any method	
Resource	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds
Nonsalmon fish	**567.8**	**831.8**	**1,121.5**	**1,664.6**	**228.4**	**399.7**	**88.4**	**142.9**	**44.2**	**61.9**	**2,050.3**	**3,101.0**	**1,582.7**	**2,151.3**	**3,633.0**	**5,252.3**
Rainbow smelt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arctic lamprey	0.0	0.0	0.0	0.0	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	0.0	0.0	0.0	0.0	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	1.5	1.5	13.3	13.3	0.0	0.0	29.5	29.5	0.0	0.0	44.2	44.2	1.5	1.5	45.7	45.7
Arctic char	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	14.4	10.3	14.4
Dolly Varden–freshwater	29.5	41.3	1.5	2.1	0.0	0.0	0.0	0.0	0.0	0.0	30.9	43.3	51.6	72.2	82.5	115.5
Dolly Varden–fingerling	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lake trout	26.5	37.1	58.9	82.5	0.0	0.0	8.8	12.4	44.2	61.9	138.5	193.9	101.7	142.4	240.2	336.3
Unknown char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arctic grayling	91.4	64.0	219.6	153.7	0.0	0.0	14.7	10.3	0.0	0.0	325.7	228.0	327.2	229.0	652.8	457.0
Northern pike	48.6	136.2	75.2	210.4	0.0	0.0	29.5	82.5	0.0	0.0	153.3	429.1	39.8	111.4	193.1	540.5
Longnose sucker	15.1	22.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	15.1	22.7	0.0	0.0	15.1	22.7
Rainbow trout	22.1	30.9	72.2	101.1	0.0	0.0	5.9	8.3	0.0	0.0	100.2	140.3	389.1	544.7	489.3	685.0
Unknown trout	0.0	0.0	0.0	0.0	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
Broad 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
Bering cisco	0.0	0.0	4.4	6.2	0.0	0.0	0.0	0.0	0.0	0.0	4.4	6.2	0.0	0.0	4.4	6.2
Least cisco	54.5	21.8	29.5	11.8	0.0	0.0	0.0	0.0	0.0	0.0	84.0	33.6	2.9	1.2	86.9	34.8
Humpback whitefish	263.8	461.6	582.1	1,018.7	228.4	399.7	0.0	0.0	0.0	0.0	1,074.3	1,880.1	501.1	876.8	1,575.4	2,756.9
Round whitefish	14.7	14.7	64.8	64.8	0.0	0.0	0.0	0.0	0.0	0.0	79.6	79.6	157.7	157.7	237.3	237.3
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

Source ADF&G Division of Subsistence household surveys, 2013.

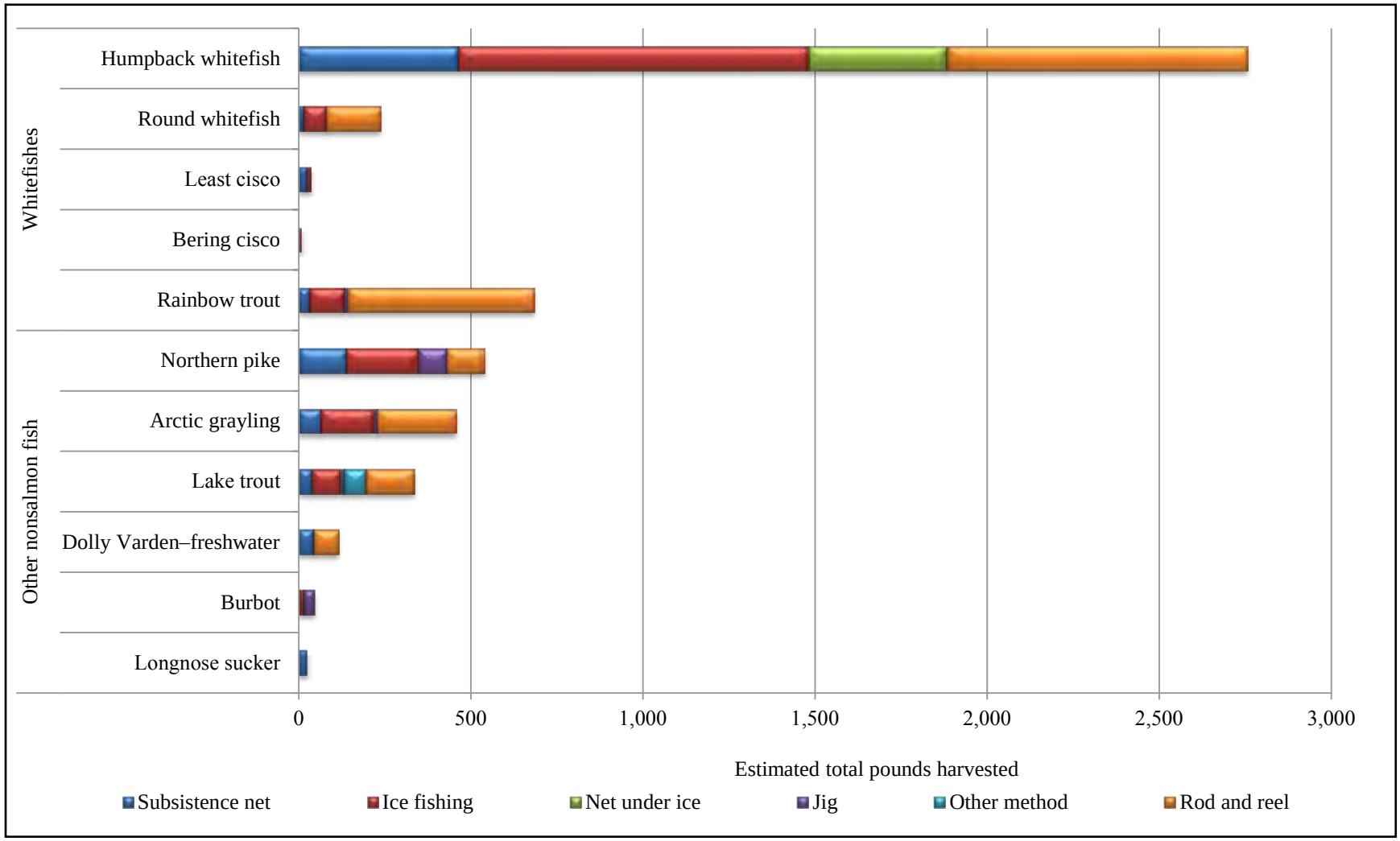


Figure 3-30.–Nonsalmon fish harvest by gear type, Nondalton, 2012.

Table 3-37.–Estimated harvest of nonsalmon fish by gear type, resource, Nondalton, 2013.

	Subsistence methods															
	Gillnet or seine		Ice fishing (hook under ice)		Net under ice		Jig		Other method		Subsistence gear, any method		Rod and reel		Any method	
Resource	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds
Nonsalmon fish	**657.4**	**1,121.8**	**1,862.0**	**2,632.7**	**440.6**	**771.0**	**0.0**	**0.0**	**158.6**	**258.6**	**3,118.6**	**4,784.0**	**2,519.7**	**4,194.5**	**5,638.2**	**8,978.5**
Rainbow smelt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arctic lamprey	0.0	0.0	0.0	0.0	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	0.0	0.0	0.0	0.0	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	2.7	2.7	48.8	48.8	0.0	0.0	0.0	0.0	58.3	58.3	109.8	109.8	0.0	0.0	109.8	109.8
Arctic char	0.0	0.0	1.4	1.9	0.0	0.0	0.0	0.0	0.0	0.0	1.4	1.9	0.0	0.0	1.4	1.9
Dolly Varden–freshwater	0.0	0.0	75.9	106.3	0.0	0.0	0.0	0.0	0.0	0.0	75.9	106.3	58.3	81.6	134.2	187.9
Lake trout	47.4	66.4	120.6	168.9	0.0	0.0	0.0	0.0	27.1	38.0	195.2	273.3	31.2	43.6	226.4	316.9
Unknown char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arctic grayling	43.4	30.4	496.1	347.3	0.0	0.0	0.0	0.0	0.0	0.0	539.5	377.7	128.8	90.1	668.3	467.8
Northern pike	51.5	144.2	78.0	218.5	0.0	0.0	0.0	0.0	33.9	94.9	163.4	457.6	59.4	166.2	222.8	623.8
Longnose sucker	33.9	50.8	0.0	0.0	0.0	0.0	0.0	0.0	5.4	8.1	39.3	59.0	0.0	0.0	39.3	59.0
Rainbow trout	0.0	0.0	202.0	282.8	0.0	0.0	0.0	0.0	0.0	0.0	202.0	282.8	287.4	402.3	489.4	685.1
Unknown trout	0.0	0.0	0.0	0.0	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
Broad 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
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
Least 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
Humpback whitefish	465.0	813.7	825.5	1,444.7	440.6	771.0	0.0	0.0	33.9	59.3	1,764.9	3,088.6	1,941.2	3,397.0	3,706.1	6,485.7
Round whitefish	13.6	13.6	13.6	13.6	0.0	0.0	0.0	0.0	0.0	0.0	27.1	27.1	13.6	13.6	40.7	40.7

Source ADF&G Division of Subsistence household surveys, 2014.

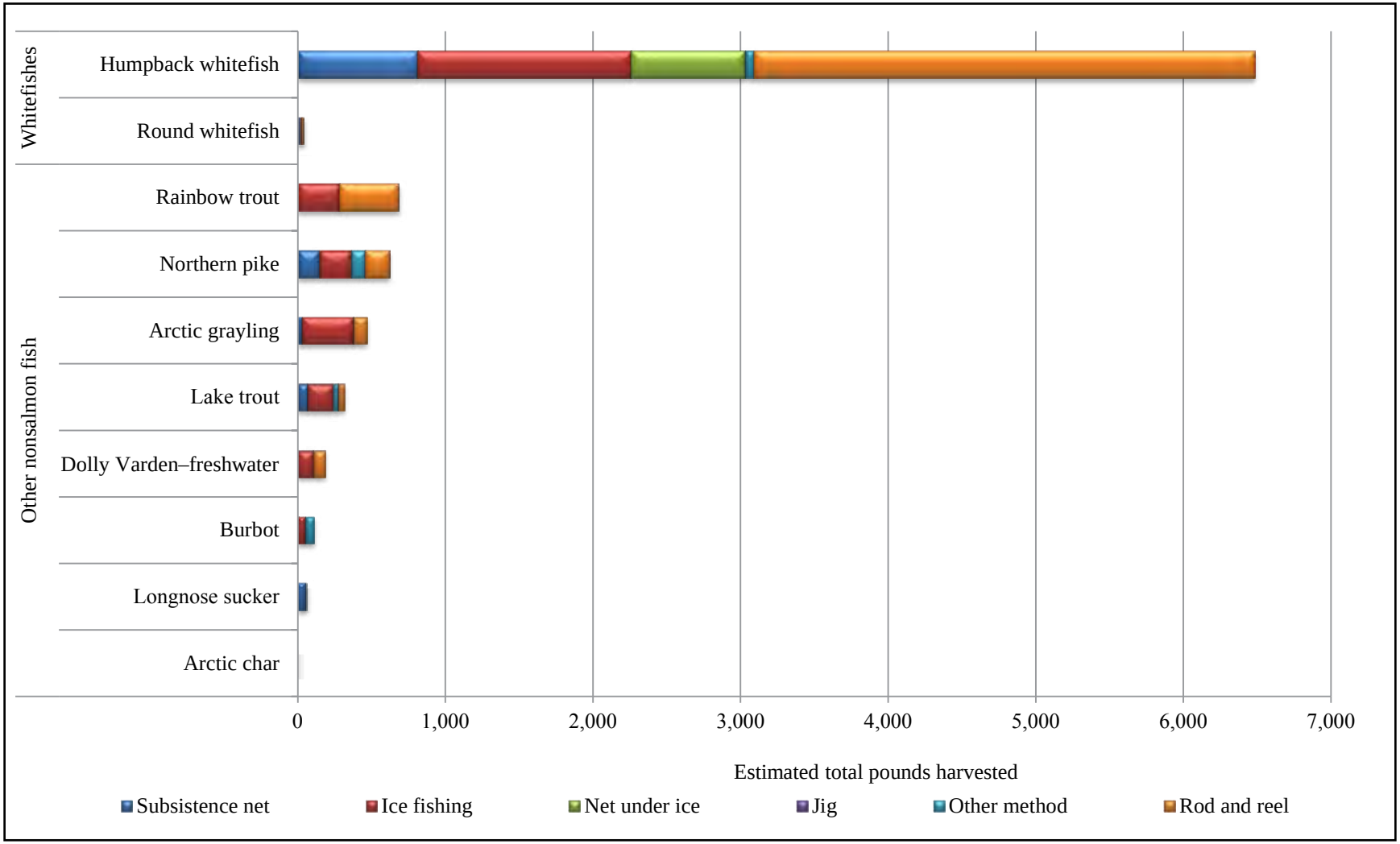


Figure 3-31.–Nonsalmon fish harvest by gear type, Nondalton, 2013.

cisco harvest was dominated by gillnet harvests accounting for 63% (55 fish) of the least cisco harvest, while most of the rest were harvested by ice fishing, and a few were harvested using rod and reel. Bering ciscoes were harvested entirely by ice fishing.

In 2013, an estimated 1,792 whitefishes (3,116 lb) were taken using subsistence gear while utilizing any method (Table 3-37). Slightly more—1,955 whitefishes (3,411 lb)—were taken with a rod and reel. This represents a shift in gear types toward more rod and reel fishing for whitefishes in 2013 than in the previous year (Table 3-36; Table 3-37). Figure 3-31 is a visual representation of whitefishes harvested by total pounds and by gear type for 2013. The most commonly used gear type for harvesting humpback whitefish was rod and reel (52%, or 1,941 fish, of the humpback whitefish harvest), followed by ice fishing (22%) and a gillnet or seine (13%). In both 2012 and 2013, humpback whitefish was the only fish species harvested using a net set under the ice (12%, or 441 fish, of the 2013 humpback whitefish harvest). The net set under the ice for harvesting humpback whitefish was set using a jiggerboard.[1] According to one Nondalton resident, the practice of using a jiggerboard was first adopted in Nondalton during the 1970s. Prior to the introduction of the jiggerboard, a simple stick was used to guide the net under the ice. A member of the household that set this net under the ice for whitefishes during both study years noted that the net not only provided enough whitefishes for his own family's needs, but also met the needs of others in the village who needed whitefishes. The net also served an educational purpose since children from Nondalton's school were taken to the harvest location and shown the net while being taught about subsistence practices in the area.

The 2013 harvest of round whitefish, the only other species of whitefish harvested that year, was split evenly among the gear types used—rod and reel, gillnet or seine, and ice fishing each accounted for one-third of the round whitefish harvest (Table 3-37). According to local residents, in the past round whitefish were not taken with rod and reel during the summer but rather through the ice during winter. Round whitefish were also harvested with hand-held snares through the ice on Lake Clark (Russell 1980:104). One Nondalton elder recalled snaring through the ice for whitefishes, "You know what, there used to be a fish snare that you take a stick and put a snare on the end and they used to catch fish that way. I remember [person's name] used to do that by [person's name]'s place. She used to use that more than hook." In a previous study, a Nondalton elder recollected fish snares:

> Snare for fish we're not talking about the rabbit snare. It's a snare they make it out of eagle feather, the wing. We kill squirrels with that too same as squirrel snare. That wing it tied to the end of a long stick and we put it through the ice and the bait is there and you watch it with the snare. As soon as you see that fish go in there, you pull him out. (Stickman et al. 2003:14)

Figure 3-32 represents the harvest locations of humpback whitefish, the primary whitefish species harvested and used at Nondalton. In both study years, humpback whitefish harvests were concentrated along the banks of Sixmile Lake and in the Pickerel lakes (locally referred to as "Picker Lake or lakes" or *Vata'esluh Vena*). Some harvests also occurred in 2012 and 2013 at Chi Point and on Lake Clark across from Keyes Point. In 2013, additional harvest locations occurred on the Newhalen River and in Chulitna Bay. The larger number of harvest locations recorded for the 2013 study years is congruent with the much larger harvest recorded for 2013 than 2012. These harvest locations are also consistent with the finding of an earlier study that recorded harvest locations for humpback whitefish as, "… all over Six Mile Lake *[sic]*. … in Pickerel Lake, Chulitna Bay, and Hudson Bay" (Krieg et al. 2005:84). For this study, Nondalton elders also noted that Rusty Point was a popular spot for harvesting humpback whitefish:

> [Respondent A] Yeah I go over to Rusty Point and catch a lot of whitefish.
>
> [Respondent B] Used to go over there [Rusty Point] a whole bunch. I remember my mom and auntie take their sleds and walk over.

1. "A jigger consists of a board and two levers so arranged that a backward pull on a line attached to one lever is translated into a forward thrust which propels the board along beneath the ice. Thus only two holes need be chopped through the ice to set a standard net, and several nets can be set in different directions from any one hole. This represents a considerable saving in time and effort when compared with other methods such as pushing a pole with an attached line from hole to hole until sufficient line has been let out to accommodate a net" (Sprules 1957).

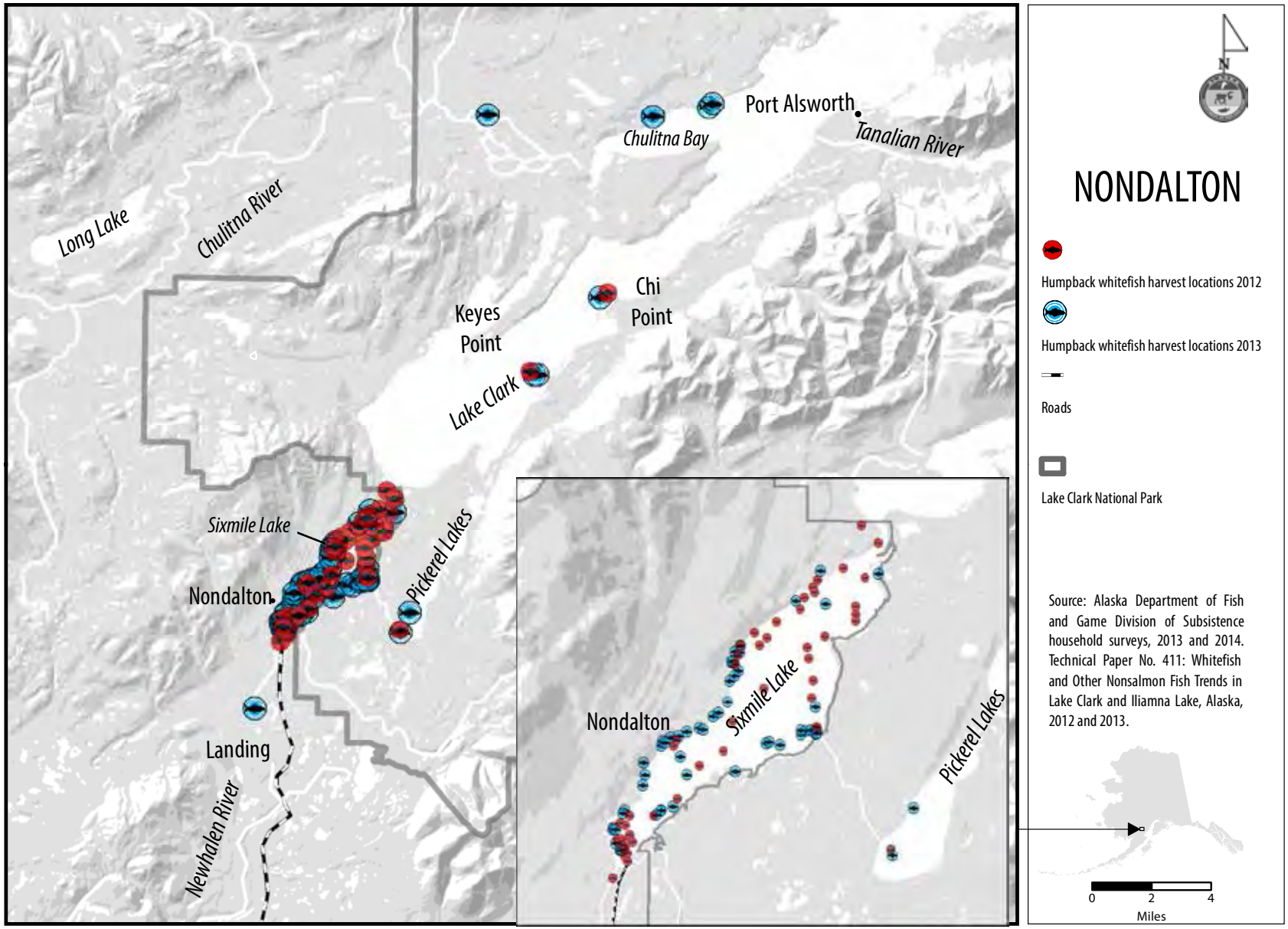


Figure 3-32.–Harvest locations of humpback whitefish, Nondalton, 2012 and 2013.

Round whitefish harvest locations were similar in both study years. Harvests were concentrated around Sixmile Lake, particularly where the lake meets the Newhalen River (Figure 3-33). Similar to the humpback whitefish harvest, 2013 harvest locations for round whitefish expanded from those of 2012 to include a number of locations in Chulitna Bay. These harvest locations reported for round whitefish are similar to those identified during a study conducted in Nondalton for 2003 suggesting that harvest locations for round whitefish have remained constant for at least the last 10 years between 2003 and 2013 (Krieg et al. 2005:87).

The least cisco harvest was concentrated within approximately 5 miles of the village of Nondalton on both sides of Sixmile Lake (Figure 3-34). The 2013 harvest included 1 location in Chulitna Bay in Lake Clark that was significantly farther from Nondalton. During a previous study, a resident of Nondalton said that many years ago, people harvested least cisco from shallow water near the beach on Chulitna Bay on a yearly basis (Krieg et al. 2005:90). Figure 3-35 represents the harvest locations for Bering cisco during 2013. The harvest location was in Sixmile Lake at the mouth of Pickerel Creek, which connects Sixmile Lake to the Pickerel lakes to the east. Figures 3-36 and 3-37 represent whitefish fishing locations by gear type for 2012 and 2013, respectively.

Harvest timing has remained largely the same in Nondalton over the last 10 years (Figure 3-38). During 2012, whitefish harvests were concentrated in the months of March, April, July, and August (Table 3-38). All harvests of whitefishes occurred between February and August in 2012. In 2013, whitefish harvests were again concentrated in March, April, July, and August but with more significant harvests in June as well (Table 3-39). Overall, there was a slightly more even distribution of the total harvest across the months of the year. Nondalton residents noted that many whitefishes were caught during the summer months as a result of children who fish for whitefishes with a rod and reel while their parents are cleaning salmon at fish camp.

Pedro Bay

No households used, attempted to harvest, or harvested whitefishes in 2012 in Pedro Bay (Table 3-40). In 2013, only 1 whitefish was harvested (Table 3-41). This harvest was made up entirely of a single least cisco caught in a salmon net in Pedro Bay directly at the waterfront of the community (Figure 3-39). Only 1 household (9%) used and harvested least cisco, and no other species of whitefish were used or harvested in 2013. No whitefishes were shared in the community in either year.

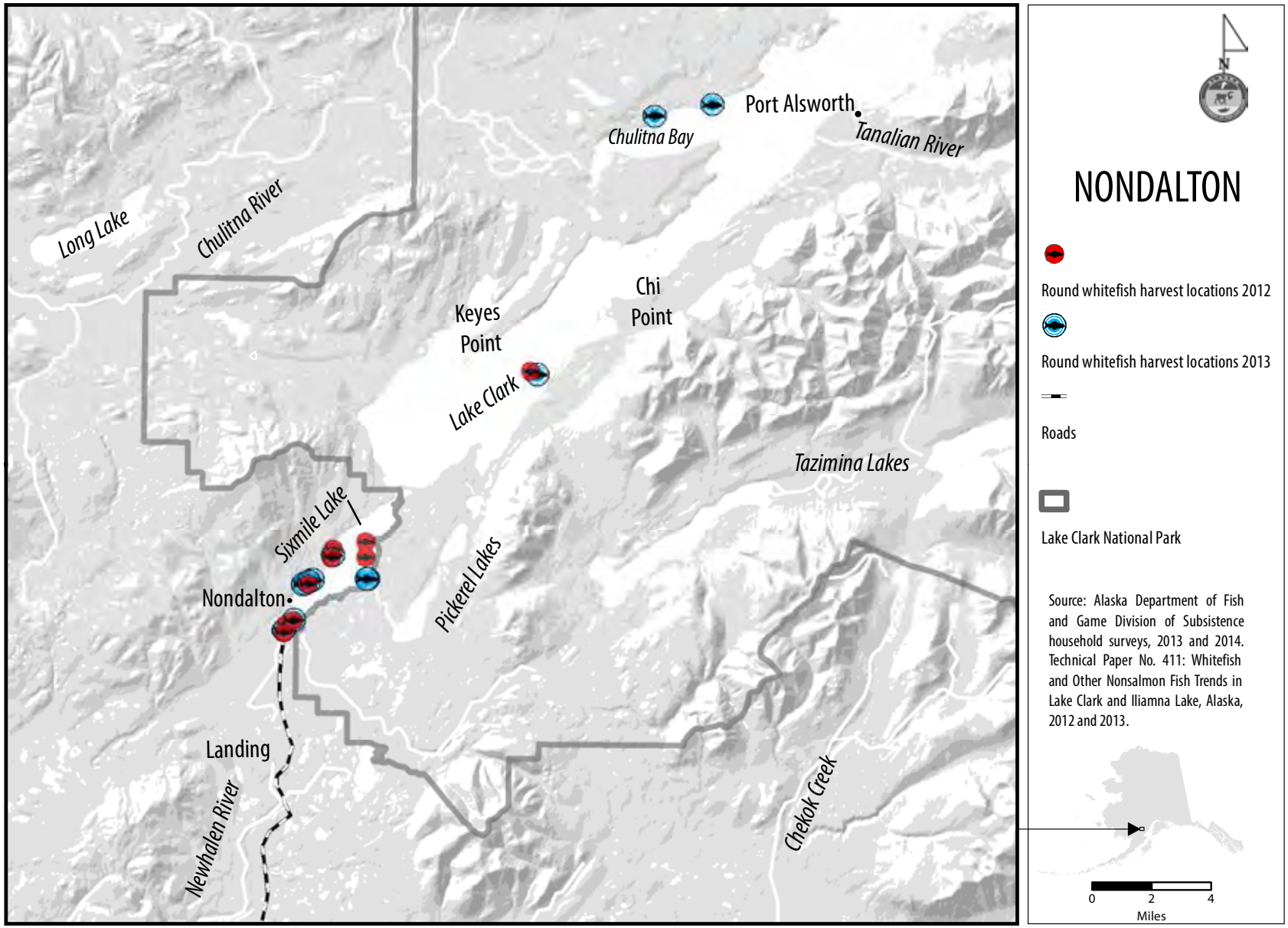


Figure 3-33.–Harvest locations of round whitefish, Nondalton, 2012 and 2013.

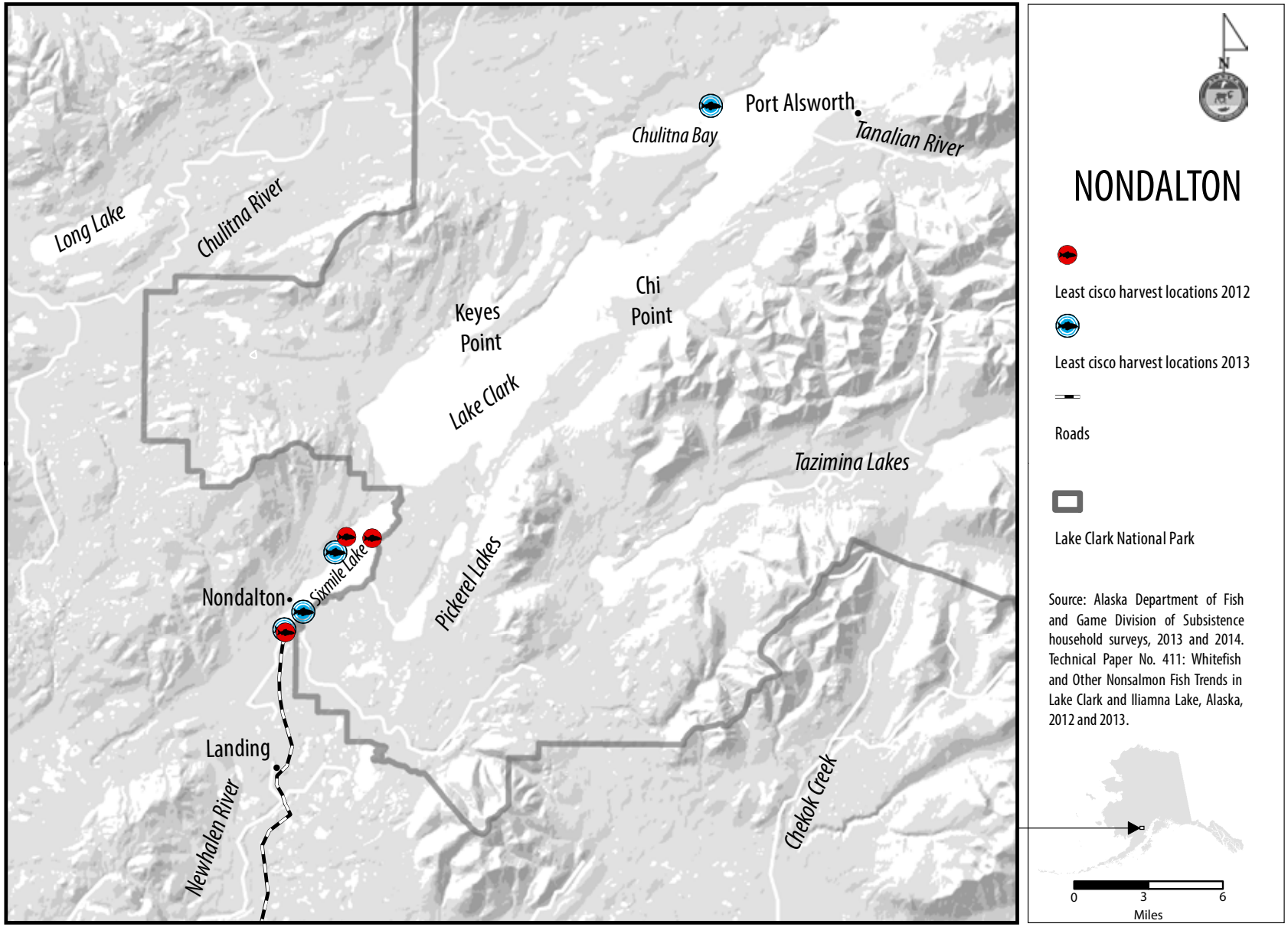


Figure 3-34.–Harvest locations of least cisco, Nondalton, 2012 and 2013.

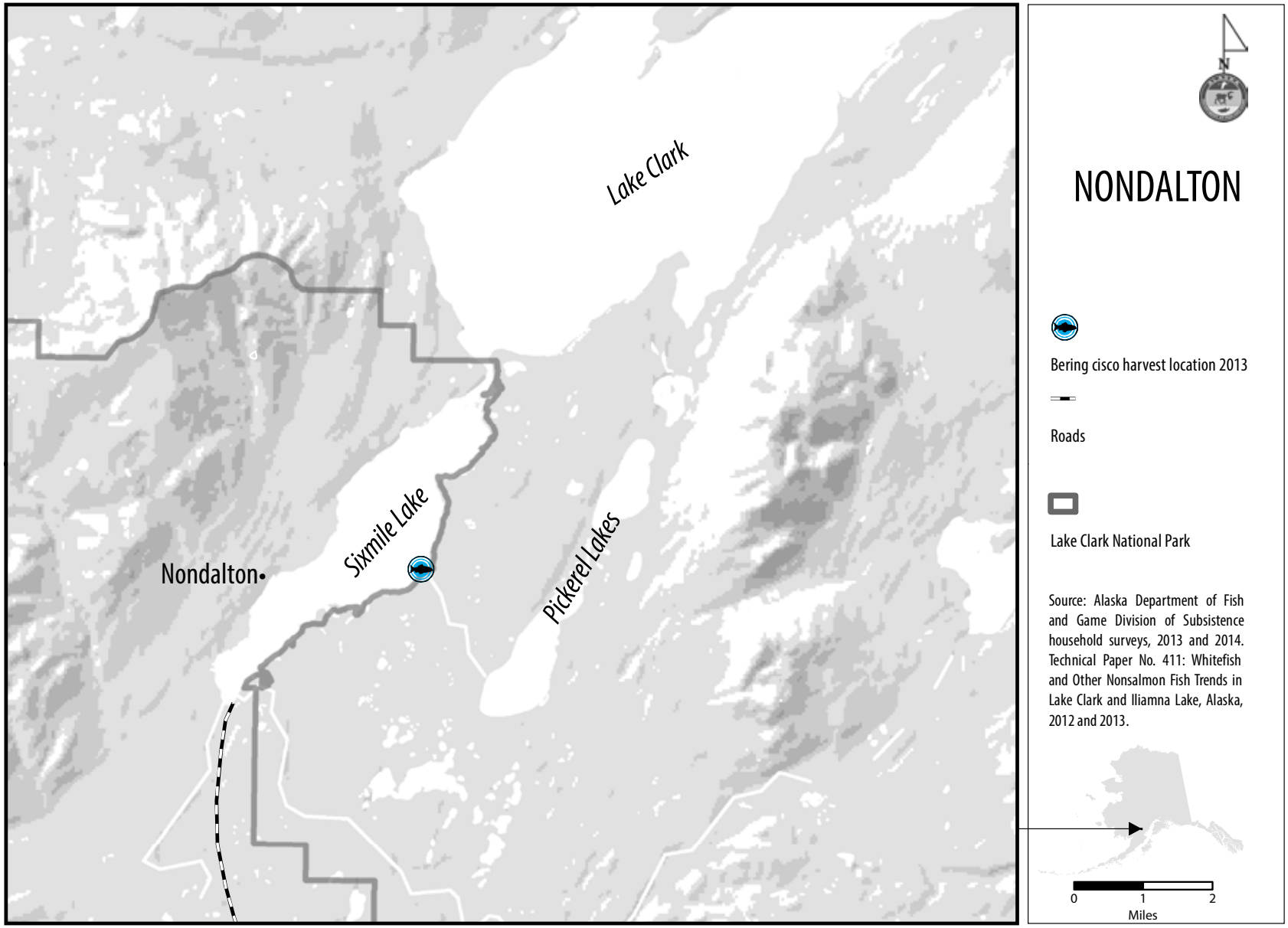


Figure 3-35.–Harvest locations of Bering cisco, Nondalton, 2013.

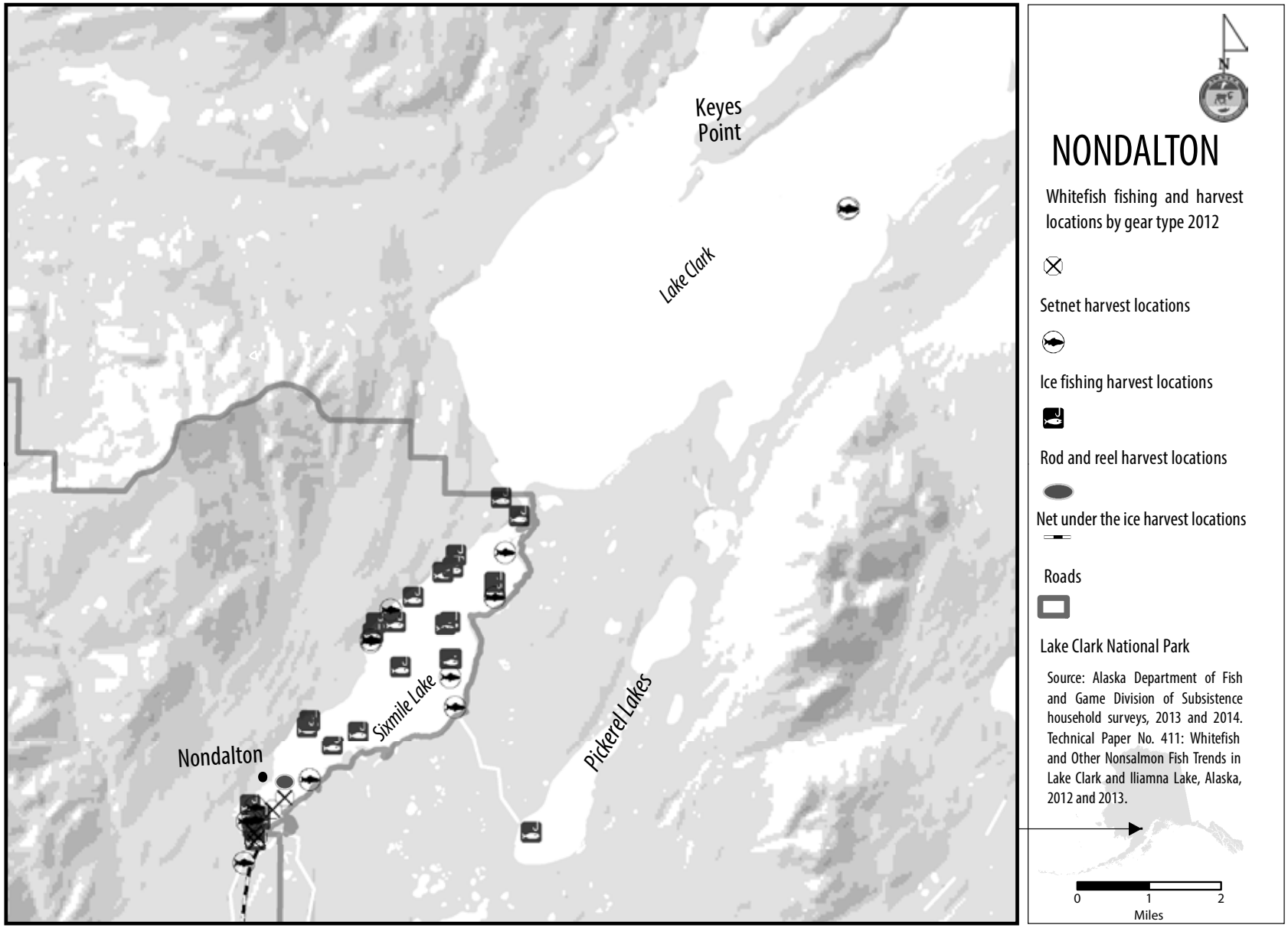


Figure 3-36.–Fishing and harvest locations of whitefish species by gear type, Nondalton, 2012.

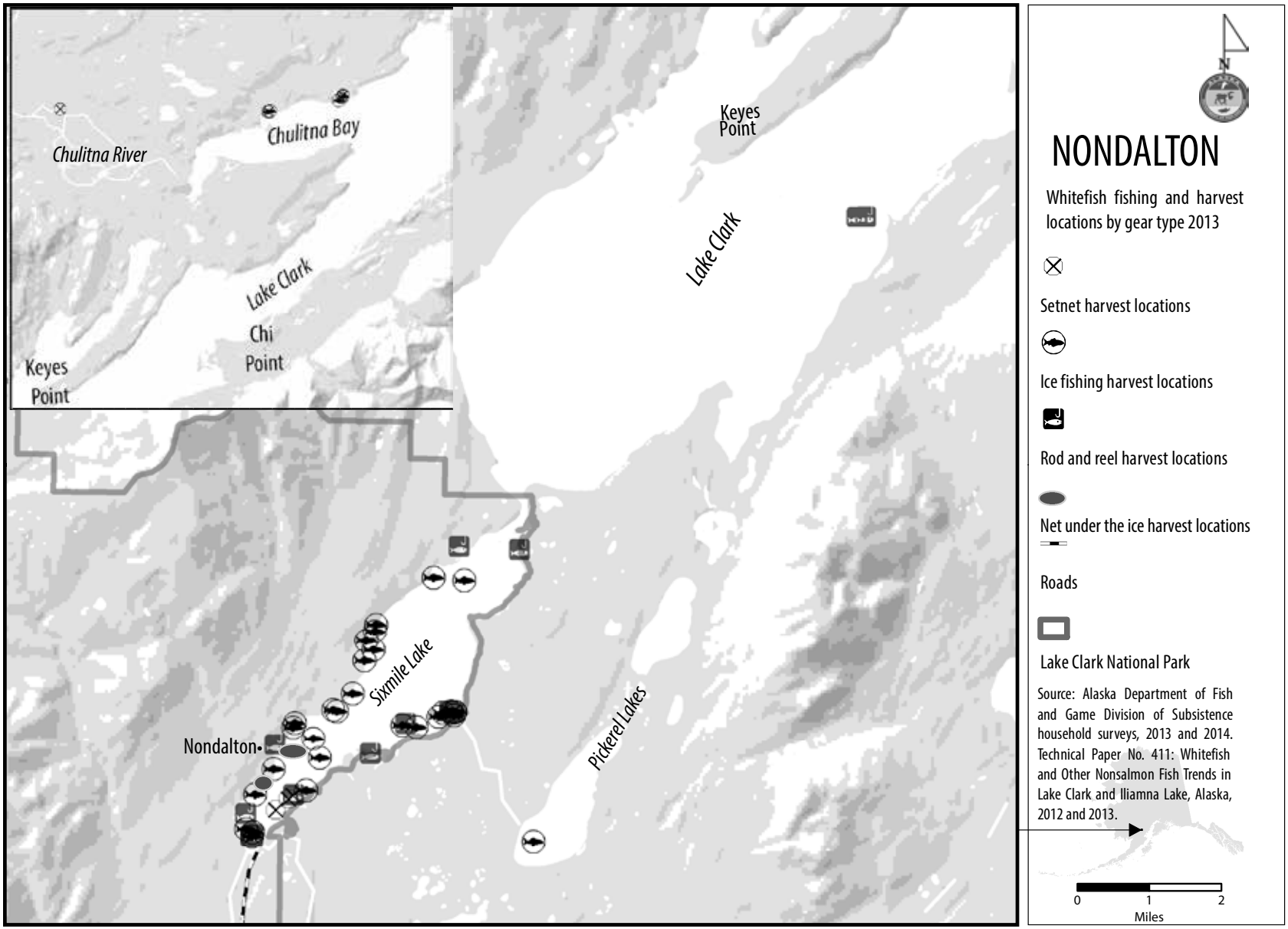
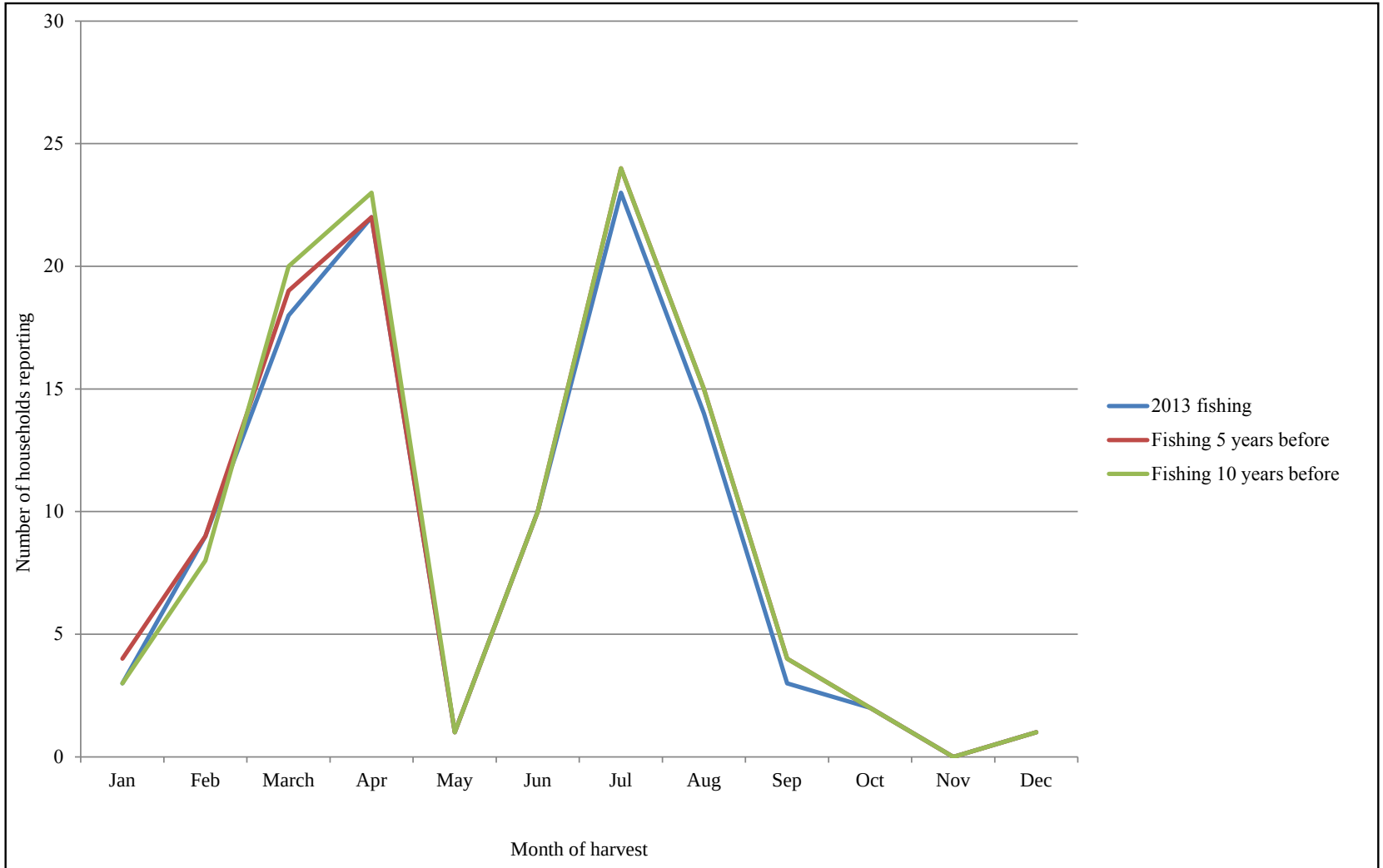


Figure 3-37.–Fishing and harvest locations of whitefish species by gear type, Nondalton, 2013.



Note Where fewer than 3 lines appear it indicates that the fishing pattern was identical for more than one timeline. For example, the fishing pattern for 5 years ago was identical to the fishing pattern for 10 years ago for May through December.

Figure 3-38.–Households reporting timing of whitefish harvests for 2013 and 5 and 10 years prior, Nondalton.

Table 3-38.–Estimated harvest of whitefishes by month, Nondalton, 2012.

	Estimated harvest of whitefishes by month													
Resource	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Unk	**Total**
Whitefishes	**0.0**	**7.4**	**238.7**	**602.7**	**48.6**	**47.2**	**545.3**	**176.8**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**1,666.7**
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**
Broad 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**
Bering cisco	0.0	0.0	0.0	4.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**4.4**
Least cisco	0.0	0.0	29.5	0.0	0.0	0.0	57.5	0.0	0.0	0.0	0.0	0.0	0.0	**86.9**
Humpback whitefish	0.0	7.4	209.3	598.3	48.6	47.2	487.8	176.8	0.0	0.0	0.0	0.0	0.0	**1,575.4**
Round whitefish	0.0	0.0	17.7	47.2	0.0	0.0	113.5	58.9	0.0	0.0	0.0	0.0	0.0	**237.3**

Source ADF&G Division of Subsistence household surveys, 2013.

Table 3-39.–Estimated harvest of whitefishes by month, Nondalton, 2013.

	Estimated harvest of whitefishes by month													
Resource	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Unk	**Total**
Whitefishes	**0.0**	**0.0**	**44.0**	**8.0**	**9.3**	**5.3**	**12.0**	**4.0**	**4.0**	**0.0**	**0.0**	**0.0**	**0.0**	**86.7**
Sheefish	0.0	0.0	0.0	5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**5.3**
Broad whitefish	0.0	0.0	0.0	0.0	0.0	5.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	**5.3**
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**
Least 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**
Humpback whitefish	0.0	0.0	44.0	2.7	9.3	0.0	12.0	4.0	4.0	0.0	0.0	0.0	0.0	**76.0**
Round whitefish	2.7	0.0	4.0	0.0	0.0	0.0	0.0	0.0	0.0	4.0	0.0	0.0	0.0	**10.7**

Source ADF&G Division of Subsistence household surveys, 2014.

Table 3-40.–Estimated use and harvests of nonsalmon fish resources, Pedro Bay, 2012.

	Percentage of households					Harvest weight (lb)			Harvest amount			95%
Resource	Use %	Attempt %	Harvest %	Receive %	Give %	Total	Mean household	Per capita	Total	Unit	Mean household	confidence limit (±)
Nonsalmon fish	**92.3**	**76.9**	**76.9**	**23.1**	**38.5**	**519.4**	**40.0**	**17.9**				**0.0**
Rainbow smelt	7.7	0.0	0.0	7.7	7.7	0.0	0.0	0.0	0.0	gal	0.0	0.0
Arctic lamprey	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	lb	0.0	0.0
Burbot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Arctic char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Dolly Varden–freshwater	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Dolly Varden–fingerling	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Lake trout	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Unknown char	84.6	69.2	69.2	23.1	23.1	271.6	20.9	9.4	194.0	ind	14.9	0.0
Arctic grayling	7.7	0.0	0.0	7.7	7.7	0.0	0.0	0.0	0.0	ind	0.0	0.0
Northern pike	7.7	0.0	0.0	7.7	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Longnose sucker	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	76.9	69.2	69.2	7.7	38.5	247.8	19.1	8.5	177.0	ind	13.6	0.0
Unknown trout	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	ind	0.0	0.0
Broad whitefish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Bering cisco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Least cisco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Humpback whitefish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Round whitefish	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		0.0	0.0

Source ADF&G Division of Subsistence household surveys, 2013.

Note Where the percentage of households using a resource is greater than the combined receiving and harvesting households indicates use from resources obtained during a previous year.

Table 3-41.–Estimated use and harvests of nonsalmon fish resources, Pedro Bay, 2013.

	Percentage of households					Harvest weight (lb)			Harvest amount			95%
Resource	Use %	Attempt %	Harvest %	Receive %	Give %	Total	Mean household	Per capita	Total	Unit	Mean household	confidence limit (±)
Nonsalmon fish	**72.7**	**63.6**	**45.5**	**54.5**	**36.4**	**577.8**	**41.3**	**16.8**				**53.2**
Rainbow smelt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	gal	0.0	0.0
Arctic lamprey	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	lb	0.0	0.0
Burbot	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Arctic char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Dolly Varden–freshwater	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Lake trout	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Unknown char	54.5	63.6	45.5	27.3	27.3	376.0	26.9	10.9	268.5	ind	19.2	56.9
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	9.1	9.1	9.1	0.0	0.0	10.7	0.8	0.3	3.8	ind	0.3	103.1
Longnose sucker	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	54.5	63.6	45.5	27.3	27.3	190.7	13.6	5.5	136.2	ind	9.7	50.3
Unknown trout	9.1	0.0	0.0	9.1	9.1	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
Broad whitefish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Bering cisco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Least cisco	9.1	9.1	9.1	0.0	0.0	0.5	0.0	0.0	1.3	ind	0.1	103.1
Humpback whitefish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Round whitefish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0

Source ADF&G Division of Subsistence household surveys, 2014.

Note Where the percentage of households using a resource is greater than the combined receiving and harvesting households indicates use from resources obtained during a previous year.

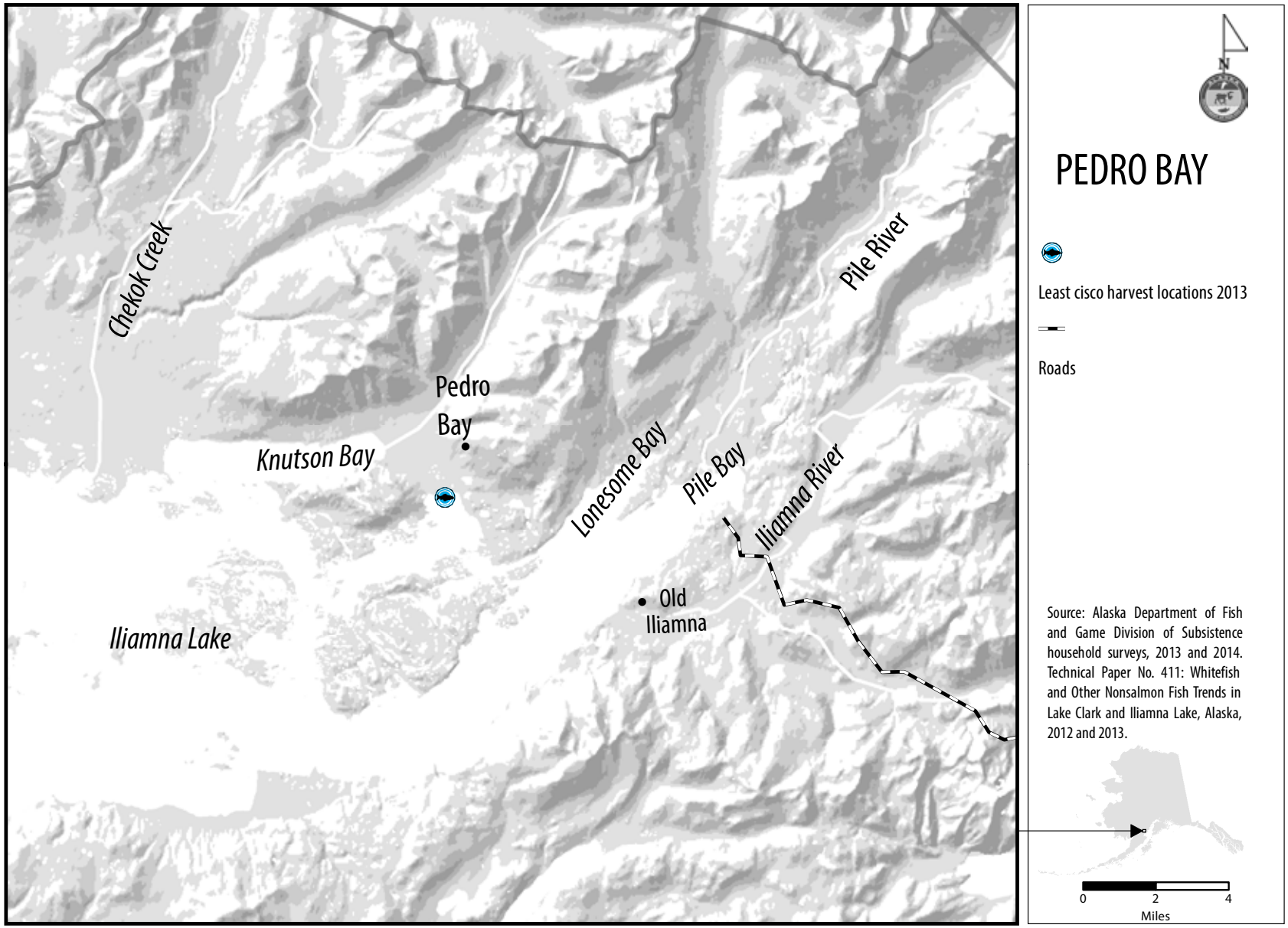


Figure 3-39.–Harvest locations of least cisco, Pedro Bay, 2013.

Port Alsworth

In 2012, an estimated 220 humpback whitefish were harvested by households in Port Alsworth while only 40 round whitefish were harvested (Table 3-42). There was no reported harvest of other species of whitefish in 2012. In 2013, 129 humpback whitefish were harvested by households while 86 round whitefish were harvested (Table 3-43). Humpback whitefish made up 49% of the total harvest of nonsalmon fish by Port Alsworth households in 2012 and 29% of the total harvest in 2013 (Figure 3-40; Figure 3-41). An estimated 385 lb of humpback whitefish were harvested in 2012, which translated to a per capita harvest of approximately 2 lb (Table 3-42). In 2013, there was a decrease in the harvest weight of humpback whitefish; 227 lb were harvested resulting in a per capita harvest of around 1 lb (Table 3-43). A different pattern was recorded for round whitefish where 40 lb (less than one-half pound per capita) were harvested in 2012, and harvest of this species increased to 86 lb (one-half pound per capita) in 2013 (Table 3-42; Table 3-43).

The amount of whitefishes harvested in Port Alsworth has remained fairly stable over time. Figure 3-42 illustrates the role of whitefishes in Port Alsworth in per capita harvest amounts over recent decades compared to this study. Since 1983, the harvest of whitefishes by Port Alsworth residents has been between 2 lb and 3 lb per capita.

In 2012, 100% of round whitefish (40 lb) were harvested while ice fishing (Table 3-44). Humpback whitefish were harvested by either a gillnet (18 lb), ice fishing (175 lb), or using a rod and reel (193 lb). Figure 3-43 is a visual representation of whitefishes harvested by total pounds and by gear type.

In 2013, round whitefish were harvested by a gillnet (27 lb), ice fishing (38 lb) or by rod and reel (22 lb) (Table 3-45). Humpback whitefish were harvested by a gillnet (66 lb), ice fishing (96 lb), a net under the ice (57 lb), or rod and reel (8 lb). Figure 3-44 is a visual representation of the total pounds of whitefishes harvested by gear type. The method of harvest for the 2 whitefish species is most likely variable between the 2 years due to weather and ice conditions.

Figures 3-45 and 3-46 represent the harvest locations for both study years for humpback whitefish, which was the primary species of whitefish harvested and used at Port Alsworth, and also for round whitefish. All harvest sites were located on Lake Clark waters close to the community of Port Alsworth. In 2012 and 2013, humpback whitefish were harvested in waters directly adjoining the community, at the mouth of Tanalian River, and at Chulitna Bay; in 2013 fishing also occurred near Chi Point (Figure 3-45). Round whitefish harvest locations were limited in both study years to waters adjacent to Port Alsworth with the exception of an additional harvest location nearby Chi Point in 2013 (Figure 3-46).

All methods of fishing for whitefishes can be done in proximity to residents' households (Figure 3-47; Figure 3-48). In 2013, an additional fishing method was used—a setnet under the ice. The fishing sites were fewer and closer to Port Alsworth than during the previous year, but there was also reduced harvest in 2013 (Table 3-42; Table 3-43).

When respondents were asked about the timing of harvests of whitefishes compared to efforts from 5 and 10 years ago, households indicated little change; namely, harvests 5 and 10 years ago occurred in the late winter and early spring between January and April after which there was generally little harvest activity (Figure 3-49). In comparison, fishing in 2013 followed a similar trajectory in the later winter and spring but with continued harvests in May and then a sharp increase in July and August followed by the absence of harvests. The observed marked difference at the height of the summer is likely a byproduct of other subsistence activities. During July, local community members are involved in the harvest of sockeye salmon. Community members from this area (Lake Clark and Iliamna Lake) often mentioned that whitefishes were not targeted in the summer but were harvested incidentally while fishing for salmon.

Table 3-42.–Estimated use and harvests of nonsalmon fish resources, Port Alsworth, 2012.

	Percentage of households					Harvest weight (lb)			Harvest amount			95%
Resource	Use %	Attempt %	Harvest %	Receive %	Give %	Total	Mean household	Per capita	Total	Unit	Mean household	confidence limit (±)
Nonsalmon fish	**55.6**	**53.3**	**53.3**	**6.7**	**11.1**	**789.1**	**15.8**	**4.9**				**22.7**
Rainbow smelt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	gal	0.0	0.0
Arctic lamprey	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	lb	0.0	0.0
Burbot	17.8	17.8	17.8	0.0	6.7	51.1	1.0	0.3	51.1	ind	1.0	24.3
Arctic char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Dolly Varden–freshwater	2.2	2.2	2.2	0.0	0.0	6.2	0.1	0.0	4.4	ind	0.1	63.7
Dolly Varden–fingerling	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Lake trout	37.8	37.8	37.8	2.2	4.4	135.3	2.7	0.8	96.7	ind	1.9	19.6
Unknown char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Arctic grayling	24.4	22.2	22.2	2.2	4.4	48.2	1.0	0.3	68.9	ind	1.4	22.9
Northern pike	24.4	22.2	22.2	4.4	4.4	118.2	2.4	0.7	42.2	ind	0.8	22.4
Longnose sucker	2.2	2.2	2.2	0.0	0.0	5.0	0.1	0.0	3.3	ind	0.1	63.7
Rainbow trout	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Unknown trout	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Sheefish	2.2	0.0	0.0	2.2	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Broad whitefish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Bering cisco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Least cisco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Humpback whitefish	28.9	28.9	28.9	2.2	2.2	385.0	7.7	2.4	220.0	ind	4.4	39.7
Round whitefish	4.4	4.4	4.4	0.0	2.2	40.0	0.8	0.2	40.0	ind	0.8	44.8
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

Source ADF&G Division of Subsistence household surveys, 2013.

Note Where the percentage of households using a resource is greater than the combined receiving and harvesting households indicate use from resources obtained during a previous year.

Table 3-43.–Estimated use and harvests of nonsalmon fish resources, Port Alsworth, 2013.

	Percentage of households					Harvest weight (lb)			Harvest amount			95%
Resource	Use %	Attempt %	Harvest %	Receive %	Give %	Total	Mean household	Per capita	Total	Unit	Mean household	confidence limit (±)
Nonsalmon fish	**41.2**	**37.3**	**37.3**	**13.7**	**7.8**	**778.1**	**14.1**	**4.3**				**16.5**
Rainbow smelt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	gal	0.0	0.0
Arctic lamprey	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	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	lb	0.0	0.0
Burbot	9.8	7.8	7.8	2.0	2.0	31.3	0.6	0.2	31.3	ind	0.6	28.5
Arctic char	2.0	2.0	2.0	0.0	0.0	1.5	0.0	0.0	1.1	ind	0.0	54.2
Dolly Varden–freshwater	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Lake trout	29.4	27.5	27.5	2.0	0.0	225.0	4.1	1.3	160.7	ind	2.9	21.1
Unknown char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0
Arctic grayling	23.5	23.5	23.5	3.9	2.0	138.1	2.5	0.8	197.4	ind	3.6	20.1
Northern pike	23.5	19.6	19.6	5.9	0.0	51.2	0.9	0.3	18.3	ind	0.3	24.8
Longnose sucker	2.0	2.0	2.0	0.0	0.0	1.6	0.0	0.0	1.1	ind	0.0	54.2
Rainbow trout	5.9	3.9	3.9	2.0	0.0	16.6	0.3	0.1	11.9	ind	0.2	49.4
Unknown trout	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	ind	0.0	0.0
Broad whitefish	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Bering cisco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Least cisco	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	ind	0.0	0.0
Humpback whitefish	13.7	13.7	11.8	0.0	3.9	226.5	4.1	1.3	129.4	ind	2.4	24.4
Round whitefish	3.9	3.9	3.9	0.0	0.0	86.3	1.6	0.5	86.3	ind	1.6	40.6

Source ADF&G Division of Subsistence household surveys, 2014.

Note Where the percentage of households using a resource is greater than the combined receiving and harvesting households indicate use from resources obtained during a previous year.

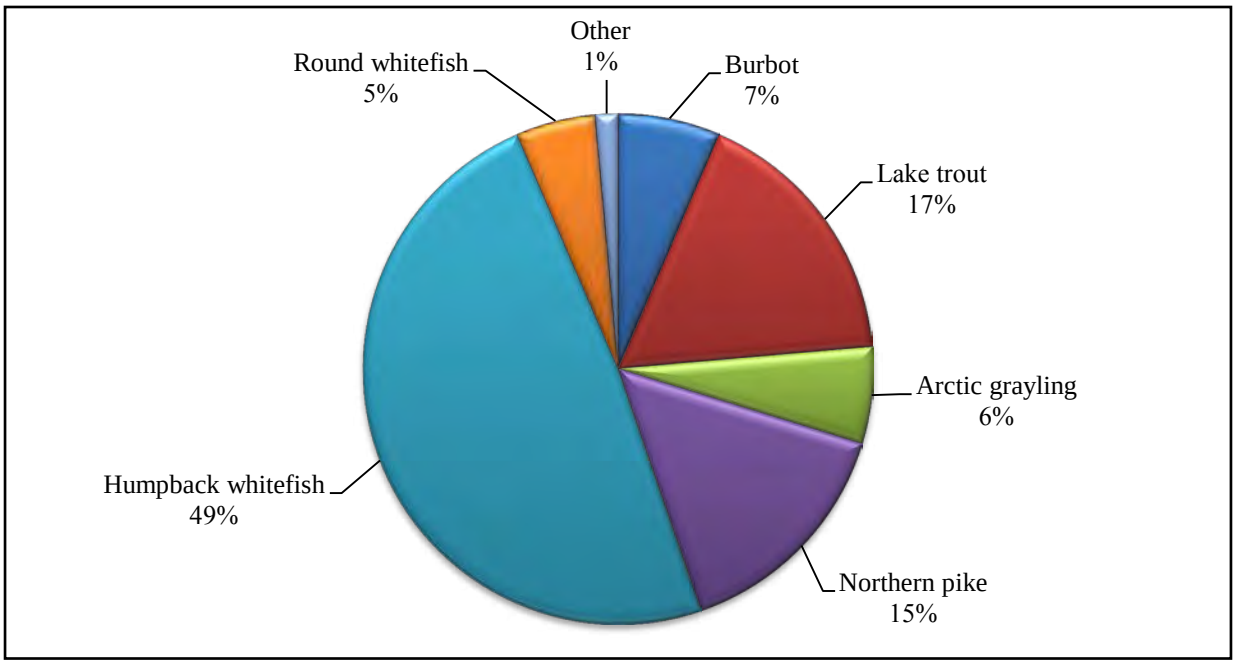


Figure 3-40.–Composition of nonsalmon fish harvest in pounds usable weight, Port Alsworth, 2012.

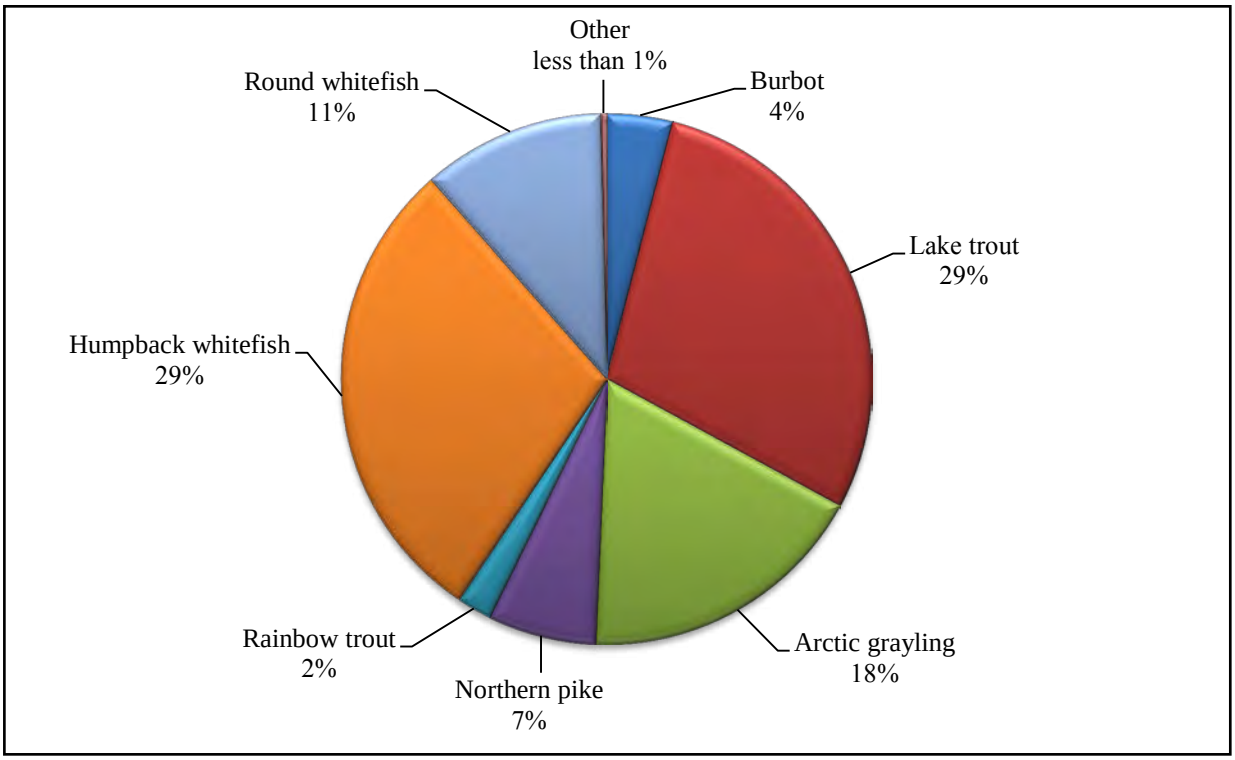
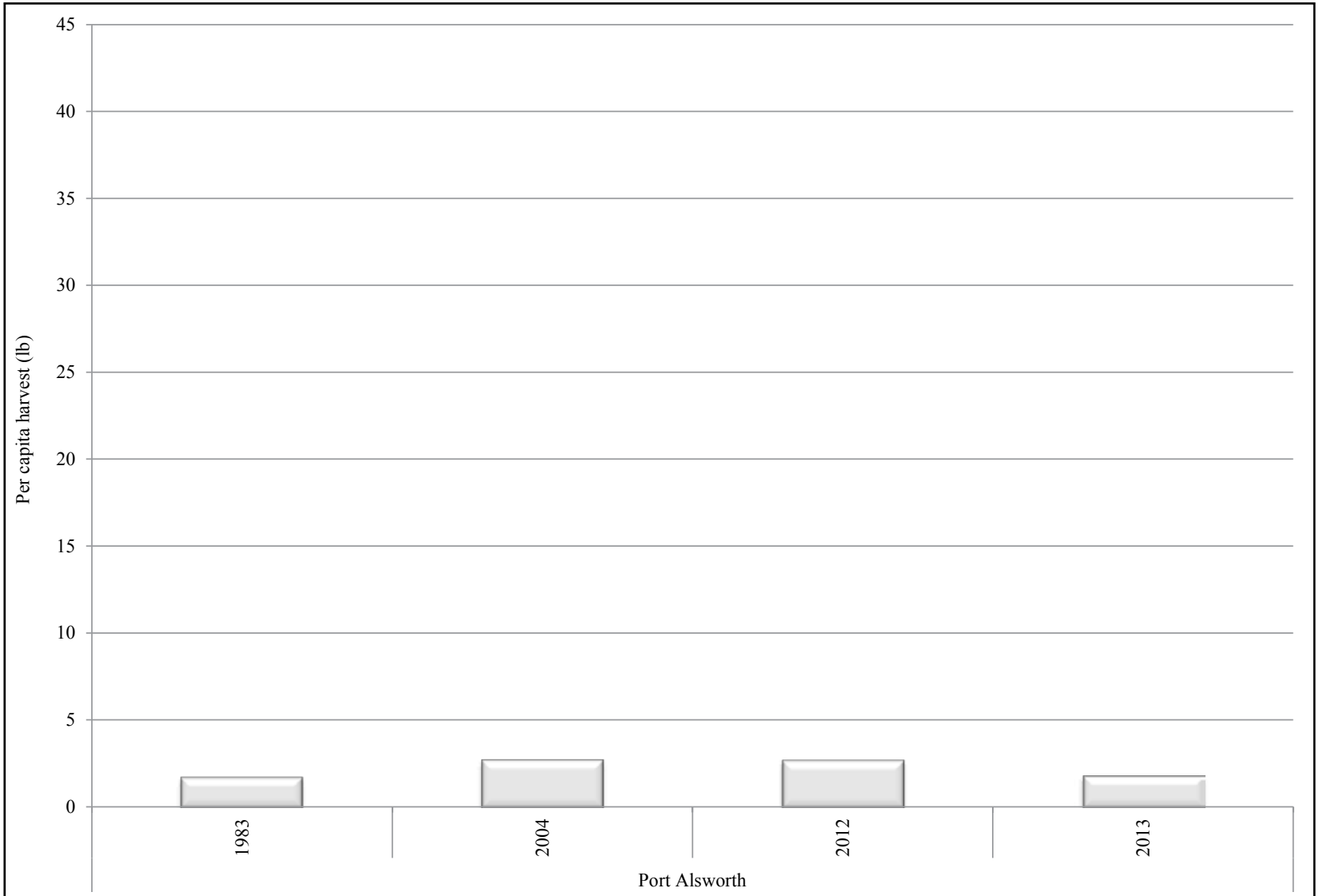


Figure 3-41.–Composition of nonsalmon fish harvest in pounds usable weight, Port Alsworth, 2013.



Note For all study years, sheefish harvests were included in the estimated harvest of whitefishes.

Figure 3-42.–Estimated harvests of whitefishes by pounds per capita, Port Alsworth, 1983, 2004, 2012, and 2013.

Table 3-44.–Estimated harvest of nonsalmon fish by gear type, resource, Port Alsworth, 2012.

	Subsistence methods															
	Gillnet or seine		Ice fishing (hook under ice)		Net under ice		Jig		Other method		Subsistence gear, any method		Rod and reel		Any method	
Resource	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds
Nonsalmon fish	**37.8**	**72.2**	**187.8**	**263.7**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**225.6**	**335.8**	**301.1**	**453.3**	**526.7**	**789.1**
Rainbow smelt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arctic lamprey	0.0	0.0	0.0	0.0	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	0.0	0.0	0.0	0.0	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	2.2	2.2	45.6	45.6	0.0	0.0	0.0	0.0	0.0	0.0	47.8	47.8	3.3	3.3	51.1	51.1
Arctic char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dolly Varden–freshwater	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.4	6.2	4.4	6.2
Dolly Varden–fingerling	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lake trout	5.6	7.8	2.2	3.1	0.0	0.0	0.0	0.0	0.0	0.0	7.8	10.9	88.9	124.4	96.7	135.3
Unknown char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arctic grayling	3.3	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	2.3	65.6	45.9	68.9	48.2
Northern pike	13.3	37.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.3	37.3	28.9	80.9	42.2	118.2
Longnose sucker	3.3	5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.3	5.0	0.0	0.0	3.3	5.0
Rainbow trout	0.0	0.0	0.0	0.0	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 trout	0.0	0.0	0.0	0.0	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
Broad 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
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
Least 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
Humpback whitefish	10.0	17.5	100.0	175.0	0.0	0.0	0.0	0.0	0.0	0.0	110.0	192.5	110.0	192.5	220.0	385.0
Round whitefish	0.0	0.0	40.0	40.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0	40.0	0.0	0.0	40.0	40.0
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

Source ADF&G Division of Subsistence household surveys, 2013.

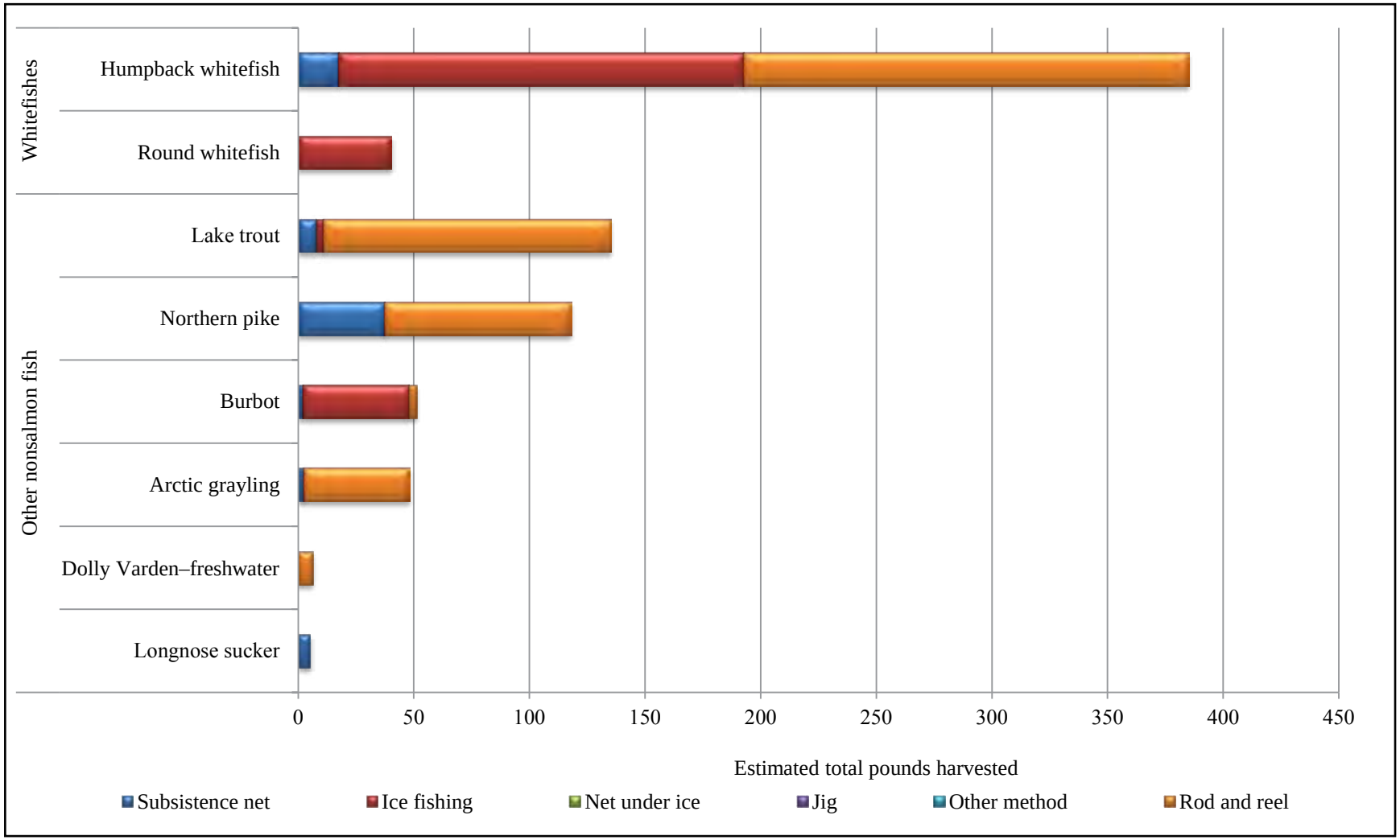


Figure 3-43.–Nonsalmon fish harvest by gear type, Port Alsworth, 2012.

Table 3-45.–Estimated harvest of nonsalmon fish by gear type, resource, Port Alsworth, 2013.

	Subsistence methods															
	Gillnet or seine		Ice fishing (hook under ice)		Net under ice		Jig		Other method		Subsistence gear, any method		Rod and reel		Any method	
Resource	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds
Nonsalmon fish	**126.1**	**176.2**	**146.7**	**184.3**	**32.4**	**56.6**	**0.0**	**0.0**	**0.0**	**0.0**	**305.1**	**417.0**	**332.2**	**361.1**	**637.3**	**778.1**
Rainbow smelt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arctic lamprey	0.0	0.0	0.0	0.0	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	0.0	0.0	0.0	0.0	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	3.2	3.2	6.5	6.5	0.0	0.0	0.0	0.0	0.0	0.0	9.7	9.7	21.6	21.6	31.3	31.3
Arctic char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.5	1.1	1.5
Dolly Varden–freshwater	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lake trout	31.3	43.8	15.1	21.1	0.0	0.0	0.0	0.0	0.0	0.0	46.4	64.9	114.3	160.0	160.7	225.0
Unknown char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arctic grayling	10.8	7.5	32.4	22.6	0.0	0.0	0.0	0.0	0.0	0.0	43.1	30.2	154.2	108.0	197.4	138.1
Northern pike	4.2	11.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4.2	11.9	14.1	39.4	18.3	51.2
Longnose sucker	1.1	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	1.6	0.0	0.0	1.1	1.6
Rainbow trout	10.8	15.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.8	15.1	1.1	1.5	11.9	16.6
Unknown trout	0.0	0.0	0.0	0.0	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
Broad 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
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
Least 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
Humpback whitefish	37.7	66.1	55.0	96.3	32.4	56.6	0.0	0.0	0.0	0.0	125.1	218.9	4.3	7.5	129.4	226.5
Round whitefish	27.0	27.0	37.7	37.7	0.0	0.0	0.0	0.0	0.0	0.0	64.7	64.7	21.6	21.6	86.3	86.3

Source ADF&G Division of Subsistence household surveys, 2014.

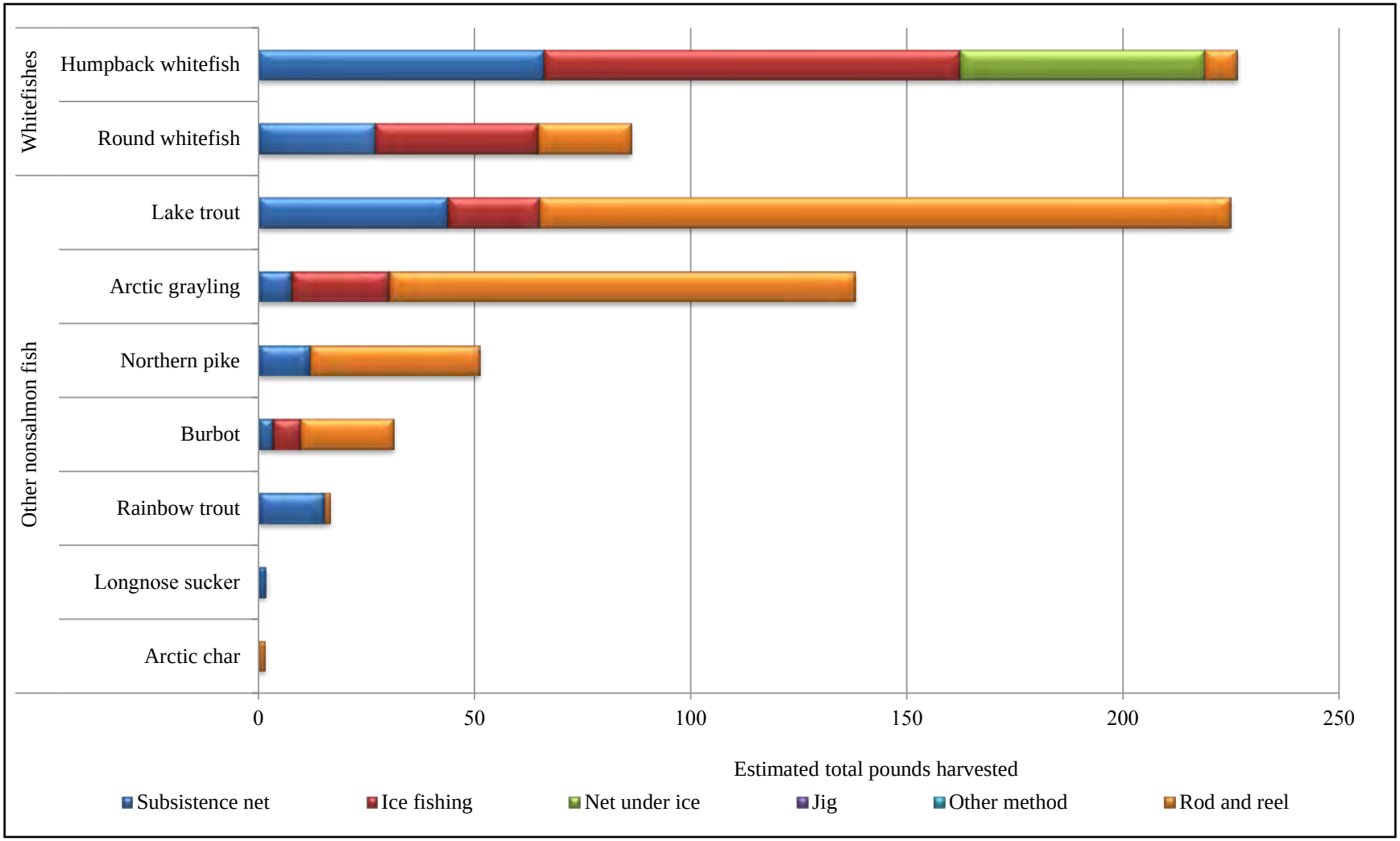


Figure 3-44.–Nonsalmon fish harvest by gear type, Port Alsworth, 2013.

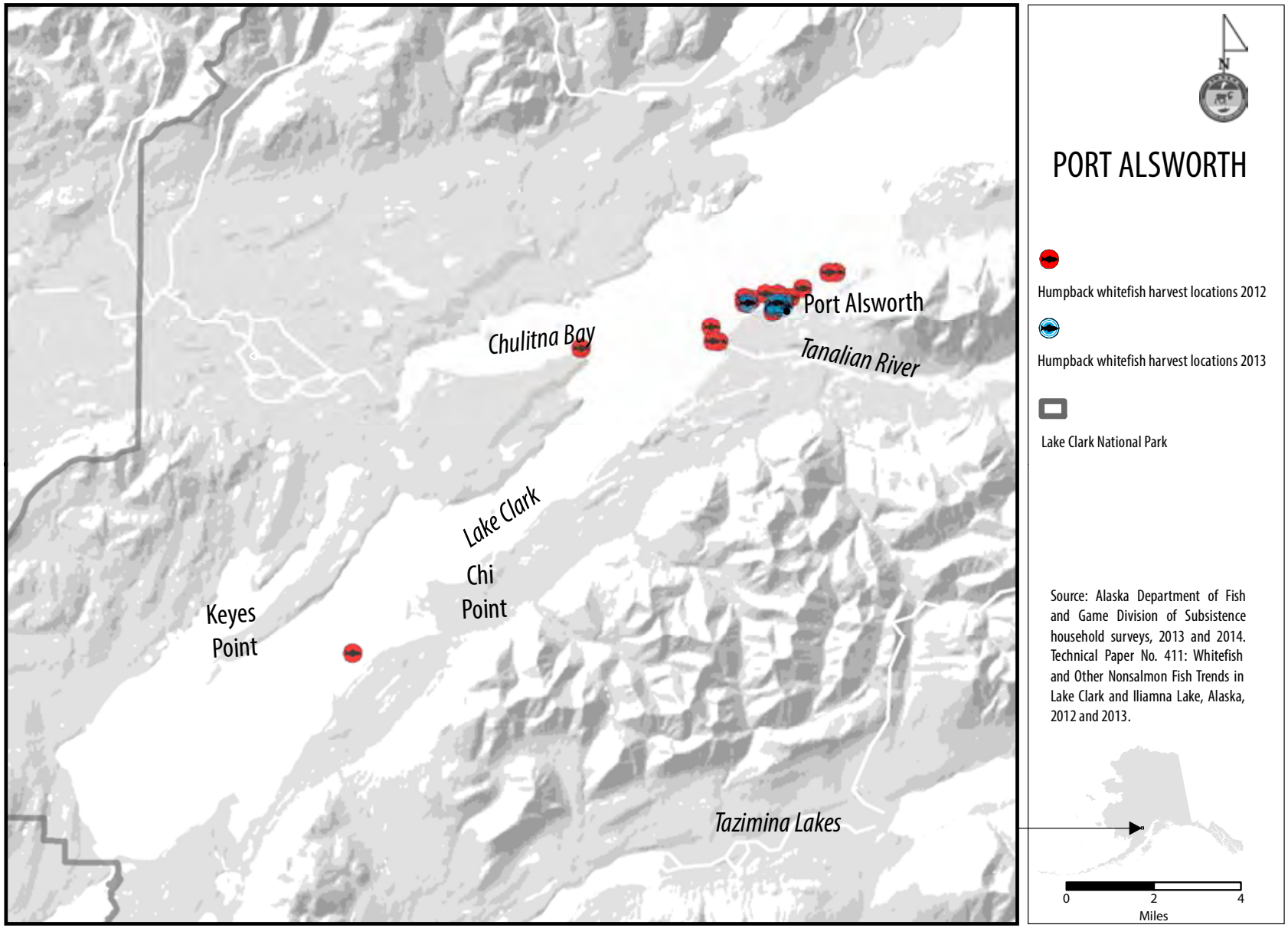


Figure 3-45.–Harvest locations of humpback whitefish, Port Alsworth, 2012 and 2013.

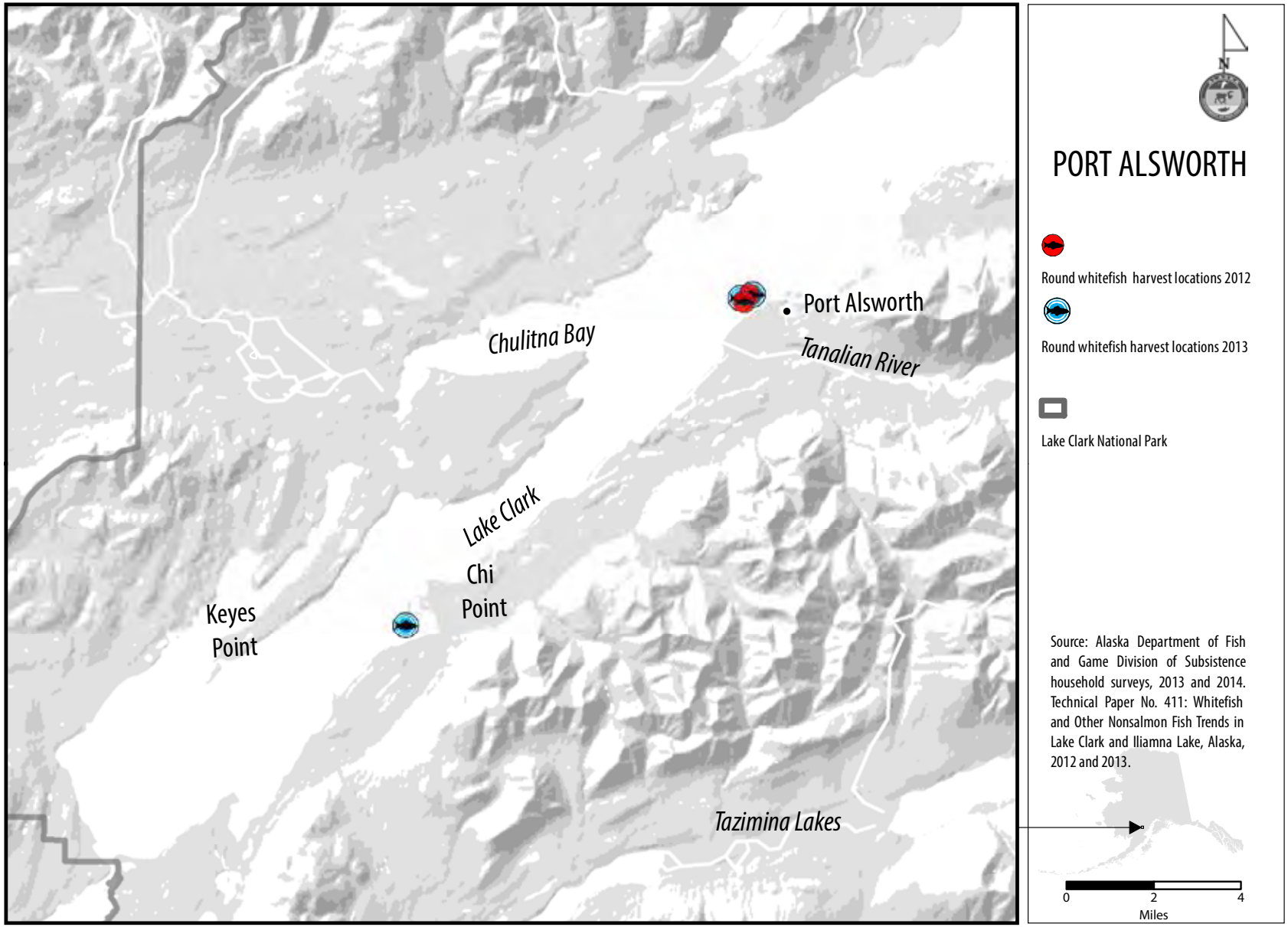


Figure 3-46.–Harvest locations of round whitefish, Port Alsworth, 2012 and 2013.

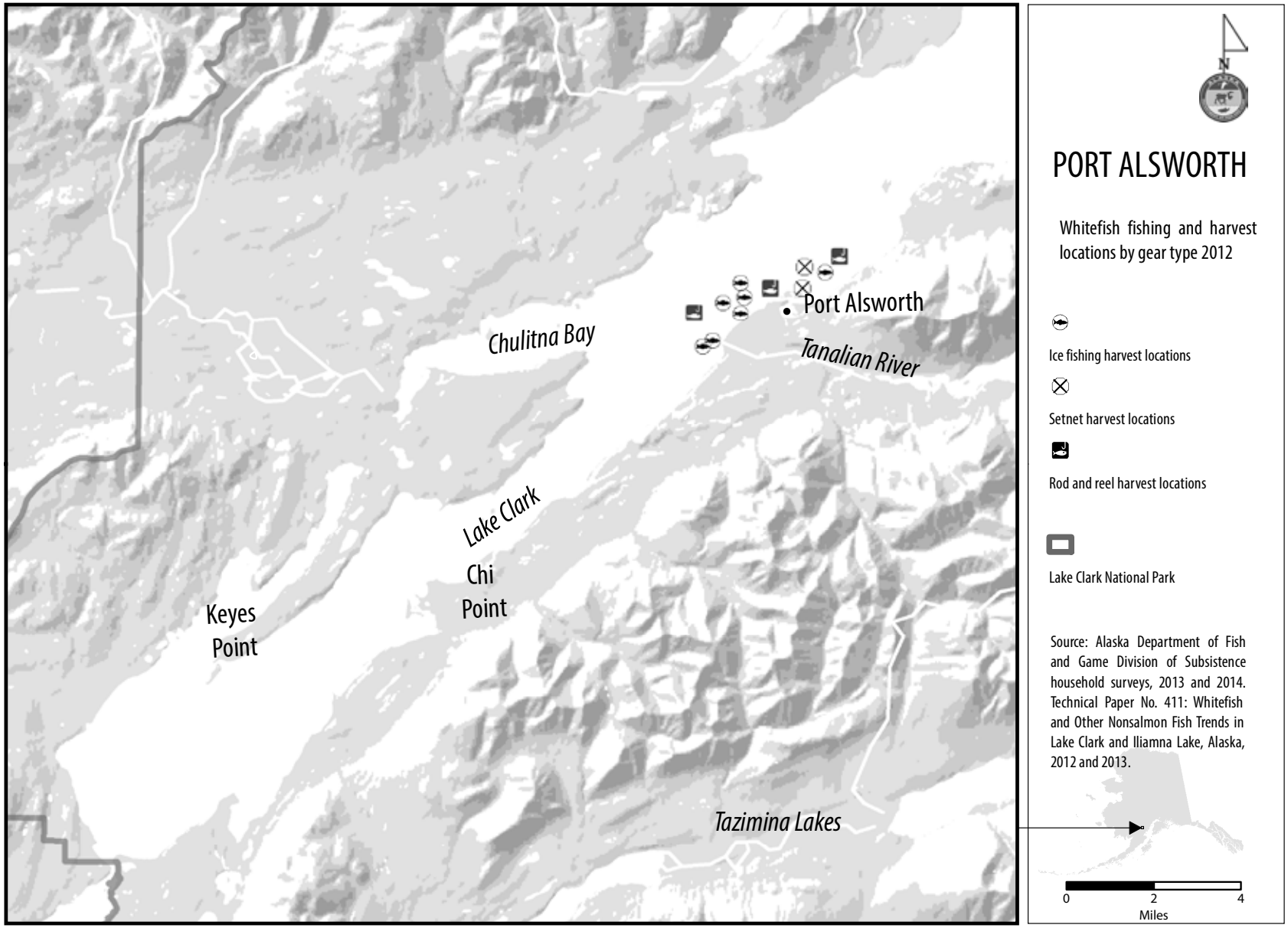


Figure 3-47.–Fishing and harvest locations of whitefish species by gear type, Port Alsworth, 2012.

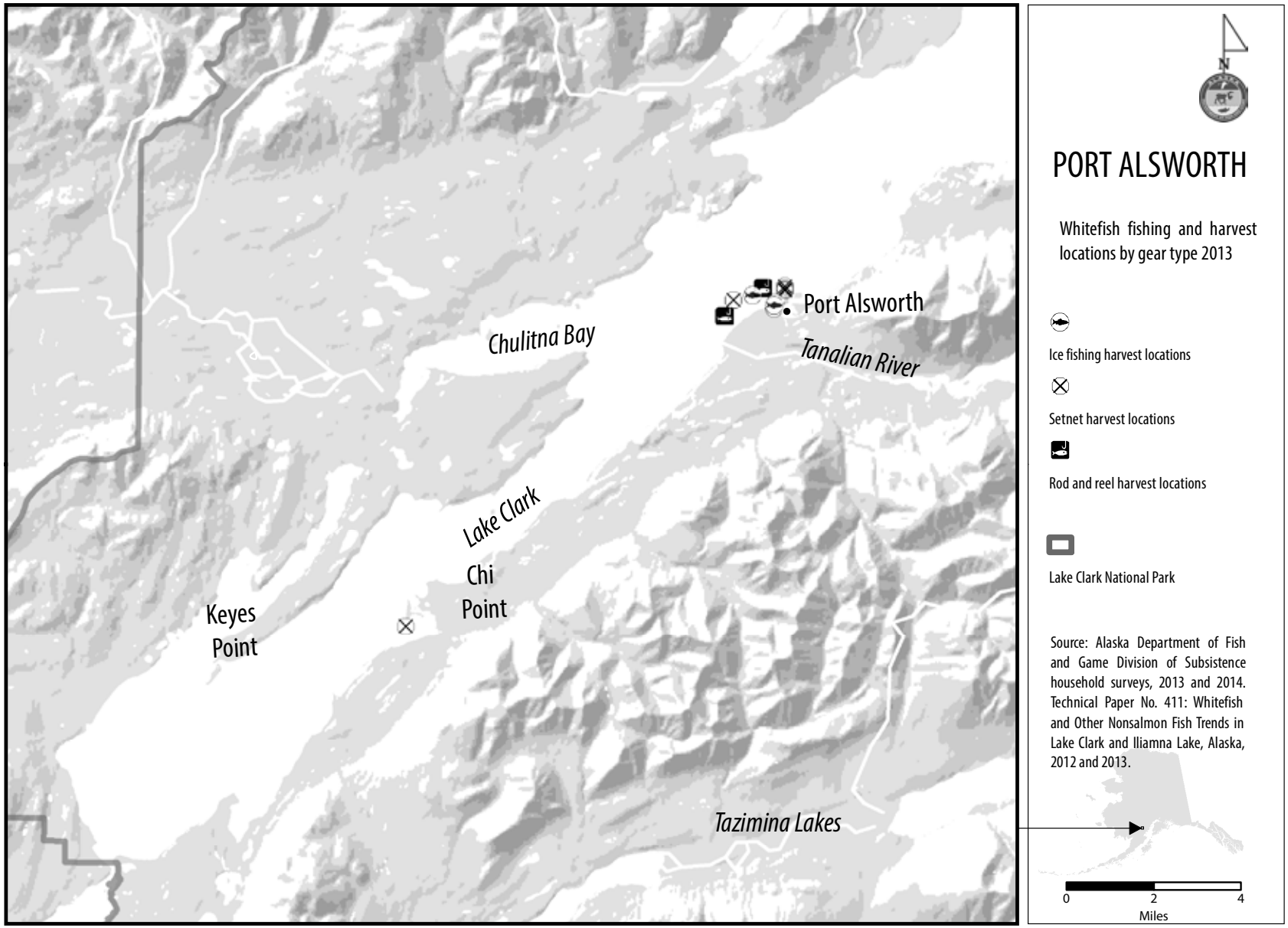
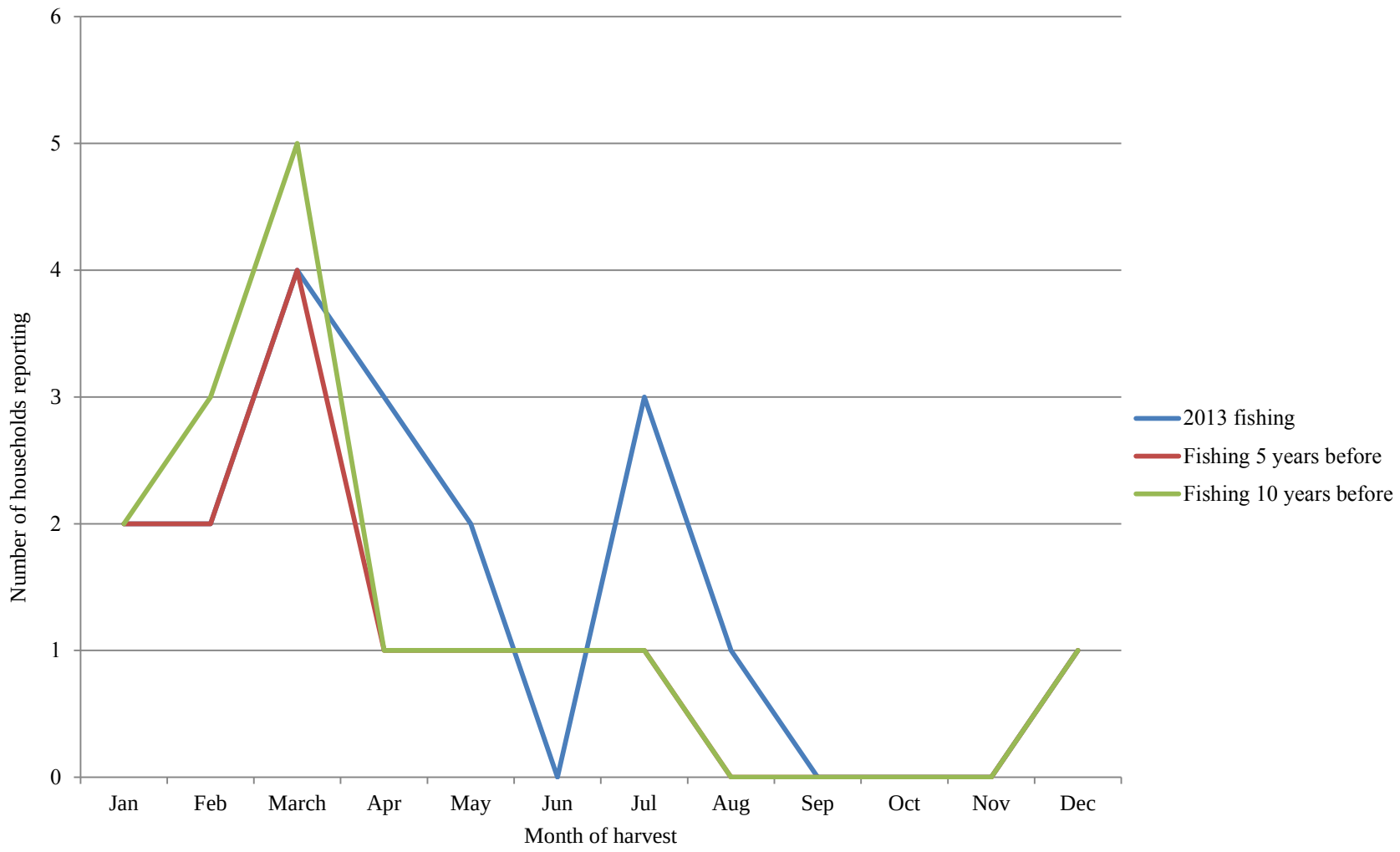


Figure 3-48.–Fishing and harvest locations of whitefish species by gear type, Port Alsworth, 2013.



Note Where fewer than 3 lines appear it indicates that the fishing pattern was identical for more than one timeline. For example, the fishing pattern for 5 years ago was identical to the fishing pattern for 10 years ago for April through December.

Figure 3-49.–Households reporting timing of whitefish harvests for 2013 and 5 and 10 years prior, Port Alsworth.

Other Nonsalmon Fish Harvests

For each study community, survey results of estimated household uses and harvests of other nonsalmon fish are presented for each study year. Note that the term "other nonsalmon fish" refers to freshwater fish species excluding whitefishes whereas the term "nonsalmon fish" includes whitefishes with other freshwater fish. Tables and figures appearing in the section "Whitefishes Harvests" that provide data for other nonsalmon fish are referred to throughout the upcoming community discussions. Similar to the use patterns for whitefishes, differences between household harvest and use percentages for other nonsalmon fish are indicative of participation in wild resources sharing among community households and with households in the region and rest of the state. Figures in the upcoming community discussions will correspond with historical harvest estimate comparisons and fishing location discussions. The household survey did not ask for information about the months that other nonsalmon fish were harvested, so harvest timing for other nonsalmon fish is not discussed.

Igiugig

While no single other nonsalmon fish species harvest exceeded the harvest weight of whitefishes (humpback whitefish and round whitefish combined), local residents asserted that other nonsalmon fish are also important to household and community well-being. At least 65% of Igiugig households used at least 1 species of other nonsalmon fish (i.e., rainbow trout) in 2012 (Table 3-19). For 2013, the percentage of households identifying themselves as users of at least 1 species of nonsalmon fish was 56% (also rainbow trout) (Table 3-20). While whitefishes contributed to a higher amount of the overall harvest, more households harvested other nonsalmon fish, as demonstrated by the rainbow trout harvest rate in both years: 59% of households harvested rainbow trout in 2012 compared to 35% of households contributing to the more prolific harvest of humpback whitefish, and 39% harvested rainbow trout in 2013 compared to 22% harvesting humpback whitefish. Furthermore, the total harvest of other nonsalmon fish exceeded the total harvest of whitefishes in both years. For example, 395 lb of other nonsalmon fish were harvested in 2012 and 217 lb were harvested in 2013, compared to whitefish harvests of 216 lb and 111 lb in 2012 and 2013, respectively.

In both 2012 and 2013, rainbow trout made up the largest percentage of the nonsalmon fish harvest (excluding whitefishes) by pounds usable weight: 28% of the nonsalmon fish harvest in 2012 and 18% in 2013 (Figure 3-1; Figure 3-2). The harvest of rainbow trout translated to a per capita harvest of 3 lb in 2012 and 1 lb in 2013 (Table 3-19; Table 3-20). In terms of contributing to the total harvest of nonsalmon fish, rainbow trout were followed by northern pike (19% of the nonsalmon fish harvest in 2012 and 16% in 2013) and then Dolly Varden (7% in 2012 and 13% in 2013) in both study years (Figure 3-1; Figure 3-2). Similar to the harvest weight of whitefishes, the harvest weight of other nonsalmon fish was reduced between the 2 study years (43% reduction in 2013); however; the composition of the harvest remained similar both years. The estimated harvest weight of rainbow trout fell from 173 lb in 2012 to 61 lb in 2013 (Table 3-19; Table 3-20). During the same time period the northern pike harvest weight fell from 115 lb to 56 lb. The harvests of Dolly Varden represented the only increase: more households fished for Dolly Varden in 2013 (28% of households) and there was a modest increase in the estimated harvest weight between the 2 study years (40 lb in 2012 to 43 lb in 2013), which resulted in an increase in the percentage that Dolly Varden contributed to the composition of the nonsalmon fish harvest.

Alaska blackfish and burbot are locally available, but neither species was harvested in 2013. However, 6% of households received and used Alaska blackfish and burbot, which indicates these resources were likely harvested elsewhere and shared by households from another community with the Igiugig households.

The harvest of other nonsalmon fish has declined significantly over time (Figure 3-50). In 1983 and 1992, the estimated per capita harvest was greater than 40 lb in both years. Other nonsalmon fish harvests were lower in 2003 (17 lb per capita) but increased 2 years later in 2005 to 37 lb per capita. However, harvests of other nonsalmon fish in both the 2012 and 2013 were exceptionally low with less than 10 lb per capita harvested in both years.

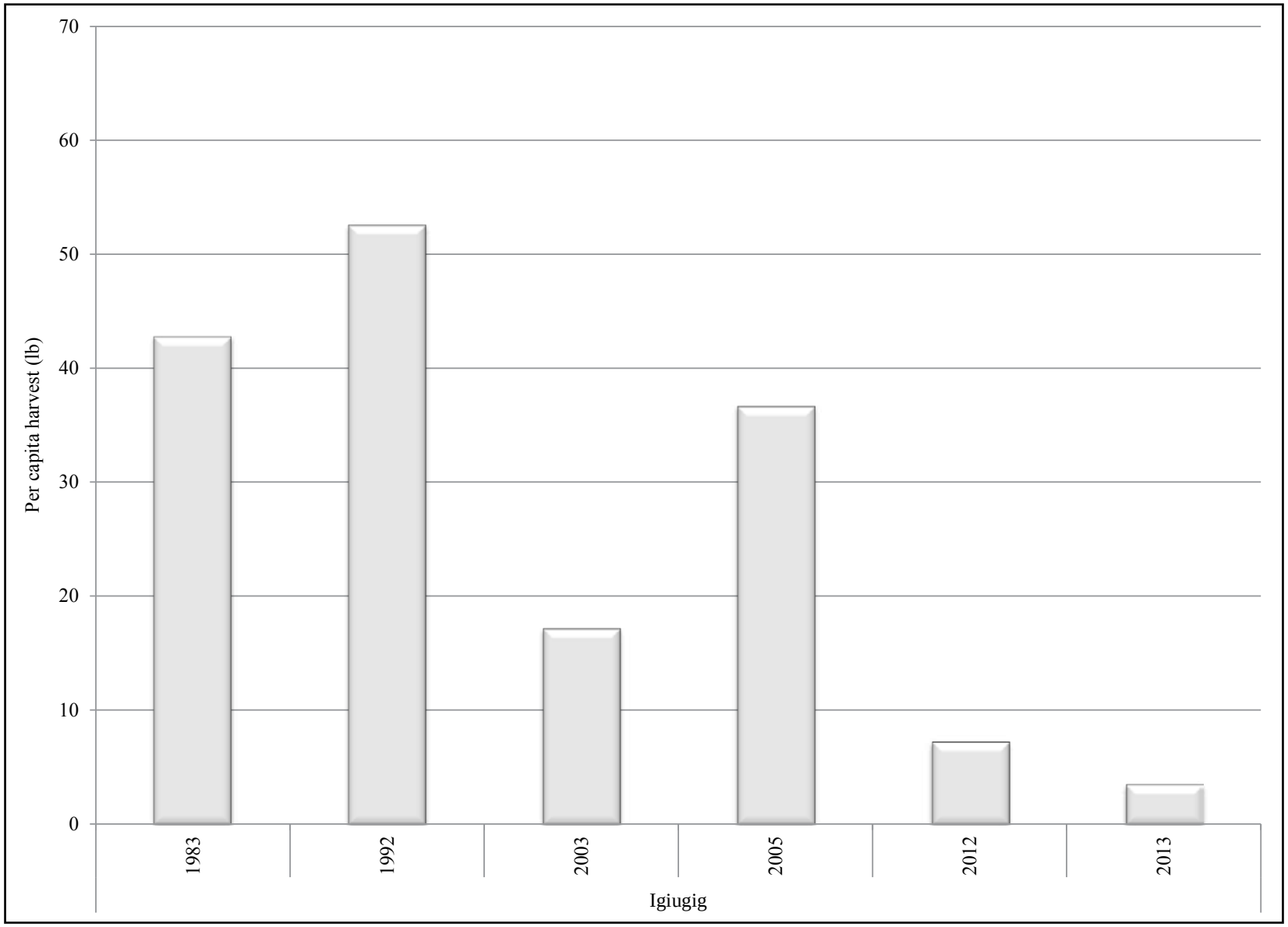


Figure 3-50.–Estimated harvests of other nonsalmon fish by pounds per capita, Igiugig, 1983, 1992, 2003, 2005, 2012, and 2013.

The reasons provided by study participants for the decrease in harvest attempts and harvests of other nonsalmon fish in 2013 compared to 2012 were essentially identical to the explanations for the decreased whitefish harvests between 2012 and 2013: bad weather and fishing conditions in 2013 and 2012, as well as a variety of personal reasons, resulted in less harvest effort for the community of Igiugig as a whole. A household survey conducted by Division of Subsistence and Bristol Bay Native Association staff in Igiugig for study year 2003 recorded several reasons offered by Igiugig residents for the decline in the use of freshwater fish over time. The most common reason given for less use of nonsalmon fish in 2003 compared to recent years was climatic conditions (50% of respondents that used less freshwater nonsalmon fish) followed by less harvest effort (25% of respondents that used less freshwater nonsalmon fish) (Krieg et al. 2005:209). Local residents suggested that another potential cause for the observed decline in other nonsalmon fish harvests was that through the mid-1980s, and possibly somewhat later, fish were used to feed dogsled teams, which contributed to larger other nonsalmon fish harvests during that time (Krieg et al. 2005). Factors that Igiugig residents said contributed to harvest declines during this study (2012–2013) are outlined in more detail in chapter 5, "Factors Influencing Residents' Ability to Harvest Nonsalmon Fish."

Changes in gear choice may be attributed to climatic and resource conditions, economic costs, and access to various gear types. These factors might have contributed to the significant shift in gear types used for fishing for other nonsalmon fish from one study year to the next. In 2012, about 211 other nonsalmon fish (approximately 325 lb) were harvested using subsistence methods and about 42 other nonsalmon fish (approximately 69 lb) were harvested using rod and reel (Table 3-21). Figure 3-4 is a visual representation of other nonsalmon fish harvested by total pounds and by gear type. As estimated in numbers of fish, just more than one-half (54%) of the total harvest of other nonsalmon fish was caught while ice fishing, 29% of other nonsalmon fish were caught using gillnets, and the remaining harvest (17%) was caught using a rod and reel (Table 3-21). For rainbow trout, about 55% were caught in a subsistence net, 24% by rod and reel, and 21% by ice fishing. The Arctic grayling harvest was done predominantly by ice fishing (80%) and the remaining harvest was accomplished with a rod and reel. Northern pike were also most often taken by ice fishing (94%) and the remainder of the harvest was caught in a gillnet. All of the Dolly Varden harvest was by ice fishing as was the limited harvest of Alaska blackfish and lake trout. All of the rainbow smelt harvest was done with a rod and reel, and all of the Arctic char harvest was caught in a gillnet.

During 2013, an estimated 159 other nonsalmon fish (approximately 167 lb) were taken using subsistence gear and 32 other nonsalmon fish (approximately 50 lb) were harvested using rod and reel (Table 3-22). Figure 3-5 is a visual representation of the other nonsalmon fish harvested by total pounds and by gear type. As estimated in numbers of fish, about 67% of the other nonsalmon fish harvest was achieved while ice fishing, 17% using rod and reel, and about 16% were harvested using a gillnet (Table 3-22). The second study year saw a shift in fishing method for rainbow trout with emphasis moving away from gillnet harvests; 53% of fish were harvested by ice fishing in 2013 and 26% by gillnet. The remaining 21% of the rainbow trout harvest was by rod and reel. During 2013, the Arctic grayling harvest was once again primarily by ice fishing (71% of harvest) with the rest of the harvest (29%) caught with rod and reel. Ice fishing for northern pike accounted for a much smaller percentage of the harvest in 2013 when compared to the previous year with ice fishing accounting for only 16% of the harvest. During 2013, the most commonly used gear type for harvesting northern pike was rod and reel, which accounted for just more than one-half of the harvest (52%); by comparison, no northern pike were caught with a rod and reel in 2012. Around one-third (32%) of the northern pike were harvested in gillnets in 2013. Following the pattern of the 2012 harvest, 100% of the 2013 Dolly Varden harvest by residents of Igiugig was gathered while ice fishing. As opposed to 2012, when 100% of the rainbow smelt harvest was done with rod and reel, the entire 2013 rainbow smelt harvest was caught by ice fishing. All of the longnose suckers harvested in 2013 were caught in a gillnet.

Figures 3-51 and 3-52 represent Igiugig residents' harvest locations of other nonsalmon fish by gear type for 2012 and 2013, respectively. In both study years, ice fishing occurred at favorite locations just downstream from Igiugig on the Kvichak River, along the shoreline of Iliamna Lake to the east of Igiugig, and also near Big Island farther to the east along the shoreline of Iliamna Lake. In 2012, ice fishing for northern pike took place in the unnamed lagoon adjacent to the western shoreline of Iliamna Lake just to the north of Igiugig. Fishing with rod and reel and setnets took place near Igiugig and downstream as far as Kaskanak Creek.

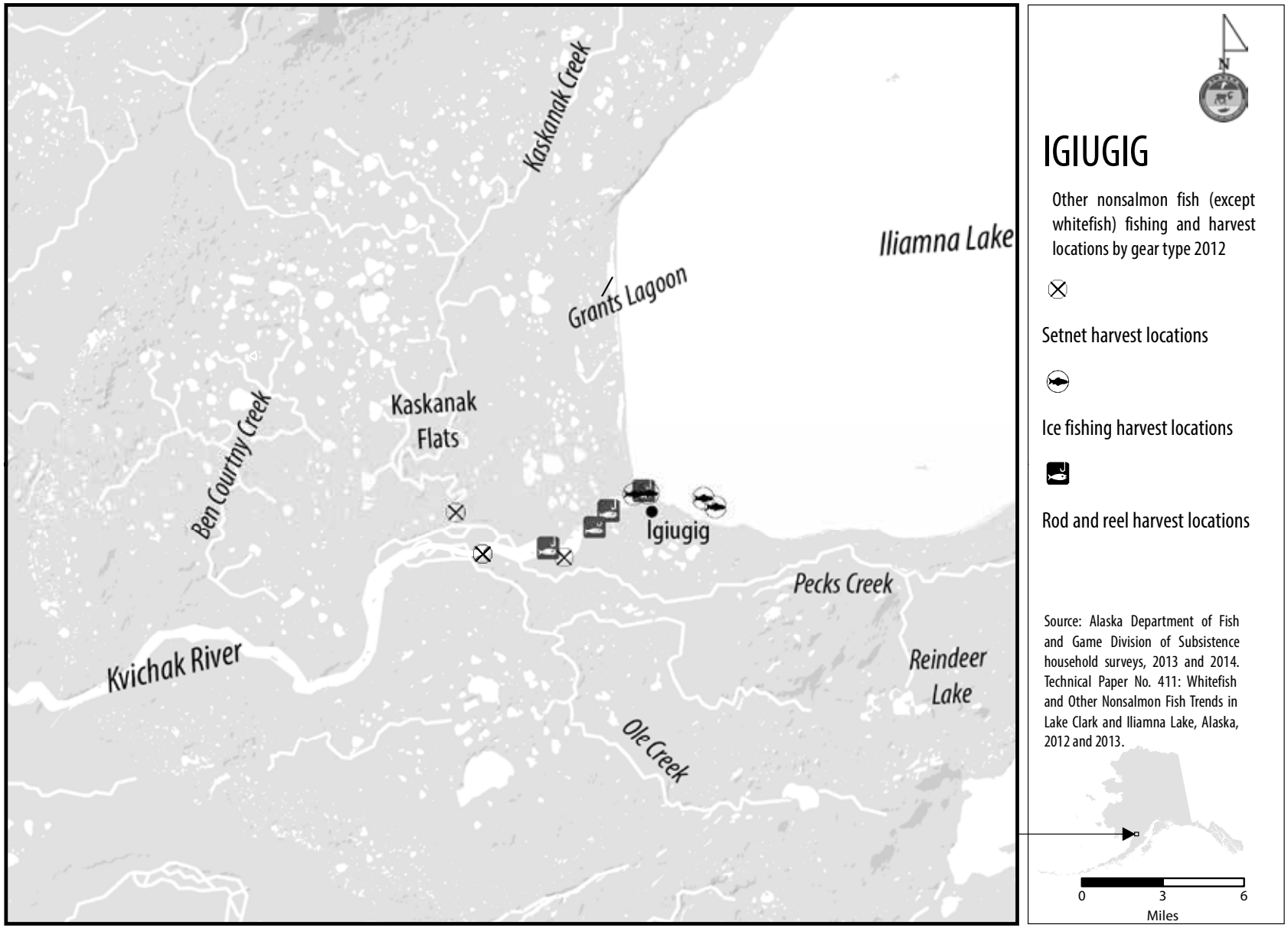


Figure 3-51.–Fishing and harvest locations of other nonsalmon fish species by gear type, Igiugig, 2012.

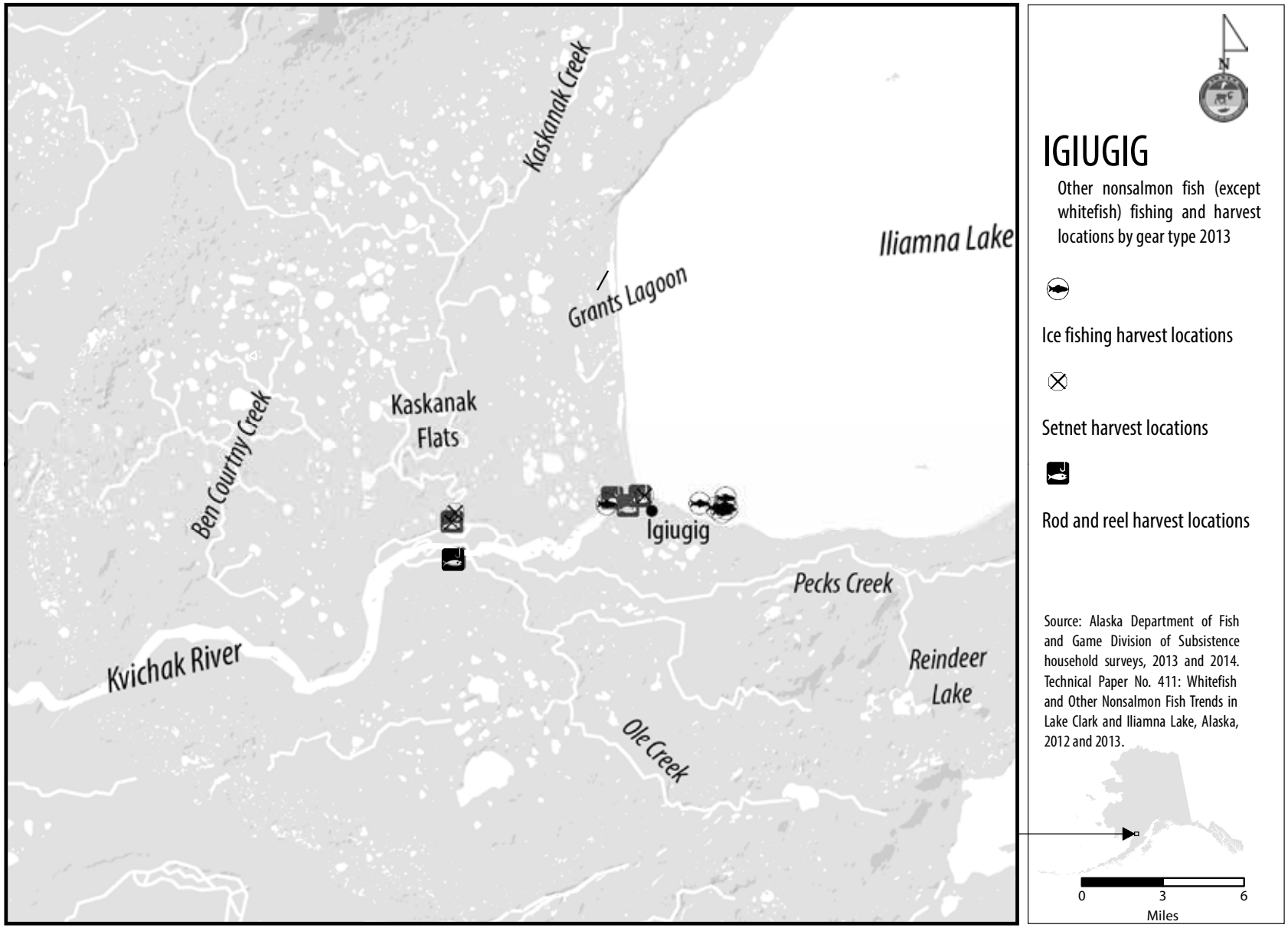


Figure 3-52.–Fishing and harvest locations of other nonsalmon fish species by gear type, Igiugig, 2013.

Some rod and reel fishing was also recorded near Big Island. Harvest locations and gear type appeared to be fairly consistent between the 2 study years.

Figure 3-53 represents harvest locations for rainbow trout during 2012 and 2013. In both years, harvests of rainbow trout were concentrated within 4 miles of Igiugig village in Iliamna Lake and the Kvichak River downstream to Ole and Kaskanak creeks. Figure 3-54 represents harvest locations for Arctic grayling for both study years. The 2012 harvest of Arctic grayling took place on the Kvichak River near Igiugig and at the ice fishing location on Iliamna Lake to the east of the village (Figure 3-54; Figure 3-51). The 2013 harvest took place primarily east of the village in Iliamna Lake by ice fishing and in the Kaskanak Flats area near the mouth of Ole Creek with rod and reel (Figure 3-54; Figure 3-52).

Figure 3-55 represents northern pike harvest locations for Igiugig residents during 2012 and 2013. Harvests of northern pike during both years occurred at the mouth of Kaskanak Creek and across from Big Island in Reindeer Bay. A knowledgeable fisher and Igiugig elder noted that in both historical and contemporary times, Kaskanak Creek was and is an important northern pike harvest location because the creek has a lot of weeds in it that the northern pike use as cover when feeding on other fish. As stated above, in 2012, northern pike were also harvested in the unnamed lagoon just to the north of Igiugig.

Figure 3-56 depicts harvest locations of Dolly Varden during 2012 and 2013. These harvests took place along the shore of Iliamna Lake east of the mouth of the Kvichak River within 4 miles of the village site. Figure 3-57 shows the harvest locations of longnose suckers in 2012. The harvests took place at the mouth of Kaskanak Creek while fishing for whitefishes occurred. No harvest of longnose suckers by the residents of Igiugig was recorded for the 2013 study year.

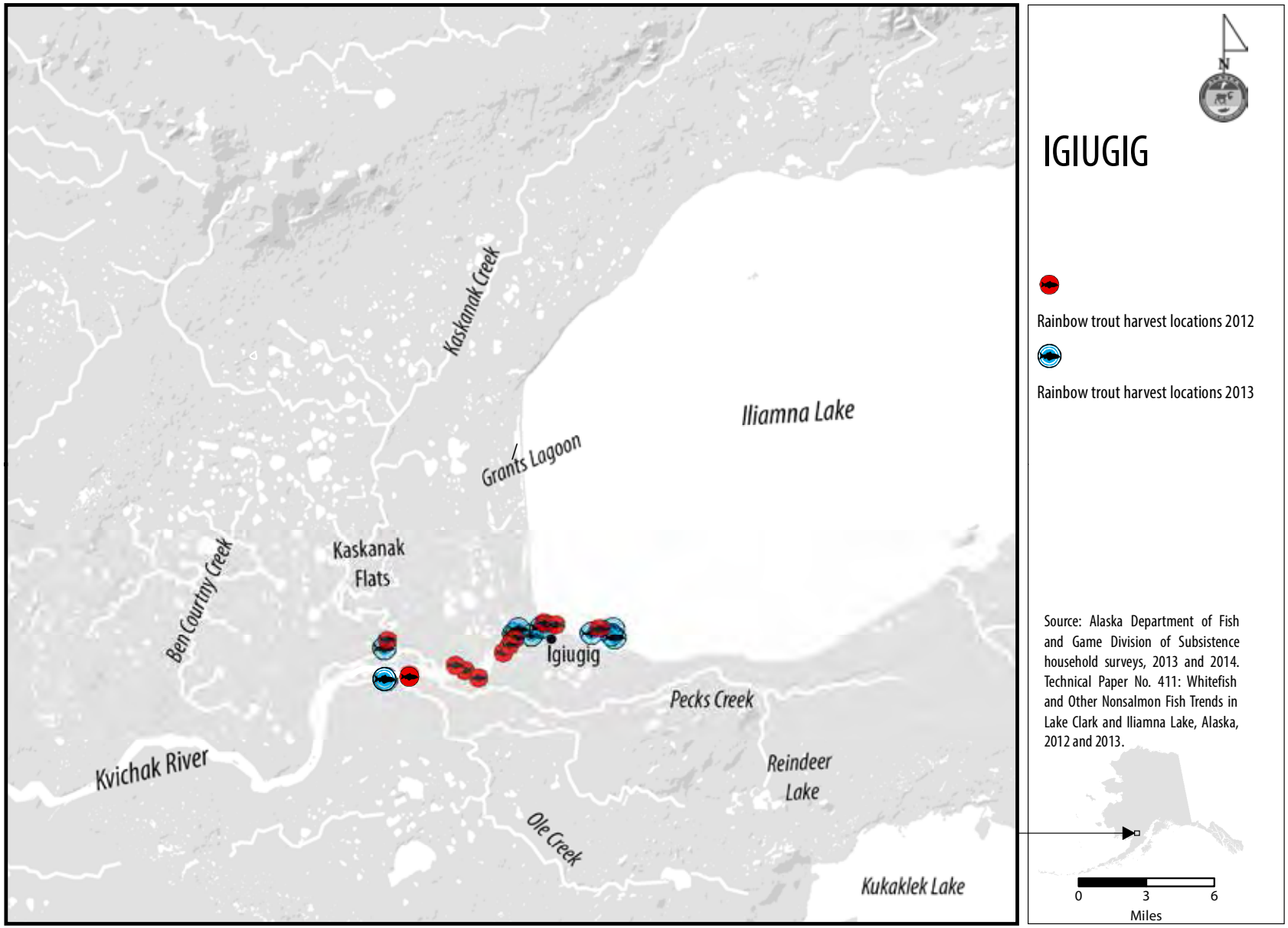


Figure 3-53.–Harvest locations of rainbow trout, Igiugig, 2012 and 2013.

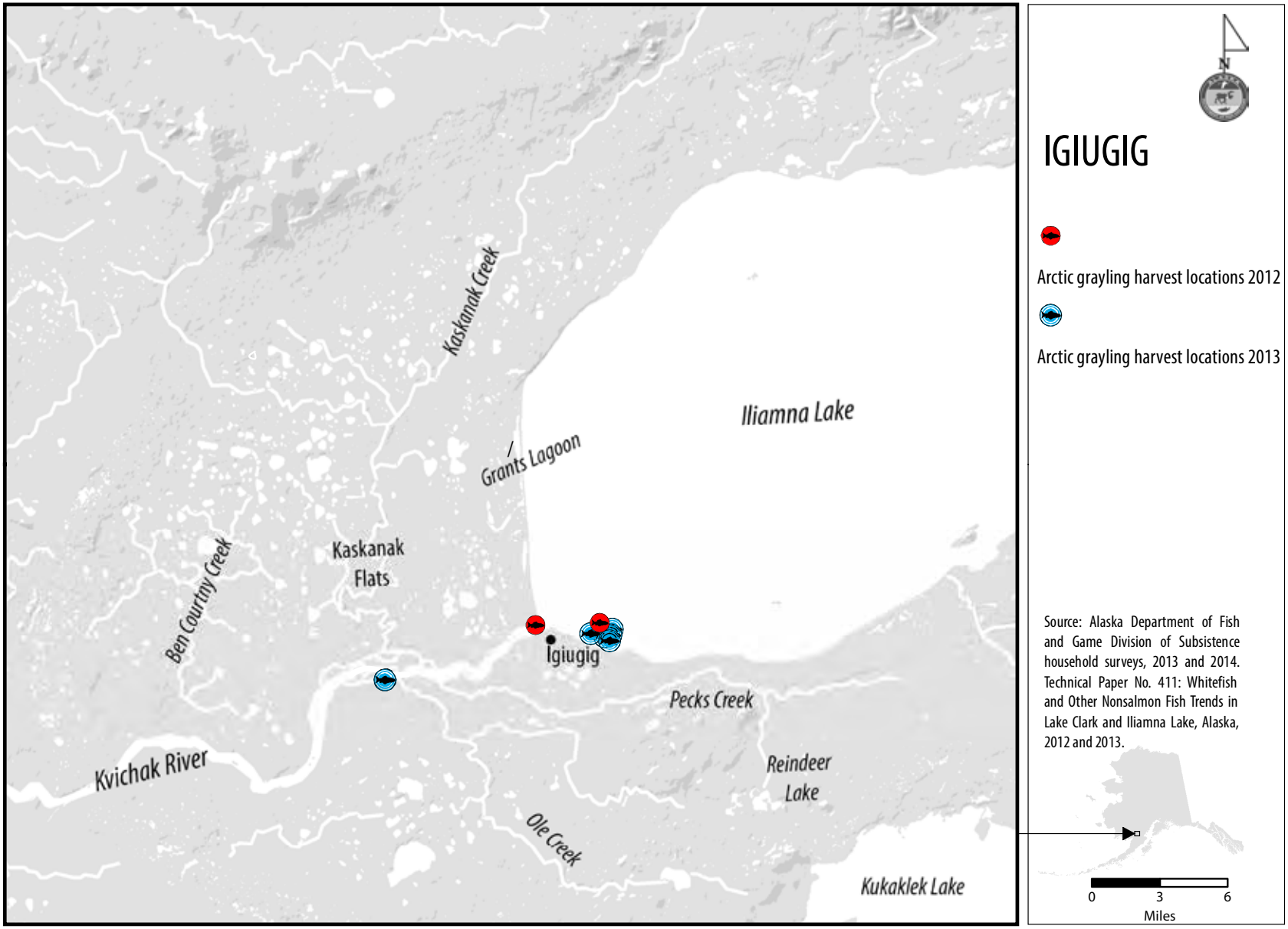


Figure 3-54.–Harvest locations of Arctic grayling, Igiugig, 2012 and 2013.

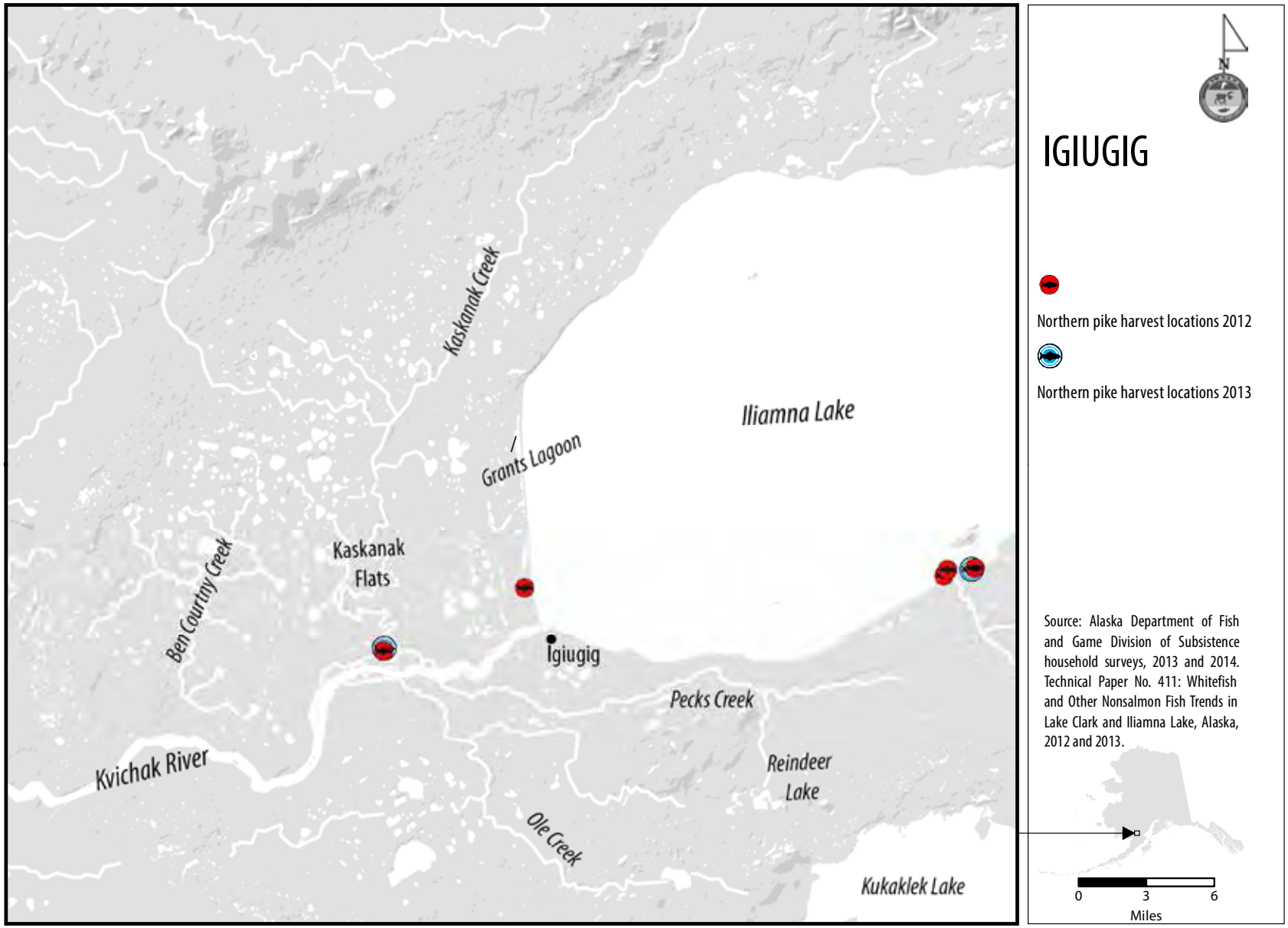


Figure 3-55.–Harvest locations of northern pike, Igiugig, 2012 and 2013.

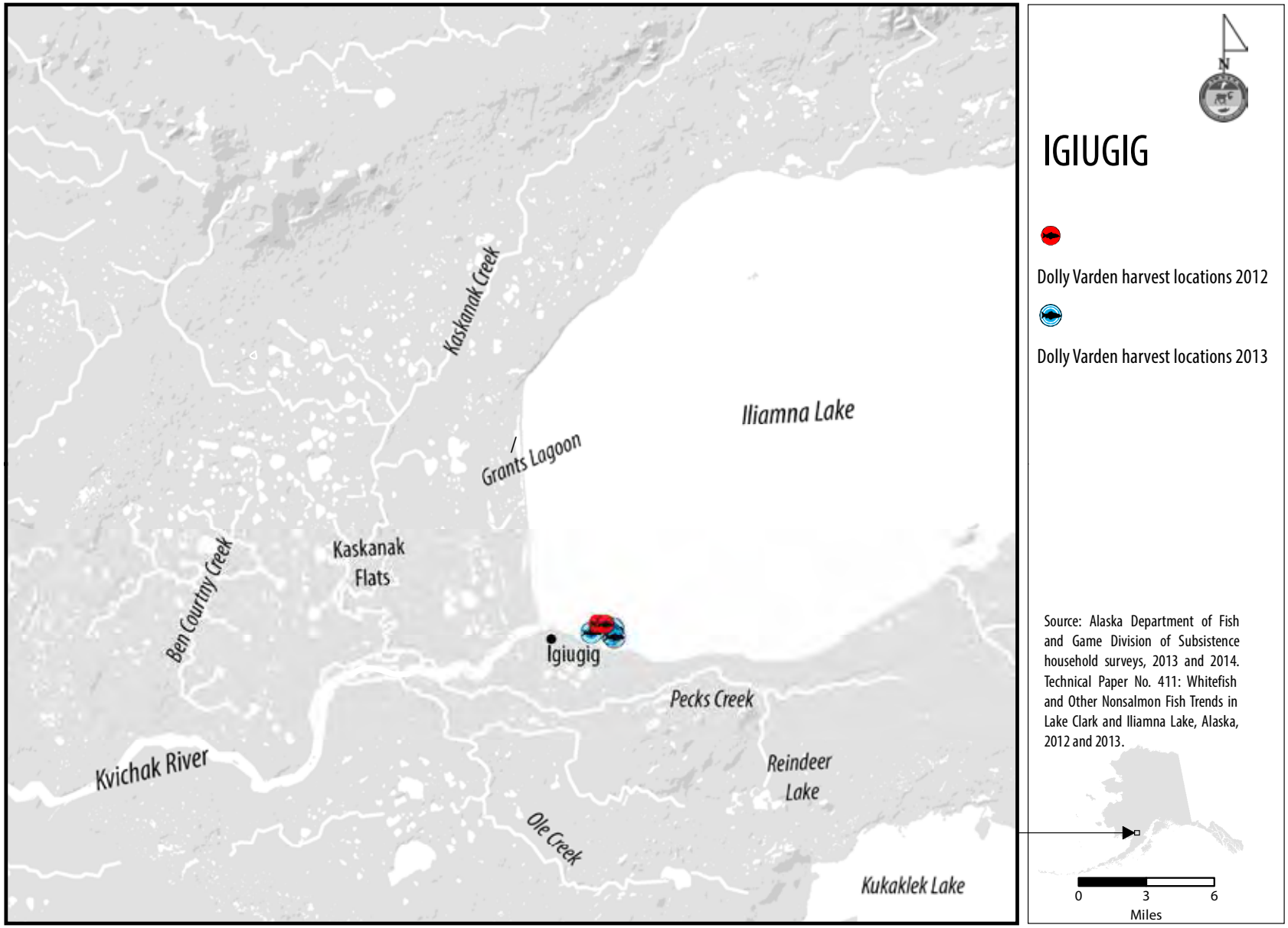


Figure 3-56.–Harvest locations of Dolly Varden, Igiugig, 2012 and 2013.

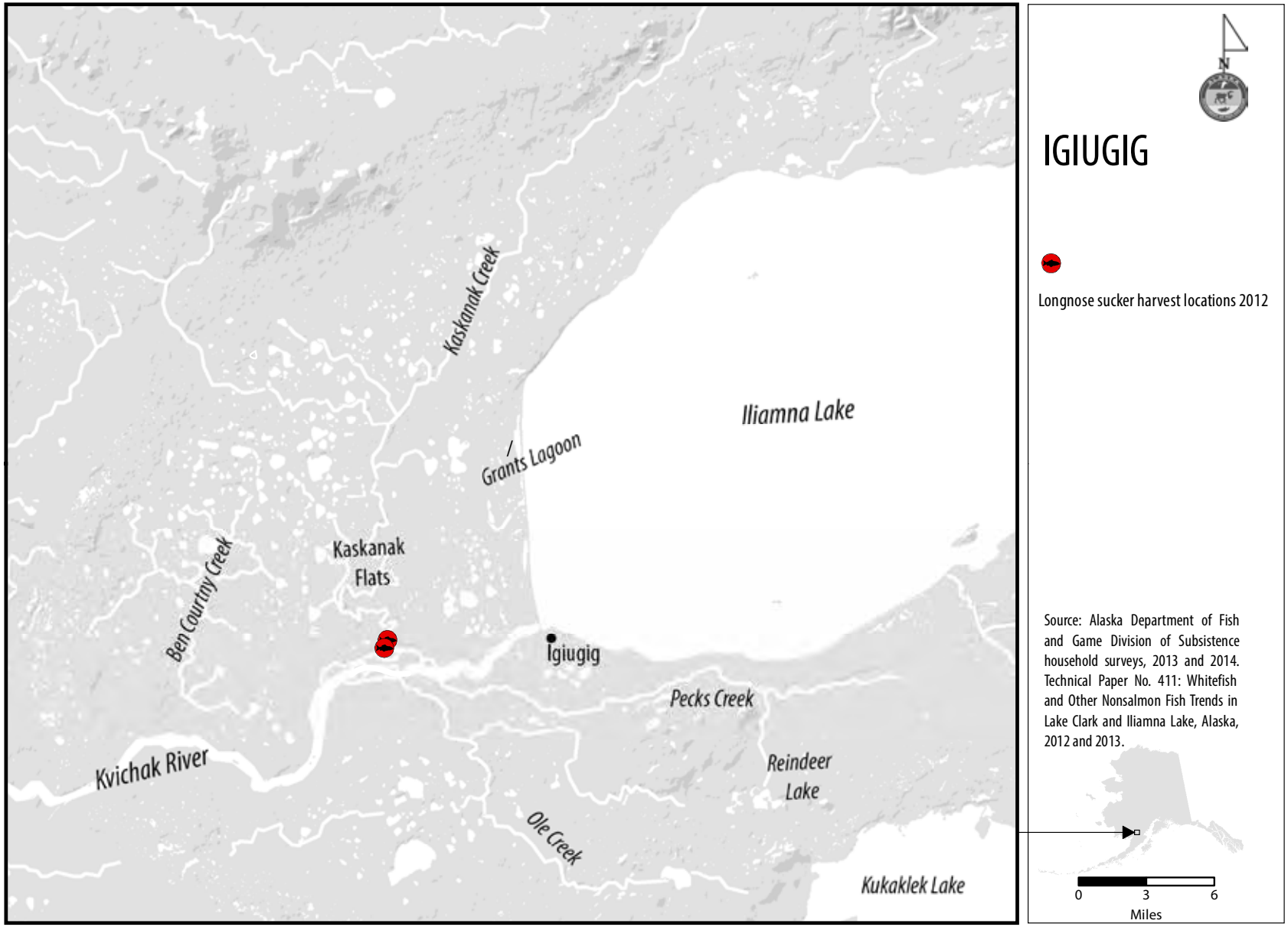


Figure 3-57.–Harvest locations of longnose sucker, Igiugig, 2012.

Iliamna

A variety of other nonsalmon fish are locally available in the direct vicinity of the community in Iliamna Lake and the Newhalen River. The harvest of other nonsalmon fish was an important subsistence activity for Iliamna residents in 2013. Other nonsalmon fish accounted for 96% of the total harvest of nonsalmon fish (including whitefishes) (Figure 3-11; Table 3-25). By far, the harvest of Dolly Varden contributed the most to the overall harvest of nonsalmon fish in pounds edible weight (1,583 lb, or 57% of the total harvest). After Dolly Varden, the top 3 fish species harvested were rainbow trout (11%), northern pike (8%), and Arctic grayling (8%). More households used the top harvested other nonsalmon fish species than any single whitefish species. Humpback whitefish was the most widely used type of whitefish (used by 35% of households), but more households used Dolly Varden (57%), rainbow trout (55%), northern pike (45%), and Arctic grayling (48%).

Historically, the per capita harvest of other nonsalmon fish has been relatively stable between 25 and 30 lb since 1983 (Figure 3-58). There is one exception, the year 1991, when a per capita harvest of 67 lb was estimated. It is not clear what contributed to the significant increase that year. The neighboring community of Newhalen did not exhibit a similar trend for 1991.

Other nonsalmon fish were mostly harvested by ice fishing (71%) (Table 3-27; Figure 3-13). For example, 1,423 lb of Dolly Varden were harvested by ice fishing (i.e., 90% of total Dolly Varden harvest weight). A very small amount of lake trout were harvested by gillnet or seine, likely as incidental catch while salmon fishing. The remaining other nonsalmon fish were harvested by rod and reel, including Arctic char, Dolly Varden, lake trout, Arctic grayling, northern pike, and rainbow trout. Fishing locations and the gear type used to harvest other nonsalmon fish are depicted for 2013 in Figure 3-59.

Dolly Varden were harvested in the Newhalen River at a number of locations (including Landing) and at the mouth of the Newhalen River (Figure 3-60). Dolly Varden were also harvested in Roadhouse Bay, which is located just south of Iliamna. Rainbow trout fishing locations mirror Dolly Varden harvests but with additional fishing occurring at the mouth of the Lower Talarik Creek and at Tommy Creek (Figure 3-61). The most popular location for northern pike fishing by Iliamna households was Alexcy Lake, which is known locally as a good place to fish for pike (Figure 3-62). Close to Roadhouse Bay is a small lake that a Yup'ik elder indicated was full of pike. The elder called the lake *Chook'fa'lik* (phonetically spelled) but is likely a local variant of C*uukvaklik*, which is the word used in Bristol Bay for "place of many pike" (Jacobson 1984).

Iliamna households harvested Arctic grayling in a variety of locations—mostly along the Newhalen River but also at Roadhouse Bay, Seversons, Alexcy Lake, and Lake Clark (Figure 3-63). In contrast, lake trout were mainly harvested at 2 locations: Sixmile Lake and the mouth of the Newhalen River (Figure 3-64). Burbot were caught by ice fishing from the western edge of Chulitna Bay (Figure 3-65).

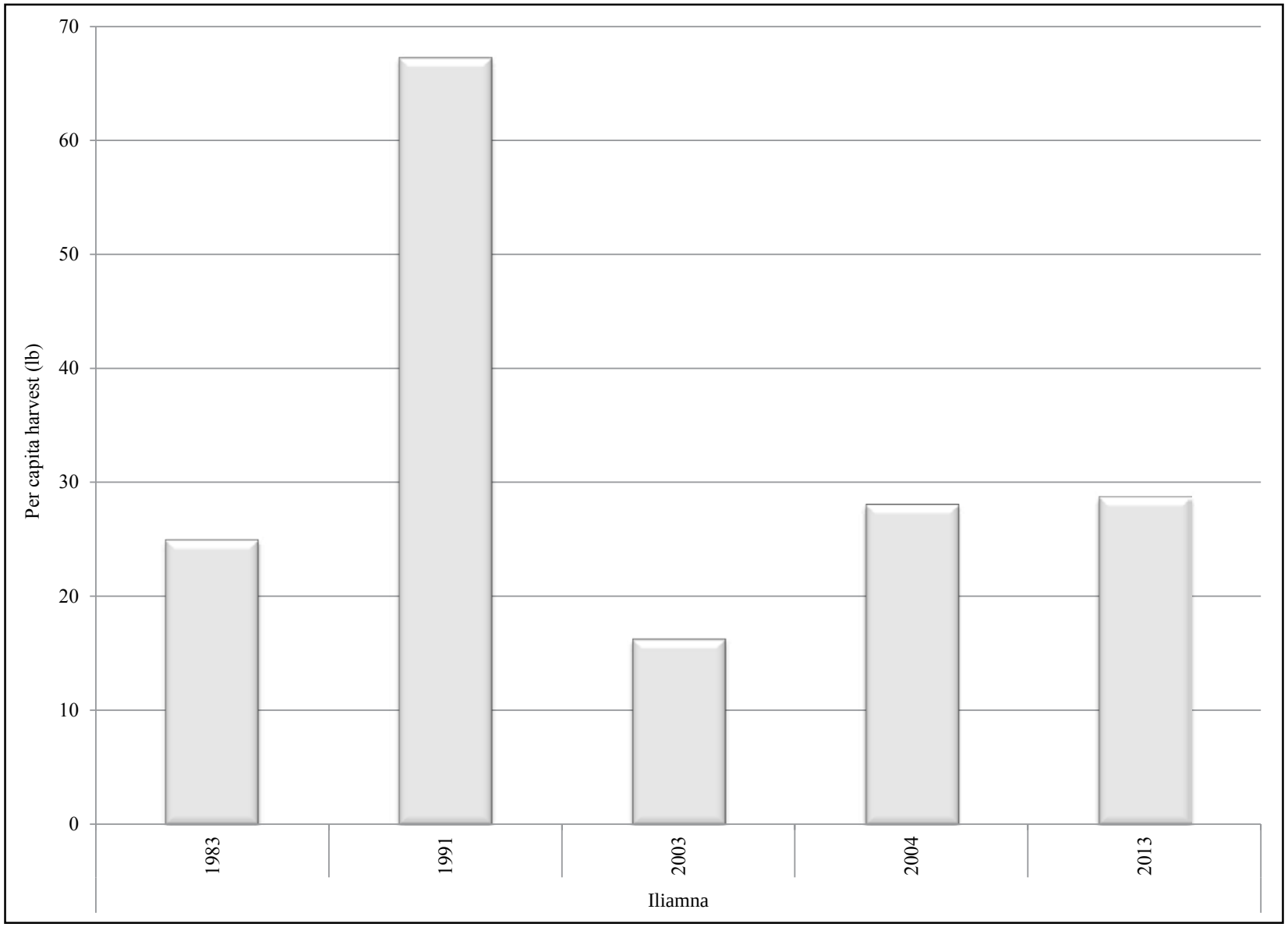


Figure 3-58.–Estimated harvests of other nonsalmon fish by pounds per capita, Iliamna, 1983, 1991, 2003–2004, and 2013.

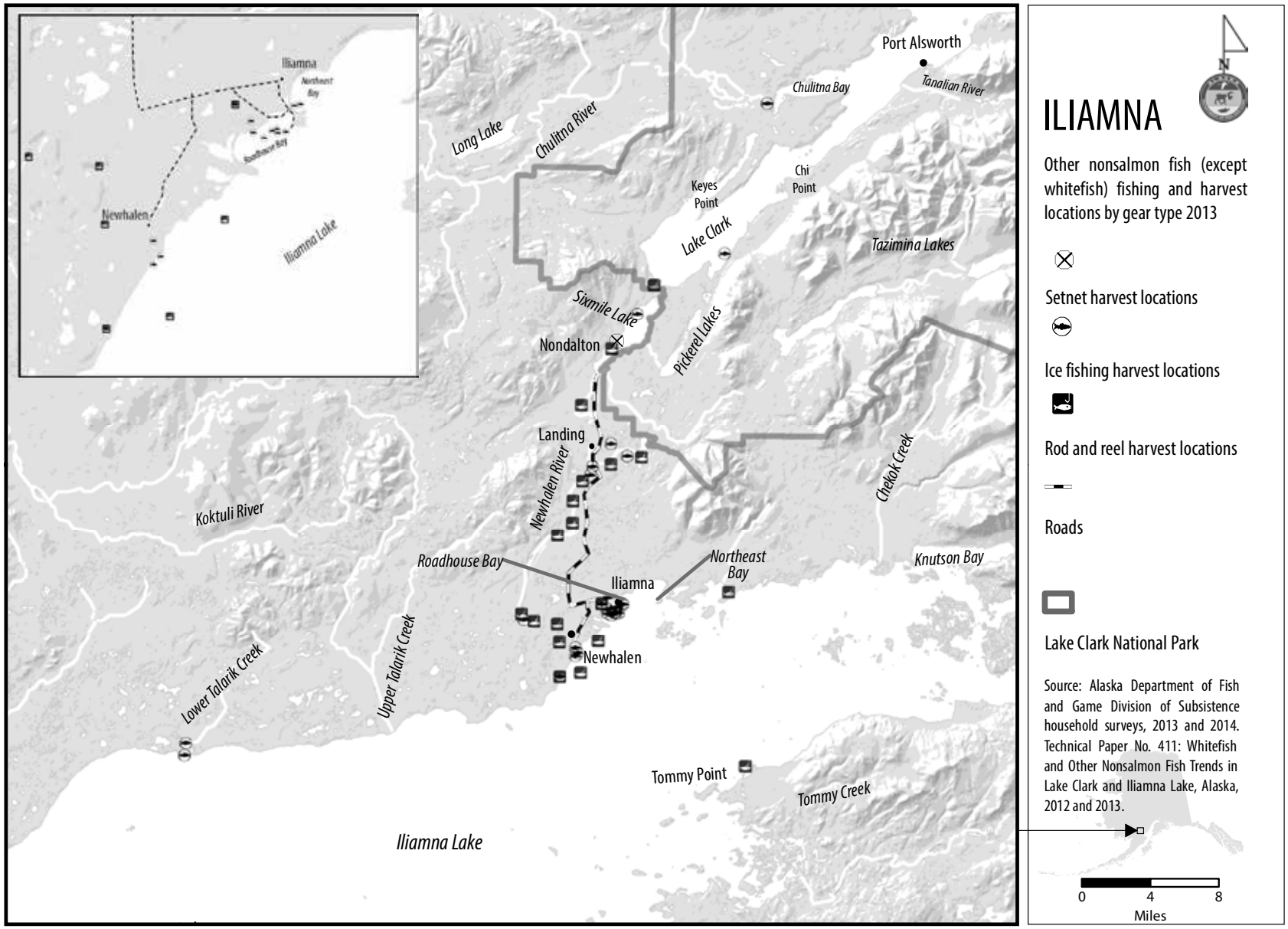


Figure 3-59.–Fishing and harvest locations of other nonsalmon fish species by gear type, Iliamna, 2013.

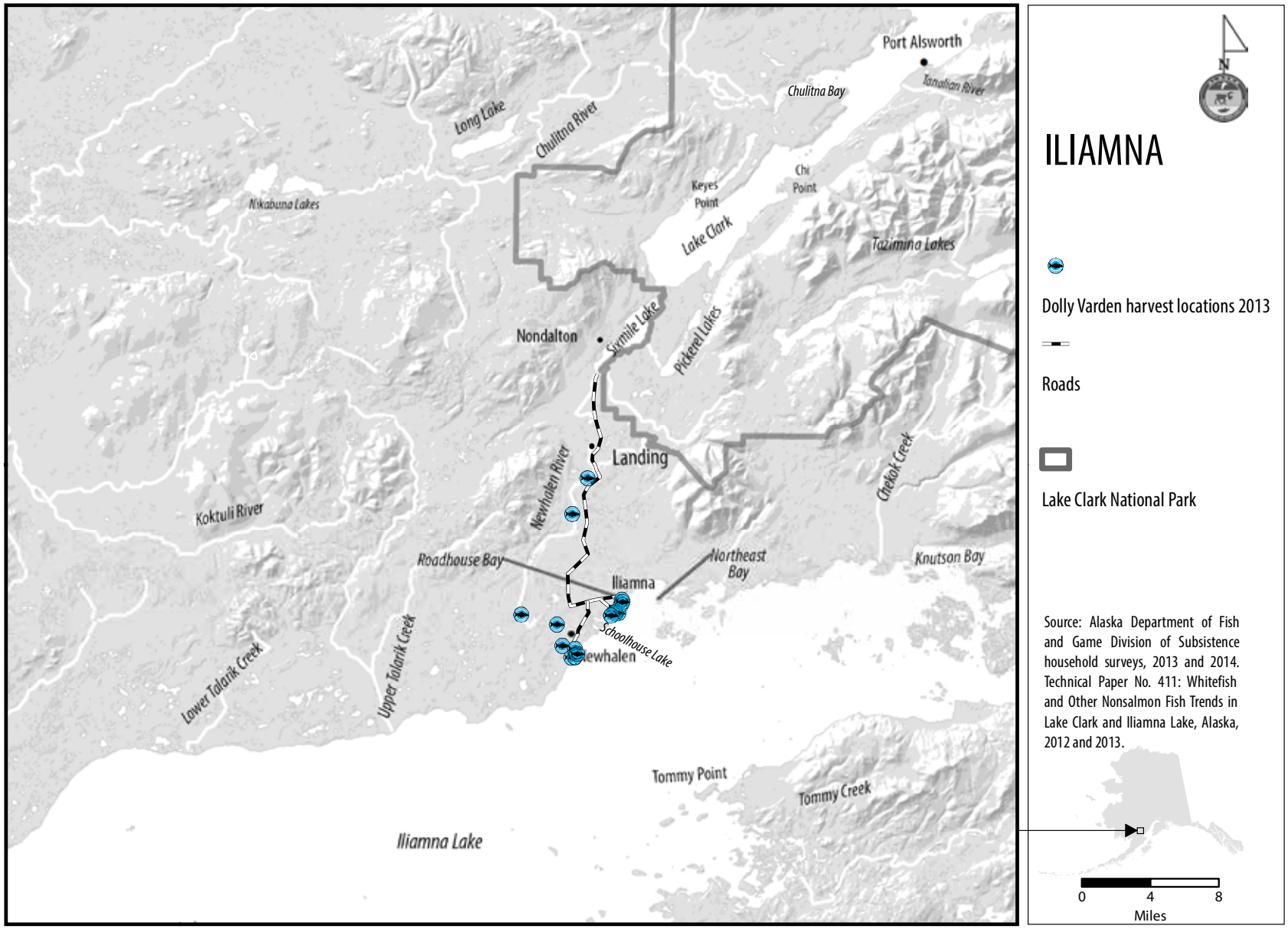


Figure 3-60.–Harvest locations of Dolly Varden, Iliamna, 2013.

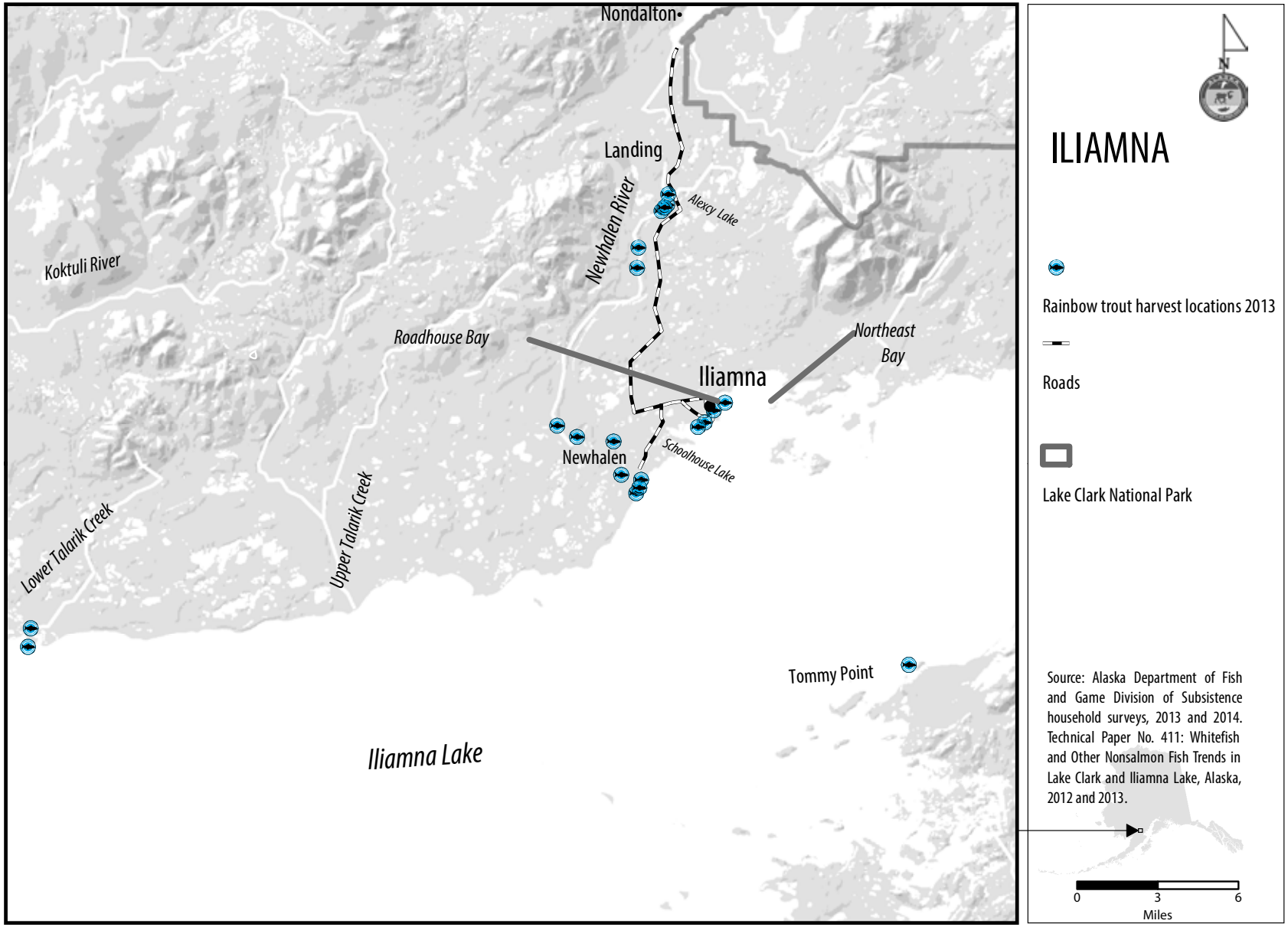


Figure 3-61.–Harvest locations of rainbow trout, Iliamna, 2013.

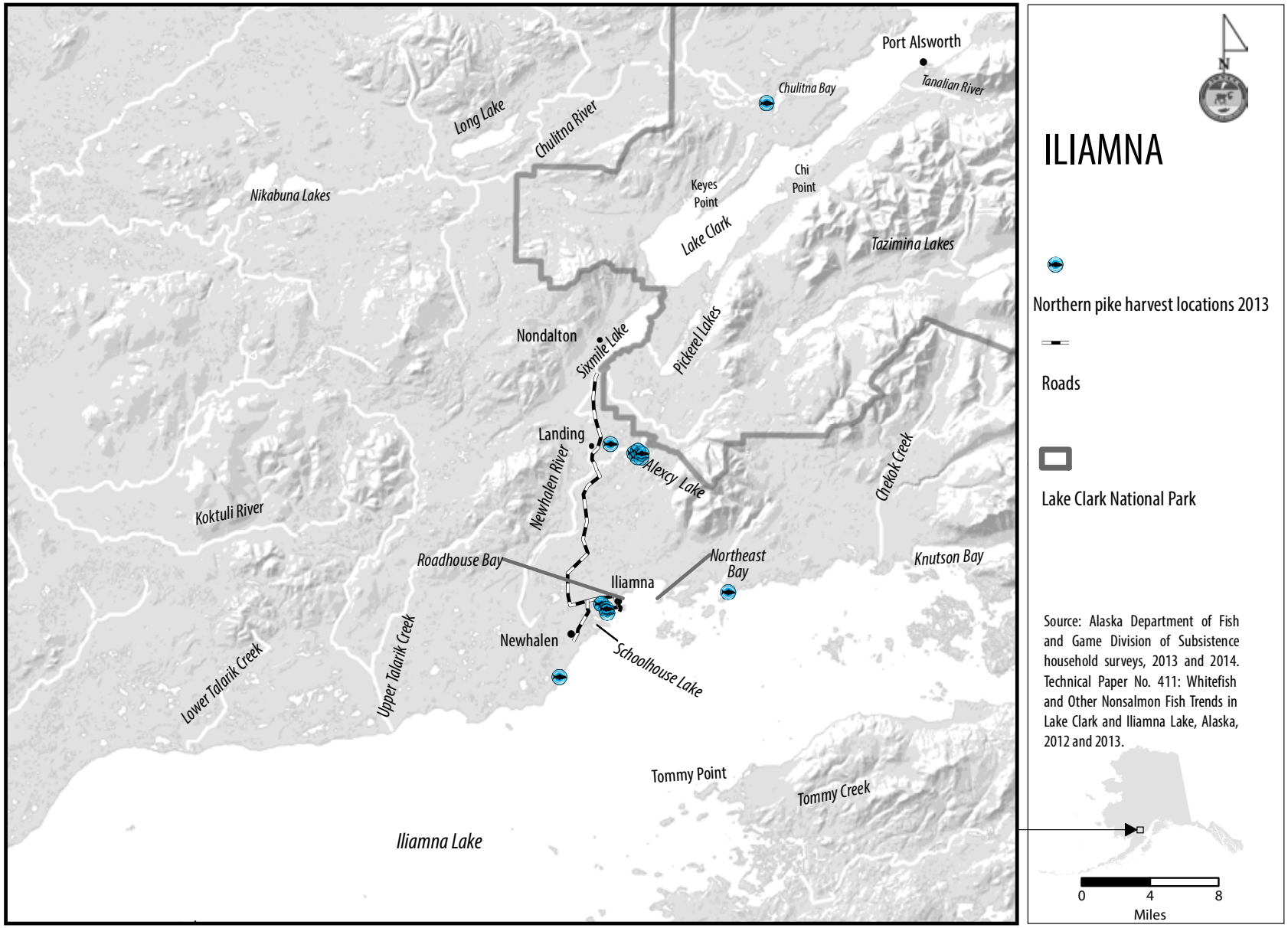


Figure 3-62.–Harvest locations of northern pike, Iliamna, 2013.

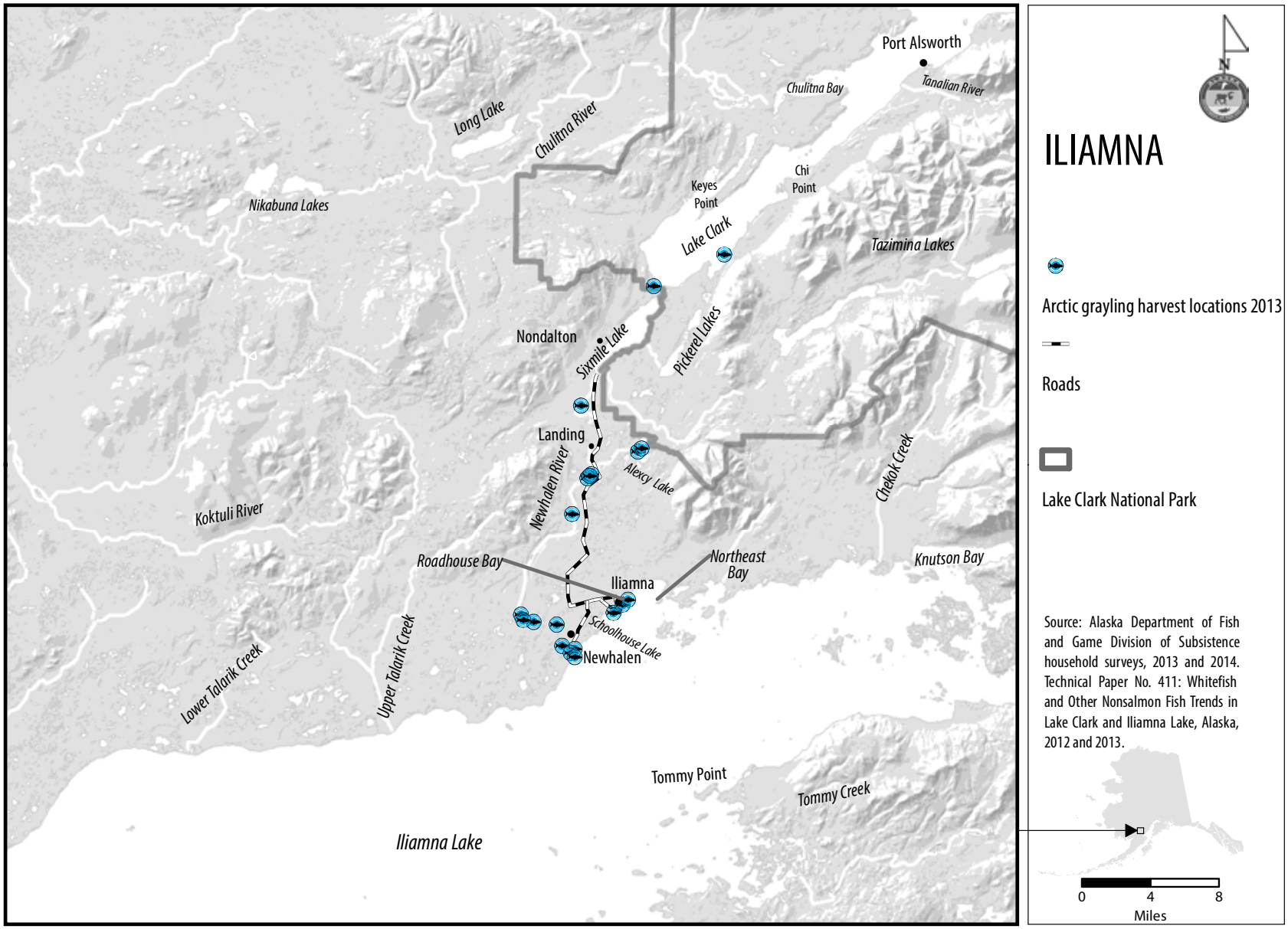


Figure 3-63.–Harvest locations of Arctic grayling, Iliamna, 2013.

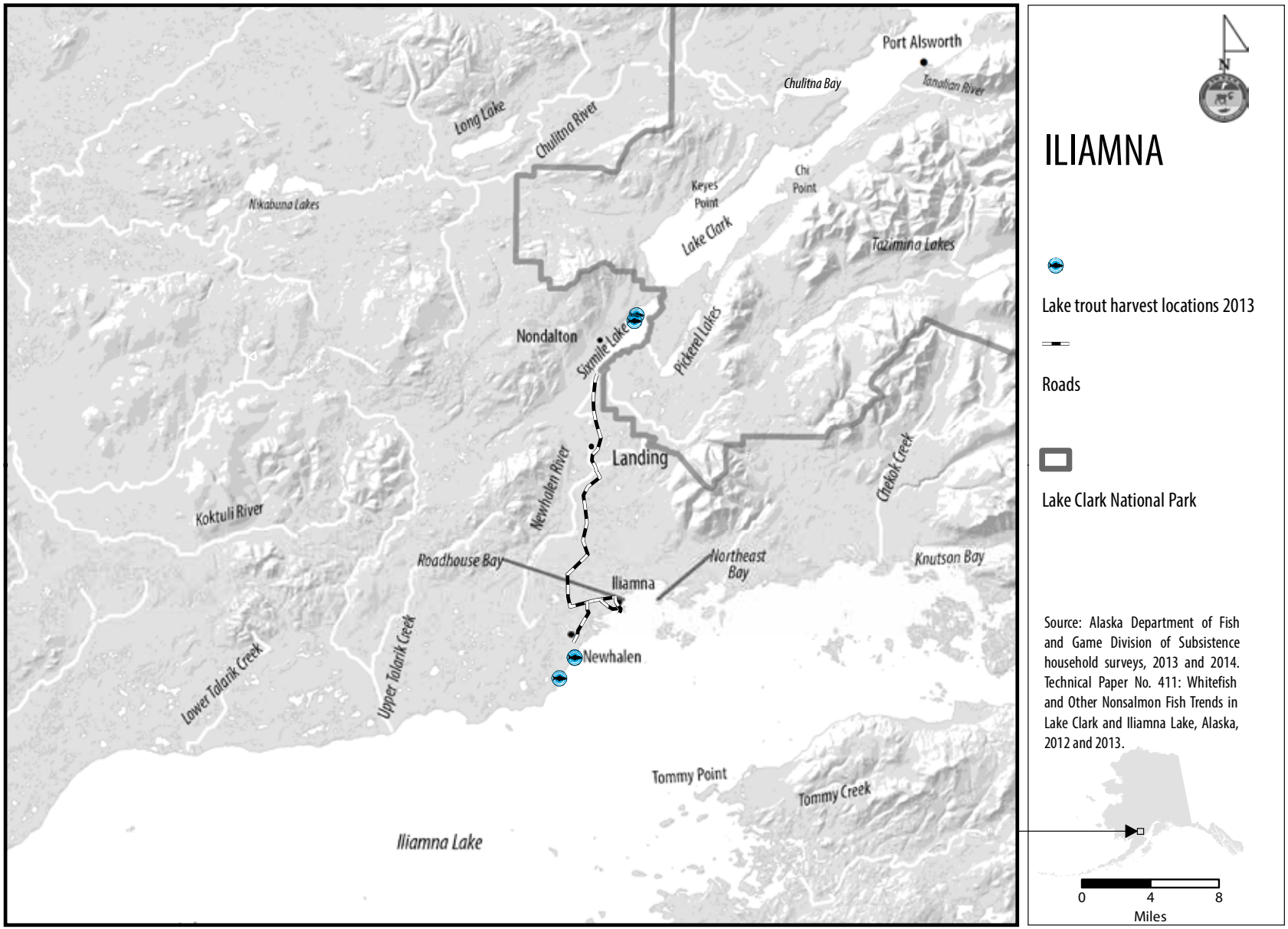


Figure 3-64.–Harvest locations of lake trout, Iliamna, 2013.

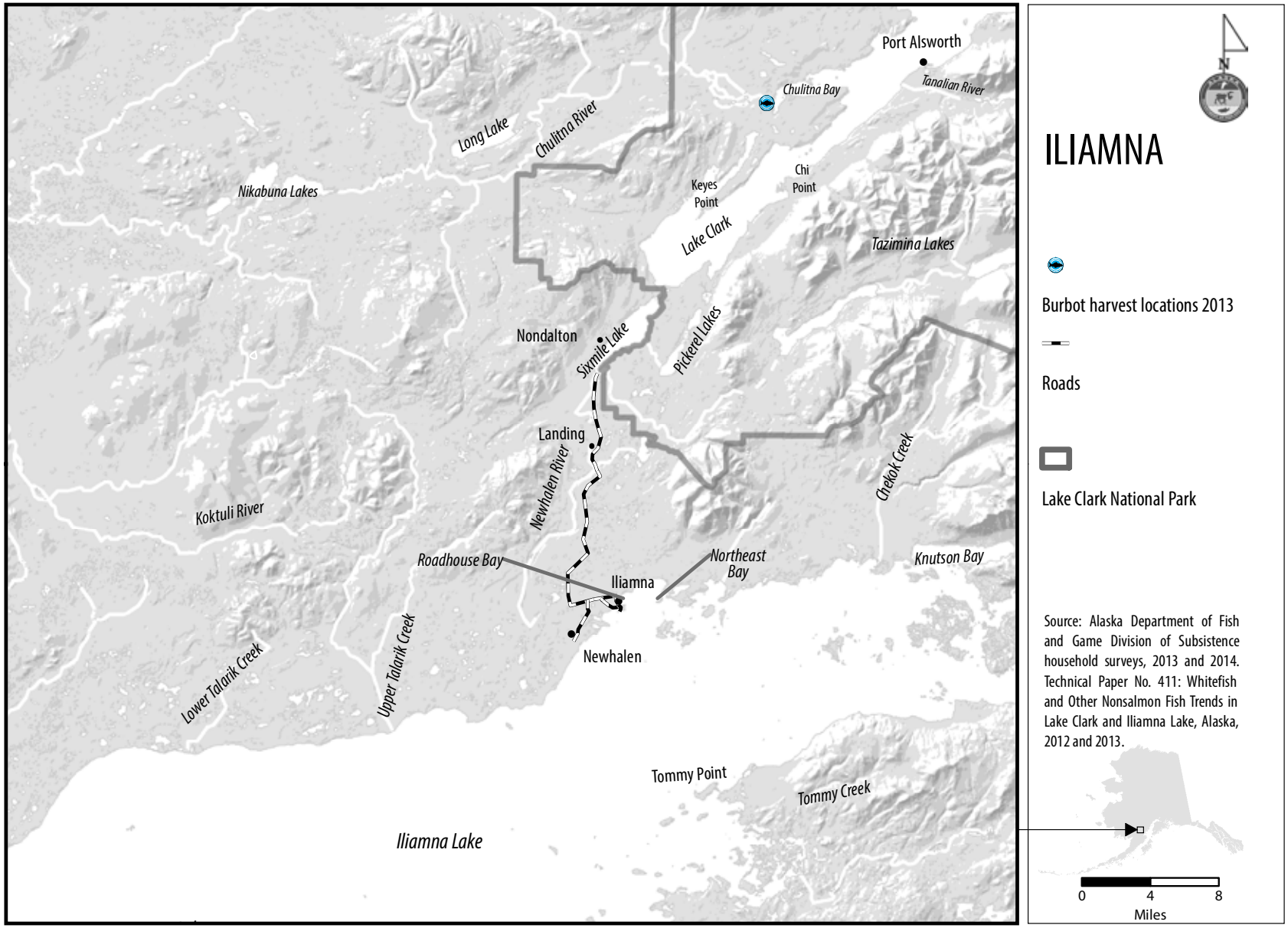


Figure 3-65.–Harvest locations of burbot, Iliamna, 2013.

Newhalen

Overall, 94% of households in 2012, and 88% of households in 2013, used nonsalmon fish. Other nonsalmon fish are an important subsistence resource for Newhalen residents as evidenced by the harvests for both study years. In 2012, other nonsalmon fish composed 97% (4,248 lb) of the total nonsalmon fish harvest and in 2013 they made up 88% (1,483 lb) of the entire harvest (Table 3-28; Table 3-29). The composition of the harvest changed over the 2 study years (Figure 3-17; Figure 3-18). For example, in 2012, rainbow trout were harvested the most and made up 52% of the entire nonsalmon fish harvest by pounds usable weight; Dolly Varden contributed the second highest harvest weight with 15% of the total nonsalmon fish harvest. In 2013, the harvest of rainbow trout decreased considerably to 31% of the entire nonsalmon fish harvest while the Dolly Varden harvest weight increased to match rainbow trout with 31% of the total nonsalmon fish harvest. This decrease in the amount of rainbow trout harvested (from 13 lb per capita in 2012 to 4 lb per capita in 2013) is the main cause for the observed reduction in the per capita harvest of all nonsalmon fish between study years (Table 3-28; Table 3-29). Additional species that contributed to the overall harvest of other nonsalmon fish include northern pike, Arctic grayling, and lake trout; also, less than one-half pound per capita of longnose suckers and burbot were harvested in 2012.

Historically, the harvest of other nonsalmon fish has been relatively stable over time (Figure 3-66). For instance, documented harvests between 1983 and 2012 were more than 20 lb per capita, although in 1991 and 2003 harvests exceeded 30 lb per capita. This is in sharp contrast to 2013 where the estimated harvest was only 11 lb per person.

Most other nonsalmon fish (by individual fish) were harvested by ice fishing in 2012 (63%) and 2013 (63%), which included burbot, Dolly Varden, lake trout, Arctic grayling, Northern pike, rainbow trout, and unspecified trout species harvested (Table 3-32; Table 3-33). Rod and reel fishing was also a preferred method for obtaining other nonsalmon fish (20% or more of the individual other nonsalmon fish harvested) (Figure 3-20; Figure 3-21). Additionally, jigging was used to harvest other nonsalmon fish in 2012; in 2013, other unspecified subsistence gear types, specifically a handline, were used to harvest rainbow trout and Dolly Varden and an estimated 3 Dolly Varden were caught in a gillnet. Fishing locations and the gear type used to harvest other nonsalmon fish are depicted for 2012 and 2013 in Figure 3-67 and Figure 3-68, respectively.

Newhalen households fished for rainbow trout mostly in the vicinity of the community in 2012, although some harvests did occur farther up the Newhalen River (Figure 3-69). In 2013, Newhalen residents also fished near Newhalen but more harvests occurred up the Newhalen River to the north, almost to Sixmile Lake. The diversity of fishing locations may reflect peoples' inability to obtain adequate rainbow trout resources locally, which is suggested by the much lower harvest of rainbow trout in 2013. These patterns are also evidenced by Dolly Varden harvests; namely that Newhalen households traveled farther in 2013 than 2012 to harvest other nonsalmon fish (Figure 3-70). Despite traveling farther, Dolly Varden harvests also decreased in 2013 compared to 2012, although not nearly as much as compared to rainbow trout (Table 3-28; Table 3-29).

Two preferred locations exist for northern pike fishing: Alexcy Lake and at Cuukvaklik located in the vicinity of Iliamna (Figure 3-71). Most pike were harvested in these locations in 2012 and 2013 with the exception of a couple of added harvest locations occurring along the Newhalen River and small creeks or lakes inland on the east side of the Newhalen River. In contrast, Arctic grayling in both years were harvested in a variety of locations near the mouth of the Newhalen River and all the way up to Sixmile Lake, indicating widespread abundance in the drainage (Figure 3-72). Based on Arctic grayling harvest patterns, these fish do not appear to be abundant in Iliamna Lake. Local residents often mentioned Arctic grayling do not hold up well to freezing (i.e., stored in the freezer for future use) and that these fish are best served fresh. Consequently, Arctic grayling may not have been more intensely harvested regardless of possible decreases in abundance of other nonsalmon fish resources because of the low potential for preservation. Likewise, lake trout were also harvested in a variety of locations but mainly in the Newhalen River, including at the mouth, and around Sixmile Lake (Figure 3-73). Figures 3-74 and 3-75 depict harvest locations of Arctic char and burbot, which contributed low per capita harvests to the other nonsalmon fish harvest for Newhalen.

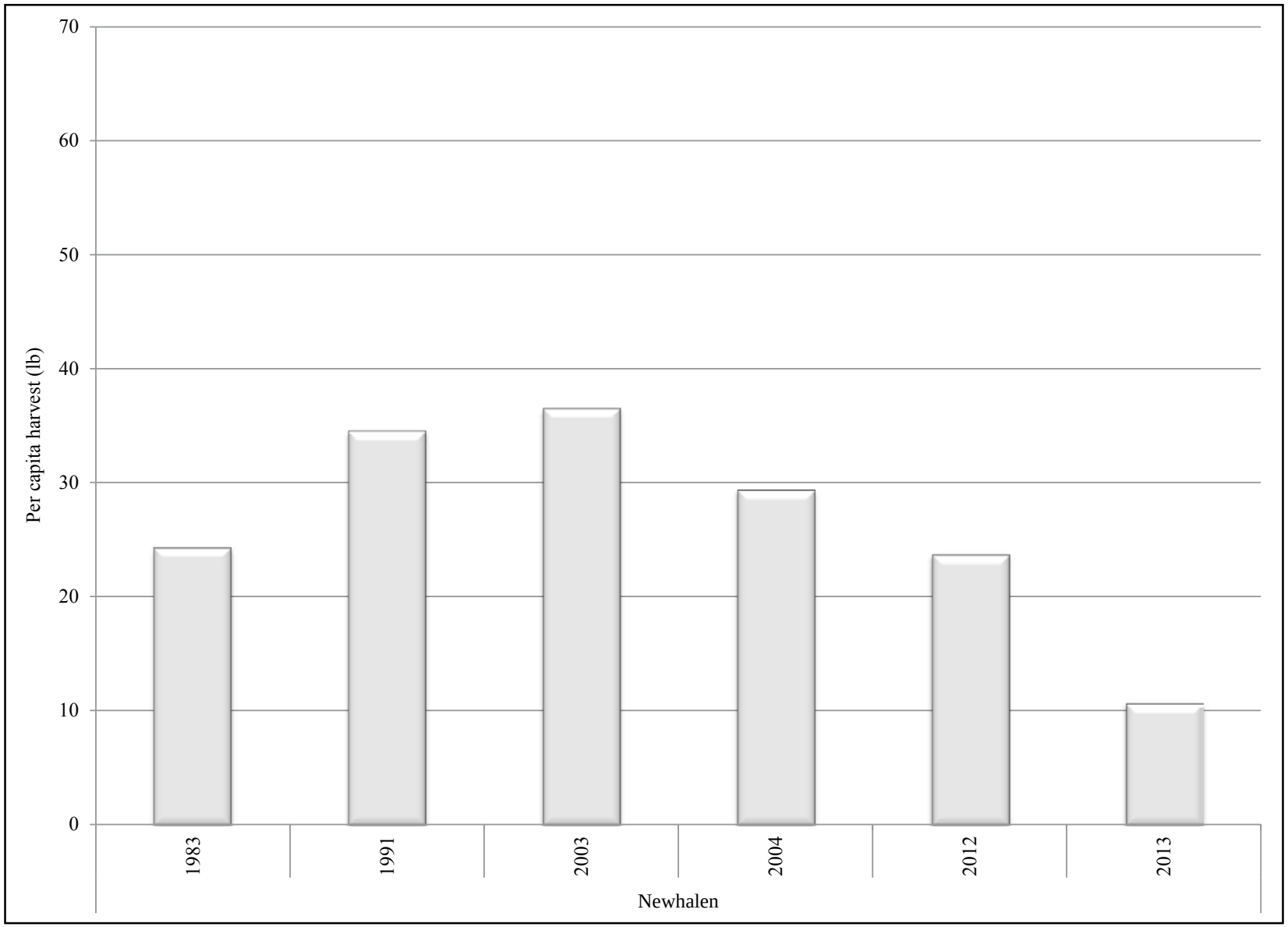


Figure 3-66.–Estimated harvests of other nonsalmon fish by pounds per capita, Newhalen, 1983, 1991, 2003–2004, 2012, and 2013.

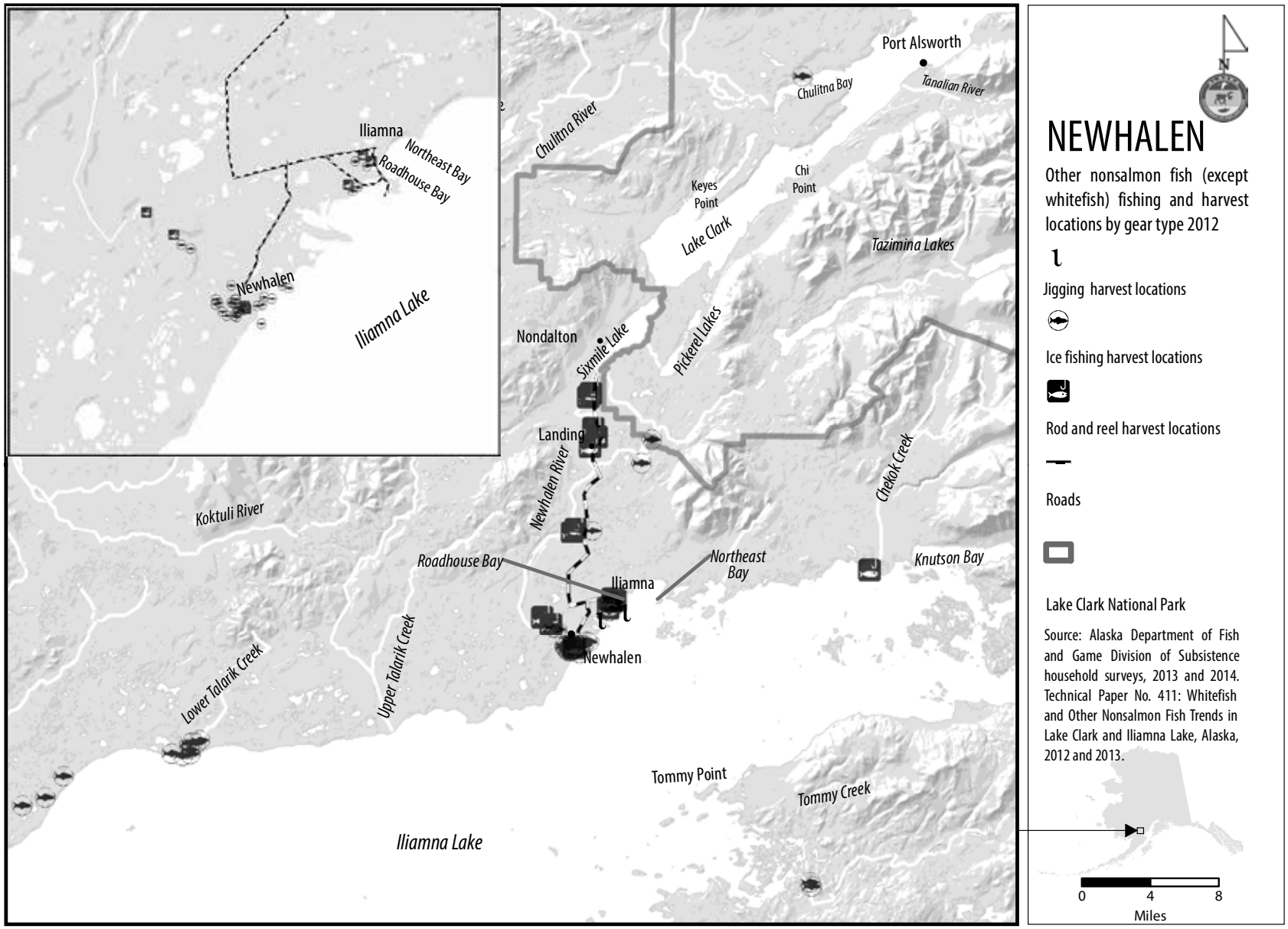


Figure 3-67.–Fishing and harvest locations of other nonsalmon fish species by gear type, Newhalen, 2012.

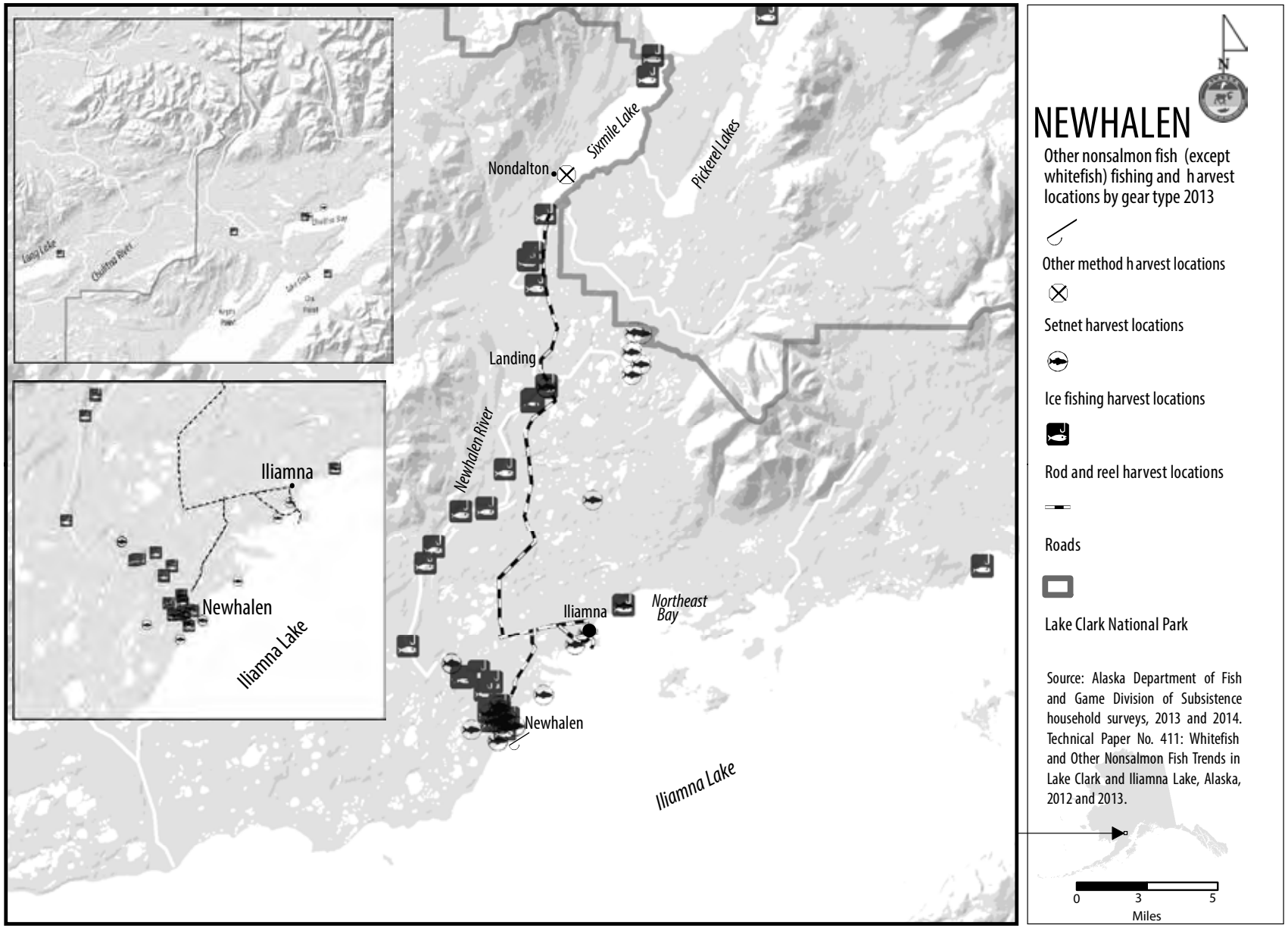


Figure 3-68.–Fishing and harvest locations of other nonsalmon fish species by gear type, Newhalen, 2013.

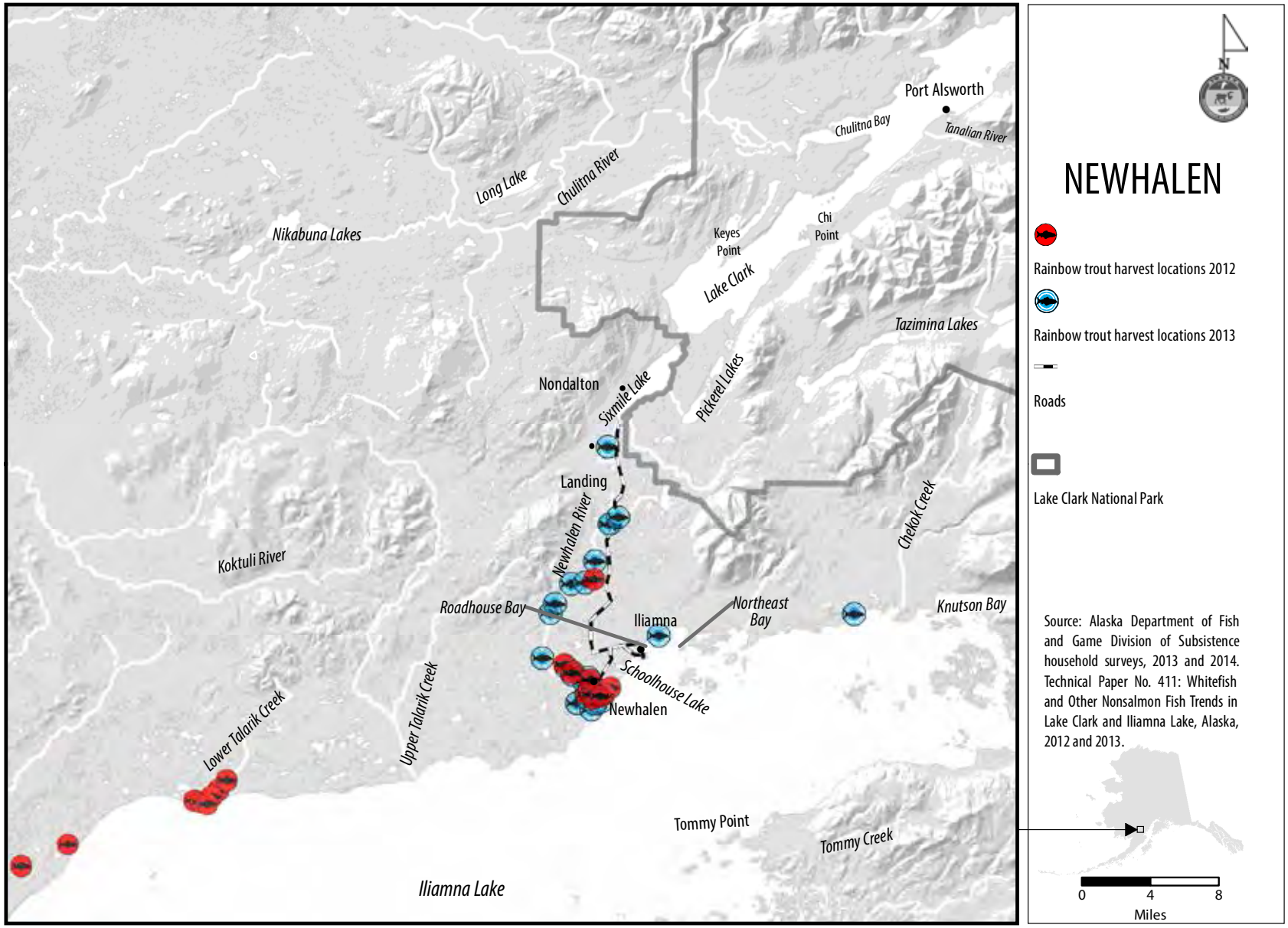


Figure 3-69.–Harvest locations of rainbow trout, Newhalen, 2012 and 2013.

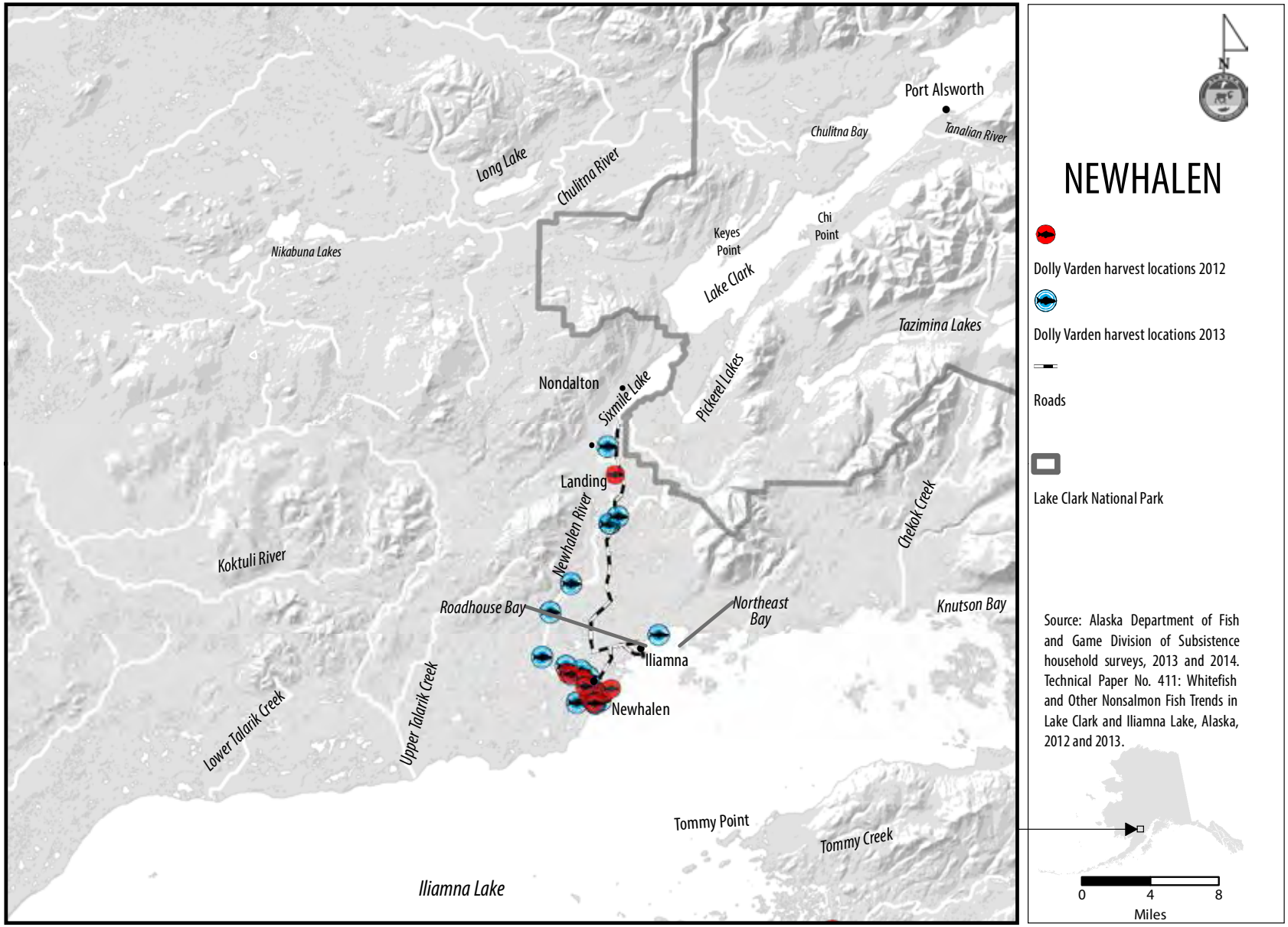


Figure 3-70.–Harvest locations of Dolly Varden, Newhalen, 2012 and 2013.

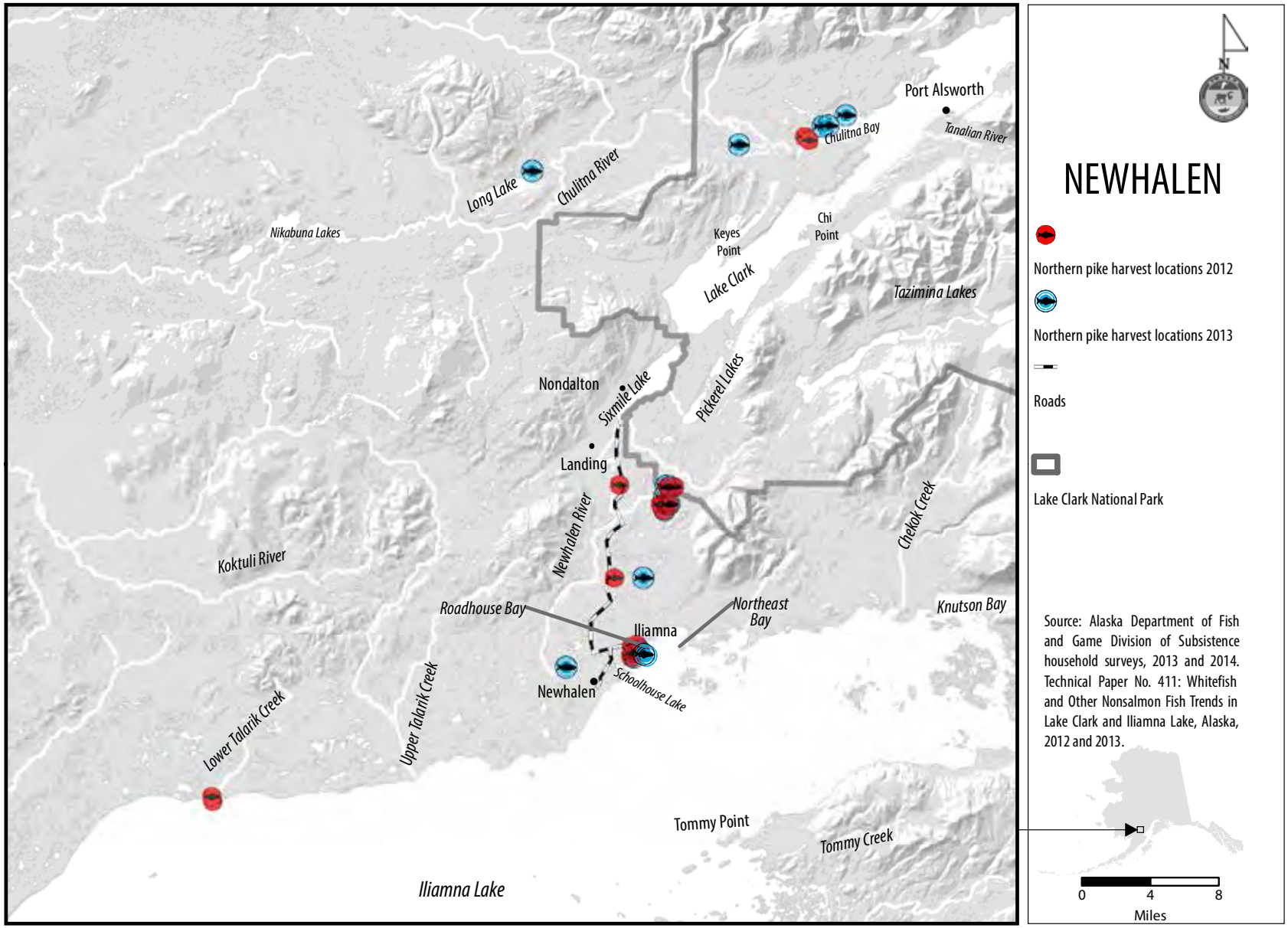


Figure 3-71.–Harvest locations of northern pike, Newhalen, 2012 and 2013.

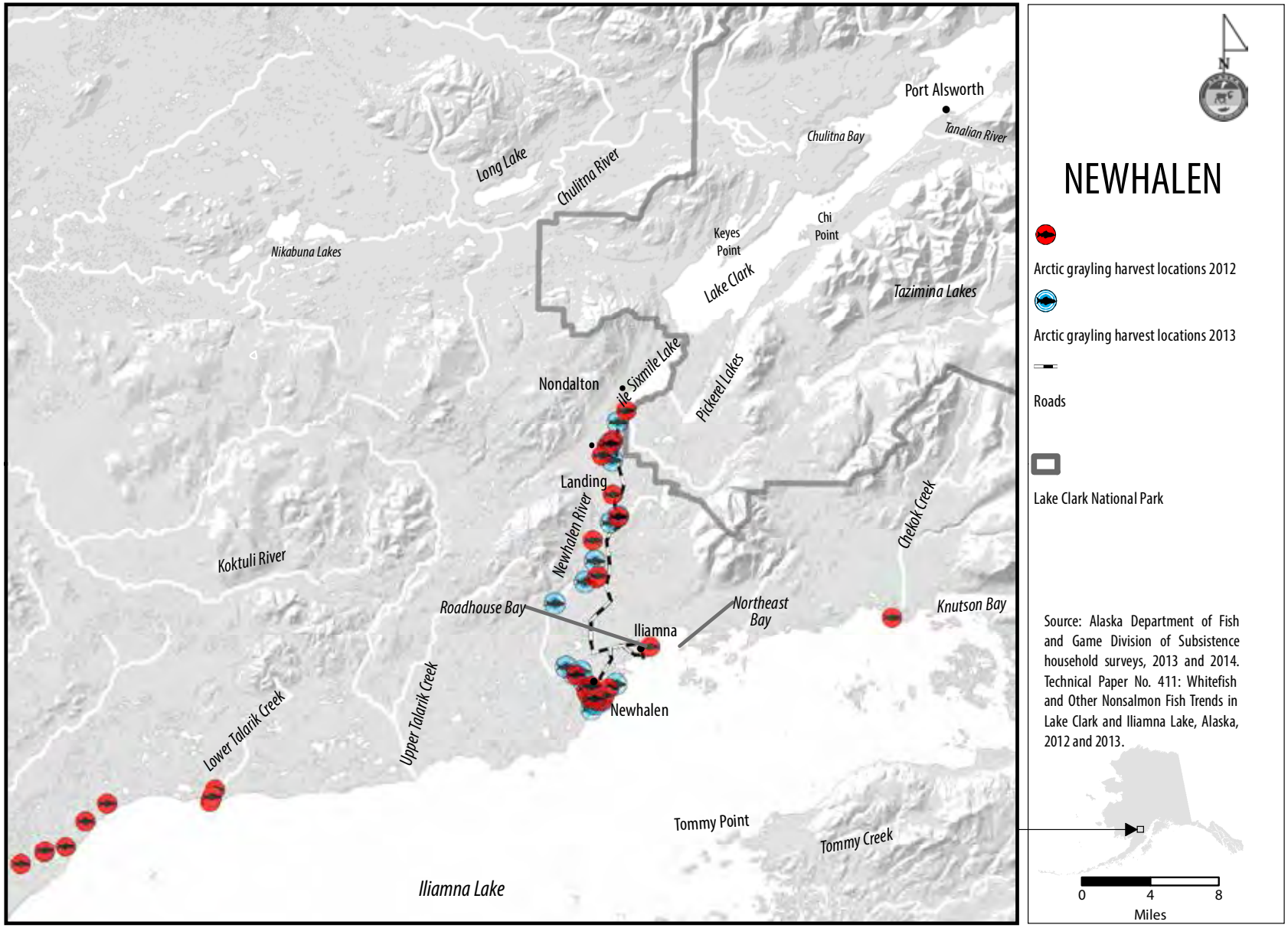


Figure 3-72.–Harvest locations of Arctic grayling, Newhalen, 2012 and 2013.

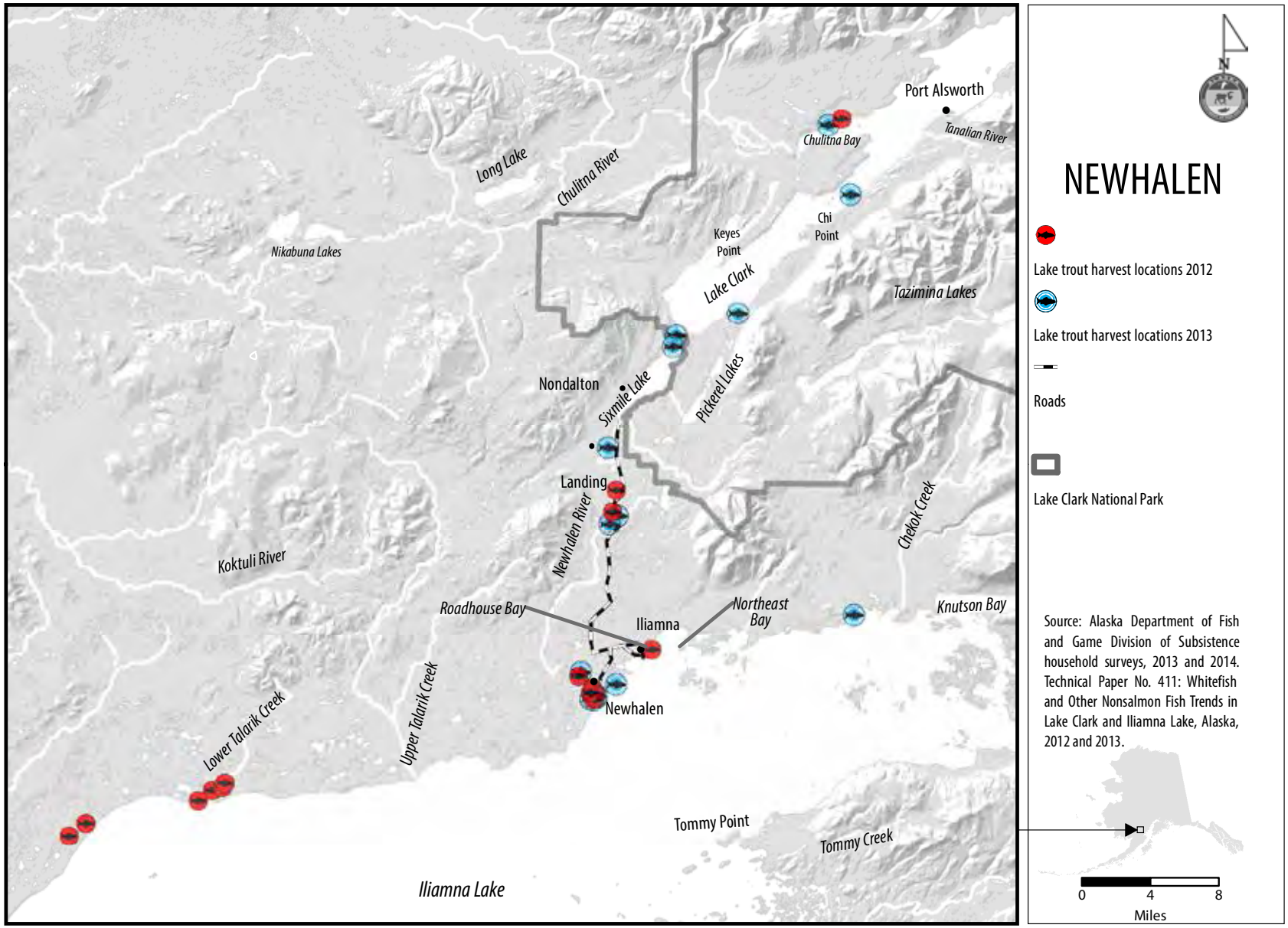


Figure 3-73.–Harvest locations of lake trout, Newhalen, 2012 and 2013.

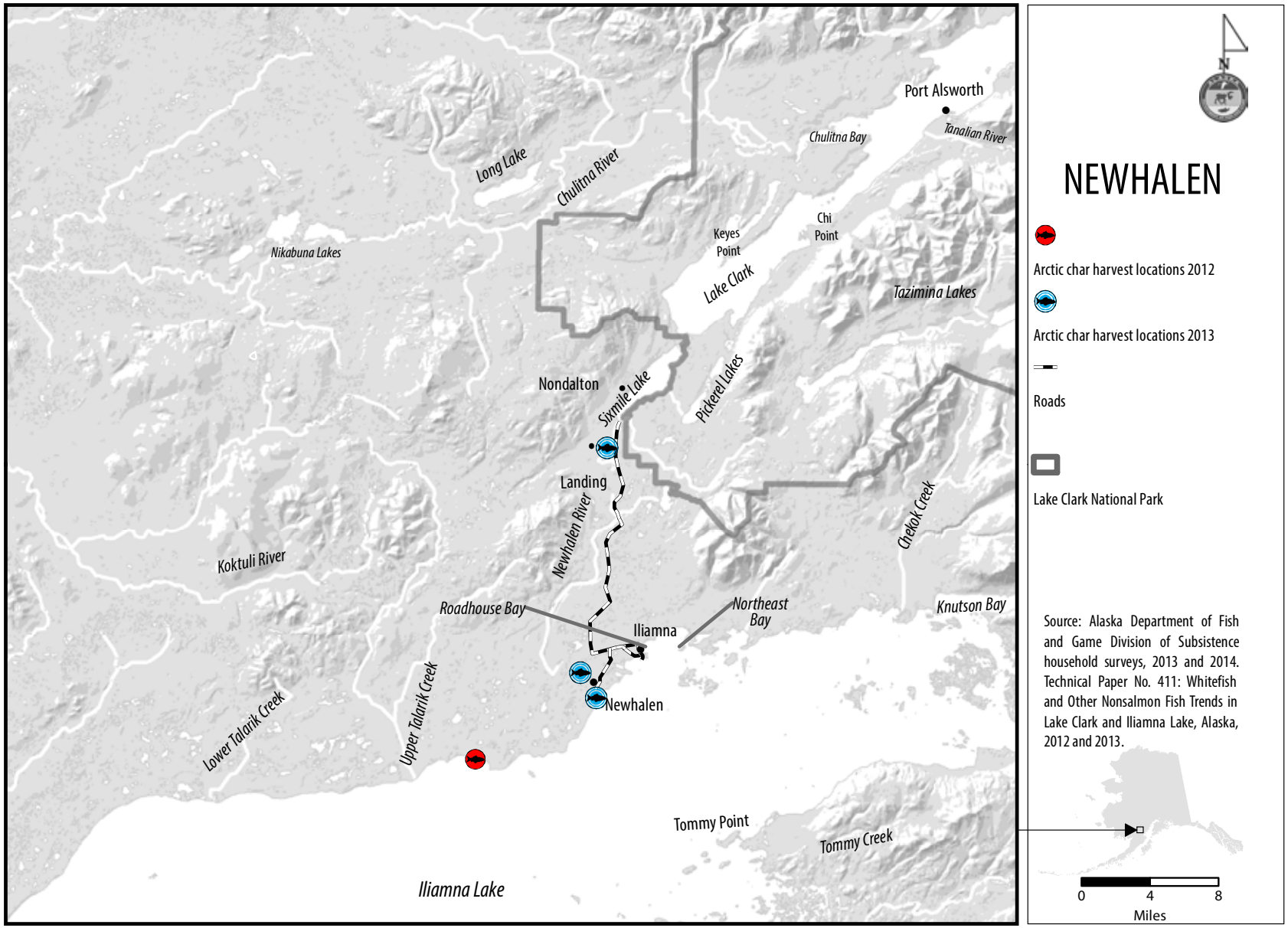


Figure 3-74.–Harvest locations of Arctic char, Newhalen, 2012 and 2013.

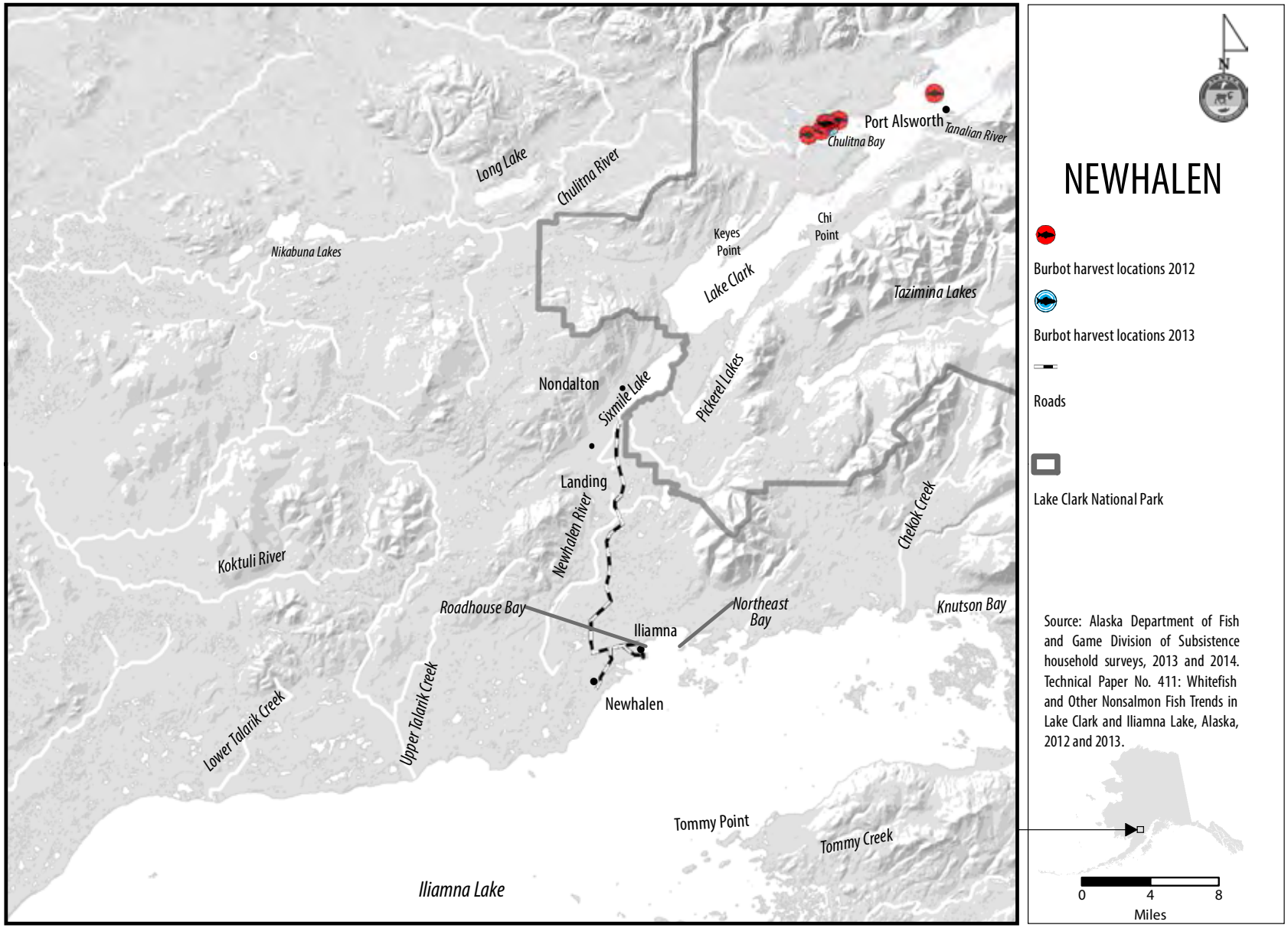


Figure 3-75.–Harvest locations of burbot, Newhalen, 2012 and 2013.

Nondalton

Whitefishes made up the majority of the overall nonsalmon fish harvest in Nondalton during both study years (approximately 58% in 2012 and 72% in 2013) (Figure 3-26; Figure 3-27). However, Nondalton residents clearly articulated the importance of other nonsalmon fish species to their physical, social, and cultural well-being during the course of survey administration. These species, together with whitefishes, were harvested by the vast majority of the households in Nondalton during both study years. During 2012, 97% of Nondalton households used 1 or more nonsalmon fish species (Table 3-34). Almost 90% of households attempted to harvest nonsalmon fish and all were successful in the harvest of at least 1 species. Giving and receipt of these species were also common with almost two-thirds of the households giving and receiving some nonsalmon fish. During 2013, the percentage of households that used 1 or more nonsalmon fish species dropped by 13% compared to 2012 but still remained high at 84% of households using nonsalmon fish (Table 3-35). All households that attempted to harvest nonsalmon fish were successful in 2013 (73%). The percentage of households that shared and received nonsalmon fish remained constant between the 2 study years at around 62% (Table 3-34; Table 3-35). These sharing percentages underscore the importance of nonsalmon fish to the people of Nondalton and highlight the functions of social and kinship networks in the distribution of nonsalmon fish. The harvest of these fish also illustrates the role of nonsalmon fish in supporting food security among Nondalton residents.

Note that in both study years all households that fished for nonsalmon fish were successful at harvesting at least 1 species, but the lower rate of households attempting harvest in 2013 resulted in a similar decrease in the percentage of households using nonsalmon fish in comparison to 2012. Significantly, while the percentage of households that used nonsalmon fish dropped, the total harvest of other nonsalmon fish increased from 2,217 lb harvested in 2012 to 2,452 lb in 2013 (Table 3-34; Table 3-35).

The composition of the other nonsalmon fish harvest remained relatively constant over the study years. During both 2012 and 2013, rainbow trout made up the largest percentage of the other nonsalmon fish harvest by pounds usable weight (Figure 3-27; Figure 3-28). In 2012, rainbow trout made up 13% of the total harvest of nonsalmon fish and 8% in 2013. While rainbow trout composed a smaller percentage of the total nonsalmon fish harvest in 2013 compared to 2012, the harvest remained relatively constant between the 2 study years both in terms of estimated harvest weight and per capita harvest (685 lb both years and 3.9 lb and 3.5 lb per capita in 2012 and 2013, respectively) (Table 3-34; Table 3-35). In terms of percentage of the total harvest of nonsalmon fish, rainbow trout was followed by northern pike (10% of total nonsalmon fish harvest in 2012 and 7% in 2013) and Arctic grayling (9% of total nonsalmon fish harvest in 2012 and 5% in 2013) (Figure 3-27; Figure 3-28). While the harvest weight of rainbow trout remained constant, the harvest of northern pike increased slightly, as did harvests of Arctic grayling, Dolly Varden, burbot, and longnose suckers (Table 3-34; Table 3-35). The harvest weights of lake trout and Arctic char were the only ones that decreased for other nonsalmon fish species: lake trout went from approximately 336 lb harvested to 317 lb harvested and the Arctic char harvest went from 14 lb harvested to 2 lb harvested.

The harvest of other nonsalmon fish by Nondalton residents over time is variable. For instance, harvests for 1980 and 1981 were greater than 20 lb per capita but less than 30 lb per capita (Figure 3-76). Between 2003 and 2013, harvests have been more stable at approximately 10 lb per capita, although the harvest in 2004 was more similar to early documented harvests with 22 lb per capita.

In 2012, an estimated 808 other nonsalmon fish, or 1,102 lb, were harvested in Nondalton using subsistence gear and 921 other nonsalmon fish, or 1,116 lb, were harvested using rod and reel (Table 3-36). Figure 3-30 is a visual representation of the other nonsalmon fish harvested by total pounds and by gear type. Ice fishing was the most commonly used subsistence gear type for harvesting other nonsalmon fish (441 fish, or 55% of the other nonsalmon fish harvest by subsistence methods) (Table 3-36). Estimated in numbers of fish, almost 80% of the rainbow trout harvested by the people of Nondalton in 2012 was caught using a rod and reel. The remainder of the harvest was caught while ice fishing (15%) and using gillnets (5%). Almost 40% of the northern pike harvest was done while ice fishing during the first study year. The use of a gillnet also accounted for a significant proportion of the northern pike harvest (25%) while about 21% of the harvest was done with a rod and reel. Rod and reel fishing accounted for one-half of the Arctic grayling harvest in

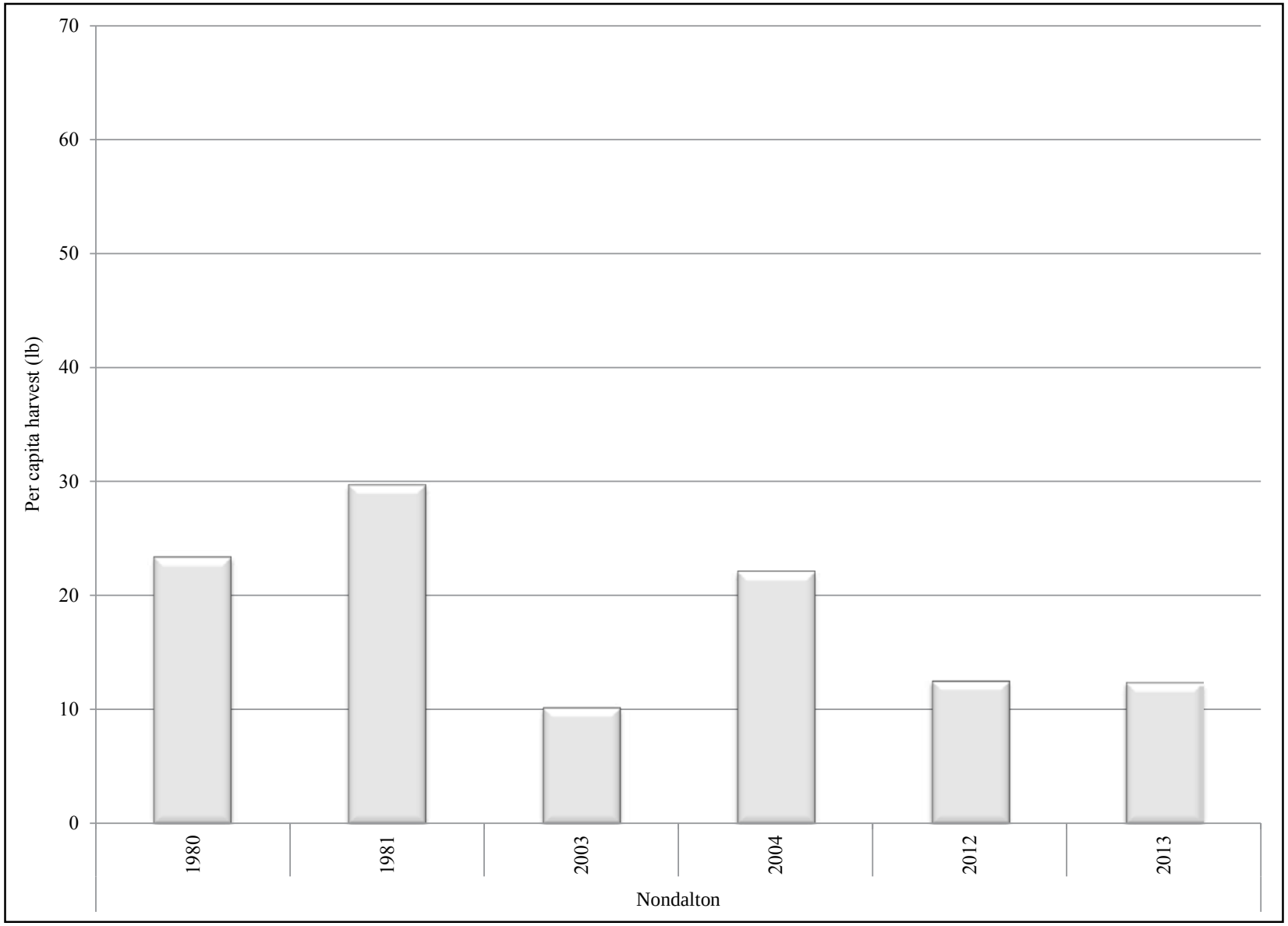


Figure 3-76.–Estimated harvests of other nonsalmon fish by pounds per capita, Nondalton, 1973, 1980–1981, 1983, 2003–2004, 2012, and 2013.

Nondalton during 2012. Other important gear types used to harvest Arctic grayling were ice fishing (34%) and gillnets (14%). The harvest of lake trout was accomplished primarily by the use of rod and reel (42%) and ice fishing (25%) during 2012.

In 2013, an estimated 1,327 other nonsalmon fish, or 1,668 lb, were harvested by Nondalton households using subsistence gear while utilizing any method and 565 other nonsalmon fish, or 784 lb, were caught using rod and reel (Table 3-37). Figure 3-31 is a visual representation of the other nonsalmon fish harvested by total pounds and by gear type. Like the previous year, ice fishing was the most common subsistence method used by Nondalton households while fishing for other nonsalmon fish (77% of the other nonsalmon fish harvest by subsistence methods) (Table 3-37). Estimated in numbers of fish, the percentage of rainbow trout harvested with rod and reel dropped from the previous year to 59% in 2013. The remainder of the harvest was done by ice fishing (41% of rainbow trout harvest). Thirty-five percent of the northern pike harvest in year 2 of the study was done by ice fishing; 27% of the northern pike harvested by the people of Nondalton were harvested using a rod and reel. The use of a gillnet was also important for the northern pike harvest; gillnets accounted for 23% of the northern pike harvest. Fishing methods in 2013 shifted for Arctic grayling with ice fishing accounting for a much larger percentage of the harvest (74% in 2013 compared to 34% in 2012) (Table 3-36; Table 3-37). The rise in the use of ice fishing for harvesting Arctic grayling was accompanied by an associated decline in the use of rod and reel (19% of Arctic grayling harvest in 2013). Ice fishing was also more popular for harvesting lake trout during 2013 than it was in 2012 (53% of lake trout harvest in 2013 compared to 25% in 2012). There was also a decrease in the use of rod and reel to harvest lake trout during 2013 (14% of lake trout harvest in 2013 compared to 42% in 2012).Twenty-one percent of the lake trout harvested in 2013 by the households of Nondalton was harvested with the use of a gillnet (Table 3-37). Ice fishing was also a popular fishing method used to harvest Dolly Varden (57%) and burbot (44%). One elder from Nondalton said that he sometimes sets hooks to catch burbot in March (these harvests are classified as a subsistence "other method" of fishing in the harvest tables). The increased ice fishing harvests for several other nonsalmon fish species suggest that ice fishing conditions were better for harvesting other nonsalmon fish during 2013 than in 2012.

Figures 3-77 and 3-78 represent the harvest locations of Nondalton residents' other nonsalmon fish harvests by gear type for 2012 and 2013, respectively. In both study years, setnet, rod and reel, and ice fishing locations were concentrated around Sixmile Lake, particularly where the Newhalen River meets Sixmile Lake and at Chulitna Bay in Lake Clark. Gear type by location remained relatively consistent between the 2 study years. Changes in gear type and location are most likely an adaptation by local harvesters to weather conditions and observations of fish populations.

Rainbow trout harvest locations remained consistent between 2012 and 2013 (Figure 3-79). Rainbow trout harvest locations were concentrated across from Nondalton on Sixmile Lake and along the Newhalen River within a couple of miles of the community. The 2013 harvest area was expanded to include a couple of additional locations at the head of Pickerel Creek in Sixmile Lake and another location farther down the Newhalen River from Nondalton.

Figure 3-80 represents harvest locations of northern pike during 2012 and 2013. During both study years northern pike harvests were concentrated in Sixmile Lake at the juncture with the Newhalen River and at the head and mouth of Pickerel Creek and in Chulitna Bay in Lake Clark. Chulitna Bay has historically been an important northern pike harvest area for the people of Nondalton (Russell 1980:91). In a previous study, a Nondalton resident recalled the importance of Chulitna Bay for the harvest of pike in the following way, "I remember we used to camp up there. My dad used to set net in that little lake. Gee, lots of pike up around Chulitna. Great big pikes, too" (Stickman et al. 2003:53). During the current study, northern pike were also harvested in the Pickerel lakes, the Tazimina River, at Chi Point and on either side of Keyes Point.

The harvests of Arctic grayling took place primarily in Sixmile Lake at the confluence of the Newhalen River during 2012 (Figure 3-81). The Arctic grayling harvest areas during 2013 also included the east bank of Sixmile Lake across from Nondalton, the mouth of Pickerel Creek, and a spot in the Pickerel lakes. Harvest locations of lake trout remained largely the same during both study years (Figure 3-82). The harvests were concentrated on the banks of Sixmile Lake across from Nondalton and where the Newhalen

River runs into Sixmile Lake. There were additional lake trout harvest locations across from Keyes Point, at Chi Point, and in Chulitna Bay in Lake Clark.

Figure 3-83 depicts harvest locations of Dolly Varden identified by Nondalton residents. Harvest locations of Dolly Varden remained highly consistent between the 2 years of this study. The harvests took place primarily in Sixmile Lake. Several harvests of Dolly Varden took place where the Newhalen River runs into Sixmile Lake. Other harvests occurred at a bend in the Newhalen River downriver from Nondalton and along the banks of Lake Clark across from Keyes Point. The entirety of the 2012 burbot harvest by Nondalton residents occurred across from Nondalton in Sixmile Lake (Figure 3-84). The 2013 burbot harvest included locations close to those used in 2012 with the addition of 2 locations father north of the community in Lake Clark at Chulitna Bay.

The aptly named Sucker Lake near the Pickerel lakes was a good place to harvest longnose suckers in the past according to an elder from Nondalton (Stickman et al. 2003:55).The entire longnose sucker harvest by the people of Nondalton took place at a single location in Sixmile Lake in 2013 (Figure 3-85). One resident of Nondalton stated that although he did not attempt to harvest longnose suckers, they can be found in Pickerel Creek (locally called Picker Creek) in July. The Arctic char harvests of 2012 and 2013 by residents of Nondalton were concentrated south of the community close to the confluence of the Newhalen River and Sixmile Lake (Figure 3-86). The 2013 harvest also included locations just north of Nondalton in Sixmile Lake and in Lake Clark.

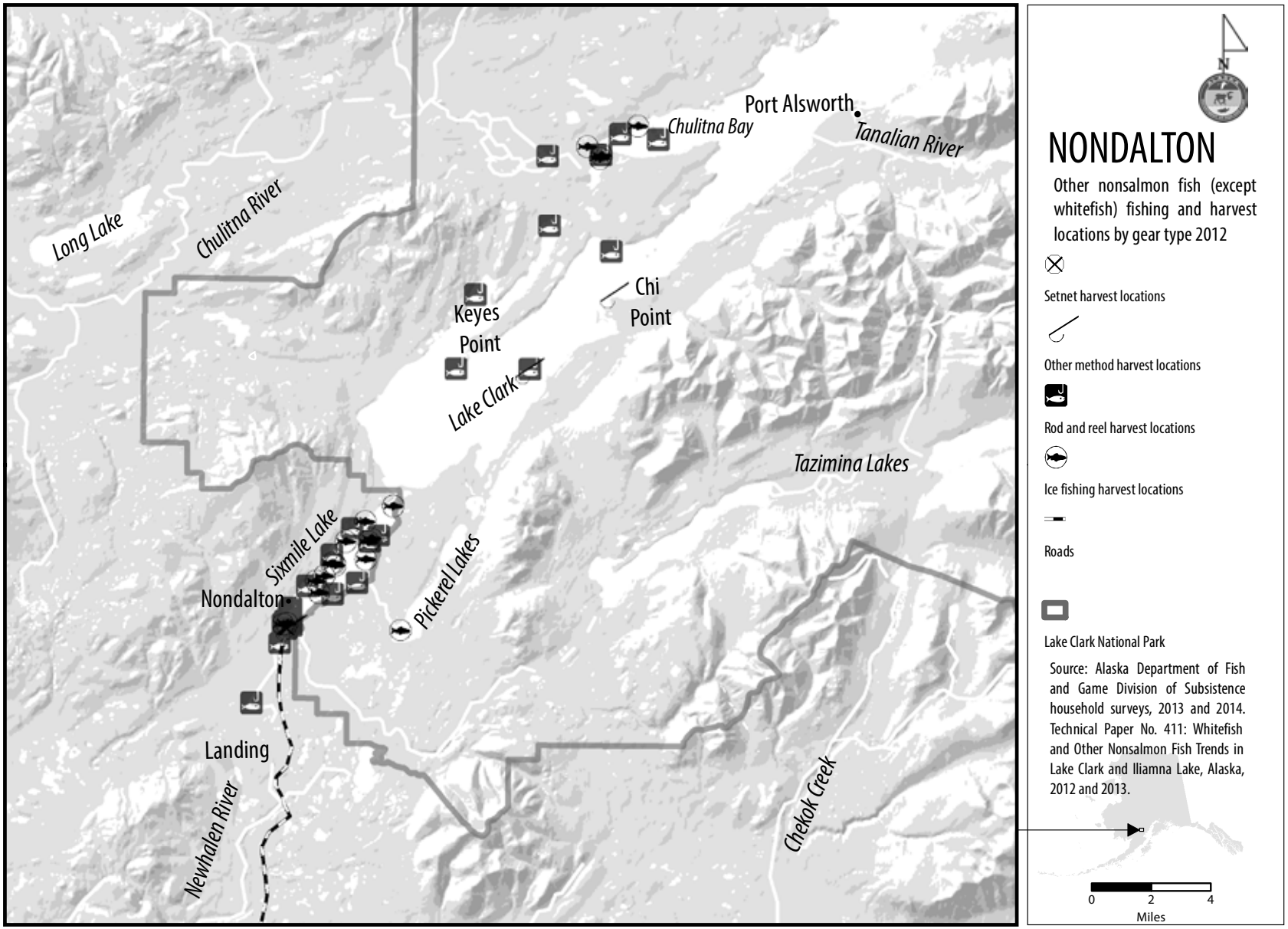


Figure 3-77.–Fishing and harvest locations of other nonsalmon fish species by gear type, Nondalton, 2012.

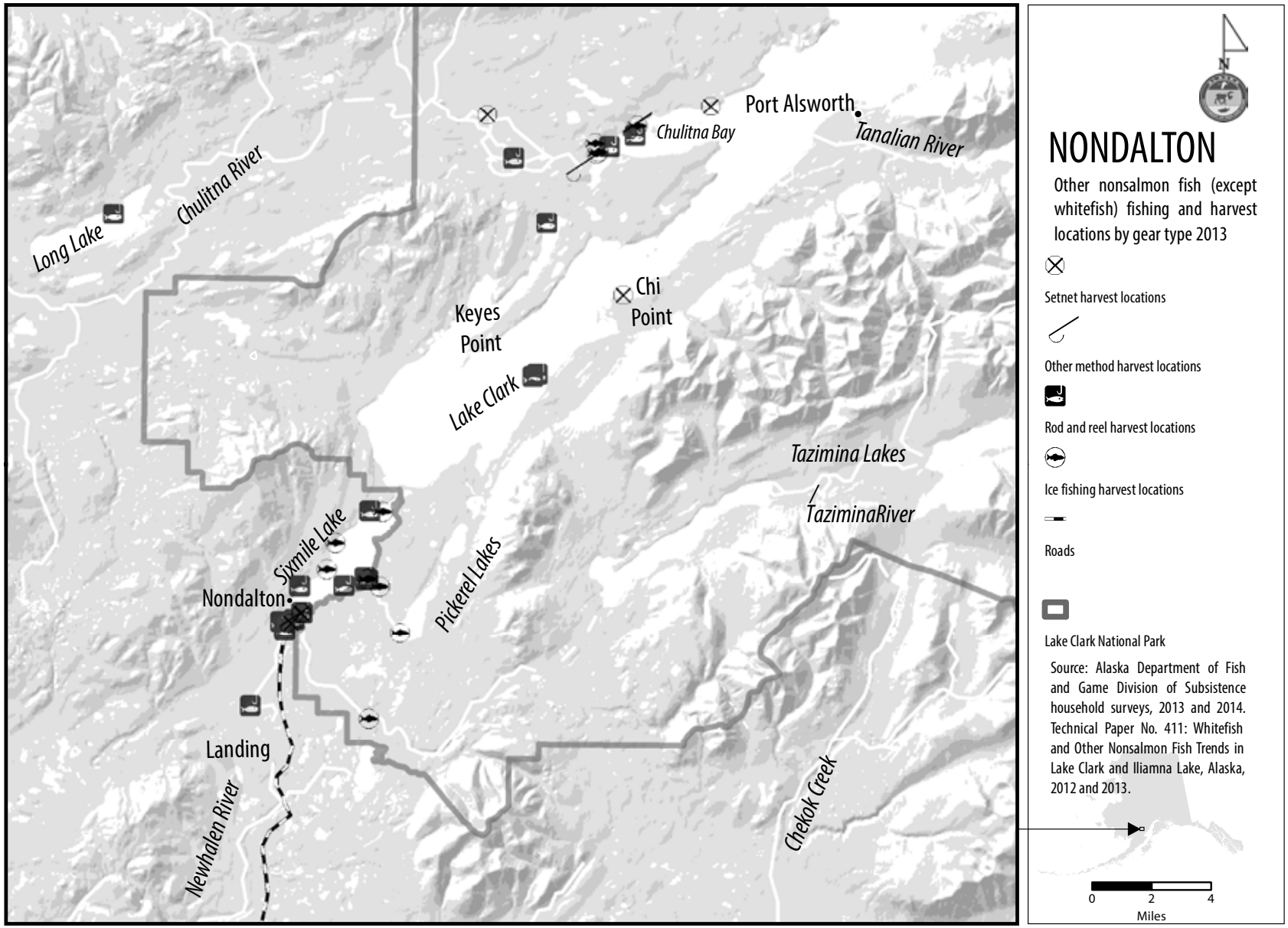


Figure 3-78.–Fishing and harvest locations of other nonsalmon fish species by gear type, Nondalton, 2013.

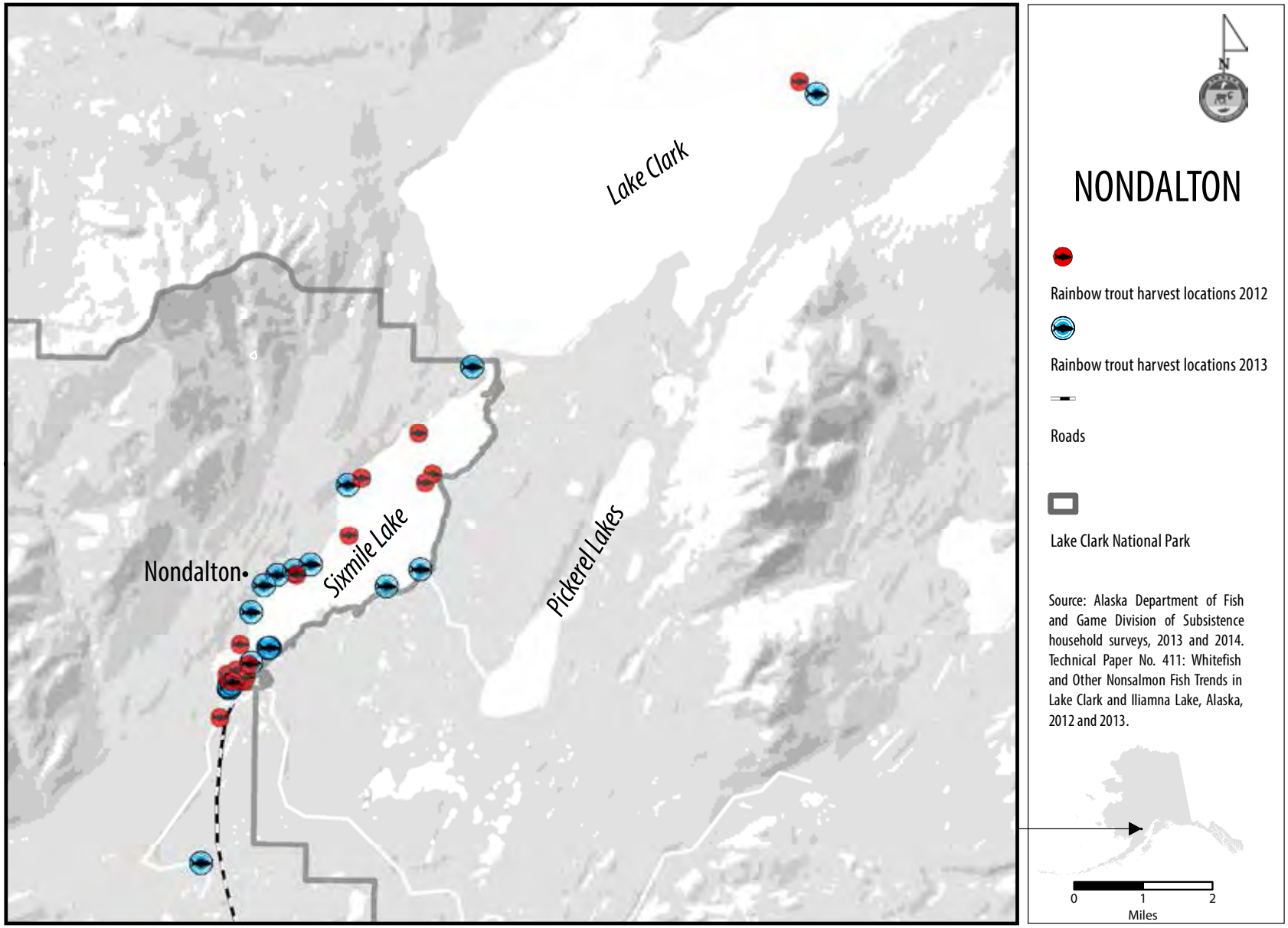


Figure 3-79.–Harvest locations of rainbow trout, Nondalton, 2012 and 2013.

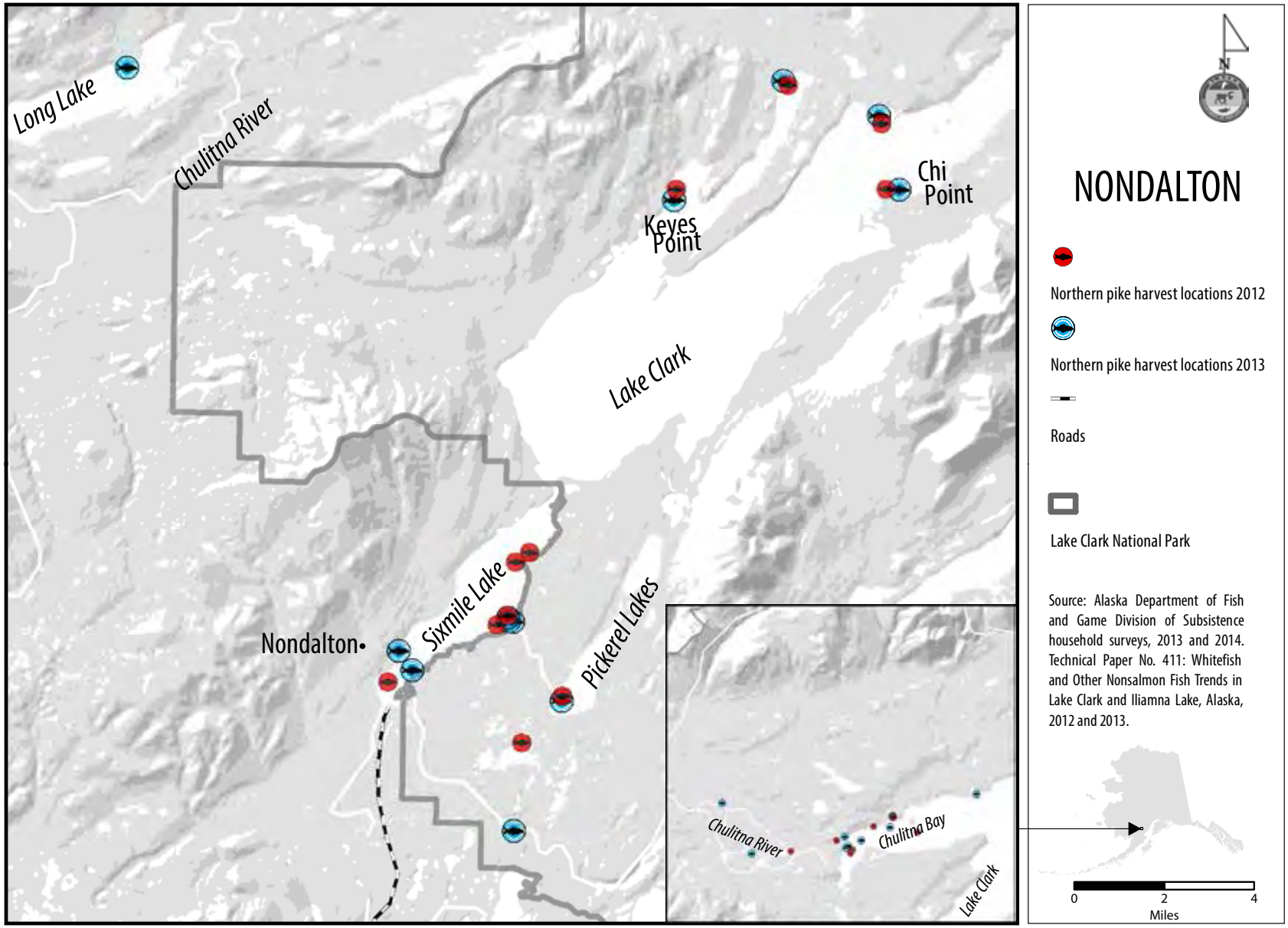


Figure 3-80.–Harvest locations of northern pike, Nondalton, 2012 and 2013.

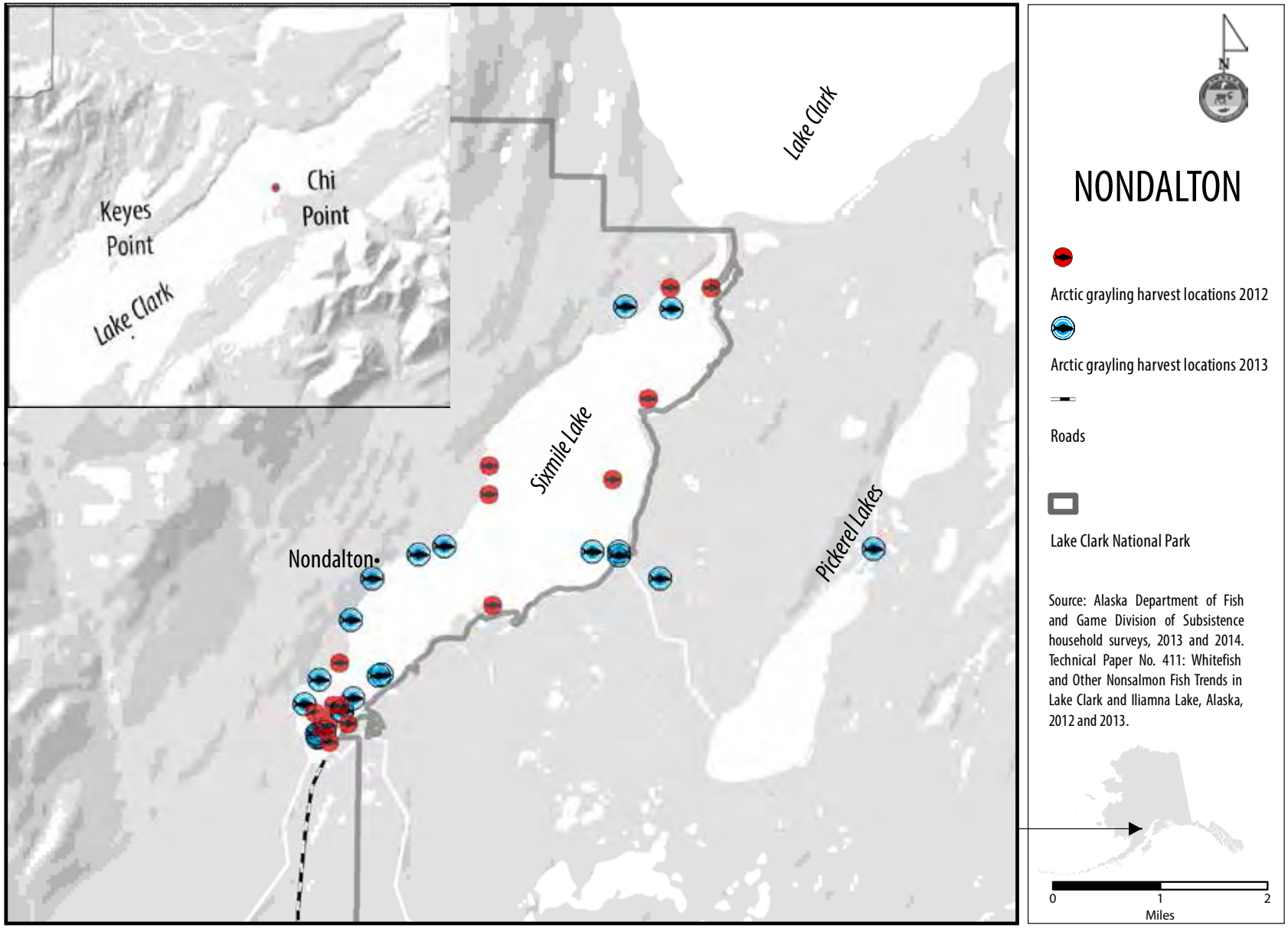


Figure 3-81.–Harvest locations of Arctic grayling, Nondalton, 2012 and 2013.

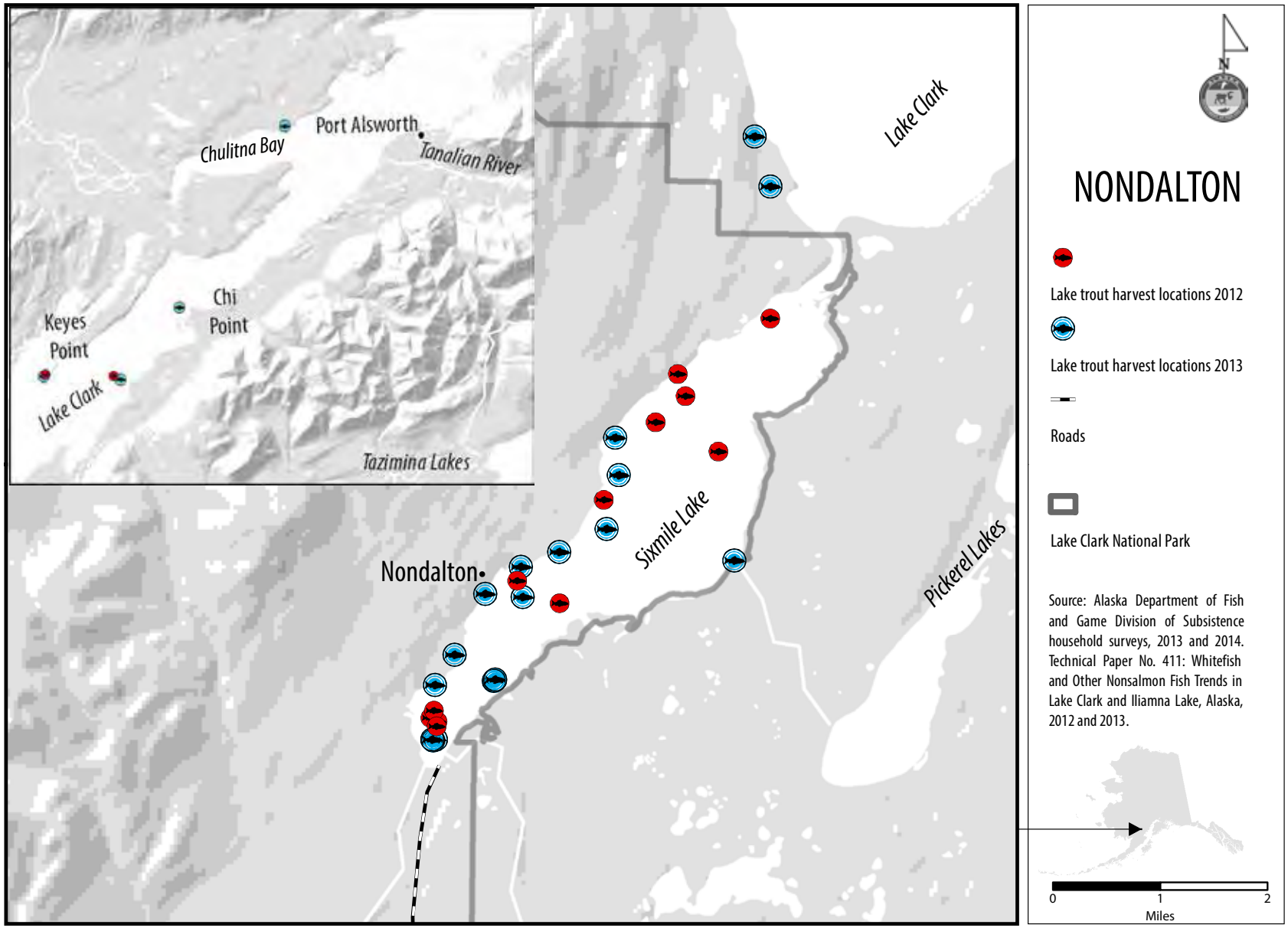


Figure 3-82.–Harvest locations of lake trout, Nondalton, 2012 and 2013.

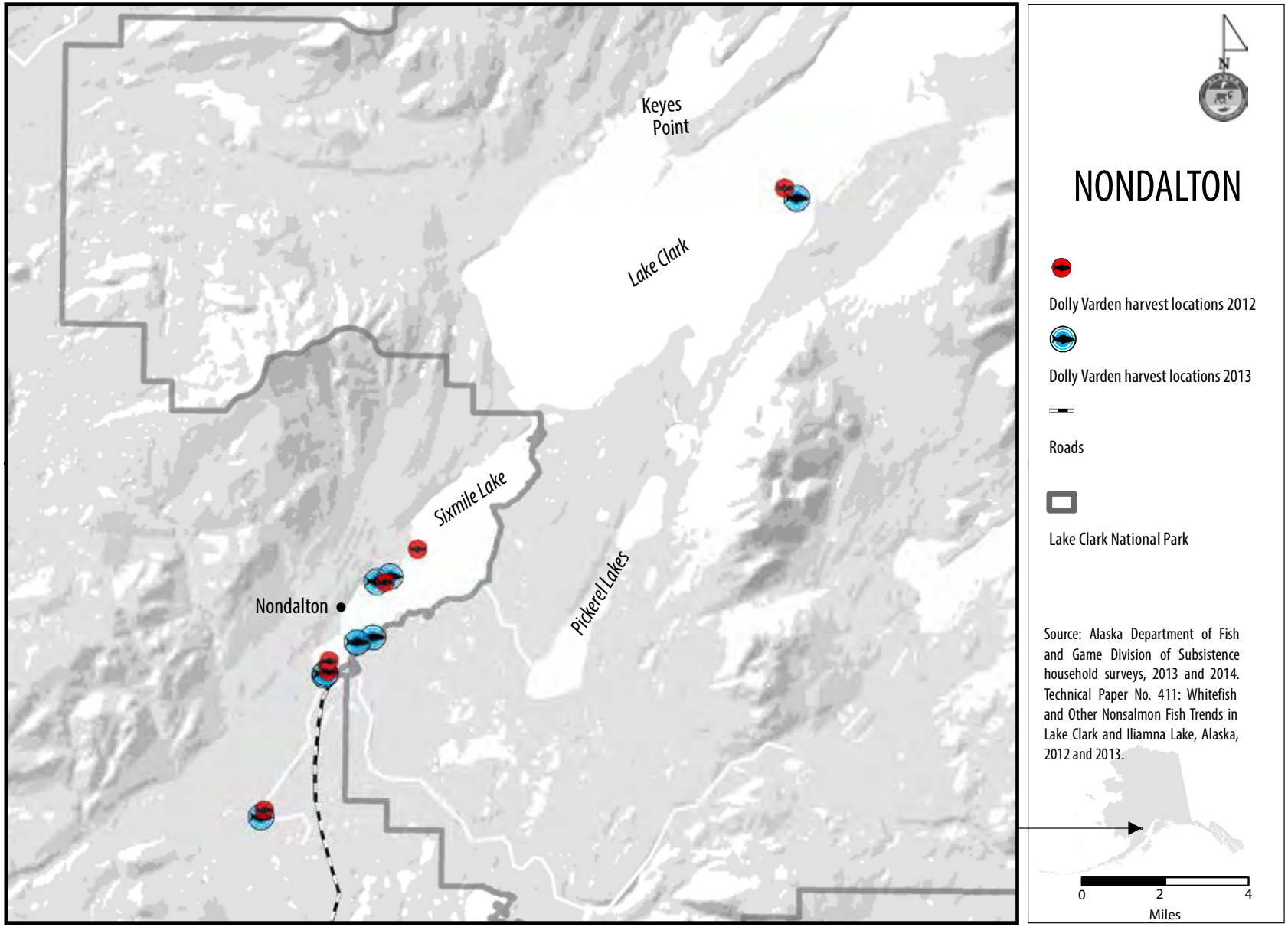


Figure 3-83.–Harvest locations of Dolly Varden, Nondalton, 2012 and 2013.

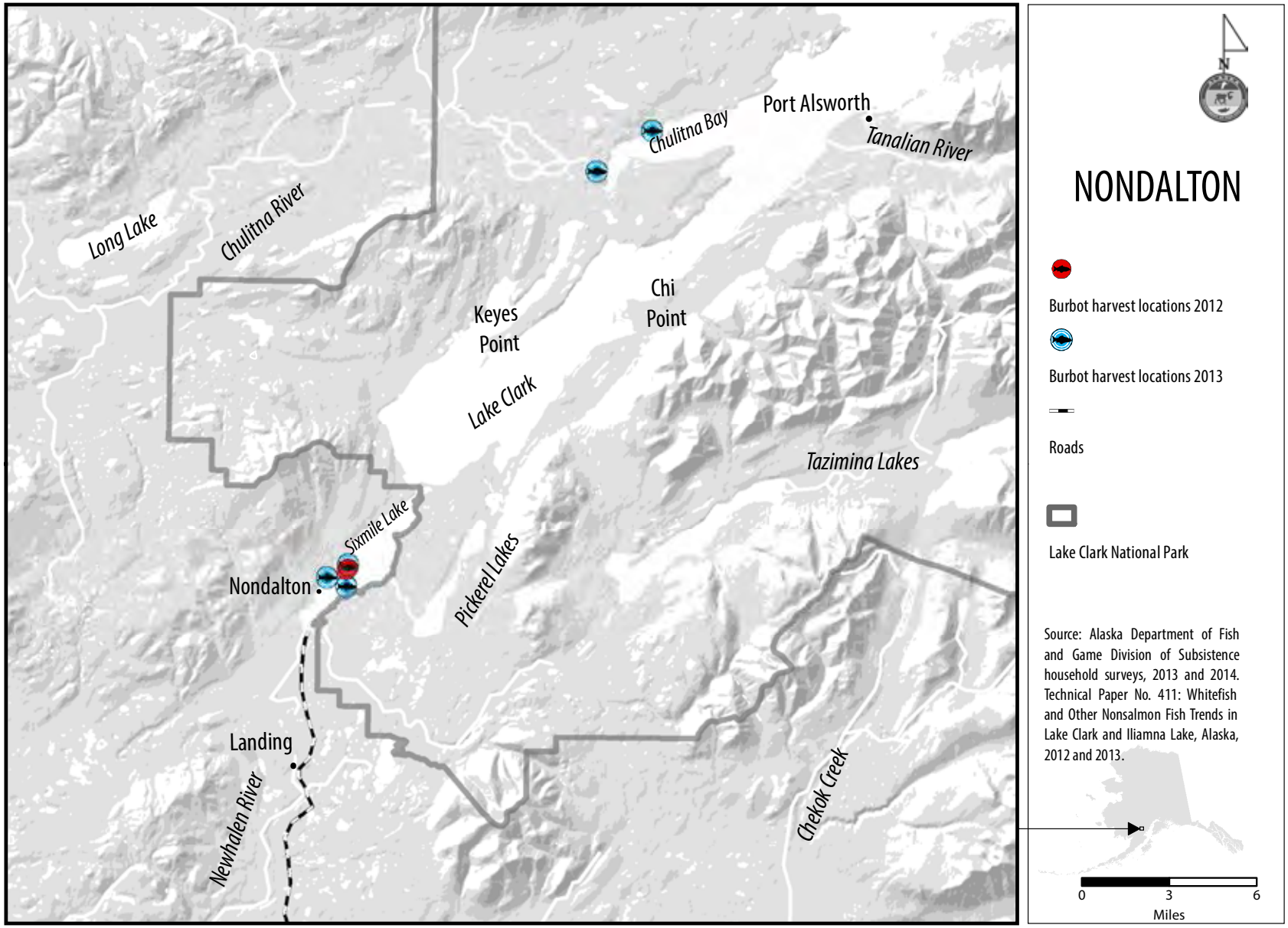


Figure 3-84.–Harvest locations of burbot, Nondalton, 2012 and 2013.

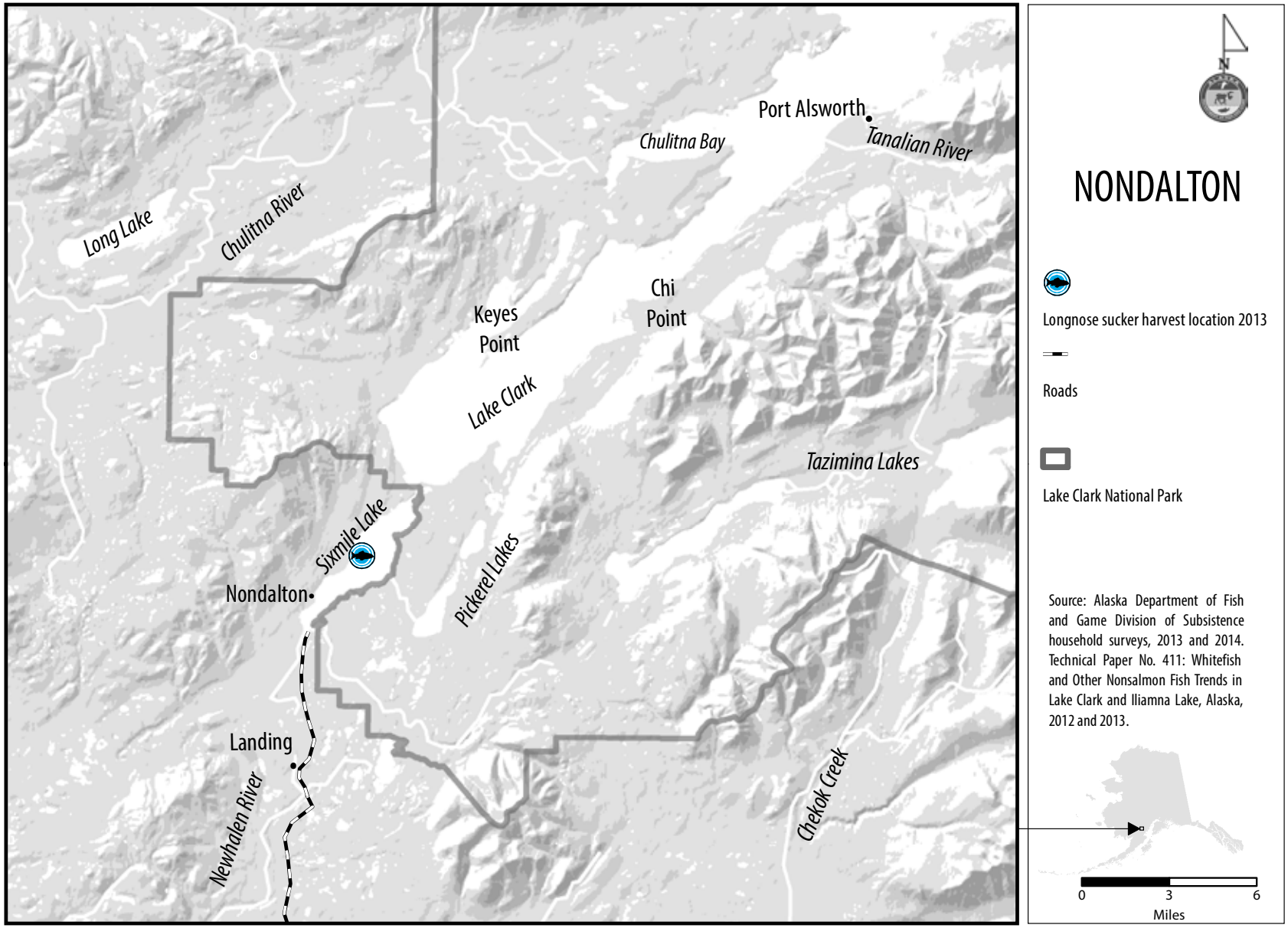


Figure 3-85.–Harvest locations of longnose sucker, Nondalton, 2013.

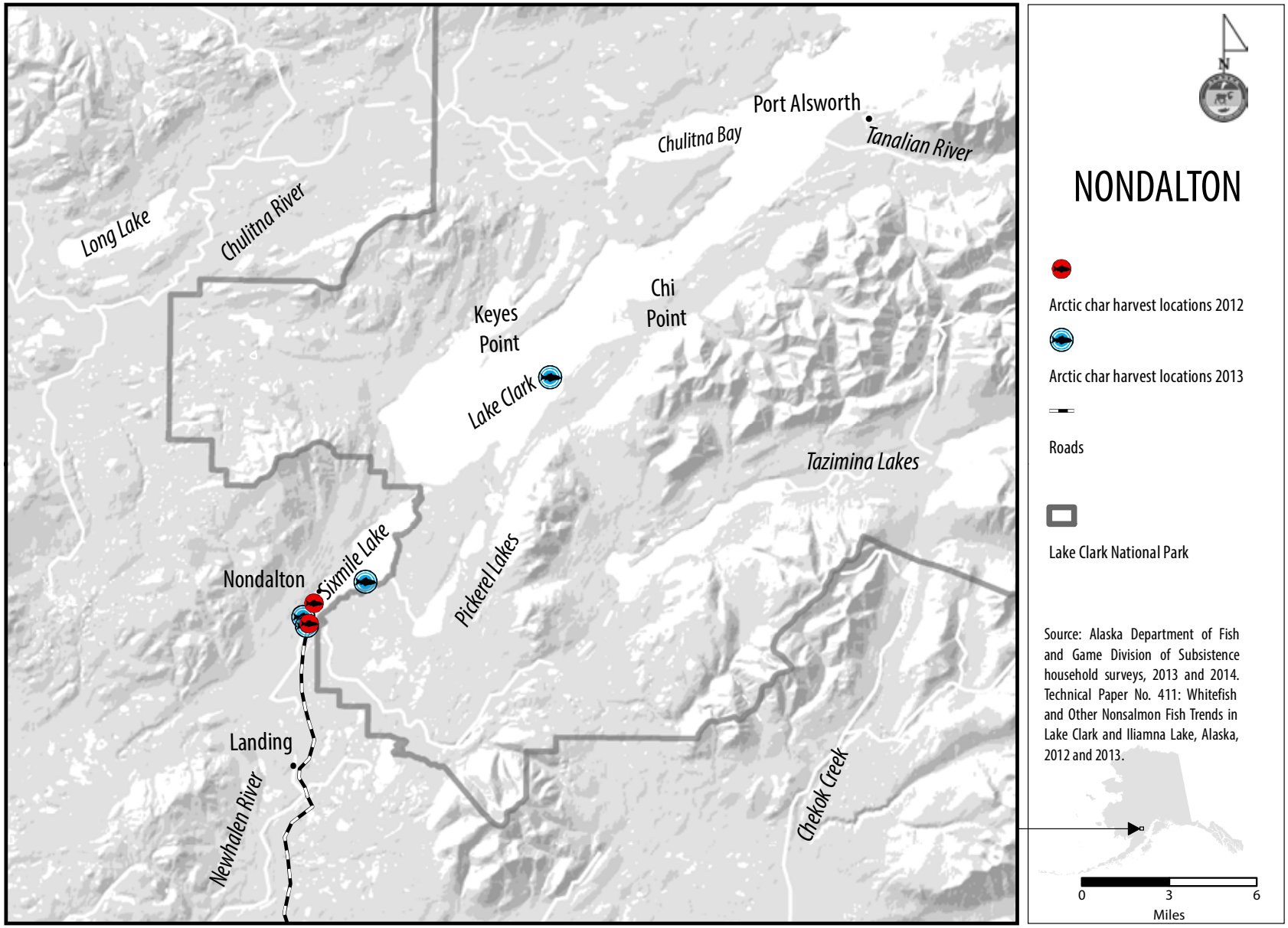


Figure 3-86.–Harvest locations of Arctic char, Nondalton, 2012 and 2013.

Pedro Bay

The average household harvest of nonsalmon fish was 40 lb in 2012 and 41 lb in 2013 (Table 3-40; Table 3-41). Two species of other nonsalmon fish were by far the most predominantly harvested species in both 2012 and 2013: char and rainbow trout. These 2 species composed 100% of the total nonsalmon fish harvest in 2012 and approximately 98% in 2013 (Figure 3-87; Figure 3-88). Contributing factors for the lack of variety of other nonsalmon fish species harvested included location and timing of harvest efforts, abundance of other fish species in nearby waters to Pedro Bay, and other factors that limited residents' ability to travel to other areas on the lake (see chapter 5, "Factors Influencing Residents' Ability to Harvest Nonsalmon Fish").

More species diversity is shown in the "use" category, where people used Arctic grayling, rainbow smelt, trout, and northern pike across the 2 study years (Table 3-40; Table 3-41). The use of char and rainbow trout declined from 2012 to 2013. The percentage of households using char decreased from 85% to 55%, and those using rainbow trout declined from 77% to 55%. This could be due to a lower successful harvest rate of char and rainbow trout in 2013; 69% of households harvested char and rainbow trout in 2012, but 46% of households harvested those species in 2013, which is a 33% reduction of harvesting households. Residents reported a 100% success rate in 2012, meaning that every fishing expedition resulted in at least 1 fish harvested (i.e., they did not get "skunked"—a local term for harvest failure). Success only indicates that at least 1 fish was harvested but does not indicate whether the quantity of fish harvested met the needs of the household. A lower success rate in 2013 (64% of households attempted to harvest nonsalmon fish while 46% harvested fish) could have been a reason why more people received fish in 2013 (more than one-half of community households received nonsalmon fish as opposed to 2012 when fewer than one-quarter of community households received nonsalmon fish). In both years, the higher percentage of households using resources compared to the percentage of harvesting households shows that sharing of fish took place both between households in Pedro Bay and with other Iliamna Lake and Lake Clark communities. Specifically, in 2012, 3 species of other nonsalmon fish were not harvested by any Pedro Bay households but were used in the community, which indicates these fish resources came from another community.

With the exception of an estimated harvest of 69 lb per capita in 1982, the harvest of other nonsalmon fish has remained stable over time (Figure 3-89). Between 2004 and 2013, the harvest of other nonsalmon fish was more than 10 lb per capita but less than 20 lb per capita, which is also the same for 1996. The lowest estimated harvest of other nonsalmon fish occurred in 2003 at 7 lb per capita.

The most common method of harvesting other nonsalmon fish in 2012 was rod and reel fishing, which accounted for an estimated 45% of the total other nonsalmon fish harvest (Table 3-46; Figure 3-90).[2] This was closely followed by ice fishing, which made up 40% of the harvest. In 2012, char and rainbow trout (148 fish, or 207 lb) were fished for through the ice. These 2 types of fish were also harvested using rod and reel (235 lb) and a smaller amount by other subsistence gear (77 lb). In 2013, an additional other nonsalmon fish species was harvested: northern pike. Rod and reel accounted for the total harvest of northern pike and a small portion of the char and rainbow trout harvests (68 lb for all 3 species combined) (Table 3-47; Figure 3-91). In 2013, an incidental harvest of a species of whitefish, least cisco, was caught in a net, and a few char (11 lb) were harvested by gillnet or seine as well. And as in 2012, char and rainbow trout made up the bulk of the year's overall harvest, caught mostly via ice fishing (499 lb).

In 2013, there was a dramatic rise in fish caught through the ice, doubling the previous year's harvest at 87% of the total other nonsalmon fish harvested. While ice fishing was the most commonly used method for harvesting char in both years (43% in 2012 and 91% in 2103), rainbow trout caught through the ice increased from 36% in 2012 to 83% in 2013 (Table 3-46; Table 3-47). This increase in ice fishing for 2013 can most likely be attributed to poor ice conditions in 2012.

Where people traditionally and currently harvest other nonsalmon fish has shifted over the years because of numerous factors (see chapter 5, "Factors Influencing Residents' Ability to Harvest Nonsalmon Fish"). During the study, one factor that greatly impacted other nonsalmon fishing locations and practices occurred

2. See the regulatory context discussion in chapter 1, "Introduction," for descriptions about gear types.

in fall 2012 to spring 2013 when Iliamna Lake did not freeze over. The lack of ice limited residents' ability to move around to other communities to hunt and ice fish, thus influencing the harvesting and sharing of other nonsalmon fish. These effects are reflected in the harvest areas of other nonsalmon fish, which were condensed around Pedro Bay during that time (Figure 3-92; Figure 3-93). This was one of the few times in residents' living memory that Iliamna Lake did not freeze all the way over. In winter 2012–2013, ice formed later, broke up earlier, and was less stable when it was formed. A key respondent from 2012 said that they did not fish anywhere outside Pedro or Knutson bays that year because the ice over deeper water was too hazardous. While conducting fieldwork in March 2013, researchers noted that many survey and key respondents said that the ice was unsafe outside of the bay and was already starting to "rot" in the bays, something that usually occurred in mid- to late April. The mapped harvest areas for rainbow trout and char show fishing efforts for 2012 were concentrated near the shore (Figure 3-94; Figure 3-95). Harvest locations for 2013 for these species and northern pike, Dolly Varden, and lake trout are expanded (Figure 3-96; Figure 3-97).

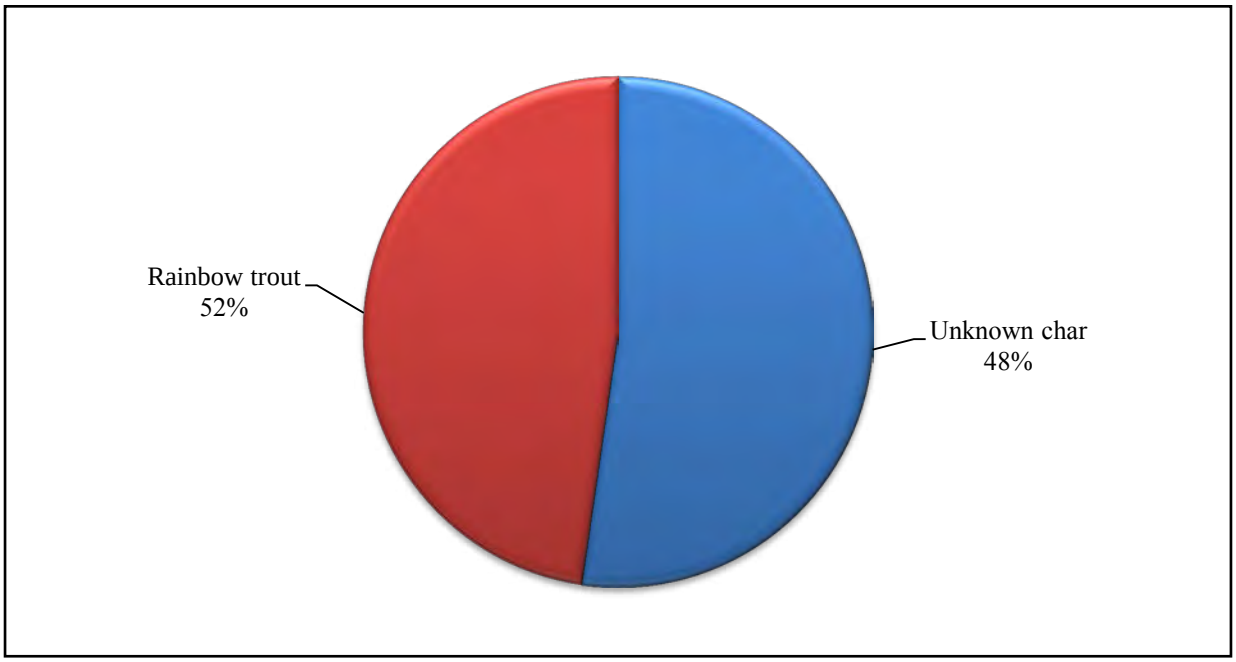


Figure 3-87.–Composition of nonsalmon fish harvest in pounds usable weight, Pedro Bay, 2012.

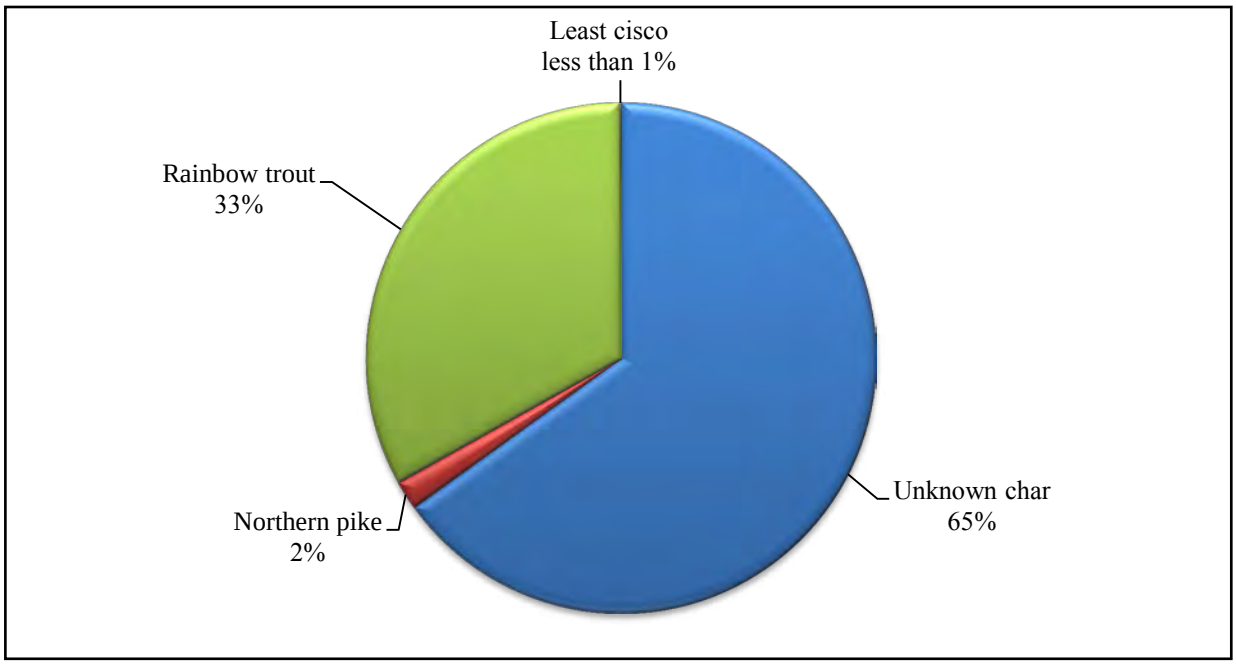


Figure 3-88.–Composition of nonsalmon fish harvest in pounds usable weight, Pedro Bay, 2013.

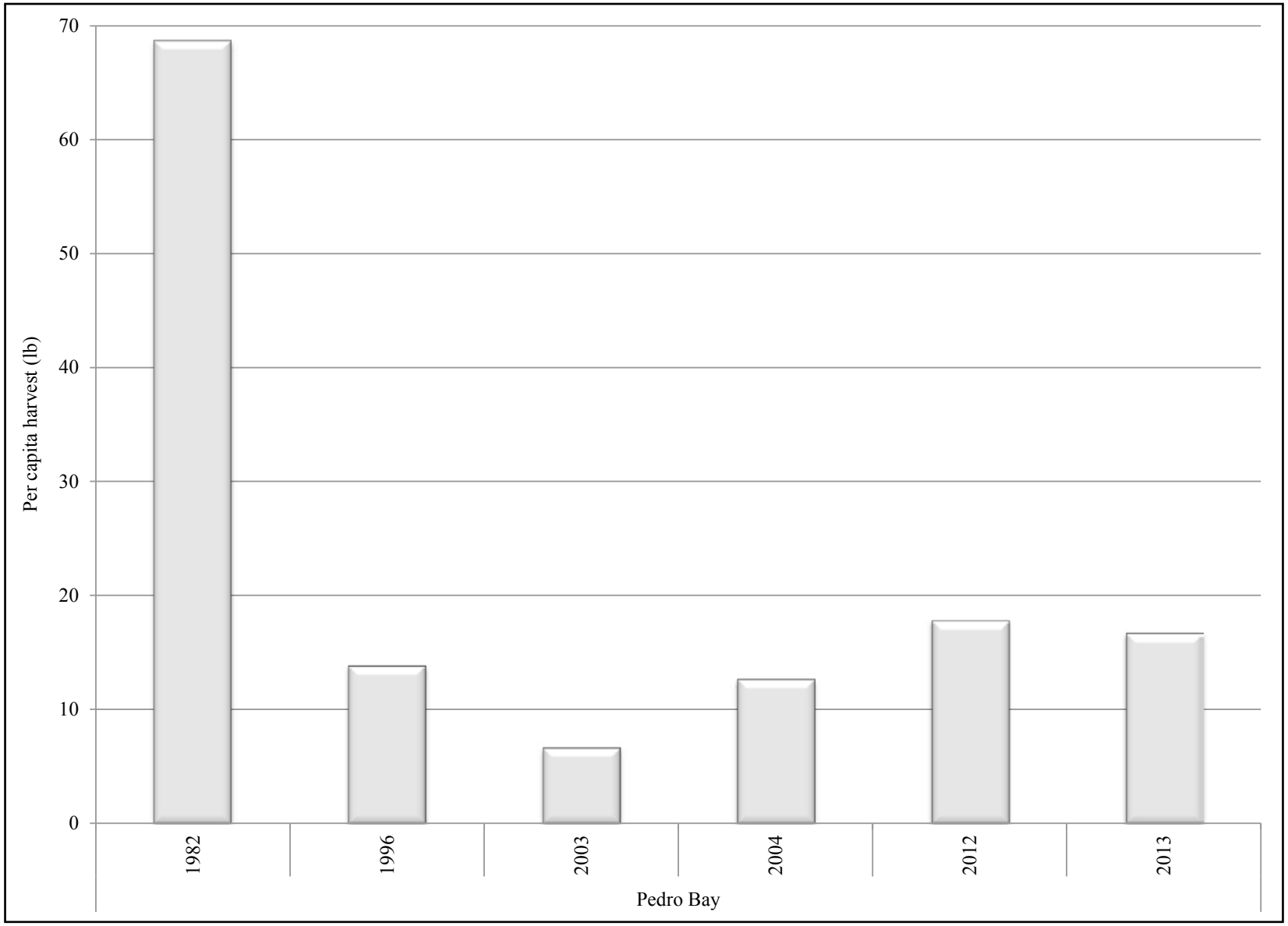


Figure 3-89.–Estimated harvests of other nonsalmon fish by pounds per capita, Pedro Bay, 1982, 1996, 2003–2004, 2012, and 2013.

Table 3-46.–Estimated harvest of nonsalmon fish by gear type, resource, Pedro Bay, 2012.

	Subsistence methods															
	Gillnet or seine		Ice fishing (hook under ice)		Net under ice		Jig		Other method		Subsistence gear, any method		Rod and reel		Any method	
Resource	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds
Nonsalmon fish	**0.0**	**0.0**	**148.0**	**207.2**	**0.0**	**0.0**	**0.0**	**0.0**	**55.0**	**77.0**	**203.0**	**284.2**	**168.0**	**235.2**	**371.0**	**519.4**
Rainbow smelt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arctic lamprey	0.0	0.0	0.0	0.0	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	0.0	0.0	0.0	0.0	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
Arctic char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dolly Varden–freshwater	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dolly Varden–fingerling	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lake trout	0.0	0.0	0.0	0.0	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 char	0.0	0.0	84.0	117.6	0.0	0.0	0.0	0.0	40.0	56.0	124.0	173.6	70.0	98.0	194.0	271.6
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
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
Longnose sucker	0.0	0.0	0.0	0.0	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	64.0	89.6	0.0	0.0	0.0	0.0	15.0	21.0	79.0	110.6	98.0	137.2	177.0	247.8
Unknown trout	0.0	0.0	0.0	0.0	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
Broad 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
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
Least 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
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
Round 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
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

Source ADF&G Division of Subsistence household surveys, 2013.

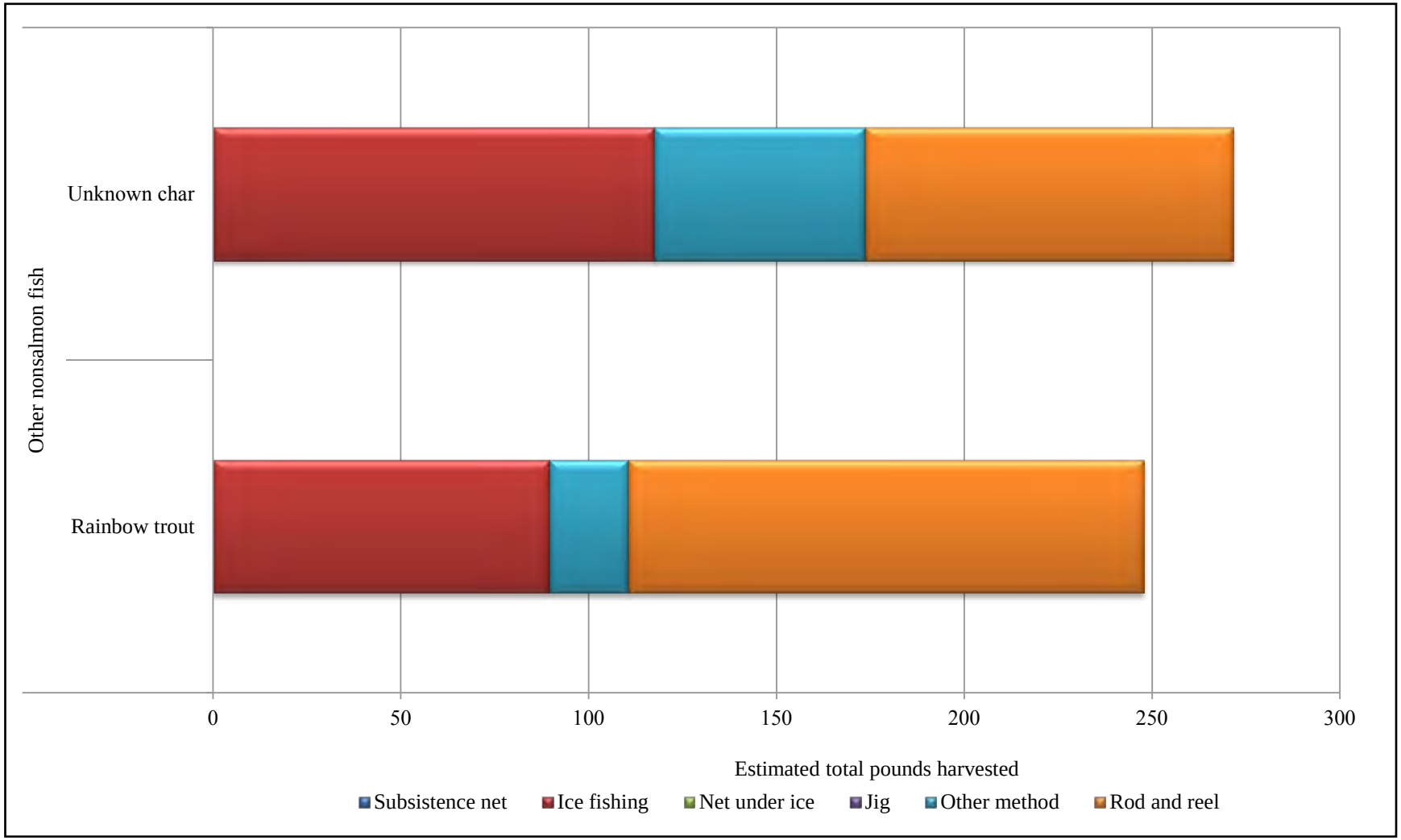


Figure 3-90.–Nonsalmon fish harvest by gear type, Pedro Bay, 2012.

Table 3-47.–Estimated harvest of nonsalmon fish by gear type, resource, Pedro Bay, 2013.

	Subsistence methods															
	Gillnet or seine		Ice fishing (hook under ice)		Net under ice		Jig		Other method		Subsistence gear, any method		Rod and reel		Any method	
Resource	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds	Number	Pounds
Nonsalmon fish	**8.9**	**11.2**	**356.4**	**498.9**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**365.3**	**510.1**	**44.5**	**67.7**	**409.8**	**577.8**
Rainbow smelt	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arctic lamprey	0.0	0.0	0.0	0.0	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	0.0	0.0	0.0	0.0	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
Arctic char	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dolly Varden–freshwater	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lake trout	0.0	0.0	0.0	0.0	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 char	7.6	10.7	243.1	340.3	0.0	0.0	0.0	0.0	0.0	0.0	250.7	351.0	17.8	24.9	268.5	376.0
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
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	3.8	10.7	3.8	10.7
Longnose sucker	0.0	0.0	0.0	0.0	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	113.3	158.6	0.0	0.0	0.0	0.0	0.0	0.0	113.3	158.6	22.9	32.1	136.2	190.7
Unknown trout	0.0	0.0	0.0	0.0	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
Broad 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
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
Least cisco	1.3	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.5	0.0	0.0	1.3	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
Round 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

Source ADF&G Division of Subsistence household surveys, 2014.

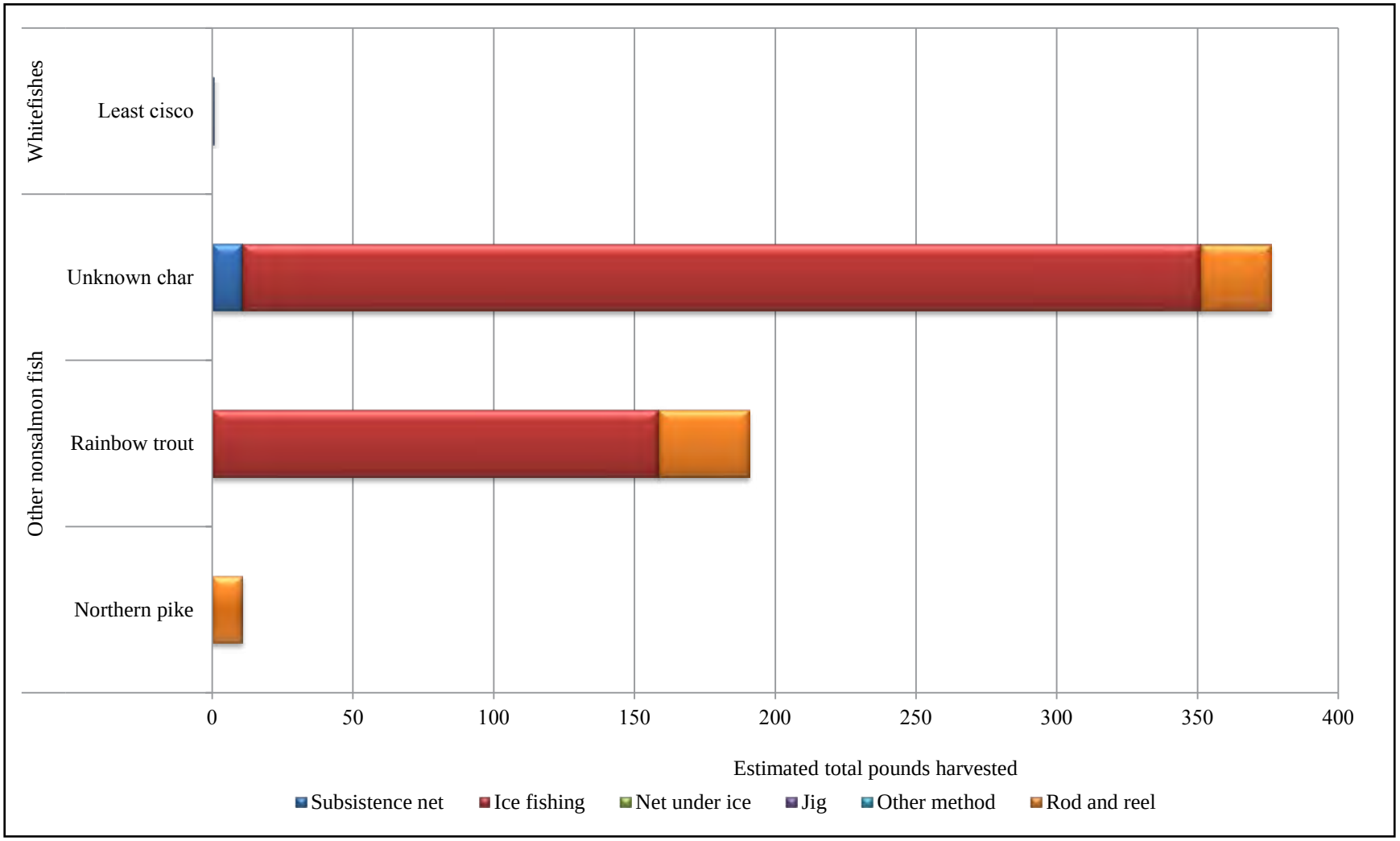


Figure 3-91.–Nonsalmon fish harvest by gear type, Pedro Bay, 2013.

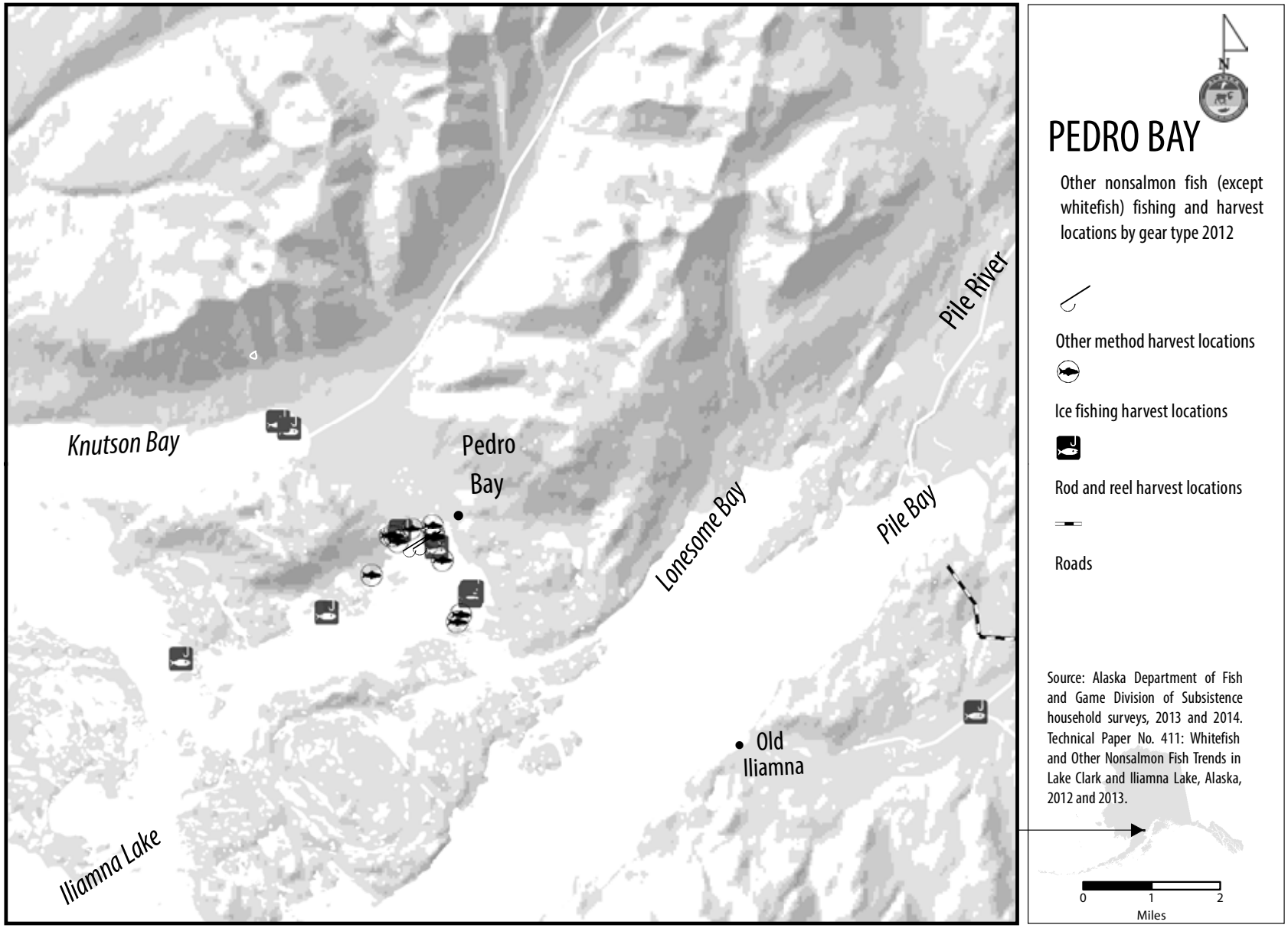


Figure 3-92.–Fishing and harvest locations of other nonsalmon fish species by gear type, Pedro Bay, 2012.

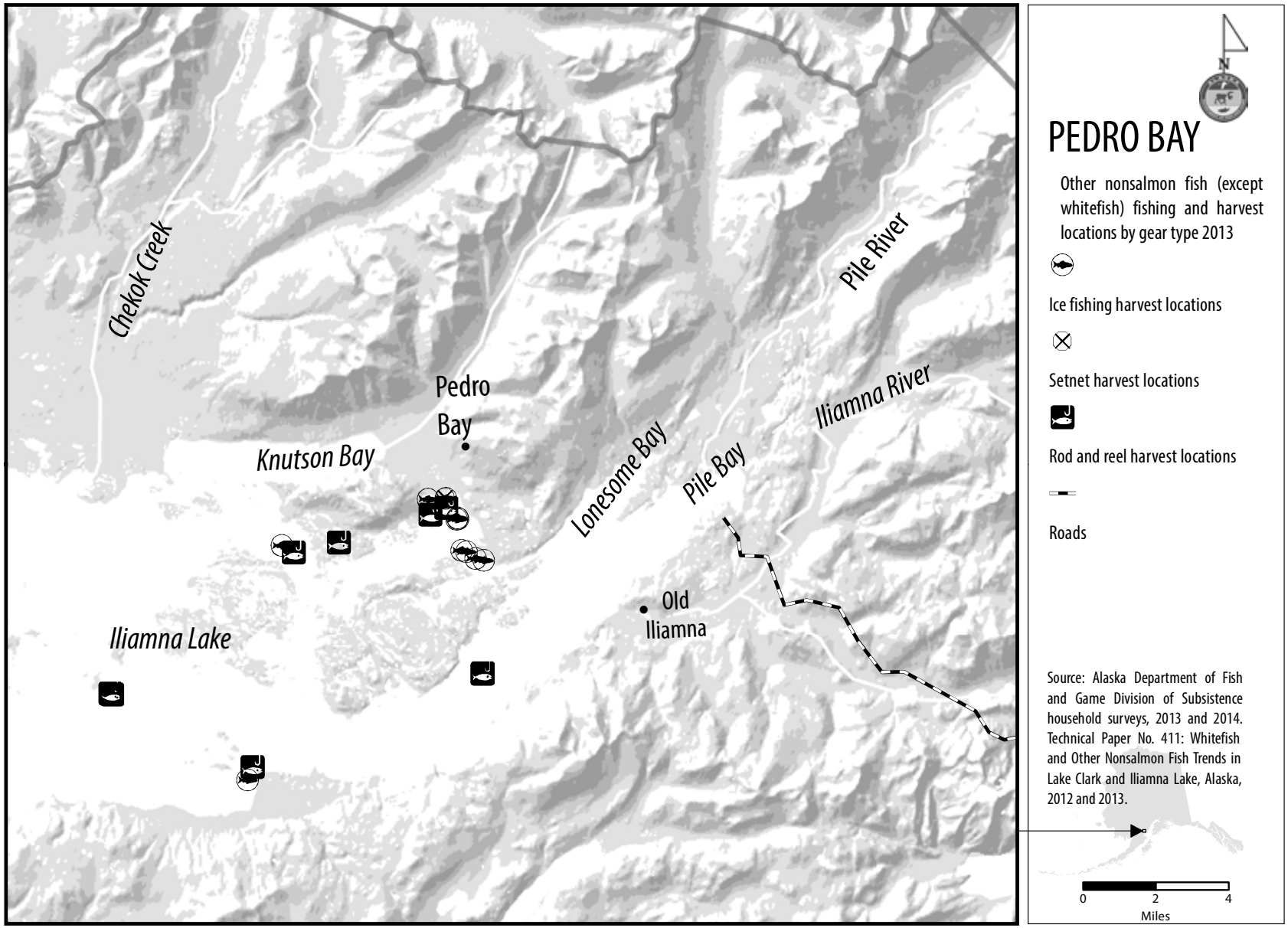


Figure 3-93.–Fishing and harvest locations of other nonsalmon fish species by gear type, Pedro Bay, 2013.

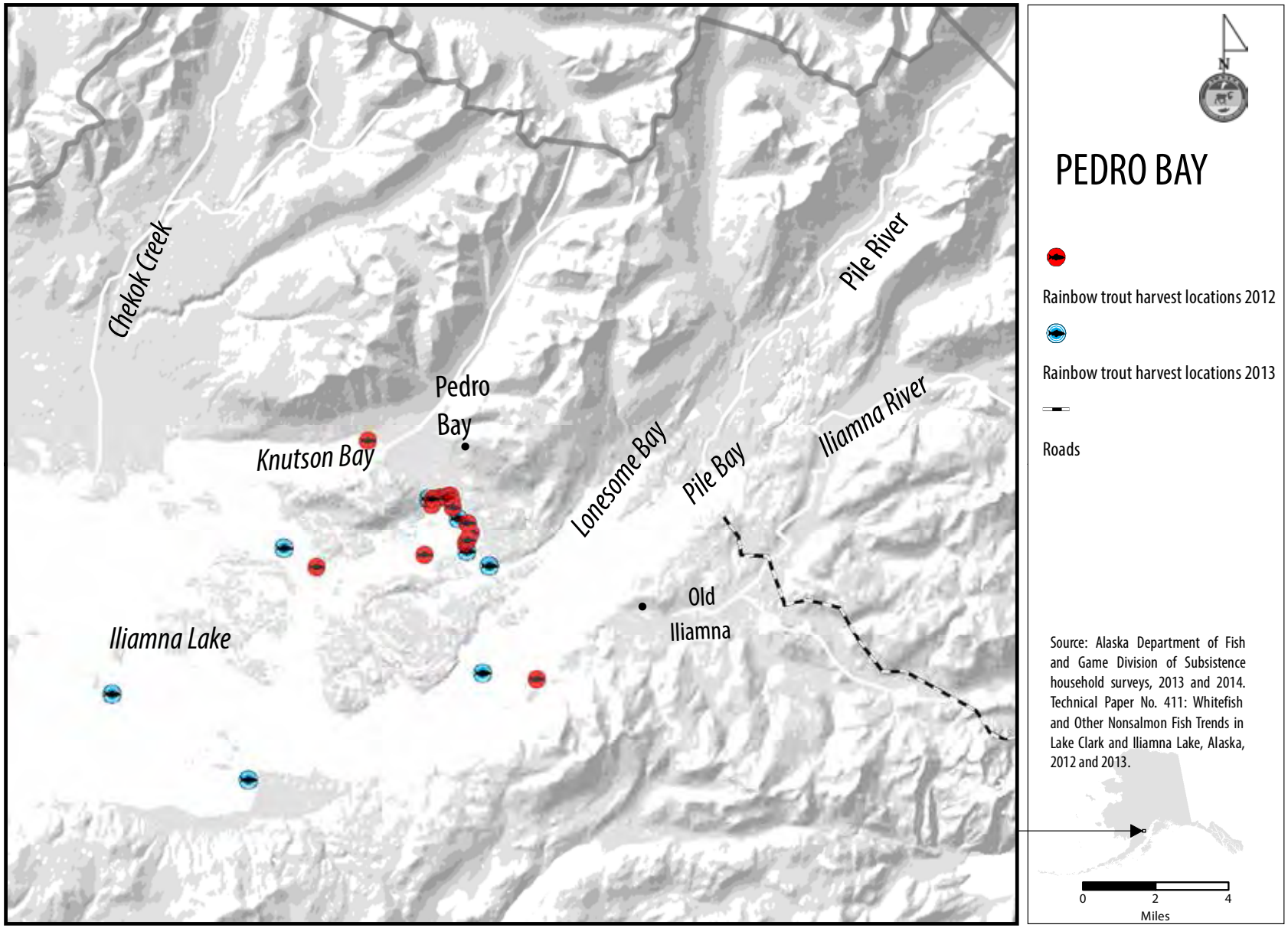


Figure 3-94.–Harvest locations of rainbow trout, Pedro Bay, 2012 and 2013.

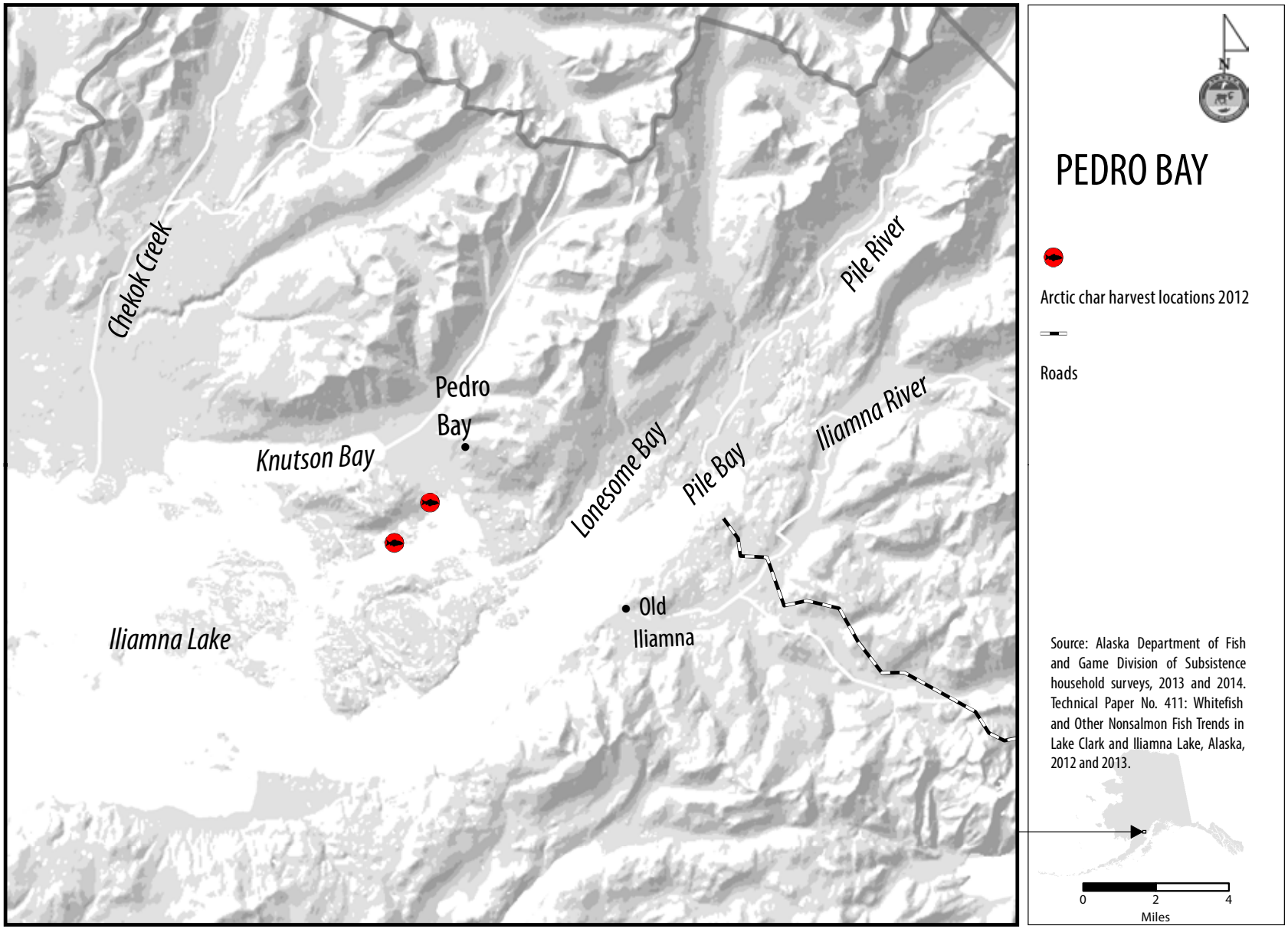


Figure 3-95.–Harvest locations of Arctic char, Pedro Bay, 2012.

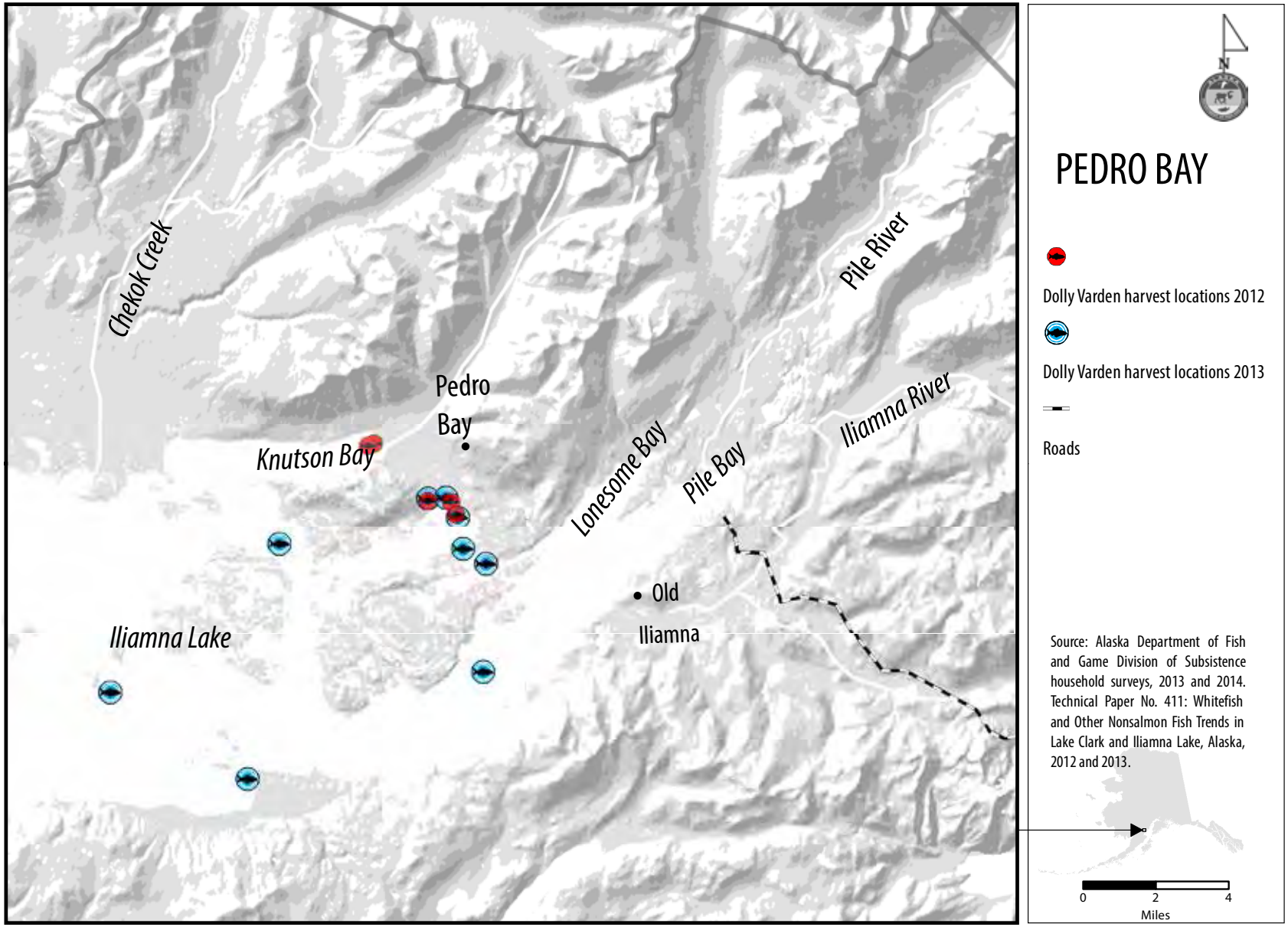


Figure 3-96.–Harvest locations of Dolly Varden, Pedro Bay, 2012 and 2013.

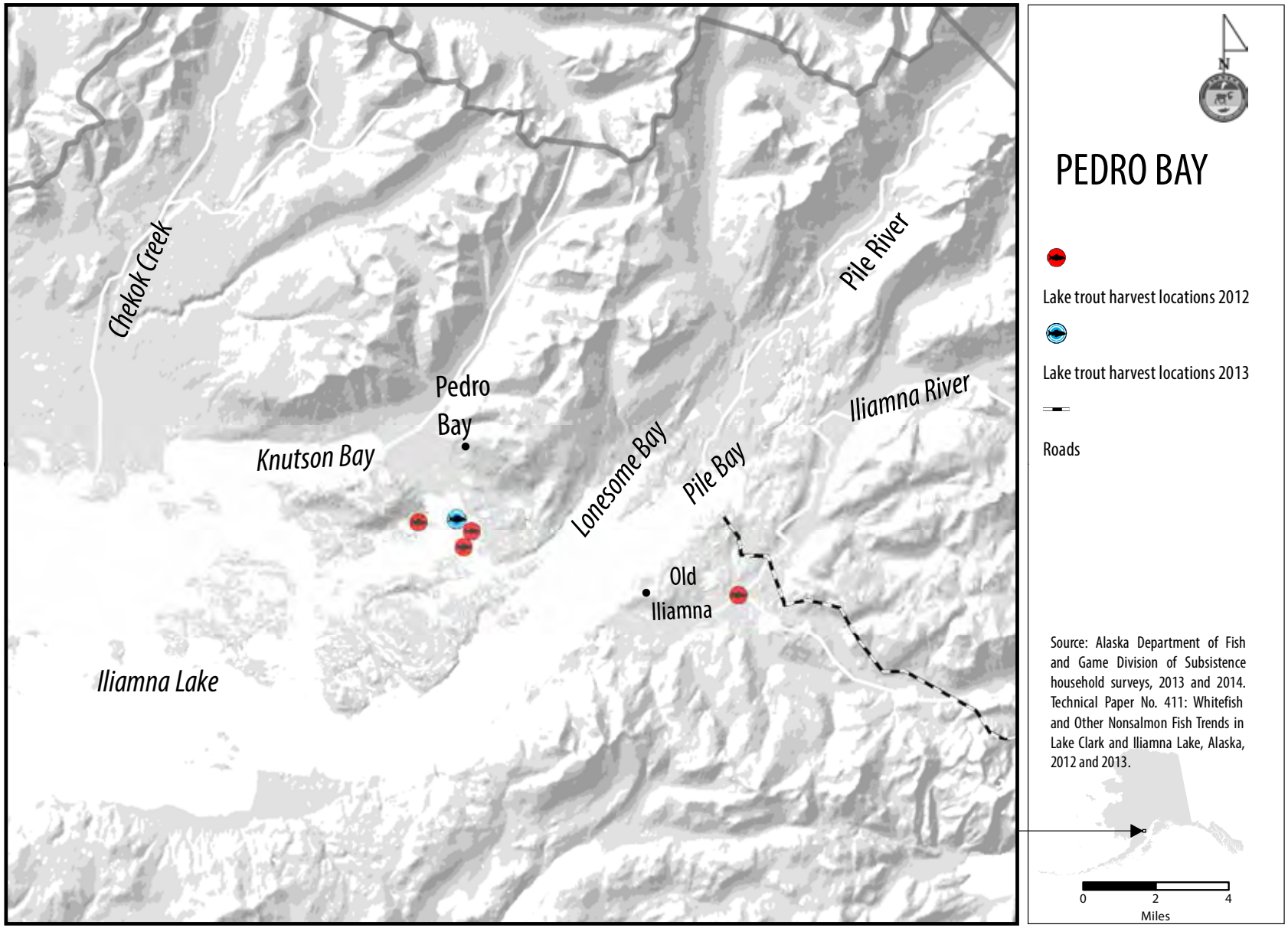


Figure 3-97.–Harvest locations of lake trout, Pedro Bay, 2012 and 2013.

Port Alsworth

During 2012, 56% of Port Alsworth households identified themselves as users of 1 or more nonsalmon fish species, while 53% attempted to harvest and successfully harvested at least 1 or more nonsalmon fish species (Table 3-42). During 2013, the percentage of households identifying themselves as users of nonsalmon fish decreased to 41% and 37% of households attempted to harvest and successfully harvested 1 or more species of nonsalmon fish (Table 3-43). However, in 2013 more households received nonsalmon fish (14%) compared to 2012 when only 7% of households received these resources.

In both 2012 and 2013, lake trout made up the largest percentage of the harvest of other nonsalmon fish by pounds usable weight: an estimated 17% of the overall harvest of nonsalmon fish in 2012 and 29% in 2013 were lake trout (Figure 3-40; Figure 3-41). The harvest of lake trout translates to a per capita harvest of almost 1 lb in 2012 and 1.3 lb in 2013. In terms of percentage of the total harvest of nonsalmon fish, excluding whitefishes, lake trout was followed by northern pike (15% of harvest) and burbot (7% of harvest) in 2012 and Arctic grayling (18% of harvest) and northern pike (7% of harvest) in 2013.

In both study years, the same 4 species of other nonsalmon fish contributed most of the other nonsalmon fish harvest (Table 3-42; Table 3-43). Lake trout harvests increased from 135 usable pounds in 2012 to 225 lb in 2013. Northern pike harvests decreased from 118 lb in 2012 to 51 lb in 2013. Arctic grayling harvests increased from 48 lb in 2012 to 138 lb in 2013. Burbot harvests decreased from 51 lb in 2012 to 31 lb in 2013. The changes in harvested amounts over the 2 study years were attributed to resource availability and weather and ice conditions.

Historically in Port Alsworth, the harvest of other nonsalmon fish has been low. For all years on record, harvests of other nonsalmon fish have not exceeded 10 lb per capita (Figure 3-98).

The majority of the other nonsalmon fish harvest was done with rod and reel for both study years (Table 3-44; Table 3-45). Figures 3-43 and 3-44 are a visual representation of the other nonsalmon fish harvested by total pounds and by gear type. Out of the 135 lb of lake trout harvested in Port Alsworth in 2012, an estimated 124 lb were taken by rod and reel (Table 3-44). The remaining harvest was by gillnet (8 lb) and ice fishing (3 lb). Of the 48 lb of Artic grayling harvested in 2012, an estimated 46 lb were harvested by rod and reel and the remaining 2 lb were harvested by gillnet. In 2012, 81 lb of northern pike were harvested by rod and reel and the remaining 37 lb were harvested by seine.

In 2013, a greater portion of the harvest of other nonsalmon fish was harvested with a variety of subsistence gear types, but rod and reel remained the most commonly used gear (Figure 3-99; Figure 3-100). Out of the 225 lb of lake trout harvested, 160 lb were taken by rod and reel, and 44 lb by gillnet while the remaining 21 lb were harvested while ice fishing (Table 3-45). Of the 138 lb of Arctic grayling harvested, 108 lb were taken using rod and reel, 8 lb by gillnet, and the remaining 23 lb by ice fishing. In 2013, an estimated 51 lb of northern pike were harvested: 39 lb were harvested by rod and reel and the remaining 12 lb by seine. No northern pike were harvested by ice fishing during both study years.

The majority of the lake trout harvests took place at the mouth of Kijik Lake or near the community and harvest locations were very similar in both study years (Figure 3-101). Most northern pike harvests were done in Chulitna Bay or near the community of Port Alsworth, which was similar for both 2012 and 2013 (Figure 3-102). The harvest locations for Arctic grayling primarily took place just east of Chi Point on Lake Clark and near the community (Figure 3-103). Harvests of the remaining other nonsalmon fish species harvested (burbot, rainbow trout, longnose sucker, Dolly Varden, and Arctic char) occurred in the same areas previously mentioned with the addition of harvests coming from the Tanalian River (figures 3-104 through 3-108).

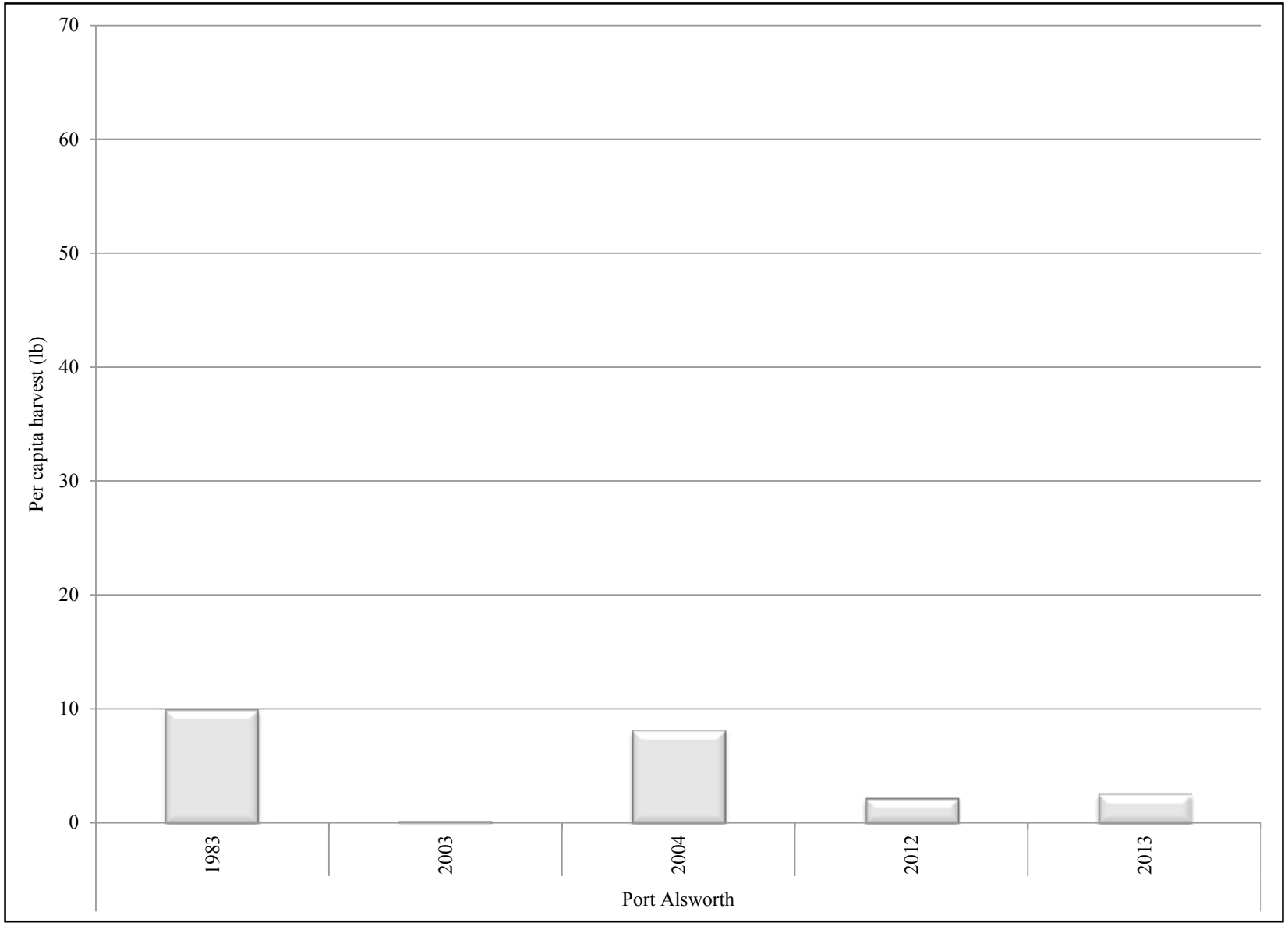


Figure 3-98.–Estimated harvests of other nonsalmon fish by pounds per capita, Port Alsworth, 1983, 2003–2004, 2012, and 2013.

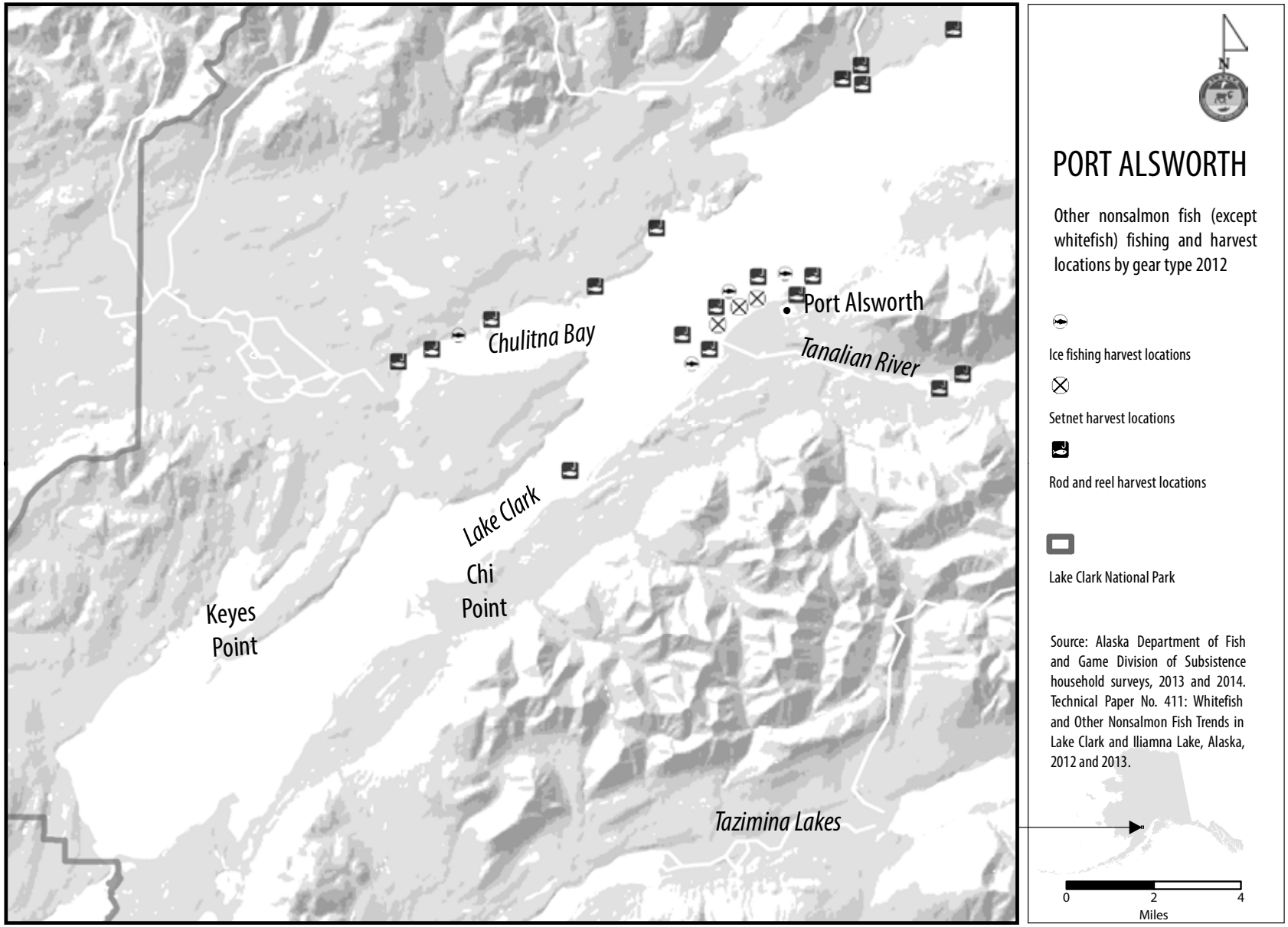


Figure 3-99.–Nonsalmon fish harvest by gear type, Port Alsworth, 2012.

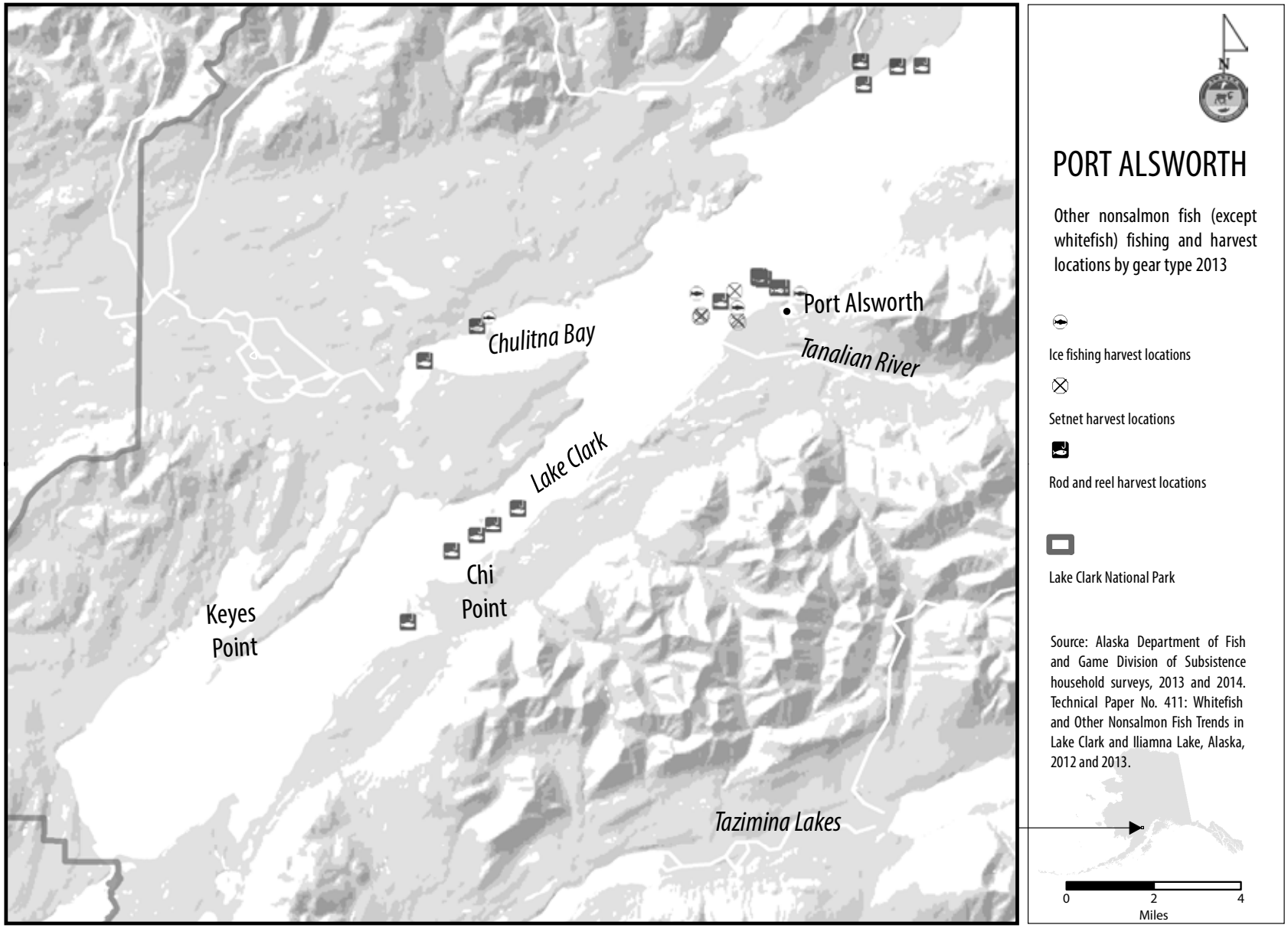


Figure 3-100.–Nonsalmon fish harvest by gear type, Port Alsworth, 2013.

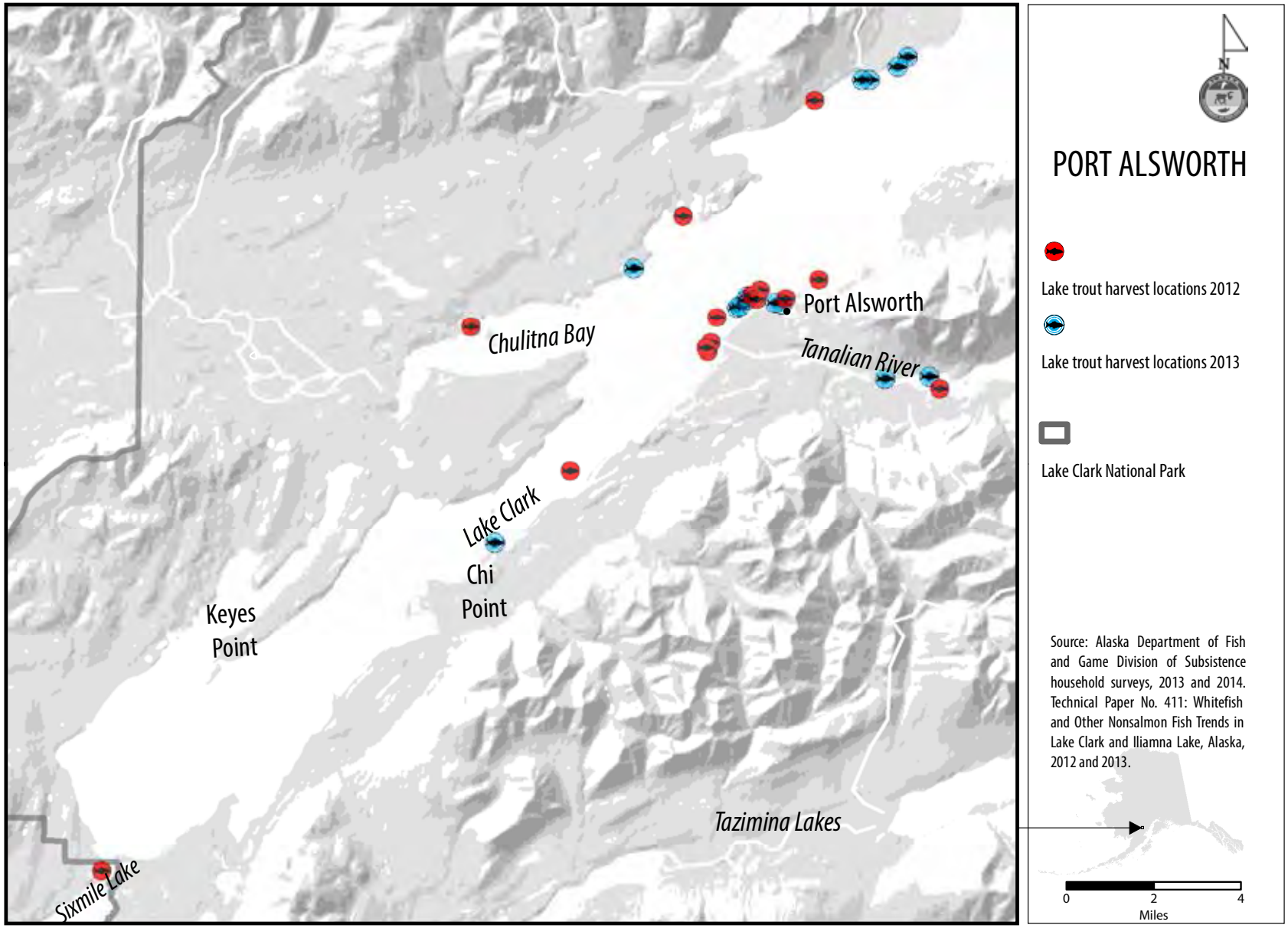


Figure 3-101.–Harvest locations of lake trout, Port Alsworth, 2012 and 2013.

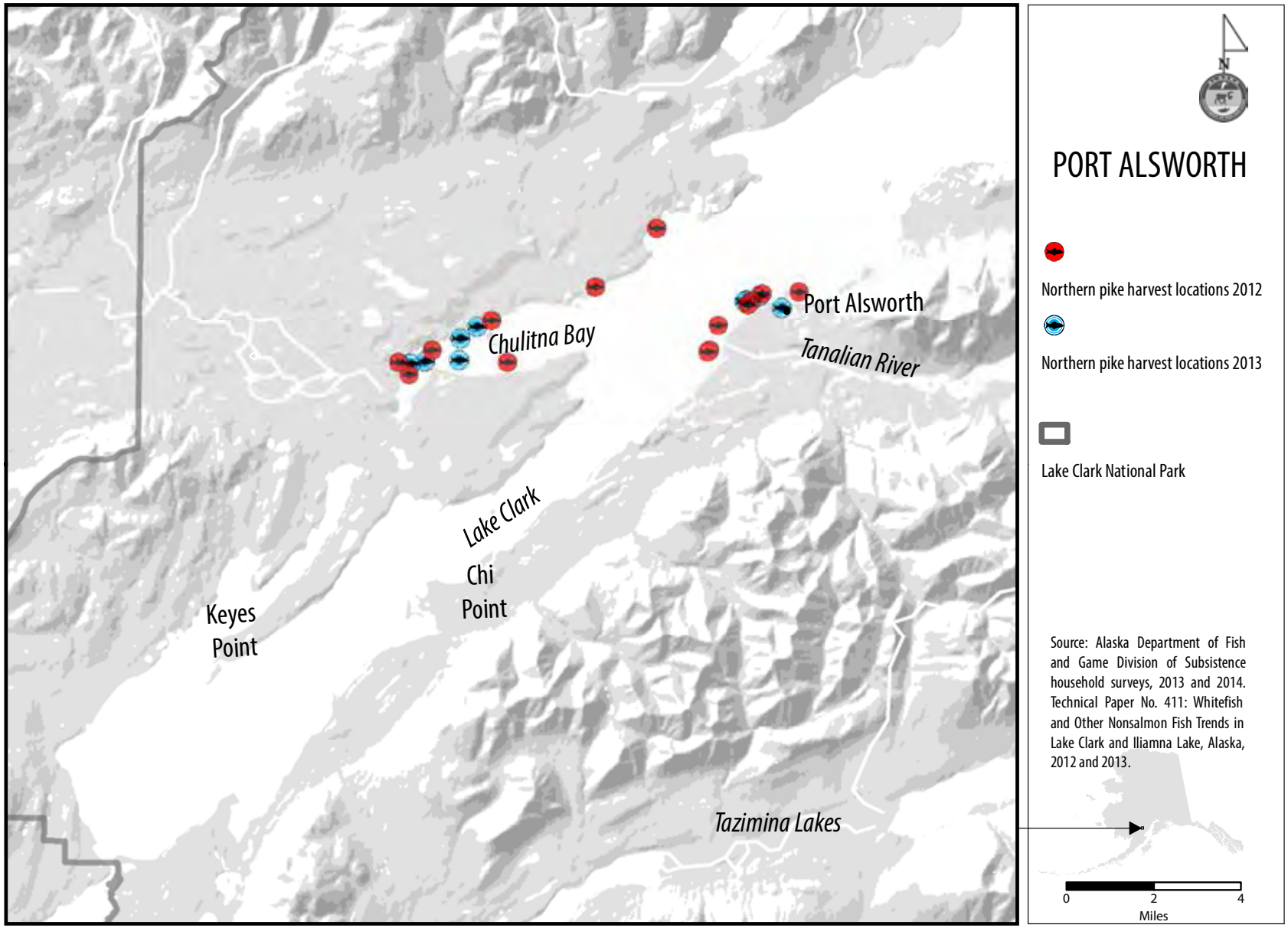


Figure 3-102.–Harvest locations of northern pike, Port Alsworth, 2012 and 2013.

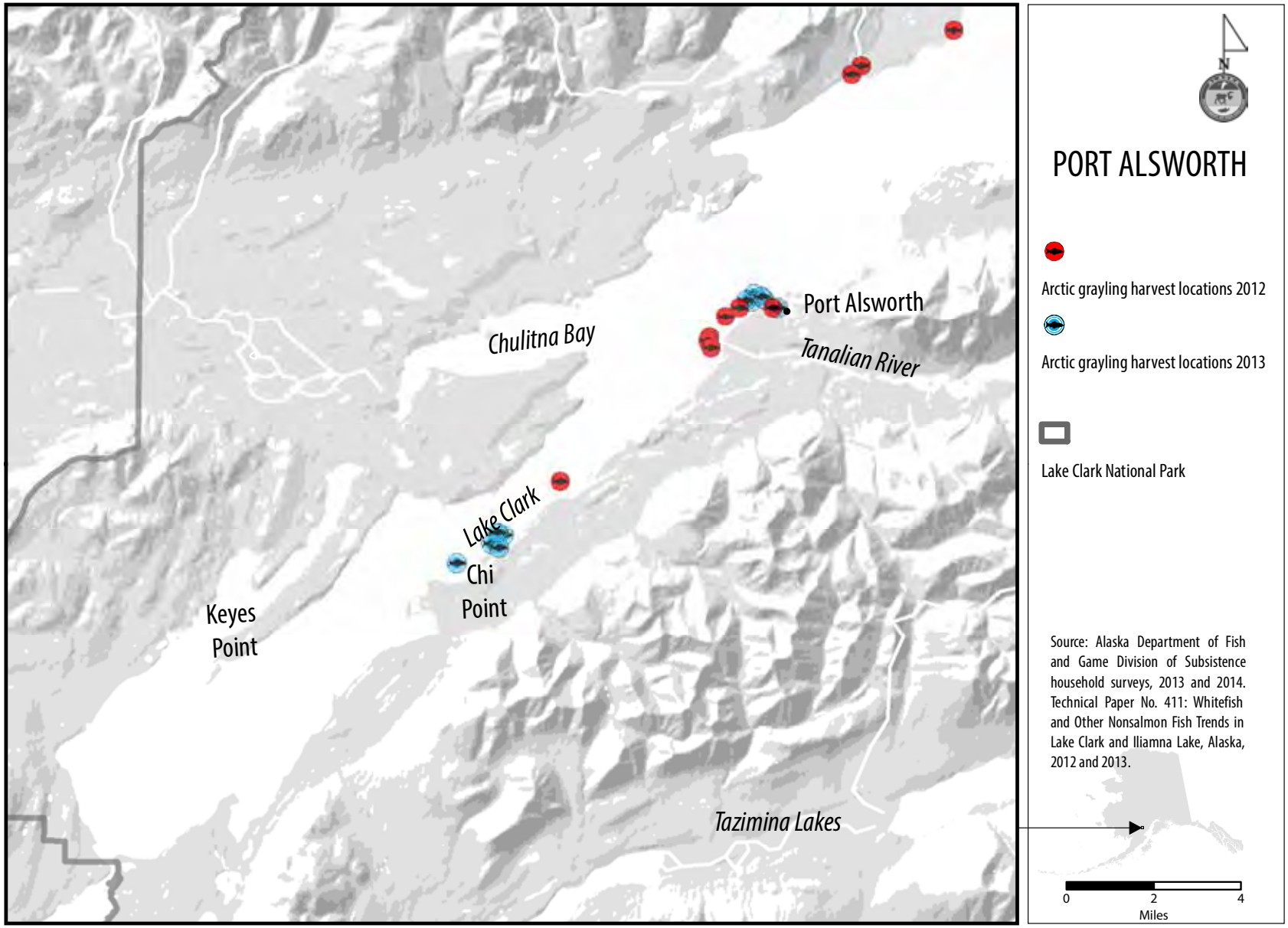


Figure 3-103.–Harvest locations of Arctic grayling, Port Alsworth, 2012 and 2013.

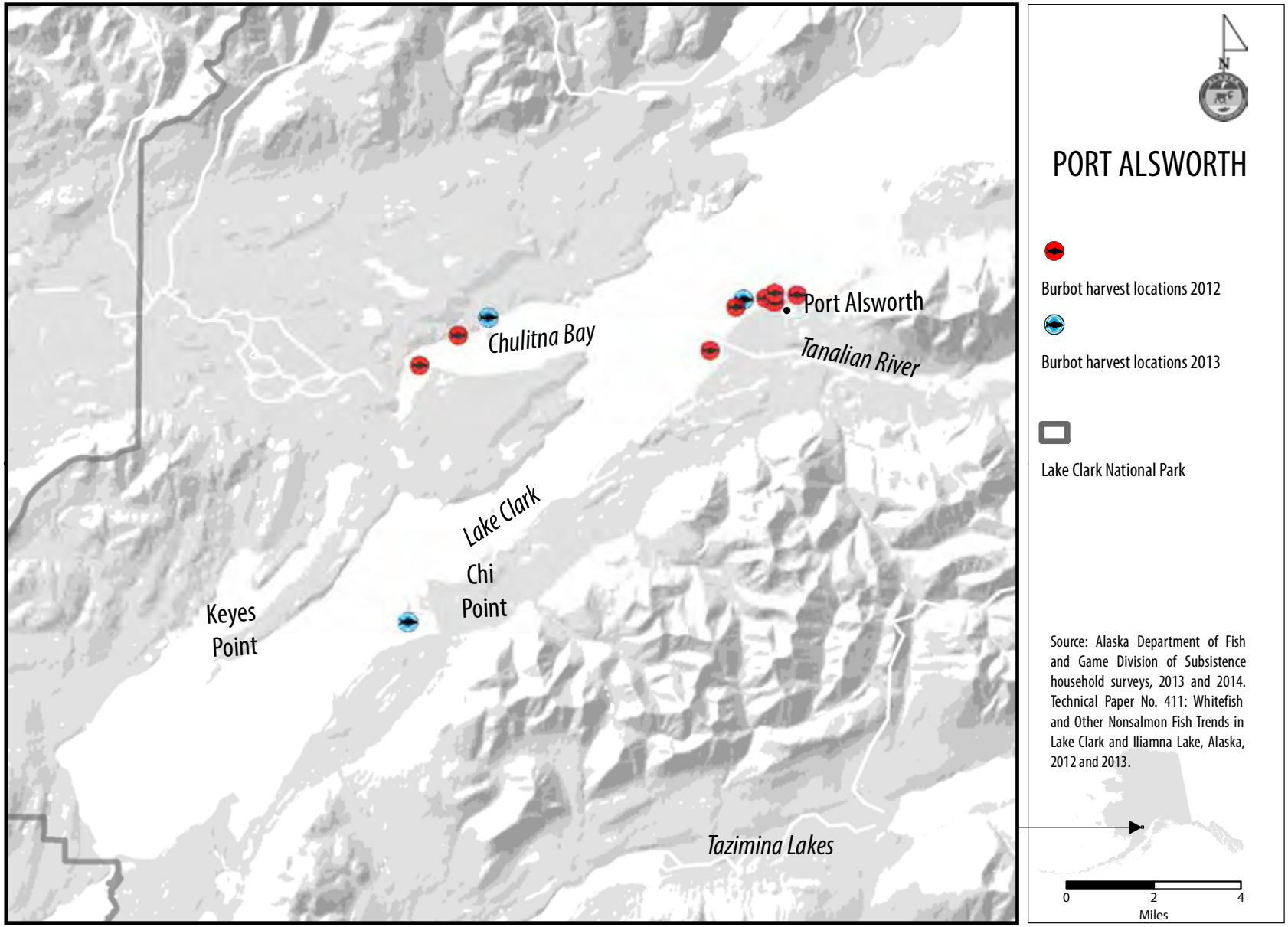


Figure 3-104.–Harvest locations of burbot, Port Alsworth, 2012 and 2013.

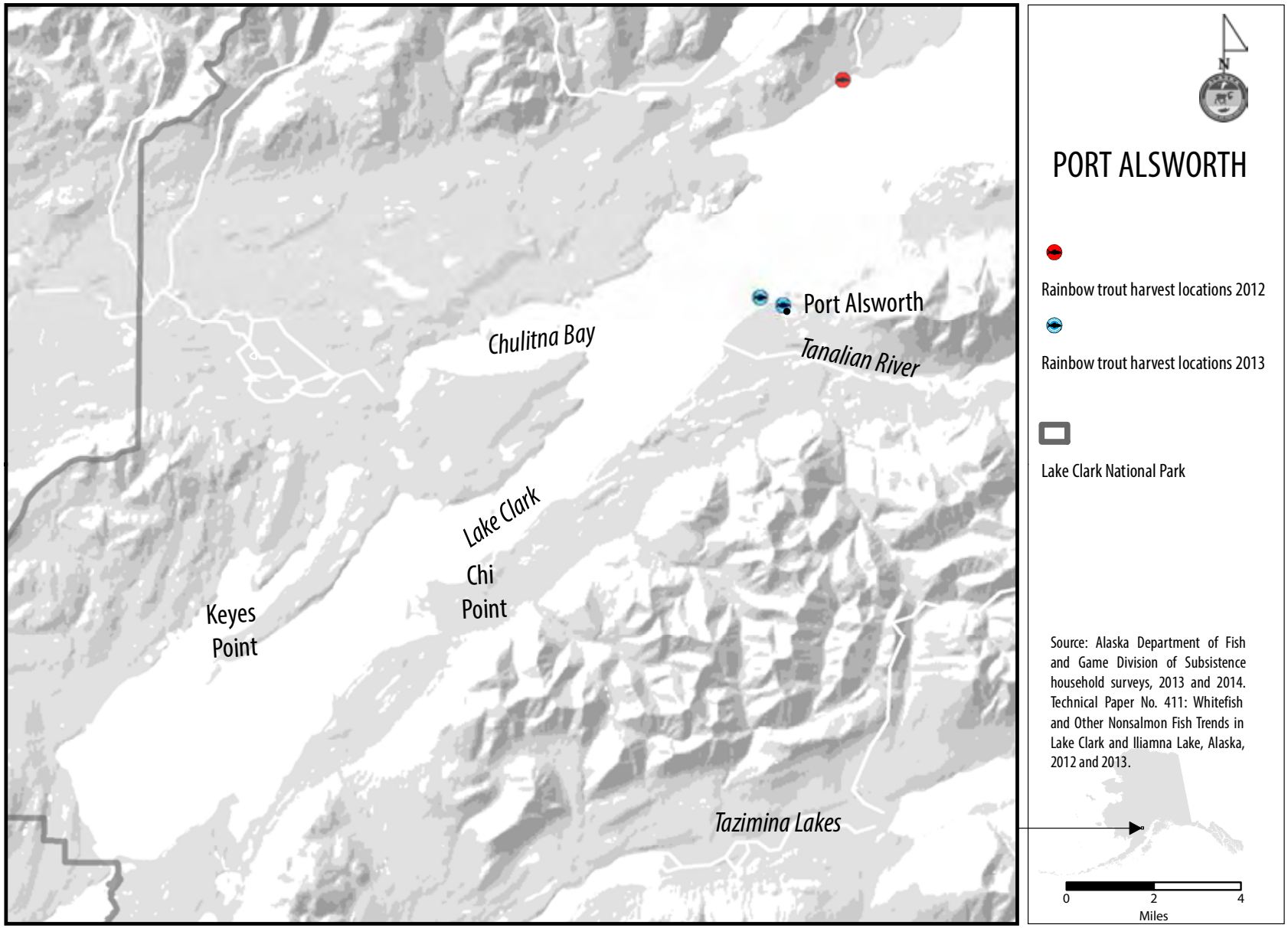


Figure 3-105.–Harvest locations of rainbow trout, Port Alsworth, 2013.

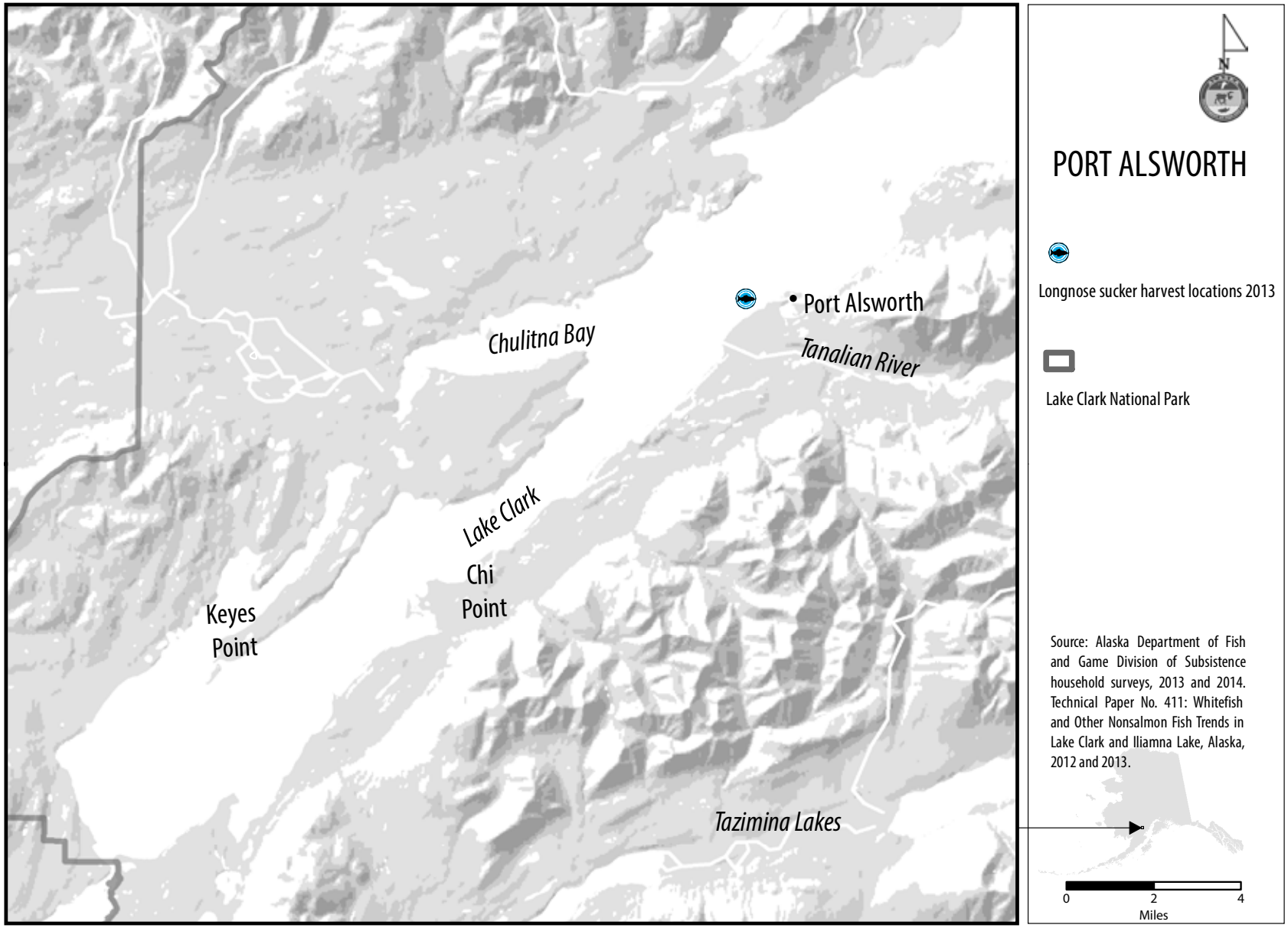


Figure 3-106.–Harvest locations of longnose sucker, Port Alsworth, 2013.

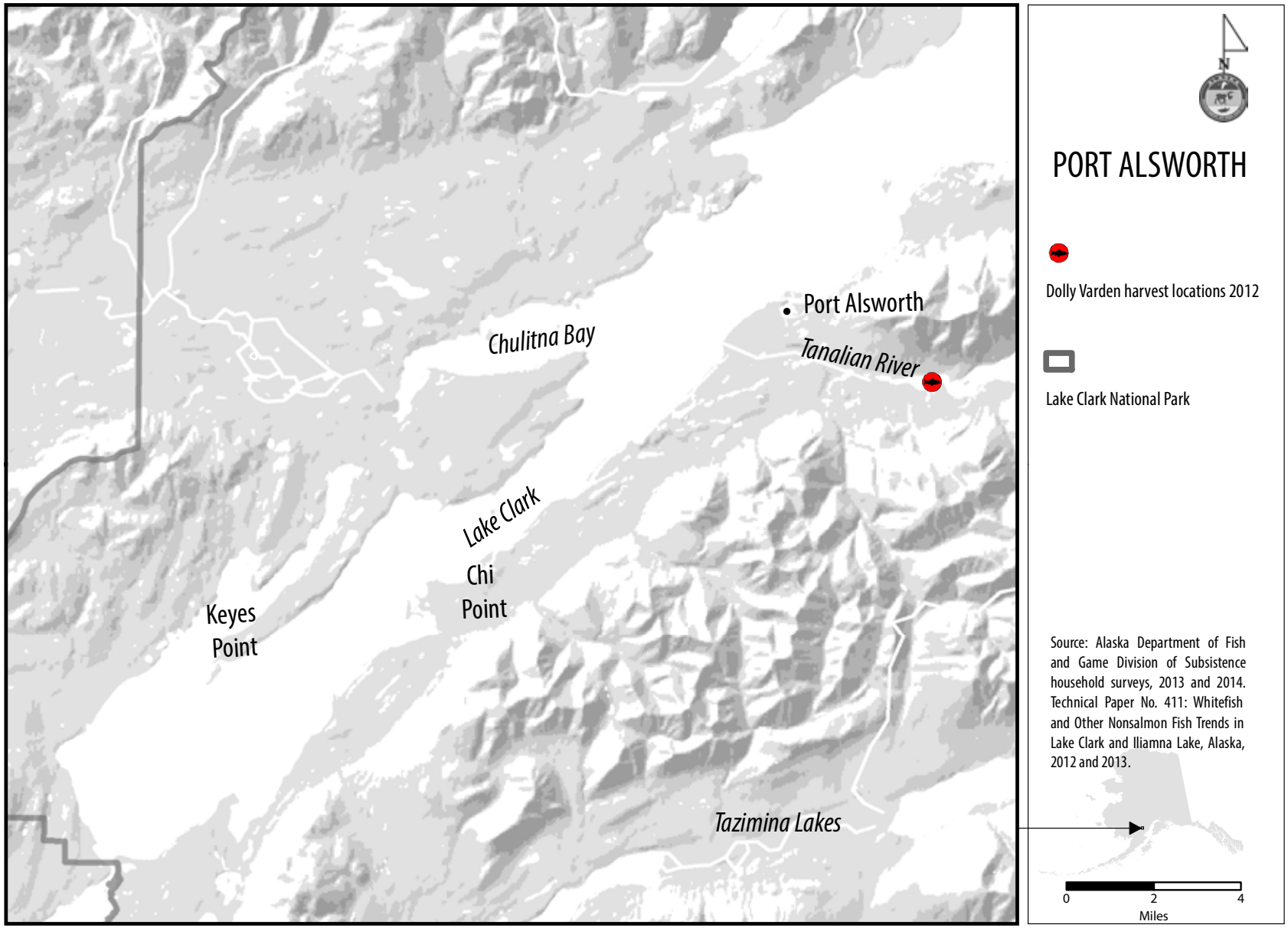


Figure 3-107.–Harvest locations of Dolly Varden, Port Alsworth, 2012.

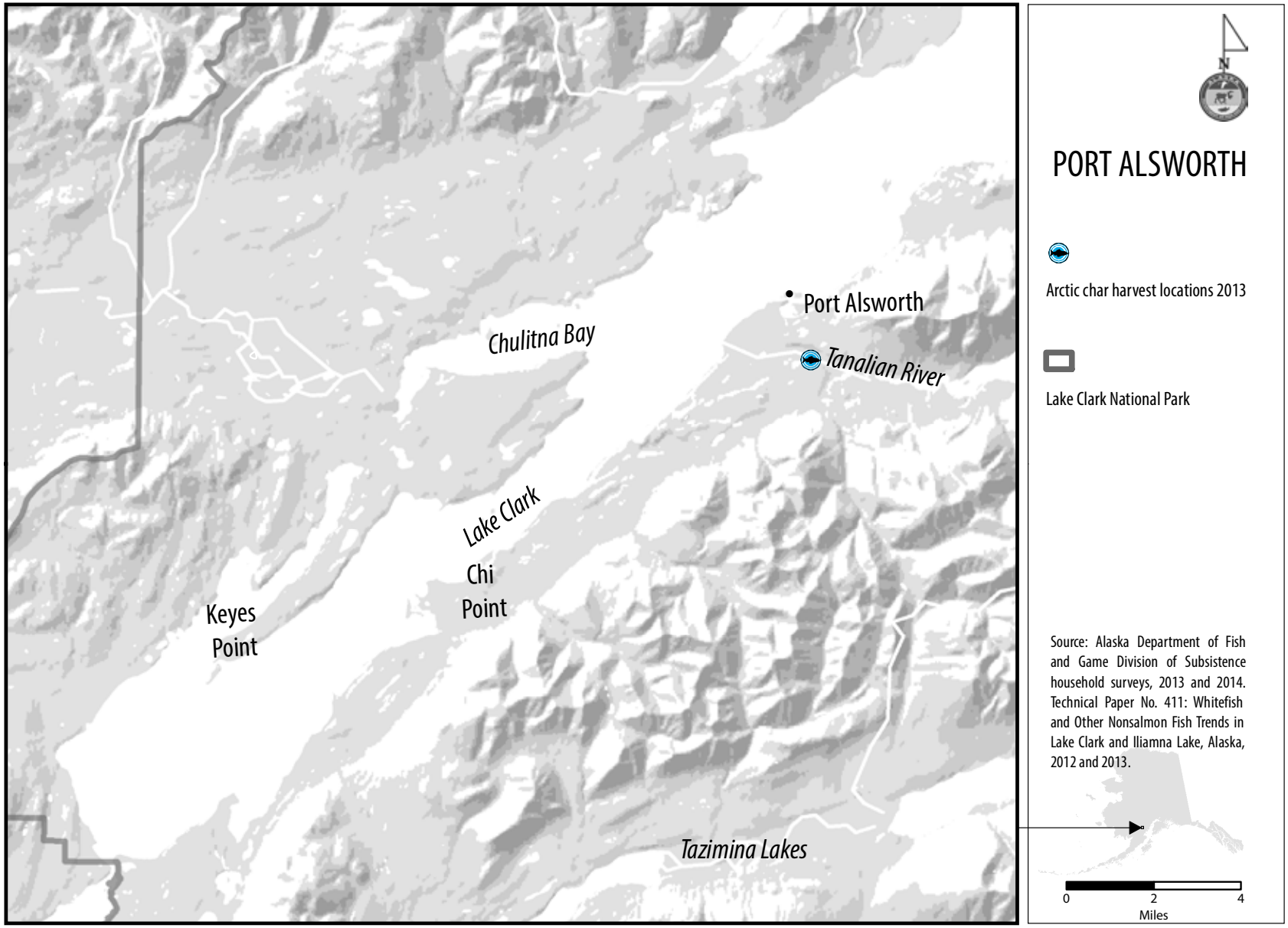


Figure 3-108.–Harvest locations of Arctic char, Port Alsworth, 2013.

4. FACTORS SHAPING HARVEST EFFORTS FOR EACH SPECIES OVER TIME

Seasonal Round and Importance of Whitefishes and Other Nonsalmon Fish

Igiugig—Seasonal Round

In Igiugig, a cyclical pattern of harvest is discernible as specific species are targeted at various times of the year based on seasonal availability. The residents of Igiugig rely on harvests of a wide variety of fish and non-fish species throughout the course of the year. The seasonal round begins in spring when people fish for whitefishes and other nonsalmon fish such as humpback whitefish, Dolly Varden, and Arctic grayling. During the spring, migratory birds travel through the area and are hunted by local residents. Bird eggs are also gathered in the spring and are an important wild food to the people of Igiugig. Once sockeye salmon arrive in the early summer, residents of Igiugig harvest them primarily with gillnets in the Kvichak River. Coho and Chinook salmon are also harvested. Later in the summer, spawning sockeye salmon are harvested at a number of fish camps primarily located downstream from the community. Salmon is "put up" for the winter after being smoked, dried, or canned. Gathering of berries also takes place at this time of year as they ripen on the tundra surrounding the village. During the fall and into the winter residents hunt caribou and moose. During the winter months, many households engage in ice fishing targeting char, trout, Arctic grayling, and northern pike. At different times throughout the year, beluga whales and freshwater seals also contribute to the diets of local people.

Igiugig—Resource Importance

Past research has demonstrated the significance of freshwater nonsalmon fish in the annual subsistence patterns observed in Igiugig and other communities along the shores of Iliamna Lake and Lake Clark (Fall et al. 1996; Krieg et al. 2005; Morris 1986). While nonsalmon fish are harvested by the people of Igiugig throughout the year, harvests are lowest during the summer months when local residents focus on salmon fishing. Whitefishes play an important role in the cyclical harvest pattern because they provide sustenance at times of potential food scarcity prior to and following the salmon runs in the area. Fishing for whitefishes with a subsistence net is most productive in the spring and fall. Whitefishes harvested in the spring are sometimes air-dried or frozen and stored for future use (Krieg et al. 2005:83). Igiugig residents commonly asserted that whitefishes caught in the spring with a net are an important food source, especially when the previous year's salmon harvests were insufficient.

The importance of whitefishes to the people of Igiugig is underscored by statements by local residents such as, "I don't know what I'm going to do if there are no whitefish … I want to keep whitefish all the time, that is good food for me." Local elders spoke of oral traditions and a warning that was passed down to them related to the coming of "a double winter" when salmon would not return to the area and nonsalmon fish would be essential to the people of Igiugig.

Iliamna and Newhalen—Seasonal Round

Iliamna and Newhalen will be combined for the following discussion because these communities share a number of characteristics, including geographical, that result in the residents for each following a similar seasonal subsistence round. In general, these communities can be characterized by a seasonal round that begins in spring with the harvest of nonsalmon fish—particularly locally available rainbow trout, Dolly Varden, Arctic grayling, and northern pike—by ice fishing. At this time, local residents may obtain whitefishes by traveling to Sixmile Lake or Igiugig where they are more plentiful. Once the ice has melted

Photo by Sarah M. Hazell, staff, ADF&G Division of Subsistence

Plate 4-1.–Local resident ice fishing near Iliamna, 2014.

and the weather becomes warmer, migratory waterfowl nest in abundance on nearby marshes and tundra where residents will go to collect duck and gull eggs. In the spring, preparations also begin for salmon fishing. In July, residents fish for sockeye salmon in large quantities using setnets at lakefront beaches and fish are "put up" for the winter by smoking, drying, canning, salting, and pickling. This is followed by fishing for spawned-out sockeye salmon from nearby streams (Fall et al. 2006). The summer season is also when berries are harvested—primarily blueberries and lowbush cranberries, but also salmonberries and crowberries ("blackberries"). Berry gathering continues into the late summer and fall when hunting activities replace fishing. Moose and caribou hunting expeditions along rivers and farther inland from Iliamna Lake ensue. At this time, upland game birds are also hunted. Some winter hunts for large land mammals may also occur. When the lake ice is thick, local residents hunt freshwater seals, although they may be taken at any time of year. In winter, residents may trap locally for small mammals, and many people ice fish until March or April, depending on the weather and timing for when the ice becomes unstable.

Iliamna—Resource Importance

As indicated in earlier chapters of this report, whitefishes are not abundant locally. An elder described her mother fishing when she was a young girl and when asked if her mother would catch whitefishes, she responded, "She wouldn't get many. Once in a while, one. We didn't have whitefish." Low abundance was commented upon by another resident who indicated he traveled approximately 15 miles by vehicle annually in March to obtain humpback whitefish (at a location close to Nondalton). He and his family would travel

to the Pickerel lakes, known locally as "Picker Creek," where whitefishes are known to be more abundant. The same respondent said, "If I catch a whitefish, I will keep it. They are all good."

Some residents indicated that sharing of whitefishes was common. When asked about sharing whitefishes, an elder said, "They always just bring us fish if they get lots. Send us 2 or 3 fish." Another respondent said, "I will give some fresh whitefish away, if I have more than I need," and also reported being a recipient of shared whitefishes: "I have cousins in Nondalton that have an underwater net. If they have extra they'll call us up. And I'll go pick them up the same day. I don't wait!"

Newhalen—Resource Importance

In general, community members did not recall fishing in the direct vicinity of Newhalen for whitefishes. When a local elder was asked if she fished for whitefishes, she responded, "Uh no. We never caught, well the only reason we caught them was because we were fishing for other fish through the ice. Every once in a while, we would get them in our nets." Rather, residents spoke of traveling to other areas to harvest whitefishes, like to Sixmile Lake and Igiugig. One resident reported going to Igiugig in the past to catch whitefishes; he said, "Oh yeah, we used to do that. Me and my cousin. In October. Enough to last us almost all winter. Roughly, almost a thousand." When an elder was asked about when he started fishing for whitefishes, he said, "When I was first born I was already thinking about whitefish, by Igiugig."

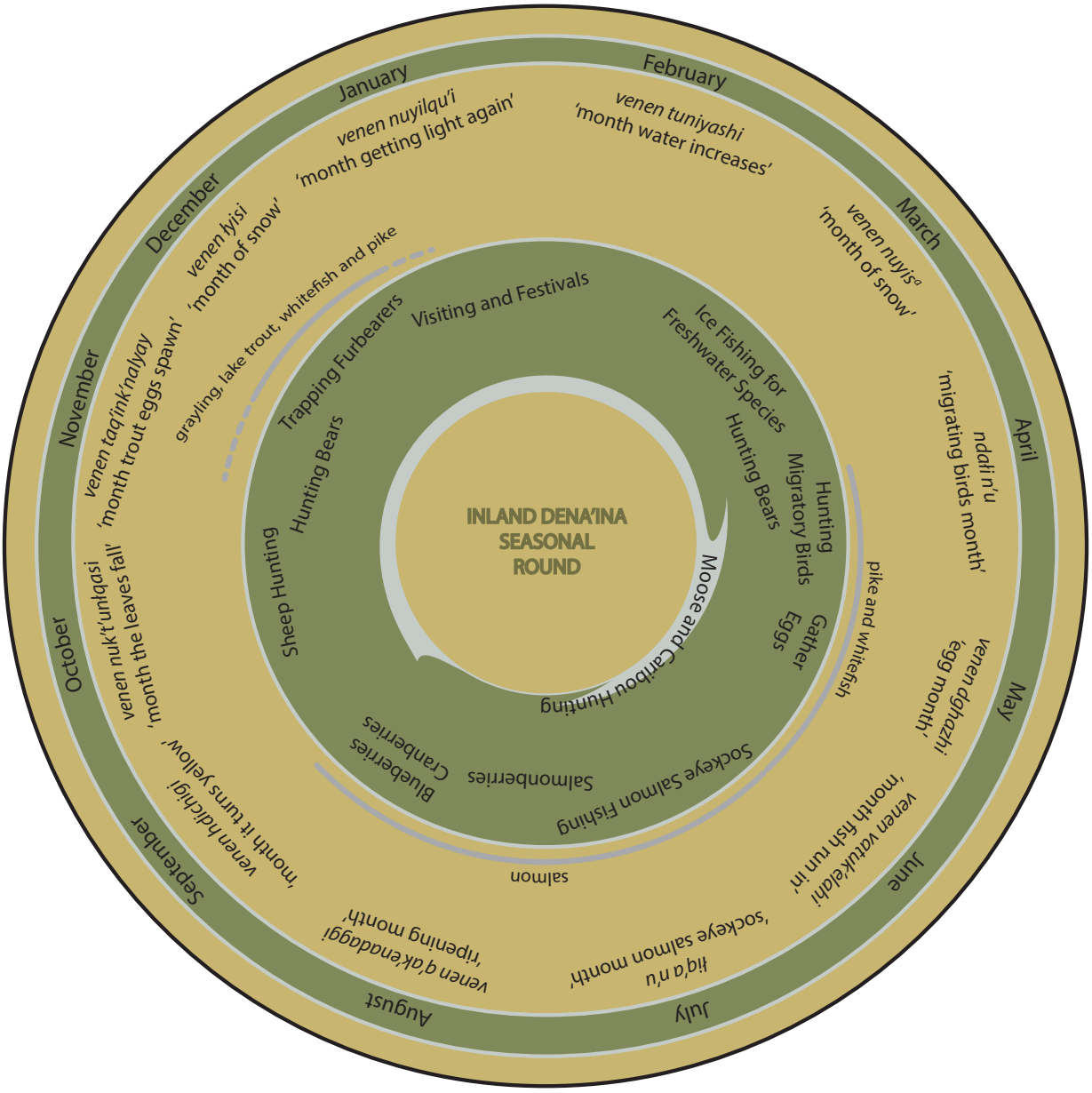
In terms of sharing, one elder spoke of a friend who would give him whitefishes; he said, "Every time around Russian Christmastime, I'd go over there. He was also dipping into his freezer and giving me a couple, 3, or 4 whitefish. And I would never eat them by myself. I always invited my friends." When whitefishes are shared, the fish may pass through a number of hands. For instance, one community member explained that she had just received some whitefishes. She said, "I just got a couple of them from one of my cousins. And she got them from someone in Nondalton."

Nondalton—Seasonal Round

Figure 4-1 represents the seasonal round as reported by researchers in the past (Ellanna and Balluta 1992:139–155; Kari 2007:161–163). Findings of this study suggest continuity of this seasonal round that continues to be practiced by members of the community. In spring, Nondalton residents enjoy fishing for whitefishes through the ice, starting as early as March when the weather starts to warm up and stored supplies of salmon are low from the previous year's harvest. Spring camp (*łitl'en nuch'etdeh*), used to primarily harvest whitefishes, other nonsalmon fish, and beavers, usually occurs from mid-April after Russian Orthodox Easter until the middle of June. Historically, the people of Nondalton had camps at locations along the Chulitna River from Nikabuna and Long lakes, as well as Caribou Creek and the Koksetna River. Other people went across Sixmile Lake to the south shore or South Pickerel Lake closer to the current community location. Nonsalmon fish and beaver availability were the most important factors in selecting spring camp locations (Ellanna and Balluta 1992:145). The hunting of migratory waterfowl also occurs during the spring. In the summer, sockeye salmon run into Sixmile Lake and move upstream into Lake Clark. Salmon and whitefishes are commonly harvested when people stay at *shan nuch'etdeh*, the Dena'ina term for summer fish camps. Residents occupy summer fish camps at the end of June until the middle of August. Berries are gathered during the summer months and into early autumn. In fall, hunting (*tunch'edał*) of caribou, moose, and black bears occurs; in addition, upland game birds are also harvested. Local residents catch whitefishes at this time, often incidental to other seasonal activities (i.e., while out hunting). Trapping (*naqeliteh ch'k'ezdlu*) occurs in the coldest months of the year when the fur of the animals—usually lynx, marten, and snowshoe hares—is at its best.

Nondalton—Resource Importance

For the majority of Alaska Native communities, salmon play a prominent and critical role in households from economic, social, and cultural perspectives. To the people of Nondalton, as with the majority of



a. March is also called *łiq'aka'a nu'u* (king salmon month) in Nondalton, *nuk'delayi n'uyi* (month wind brings things down) near Iliamna, and *ndałika'a n'u* (bald eagle month) in Lime Village.

Figure 4-1.–Seasonal round, Nondalton.

Alaska Native communities, freshwater fish have also historically played a significant role in the lives of community members, and whitefishes, in particular, continue to be important today. Local oral tradition includes stories about the importance of whitefishes when salmon and large land mammals may be limited or unavailable. These stories also emphasize the importance of whitefishes and other nonsalmon fish for dietary diversity and food security in Nondalton (Ellanna and Balluta 1992:27). According to one Nondalton resident who participated in an earlier study, whitefishes were particularly important sources of food in the spring since they were relied on when stocks of other proteins were low prior to the spring and summer runs of salmon, "Whitefish dried, we use it until the salmon come. If you got whitefish, you cut it and hang it in the smokehouse" (Stickman et al. 2003:51).

The importance of whitefishes to Nondalton residents today was stressed by 2 elder participants when they said that they might go hungry if they did not get enough whitefishes. Another Nondalton resident clearly underscored the importance of whitefishes in this way: "Whitefish is really important to us. If we don't have the salmon we have to have the whitefish." Other Nondalton residents stressed the importance of whitefishes for fostering and maintaining social networks via sharing and receiving whitefishes with communities across the Bristol Bay, Upper Kuskokwim, and Cook Inlet regions and beyond.

Pedro Bay—Seasonal Round

Whitefish species are not regularly harvested or used by residents of Pedro Bay because whitefishes are not locally available in the northeast portion of Iliamna Lake. This is reflected by the 2012 and 2013 whitefish harvests where only 1 whitefish was harvested during the 2 study years (tables 3-40 and 3-41). Whitefishes are never targeted by residents. Consequently, whitefishes do not play a role in the typical seasonal subsistence round of residents. This is highlighted by one key respondent's recollection of whitefish use when she was a young girl. She said that the last time she caught a whitefish was at Edna's Bay in Pedro Bay. It was springtime, early April, and she was approximately 8 years old. Her father said it was a whitefish and he could not believe she had caught one. He told her the name in Dena'ina but she did not recall the name. ADF&G researchers showed her a whitefish identification picture and she said it looked like broad whitefish and described it as "really fat." The very next summer in July, she said they caught 2 more in nets, but that they were the "skinny ones" (like "candlefish," the local name for round whitefish) (Krieg et al. 2005; Russell 1980). She said they did not eat them and they gave them to elders who knew what they were.

Harvesting patterns throughout the year in Pedro Bay are similar to that of other local communities (Fall et al. 2006). Following the spring thaw, residents begin harvesting edible greens as well as ducks, geese, and bird eggs. Sockeye salmon are very important to the community and these fish reach the vicinity in early July. They are harvested intensely for several weeks. During the summer months, residents also fish for nonsalmon freshwater fish. Later in the summer and early fall, residents hunt for moose and other game, and they also pick berries. Additionally, spruce grouse and spawned-out salmon are harvested in the fall (Morris 1986). As winter approaches and lakes freeze, some residents begin ice fishing for nonsalmon fish—primarily trout and char. These winter harvests provide food during a period when other resources are scarce and supplies are being depleted. Historically, trapping and hunting of small game were also undertaken primarily in the winter months. Nonsalmon fishing continues into the spring until ice conditions become unstable (Morris 1986). Many residents report that nature has become more unpredictable in recent years, and that this is making it difficult for hunters and fishermen to follow a traditional seasonal round (Holen et al. 2005).

Pedro Bay—Resource Importance

Most survey respondents from Pedro Bay admitted having little knowledge of whitefish species but highlighted the importance of other nonsalmon fish species to the community. Some respondents suggested that residents of Kokhanok and Igiugig would have more information on whitefish species. When asked if they could obtain whitefishes from other communities on Iliamna Lake if they wanted to, many respondents replied that they could, but they do not have a desire to do so. This lack of sharing of whitefishes with Pedro

Bay from other communities is supported by previous studies by ADF&G for study years 1982 and 1983 (Morris 1986), 1996/1997 (Kenner et al. 1999), 2003 (Krieg et al. 2005), and 2004 (Fall et al. 2006). When asked about the historical importance of whitefishes to the community, a key respondent stated:

> I have never even heard anyone talk about it. Not in my lifetime anyway. I don't know any traditional stories about whitefish.

In both years of this study, only one survey respondent reported that whitefishes were important to their household (Table 3-13). Importantly, this family moved to Pedro Bay from Nondalton in 2012 and spent little more than a year there before moving elsewhere; this household's members previously fished for whitefishes in the Newhalen River at Landing, but made no effort to fish for these species while in Pedro Bay. Another survey respondent noted that their household would use whitefish species if they were available locally.

It is unclear if Pedro Bay residents used whitefishes more heavily prior to the establishment of the current village site. One key respondent remembers her father bringing whitefishes home from the Nondalton area in the 1930s. She also remembers her mother preparing them, but she does not remember what the fish looked like, how they tasted, or how they were acquired. A member of a household who spent his first few years of life in Old Iliamna village indicated this about whitefishes: "Can't be important, because we don't get it and we don't try to get it."

Port Alsworth—Seasonal Round

The seasonal round of harvest in Port Alsworth is similar to other communities in the Bristol Bay region of Alaska. Sockeye salmon migrate up the Kvichak River from Bristol Bay, passing through Iliamna Lake and the Newhalen River, north into Lake Clark. Sockeye salmon typically arrive in the vicinity of Port Alsworth in early July. Sockeye salmon is the only salmon species widely harvested in Port Alsworth since other species do not normally inhabit the area.

Other mid-summer activities include fishing for trout, northern pike, and Dolly Varden, and harvesting green plants. In late summer, Port Alsworth residents pick berries and continue to fish for trout and northern pike in the open waters of Lake Clark. In fall, Port Alsworth hunters look for moose in the rivers in valleys leading into Lake Clark. Caribou hunting season begins later—in early winter.

In recent years winter activities have been limited due to lack of snow and ice, which makes traveling conditions poor. Trapping and caribou hunting activities are both largely dependent on cold weather. Some Port Alsworth residents cross the lake ice on snowmachines to track animals. During the 2 study years for this project, residents reported that the lake was never safe for crossing, so trapping and winter hunting activities were minimal.

Port Alsworth—Resource Importance

Whitefish species are not widely used in the community of Port Alsworth—as noted in Chapter 3 only 29% of surveyed households used whitefishes in study year 2012, and a smaller proportion of households used whitefishes in 2013 (14% of surveyed households) (Table 3-17). Many households that did harvest whitefishes during the 2 study years commented that the whitefishes that they did catch were not targeted; rather, whitefishes were caught incidental to other fishing effort and used in the households so as to not waste the fish. A few households in Port Alsworth commented that even though their households do not use whitefishes, they think it is very important that whitefishes are available to the people of the area. Other households commented that they do not use whitefishes in their households, but they notice that the whitefishes they see in the area seem to be abundant and healthy.

Summary of Use Patterns and Traditional Ecological Knowledge Observations by Species

Whitefishes

The study's survey asked local residents about the harvest and use of the following whitefish types: humpback whitefish *Coregonus pidschian*, round whitefish *Prosopium cylindraceum*, least cisco *C. sardinella*, sheefish *Stenodus leucichthys*, broad whitefish *C. nasus*, and Bering cisco *C. laurettae*. The ranges of sheefish, broad whitefish, and Bering cisco generally occur farther north of the study region but were included in the survey to highlight sharing practices between households across the state. By far the most common whitefish species harvested were humpback whitefish and round whitefish. Least ciscoes were only occasionally harvested.

In addition to survey administration, a total of 26 key respondent interviews were conducted in the study communities to collect traditional ecological knowledge concerning humpback whitefish, round whitefish, and least cisco. This information is grouped according to the following discussion topics: trends in harvests or populations over time, physical characteristics and health, spawning and seasonal movements, interactions with other species, local taxonomies, traditional management, and preservation and consumption methods.

The scope of data differs by community based on the qualitative data collected at each location during surveys and key respondent interviews. Regardless of the level of whitefish harvesting activity in each community, for consistency the same key respondent interview protocol was used. As noted in Chapter 3, and above, some communities are not as active in harvesting whitefishes and therefore there may not be data representative of each discussion topic. If a community is not represented in a section of discussion it is because there was an absence of these data due to inactive harvest of whitefishes.

For example, Pedro Bay residents did not contribute species descriptions for whitefishes during this project. Most households were unfamiliar with what whitefishes looked like and what species were considered a whitefish species. Of the 2 households that harvested a whitefish species in the past 10 years, neither household recognized the fish when it was caught. Both households brought the fish home in an attempt to identify the species, and later suggested that the harvest may have been of least cisco since the harvested fish most closely resembled least cisco in the fish identification guides used in this project. Consequently, Pedro Bay will be excluded from the following discussion of whitefishes.

Humpback Whitefish

Trends in Harvests or Populations Over Time

Many Igiugig elders related that they were more successful at harvesting humpback whitefish in the past than today. In speaking of past harvest efforts, one elder and experienced fisherman had the following to say: "We'd set it [the net] out and pick it because sometimes you'd get more than you could handle. Yeah, some nights if you set the net out in the morning and then in the evening you'd probably have 30 or 40 fish in about 4 or 5 hours." However, the same elder reported that in recent years humpback whitefish harvests have diminished because fishing effort by residents has decreased. Humpback whitefish remain important to the households of Igiugig, yet residents are not harvesting as many as in the past. According to the same elder quoted above, harvests from 2012 were not as plentiful as in the past:

> We haven't been doing it really, we started right after we got our red salmon and silvers [sockeye and coho salmon] and sometimes we go down and set the net out if we want fresh whitefish and then we'll catch a few, 6–7, or maybe more but just for a few hours. We'd run up the creek and do some berry picking or cut some wood for the steam bath and stuff and then when we come back we pull the net up and we come home.

When asked how many whitefishes their household usually harvested in a year, members of an active fishing household had the following to say: "Man, last year [2012] was the least we ever got. Too much

high water and rain … one time I had about 7 or 8 overnight and then a few more days and then there was nothing. Five or 6 and then we didn't catch no more so I pulled the nets up." While residents of Igiugig stated that all of the streams that humpback whitefish inhabited in the past still sustain these fish, there was a pronounced opinion that populations have been declining, particularly over the last 20 years or so. In speaking about the decline, one of the most active fishermen in the community pointed out:

> Twenty years ago, boy there were just thousands of them. Now, it's just, you have to set the net out quite a few days before you get any. But if you hit it just right there, sometimes overnight you'll get 30 or 40. I haven't seen that anymore. Now just 5 or 6 or 7. Now you have to keep on going looking for them and when you see them start to come, then you go set the net out. Then you catch quite a few.

The decline was also confirmed by another elder who simply stated, "Seems like, to me there are less nowadays." In considering the decline in humpback whitefish numbers in more recent years, another Igiugig elder suggested that the decline would continue: "Lesser and lesser [humpback whitefish], I don't care how much protection Fish and Game does, just like the herring eggs. We know it's going to go away. Right away or slowly maybe."

These sentiments are echoed by an elder from Iliamna who recalled that when she was younger it was not difficult to harvest all of the whitefishes (most likely humpback whitefish) that her family needed in a single day, which she said today is no longer possible.

According to another elder in Iliamna, the humpback whitefish populations, along with those of burbot and char, were once very healthy—healthy enough to support the beginnings of a nonsalmon fish commercial fishery in the 1960s (Metsker 1967). In his words:

> There was a commercial fishery on the lake and they would buy whitefish and there was a guy called Whitefish Wally and the fishing operation closed because of the fire at the freezer. You could fish for half a day and make 30 bucks in '64 or '65. There was a Cree guy from Canada, and he taught us how to make the jigger board, and we learned how to set the net under the ice and make the commercial fishery, bait the net at the mouth of the Newhalen River. We got some huge fish, burbot and char. That first winter there was 6 feet of snow and it did not blow. It looked like a good idea but there was too much snow. You have to start when the ice is just first frozen, before there is too much ice.

One resident of Newhalen said that she had not observed any changes in humpback whitefish populations and harvests over time. She harvests these fish through the ice and catches 3 or 5 at a time to feed her family a meal of fresh fish. An Iliamna resident during the study who returned to Newhalen in 2014 suggested that if the humpback whitefish population is changing at all, then it is due to the fact that fewer people were targeting them and harvests reduced correspondingly through time.

One elder from Newhalen pointed out that whitefishes had been so abundant in Iliamna Lake and the area around Igiugig in the 1950s that his father was able to harvest enough for his personal needs and sell any surplus. His father stopped selling humpback whitefish around 1958 "when someone told him to stop." The same elder thought that the population of humpback whitefish in Iliamna Lake had declined in recent years since his family had harvested 10 or 15 humpback whitefish during the average fishing trip in the past but now were only harvesting 8 or 9 fish with a similar amount of effort.

One knowledgeable fisherman from Newhalen explained that the population of humpback whitefish was not declining in the area but rather, "… they are popping up in different places now. Maybe they are increasing but they taste different. The same fish but maybe different populations." The same elder also pointed out how methods of harvesting humpback whitefish have changed since he had used a seine to harvest "hundreds of them" in the past and now most often uses a setnet or catches whitefishes through the ice.

One Nondalton resident thought the whitefish population was strong in 2013. He pointed out that when the net was set under the ice in winter to harvest whitefishes that there was enough for anyone who wanted

Photo by Theodore M. Krieg, staff, ADF&G Division of Subsistence

Plate 4-2.–Humpback whitefish harvested with a net under the ice, Nondalton, 2013.

some. Another elder reported there was little change in the humpback whitefish population through time and took a positive view of the health of the population and attributed harvest success to effort: "It's about the same. If they just go just out there and go for it like everybody did, everybody will have all the fish they want."

This optimistic view of the humpback whitefish population trend was not shared by everyone in Nondalton. When asked to reflect on changes in fish populations over the years, 2 elders said that they thought there were fewer fish in general in Lake Clark than in the past.

Other Nondalton residents thought the population of humpback and other whitefish species had remained relatively constant over recent years while recounting that there were larger populations of whitefishes at the lake near Nondalton when they were children (around 50 years ago).

When asked what might account for a decline in the population, one elder had the following to say: "Seem like a long time ago there was more, remember when we were in grade school, there was lots right out here … and we used to fish through the ice, but seem like now there is not that much. What I'm thinking what could be happening is the lake trout and pike are eating them up, too." One person from Nondalton indicated hearing stories in the past and seeing photos of wooden boats completely full of whitefishes (most

likely humpback whitefish), but the dwindling population over the past 10 years have made such harvests no longer possible. Another person from Nondalton said community members in the past regularly set a 300-foot net under the ice to catch humpback and other whitefish; this net would catch more than 100 fish in a day, but people are no longer fishing for whitefishes as much as in the past (see chapter 5, "Factors Influencing Residents' Ability to Harvest Nonsalmon Fish").

Almost all respondents in Port Alsworth commented that humpback whitefish populations appear healthy.

Physical Characteristics and Health

Residents of Igiugig stated they had not noticed changes in the size or health of the humpback whitefish population. One elder said that the humpback whitefish harvested in the fall were "richer." Another elder stated, "After they spawn they kind of get mushy meat, because they spawned, I think. Then they come back in the springtime and fall and they get fat again."

One elder who resides in Iliamna thought that the size of whitefishes in the area was declining as was the overall population.

An elder from Newhalen said he thought humpback whitefish were decreasing in size. Another experienced fisherman from Newhalen thought the size of humpback whitefish in the area had remained consistent through time but differentiated between those harvested around Igiugig in Iliamna Lake and those harvested in Sixmile Lake or Lake Clark in the vicinity of Nondalton: "Their humpback up there [Igiugig] are huge, like 30 inches or so, just about the size of sheefish… . Yeah at Igiugig and they have some at Nondalton. But the Nondalton ones are different, they taste different. The Igiugig ones are better." Another elder from Newhalen also said humpback whitefish near Nondalton are not as big as those near Igiugig: "Not strong like the other whitefish, they are mushy; they have no muscle when they reach Nondalton because there aren't many currents to build their muscles."

The perceived decline in the number of people from Nondalton fishing for whitefishes was attributed to the changing health of the fish: "Whitefish have worms on them these days so less people want to eat them." Another person from Nondalton said whitefishes in the area had developed a taste for oysters and corn used as bait. While residents did not report any changes in the size or health of the humpback whitefish population, they did report some differences between fish found at different locations. One Nondalton resident said whitefishes found at Indian Point, most likely humpback whitefish, were bigger with harder scales than those found in other areas of Lake Clark.

Spawning and Seasonal Movements

Residents of Igiugig said that whitefishes were in their area in the spring prior to the sockeye salmon run and in the fall after coho salmon had passed the village. One village fisherman stated humpback whitefish move into the Kvichak River system and he had observed them spawning in Kaskanak Flats, Kaskanak Creek, and the Alagnak River (known locally as "Branch River") in the later part of November. He said:

> I think they come in from down the bay because I was commercial fishing down there and I used to catch them after red [sockeye salmon] season, like the end of July and the first part of August. I used to catch whitefish out in the bay. Sometimes 10 or more.

When questioned further he stated, "They come on through and I just happened to set where they were making the run up the Kvichak and I caught them." He explained this was during the time "when silvers [coho salmon] are here." When asked if he had seen humpback whitefish in the Kvichak River going past Igiugig into Iliamna Lake he answered affirmatively: "They [humpback whitefish] come up from down the bay; they come up and feed and they live up in the lake here."

When asked if the humpback whitefish caught in other communities of the region around Iliamna Lake and Lake Clark are the same fish that are found in the Kvichak River, local residents responded that they thought they were. One local elder and active fisherman asserted that people from other villages in the area differentiated the humpback whitefish found in their communities from those found in Igiugig (stating that

the humpback whitefish found around Igiugig were bigger than those found in other areas around Iliamna Lake and Lake Clark); however, he thinks they are the same species.

Humpback whitefish movements were likened to those of salmon:

> Even the salmon down here [around Igiugig], are way bigger than the ones that are up there in the spawning areas. Because they use all their energy and fat by the time they get up there [to other communities around Iliamna Lake], and they lose a lot of weight.

Other residents were less sure of the exact paths followed by humpback whitefish throughout the year. As one knowledgeable fisher from Igiugig stated:

> They [humpback whitefish] go all over. They move around, they don't stay in one spot. When they move, that's when they disappear and we don't get them anymore. They don't stay still, them fish.

Igiugig residents stated that humpback whitefish spawn in many places in the area. As described above, many residents suggested humpback whitefish spawn in Kaskanak Flats, Kaskanak Creek, and the Branch River. Two elders discussing this issue said humpback whitefish do not spawn in Ole Creek:

> [Ole Creek] has a lot of suckers, not many whitefish. And Pecks Creek too, there are a few [whitefishes] but not that many. Kaskanak is lots of weeds and growth in the creek. Really good feeding I guess, and a lot of clams and little small fish.

When asked to describe Kaskanak Flats (the braided Kvichak River area south of the mouth of Kaskanak Creek) an elder stated:

> The flats is just all these islands and the sloughs in them, that's what they call the flats. The Kaskanak Flats, and it's all fresh water and there are no weeds or grass in them, they are all streams running pretty swift. The side sloughs is where there is really slow-moving water and where the whitefish spawn.

He also provided more in-depth descriptions of good habitat where he has seen humpback whitefish spawning in Branch River: "… where the sloughs are pretty deep and lots of moss and weeds and stuff so they protect the fish from eating them, you know other—salmon and rainbow and grayling and stuff, they eat a lot of their eggs." He also said it was similar for Kaskanak Creek:

> I've only seen them a few times [in Kaskanak Creek] but when the whitefish get ready to spawn we don't bother them, we don't put the net out anymore—so that's why I don't see them, I've only seen them a few times where the weeds and—I don't know what they call it—long weeds that they lay their eggs on and they stick the eggs to this growth that looks like seaweed.

One experienced fisher from Igiugig said that both banks of the Kvichak River downstream from Igiugig used to be spawning areas for humpback whitefish but these days the fish are spawning on the north bank of the river between the community site and the confluence of the river with Iliamna Lake. Yet another Igiugig resident suggested that humpback whitefish spawn "up and down" Iliamna Lake. In terms of timing, it was suggested by Igiugig residents that humpback whitefish spawned the latter part of November and in the spring, although not much knowledge about the spring spawning events was expressed. It was also suggested that the humpback whitefish carried their eggs all summer until the late fall when the eggs "became looser and they are getting ready to spawn."

Iliamna residents did not wish to share their knowledge of the seasonal movement of humpback whitefish. The words of one elder may help to explain this reluctance:

> … One thing that I won't share too much about is when the runs are … certain times of the year it is the locals' time. The rest of the time they are all sport fishing. The State of Alaska should come out and stay with us for a few years if they want to do that, then they can see how the locals really live … . Whitefish, suckers, in the springtime we do

> all of those. This is our time of the year before anybody comes in. And that is why I do not share the dates too much.

One Iliamna community member thought whitefish spawn in the Pickerel lakes near Sixmile Lake.

One Newhalen resident said that humpback whitefish "come up from the Kvichak in November month, down by Igiugig." Another person from Newhalen thought that the same fish come up the Kvichak River to Igiugig in October and November. An experienced fisherman from Newhalen who often fished in the Igiugig area said the following about humpback whitefish:

> [They] stay up there in the [Kaskanak] creek … they just move up and down the creek … . They only catch them in the Kaskanak side October and April, 2 runs … they go in spurts, they aren't like salmon, they don't go consistently. They go in schools, like different families that go up sporadically.

One elder from Newhalen thought humpback whitefish spawn in October before the water freezes over. The same elder thought these fish spawn in Upper and Lower Talarik creeks. Another elder from Newhalen thought that humpback whitefish came up the Kvichak River and spawned in Iliamna Lake close to the village of Igiugig. An experienced fisherman from Newhalen thought humpback whitefish may spawn in the Kvichak River before reaching Iliamna Lake sometime in the fall.

Nondalton residents identified several humpback whitefish spawning locations. Members of 2 separate households in Nondalton thought spawning occurred in Pickerel lakes. Another Nondalton resident thought humpback whitefish spawned somewhere in the Chulitna River—perhaps in the spot known as Whitefish Slough. Lower Lake Clark was also identified as a spawning location. A Nondalton elder said humpback whitefish also spawn in the Iliamna River during April or May. These locations differ from those provided by residents in a previous study conducted by the Division of Subsistence more than 10 years ago (study year 2003), when Sixmile Lake was the only humpback whitefish spawning location identified (Krieg et al. 2005:86).

Interactions with Other Species

Residents of Igiugig stated that humpback whitefish often interacted with Arctic grayling, northern pike, and rainbow trout since these species eat humpback whitefish eggs and juvenile whitefishes. Unlike other communities involved in the study, Igiugig residents were quick to point out that humpback whitefish were rarely if ever found when any type of salmon were around.

An elder from Iliamna said he caught a giant 40 lb lake trout at Landing that had whitefishes in its stomach.

One resident of Newhalen suggested that populations of whitefishes are correlated to salmon populations in the area, "… less salmon may be related to less whitefish," he said, but did not elaborate.

Other nonsalmon fish, such as Arctic char, were thought to be feeding on humpback whitefish, leading to a decline in the population. Northern pike and lake trout were also said to prey on humpback whitefish, which is why the heads and tails of these whitefishes were reportedly used as bait to harvest these predators. One Nondalton resident reported harvesting a lake trout that had 3 or 4 whitefishes in its mouth when it was caught. Arctic grayling were not reported to feed on humpback whitefish but were observed cohabiting waters in the vicinity much more often than in the past.

Residents of Port Alsworth said that humpback whitefish are often caught in their subsistence salmon nets during the salmon season and are kept as part of their harvest.

Local Taxonomies

One Igiugig elder said that the Yup'ik word for humpback whitefish is *uraruq*.

Many residents of Iliamna used the term "trout" or "trouts" when referring to humpback whitefish. One elder clarified the local use of the term "trout" in the following way, "Yeah, rainbows, Dollies, whitefish, candlefish [round whitefish]… . Trout is what we catch. Salmon is salmon but everything else is trout."

The Dena'ina name for humpback whitefish is *q'untuq* (Kari 2007:19).

Traditional Management

Igiugig elders reported that elements of what might be termed Yup'ik traditional management continue to influence their harvest practices today. One elder described traditional management patterns in the following way:

> Some people don't pay attention to what those fish look like. Unlike us, we watch for whatever fish we caught. And some people tell, told us we might get something we don't know. That's why we look at the fish. When we don't know them, we don't mess with it, we don't eat it. 'Cause old people tell us, "When you see fresh fish and something changed don't eat it. Just leave it." 'Cause we don't know what they are. Fish are law for old people, they got laws but they are not written down. That's why old people used to get a lot of fish, and when they got enough they got enough.

Many people talked about Yup'ik cultural prohibitions on wasting fish: "We don't waste it [whitefishes], we cook the eggs and we even cook the milt and the stomach, the liver. Only thing you throw away is the bile … . We don't waste nothing on our food."

The harvest of whitefishes and other nonsalmon fish in Iliamna is guided in part by customary management principles such as a prohibition on overexploitation of the resource or wanton waste of what is harvested. A community elder shared the following reflections on traditional management and the teachings that he received from his elders that inform his subsistence practices today:

> The one thing that my grandma ever told me about fish was that if you catch fish, don't waste it. That's the only taboo that she ever taught me. But she said there are the certain times that it's most abundant and that you catch them, you don't waste them, because there is a lot running at that time … . The only other taboo that we have is during Easter Lent. During the last week, nobody fishes or hunts or does anything else. So, before Good Friday, it will be starting the Sunday before Good Friday, all the way until Saturday at midnight. No fishing, no hunting, nothing.

Many Newhalen residents spoke of an existing prohibition against overexploitation of nonsalmon fish species as being related to traditional management principles. When one experienced fisherman from Newhalen was asked how many humpback whitefish he would like to harvest in a year for his family, he had the following to say, "About 30 because there are not many of them, so we did not try and catch as much. We were trying to preserve them. They are unique to the Kvichak and we only caught so many so they would come back." According to the same individual, social pressure and the threat of social sanction ensured that people adhered to the traditional management practices. In his words, "When we went to Igiugig [to harvest humpback whitefish], we told them how many we caught and that's how we managed them. People generally knew how much people were catching. They never abused this. It was a set guideline. If you caught more than what you needed, then they made you share."

This continuity of practicing self-regulation of harvest continues in the present. Residents of the region continue to practice traditional or customary forms of management and they self-regulate their harvests of nonsalmon fish. While reflecting on customary or traditional management of nonsalmon fish, one Nondalton resident stated that people know where fish spawn and do not interfere with the fish or habitat during spawning. He also noted local fishers do not overharvest. They know exactly how much they need and pull their nonsalmon fish nets when they have harvested enough. Nondalton elders often spoke of traditional or customary management in terms of using all of what was harvested. When asked what they do with nonsalmon fish bones after processing the fish, 2 elders shared the following:

> [Respondent A] If we have dogs we would give them to the dogs. I got some on the outside freezing. I'll take it out to the eagles.
>
> [Respondent B] Back to Mother Nature … give it to the eagles.

> [Respondent A] Yeah, I'd hate to throw it in the trash can, when the eagles can eat it.

In speaking about traditional management and the use of fish traps, one elder from Nondalton reported:

> That they drive the poles so where the fish is coming up the creek they would go right in the trap. They used to check that all the time, twice a day sometimes, 'til they get enough that day. Pull all the poles when the fish go by. They used to think about letting some fish by, let them go up to their spawning ground … . They used to be strict about that. If we don't let fish by—we don't get fish next year.

These sentiments were also shared by Nondalton community members 10 years ago, thus suggesting continuity in understandings and practices related to management of nonsalmon fish by Dena'ina. In 2004, a Nondalton resident shared the following: "They never wasted anything. They had ways of saving it. We still don't waste anything now; we don't get any more than we need" (Fall et al. 2006:177).

Preservation Methods and Consumption

Igiugig residents described many different methods of preserving humpback whitefish. One elder remembered her mother storing humpback whitefish in a grass basket on top of her family's cache. Smoking of humpback whitefish was not popular; yet drying fish was said to be popular in both spring and fall. One Igiugig elder described the drying process in the following way "You just hang it outside, put wood and lay them straight. Put stick through. You put 2 poles and you are having your fish—2 inside the skin, slide them straight out. Hold them down until they are nice and dry—. So you turn it so the skin faces outside. Yeah, the skin is outside and the meat is inside." Freezing of humpback whitefish was reported to occur during the fall for consumption during the winter. Canning was also mentioned as a method for preserving humpback whitefish in Igiugig, particularly for fish that was destined to become incorporated into *akutaq*, or fish ice cream (also called Eskimo ice cream). Akutaq is a sweet, frozen dessert made with flesh of the fish, as well as fat and sugar, and sometimes berries. Humpback whitefish dried in Igiugig circulated in the area and around Bristol Bay according to a survey respondent.

Igiugig elders spoke of past consumption patterns by sharing memories of women going to the bank of the Kvichak River and cleaning whitefishes that had been harvested in nets by men.

> When they bring those [humpback] whitefish, in the nighttime, the women cleaned them right away, even in the nighttime. Clean stomach, … and feed those eggs and guts to the men in the *qasgiq* [men's community house]. Brought those in and serve them.

Many people spoke of consuming dried humpback whitefish with oil harvested from bears, seals, or beluga whales. According to one elderly couple, they only began to eat akutaq in their adult years, but ate berries with rendered marrow or fat from moose when they were younger. The same couple stated that they now consume humpback whitefish as akutaq with highbush cranberries, a practice learned from a family in the neighboring community of Levelock. They also mentioned that the firm texture of humpback whitefish harvested around Igiugig, particularly from Kaskanak Flats, lends itself well to boiling after being frozen. The people of Igiugig also reported consuming the skin of the humpback whitefish, after removing the scales.

Some members of the Iliamna community remembered that when they were young people put whitefishes and other nonsalmon fish in an underground cache. An elder made a connection between the practice of storing nonsalmon fish in an underground cache and climate change in the following way:

> Well, 35 years ago the permafrost was a maximum of one-and-a-half to two feet below the surface. And we used to have, where my gram's house is, hers was one of the first here, we had a bank cutaway. There would be sod cut about a foot-and-half to a foot, we would pull it all up. Then we would dig down a little bit to the ice, so it would be like a built-in refrigerator. And we would line it with grass; put a layer of fish in there, another layer of grass, another layer of fish. And all winter long it would be like fresh. But now the permafrost is almost seven feet down.

Photo by Theodore M. Krieg, staff, ADF&G Division of Subsistence

Plate 4-3.–Local resident cleaning humpback whitefish, Nondalton, 2013.

Another elder said that she did not always preserve the humpback whitefish that she harvested but rather gave those fish that she did not consume fresh to other households in the community. She also said that during the spring she likes to dry whitefishes and northern pike for consumption during the winter months. The same elder remembered fishing for whitefishes with her mom and putting them in an underground cache, air drying them, or smoking them in the days before freezers where introduced to the community. Putting humpback whitefish and other types of nonsalmon fish in the freezer was a common practice although some people preferred to air dry or smoke their harvest. One elder from Iliamna said that she likes to have a fair amount of whitefishes in her freezer so that she is always prepared to share them with others who give her other subsistence foods.

One member of the Iliamna community stated that she liked to eat humpback whitefish boiled and dipped into local seal oil. Humpback whitefish was also used to make akutaq. Another community member shared his joy of eating whitefishes on the beach with his family: "I just love it. Just love to get out. We'll have a fire on the beach, whether it be pike or whitefish or grayling. Whatever, we are fishing, rainbows, we will have a picnic. When the fish quit biting for a while, you just go over to the fire, maybe eat something, then go back. It is just like a big picnic for us."

Residents of Newhalen said that there are many ways to eat humpback whitefish. They mentioned eating humpback whitefish raw, frozen, fried, boiled, and in akutaq. Humpback whitefish were considered a delicacy by one member of the Newhalen community when consumed frozen and dipped into rendered seal oil.

One Newhalen elder contrasted the current preservation methods of drying and freezing humpback whitefish and other whitefishes with the past practice of preserving whitefishes in underground pits. He described the process in the following way: "They put them in whole. They don't cut them up. They make good digs, almost three feet; they put grass all the way around and stick them in there. Sometimes they put bushes until they cover, and then put more grass and then more bushes. And they know exactly where they will be." The same elder also expressed a fondness for smoked whitefish: "They are good, you never stop eating them." Another resident of Newhalen spoke of his parents storing humpback whitefish harvested around Igiugig in a cache in a swamp: "They [the whitefishes stored in the pit in the swamp] would freeze but not too hard."

A Nondalton elder remembered how her mother preserved whitefishes: "In the past, I remember my mom at fish camp when we got whitefish, she fillet it and then cut it. And put it in the brine for few minutes, not too long. And hang it in the smokehouse. Dry it that way." Whitefishes were also hung outside to dry during the springtime. Another elder said that most often humpback whitefish were cut up into pieces and put in the freezer if they were going to be used to make fish *nivagi* (fish ice cream—a dessert made out of fish, fat, and sugar), which is the Dena'ina term for akutaq. Humpback whitefish were also split and hung in the smokehouse to smoke, particularly during summertime when at fish camp, while salmon were also being harvested and smoked. Another elder said she does not get as many humpback whitefish as in the past but those she does get she usually cooks and eats fresh; she also freezes some to send to her daughter who does not live in Nondalton. One elder commented that however one preserves or eats humpback whitefish that it is important to scale the fish first.

Many people in Nondalton said they like to eat humpback whitefish fresh. One elder and active fisherman from Nondalton said he prefers fresh-caught fish to be fried or cooked whole and turned into fish nivagi once the bones are removed. One elder said she likes to eat the eggs of the humpback whitefish raw as soon as the fish is harvested. Another resident said caviar was made out of whitefish eggs. Another elder mentioned eating dried whitefishes with bear fat. Historically, humpback whitefish was also consumed with seal oil in Nondalton. Seal oil was obtained from residents of the Kvichak River in batches of 1 or 2 quarts (Behnke 1982:33).

In Port Alsworth, humpback whitefish are most commonly eaten fresh.

Round Whitefish

Trends in Harvests or Populations Over Time

Igiugig residents spoke of observing round whitefish both in their nets and while ice fishing. However, these fish were reported to be less commonly observed or harvested in recent years. One long-time resident of the Igiugig area remembered harvesting round whitefish in the vicinity of Igiugig in 1979 or 1980. The same elder reported seeing more round whitefish than she had ever seen before in the flood plains between Ole and Pecks creeks in November 1992, but had not seen or harvested any since then.

One resident of Iliamna remembered fishing for round whitefish with her mother on a daily basis during spring and fall. She also pointed out that this is no longer possible due to a perceived decline in the population in the area. In her words, "Yeah they get that [round whitefish], but not as many as there used to be."

One experienced fisherman from Newhalen said that in the past his family had harvested round whitefish from a fall camp on Iliamna Lake in the vicinity of Kokhonak. He also said that his family had harvested some round whitefish in the Newhalen River close to the village of Newhalen in recent years. He said that these round whitefish were smaller than those that could be harvested around Igiugig: "Yeah we catch them out here but they are small … 6 inches maybe. Hook and line through the ice but they don't get much bigger. Probably August, in the first freeze-up is when we can catch them out here." When asked if there were any

bodies of water that used to have whitefishes in them but no longer have any, the same fisherman had the following to say about how things had changed:

> There are more or it is changing. We never used to have any up at Landing and now we have more. Over the past 10 years now we catch them there. I think that they are coming down like the candlefish; we never had them in the river before the last 5 years now we get them. They seem to be in places they never were before.

Another elder from Newhalen had the following to say about the population of round whitefish populations in the river and suggested that the populations there were very healthy:

> You know the candlefish, they're always thick. I don't know what time. I would make a snare out of thread or something and put it in the ice hole and get 'em, they're good. We would fry them up and eat. I used to do anything. I hardly played with the kids. I would be outside trying to do something. I would make a hole in the ice and snare the whitefish.

Many Nondalton residents thought the round whitefish populations in the area were decreasing over time. One elder had the following insights related to this decline: "You know what, I used to catch, there used to be a lot of candlefish. I don't hardly see them anymore … you know when we're cutting fish there used to be a lot of candlefish. I don't see 'em hardly anymore." Despite a decline in recent years, other Nondalton residents thought round whitefish were making a comeback in the area and people were starting to see them more. This was echoed by another household head when he said he noticed round whitefish returning in spring 2013 for the first time in many years.

Physical Characteristics and Health

The residents of Igiugig did not report many changes in the physical characteristics of round whitefish. They did note that in the past round whitefish would not bite a hook during ice fishing but they had started to bite hooks in recent years.

Spawning and Seasonal Movements

Igiugig residents thought that round whitefish were more likely to be seen during the winter months when residents fished through the ice adjacent to the community in sloughs off the Kvichak River. They also mentioned observing round whitefish in Iliamna Lake at different times of the year.

Interactions with Other Species

Igiugig residents reported seeing round whitefish while targeting rainbow trout as well as sockeye (red) salmon during the summer months. One elder stated round whitefish congregated in the waters of summer fish camps while salmon were being cleaned. She happily shared this insight: "Yeah, at summer fish camp when we were cleaning fish, boy I tell you those fish [round whitefish] pile up."

Local Taxonomies

One Nondalton elder said the term for round whitefish is *hu'stin*. A previous study conducted in Nondalton reports the Dena'ina term for round whitefish as *ghelguts'i k'una* (Kari 2007; Stickman et al. 2003:53).

Traditional Management

While the residents of Igiugig did not share any insights into the traditional management of round whitefish in particular, they did assert that there was a traditional management system for whitefishes that included prohibitions against disturbing the fish while they were spawning and against harvesting more than one needs.

Preservation Methods and Consumption

An Igiugig elder insisted that round whitefish are never smoked; rather, harvests are frozen if not eaten when fresh.

The only method mentioned for cooking round whitefish in Igiugig was to pan-fry the fish, with or without the head, then eat it warm.

An experienced fisherman from Newhalen said that she did not preserve candlefish; rather, she eats them fresh after frying them in a pan.

Least Cisco

Harvests of least ciscoes did not significantly contribute to the overall harvest weight of nonsalmon fish in the study communities. Due to lack of harvests and uses of least ciscoes, few local traditional knowledge comments were collected; topics for which no new information was gathered during this study have been removed.

Trends in Harvests or Populations Over Time

One elderly Igiugig couple suggested that least ciscoes could be harvested in the area with the use of a "herring net" and were particularly plentiful when the "good old East Wind was blowing." Another elder also commented that the presence of least ciscoes around the beach adjacent to Igiugig related to the East Wind in the following way:

> We had our net out here [on the beach at Igiugig], during the fall and that good old East Wind was blowing and it was bringing them right up to the net. His net was on the gravel, it was the most I have ever seen.

Igiugig respondents involved in the 2003 study year survey by ADF&G reported that least ciscoes were harvested while ice fishing and with the use of a "herring net" in the past (Krieg et al. 2005:89). Results from this study and the 2003 study confirm that there has been a population of least cisco off the beach at Igiugig that has been harvested in the past.

An elder from Iliamna remembered fishing for least ciscoes with his mother when she was young but thought that "the fishing has really gone down" (see chapter 5, "Factors Influencing Residents' Ability to Harvest Nonsalmon Fish").

Spawning and Seasonal Movements

Previously, Nondalton residents reported juvenile least ciscoes migrated up the Chulitna River in the later part of June (Russell 1980). In interviews for a study for 2003, least ciscoes were said to move up the same river in September; furthermore, a Nondalton elder said there was a second smaller run of least ciscoes in the spring (Krieg et al. 2005:91). In 2013, a resident said least ciscoes are found primarily in Iliamna Lake; in July least ciscoes move up the Newhalen River through Sixmile Lake and into Lake Clark, where they congregate in the Chulitna River and where a resident said his father set traps to harvest them in great numbers in September.

A knowledgeable resident of Newhalen said that he had seen least ciscoes (which he referred to as "like freshwater herring") in Gibraltar Lake and "Middle Talarik Creek" in late September and October. He said that the fish were 6 to 8 inches long.

In the past, a Nondalton resident suggested least ciscoes spawn in Nikabuna and Long lakes (Krieg et al. 2005:90).

Interactions with Other Species

A resident from Newhalen said that he had seen bears and eagles eating least ciscoes at "Middle Talarik Creek."

Local Taxonomies

Local residents in Igiugig and Nondalton often referred to least ciscoes as "herring" or "freshwater herring."

Other Nonsalmon Fish

Traditional ecological knowledge gathered during the course of this study is presented below for other nonsalmon fish species. Relevant information collected during key respondent interviews is presented in the following section according to species. The particular focus of this study is whitefishes; consequently the information documented concerning other nonsalmon fish is more limited in scope.

Rainbow Trout

A 2013 key respondent in Pedro Bay indicated local rainbow trout populations have declined significantly over the past 5 years. He stated that in the last couple of years this species has nearly disappeared from the area. The respondent did note this observation largely pertained to adult rainbow trout, and very small individuals of this species appear to be more common. He felt that the large amount of smaller rainbow trout was an indication that the population was rebounding. One Newhalen resident stated that rainbow trout have remained the same size over the years, and since 2012 her son has shown her rainbow trout with organisms under their fins, which she identified as sea lice.

An elder who lives in Igiugig described the seasonal movement of rainbow trout in the following way:

> Well, the rainbows will follow the salmon all over, the rainbows come down and spawn pretty soon [April]. Then when the salmon start coming up, they will follow the salmon up to these streams.

Several Pedro Bay key respondents have noted seasonal movement of rainbow trout, especially as they follow migrating salmon in the late spring and early summer. Locally, rainbow trout are known to ascend the Iliamna River following the salmon. Because of this, Old Iliamna has been a popular location for harvesting rainbow trout. A key respondent said local people do not fish the river much anymore because of heavy pressure on the fish stock from the lodges and the influx of nonlocal recreational fishermen. An Iliamna resident said that she thought that rainbow trout spawn twice a year. A Pedro Bay key respondent mentioned that both rainbow trout and lake trout are mixed in with salmon near the community between May and September, but are most abundant in July. During this time, rainbow trout are said to be following salmon and eating their eggs.

At the community data review meeting in October 2014, a resident mentioned that there used to be a substantial population of steelhead (rainbow trout that migrate to and from marine waters) in the Pedro Bay and Iliamna River area. The resident suggested steelhead no longer occur in the area, and that he had not seen these fish in several years.

An elder from Igiugig remembered often fishing with her father and that he set a net under the ice in the winter targeting and harvesting rainbow trout, which was a practice that was not observed or talked about during the 2 years covered by this study. Similarly in Newhalen, an elder remembered in the past her family used a seine to catch rainbow trout along with whitefishes. She said that no one used these methods in Newhalen anymore.

Tuni is the Dena'ina term for rainbow trout used in Nondalton (Stickman et al. 2003:11). It is also important to note residents of the study area often refer to Arctic char, Dolly Varden, and lake trout as well as rainbow trout as "trout" or "trouts." Residents of Pedro Bay did not mention rainbow trout as being categorized with

Photo by Bronwyn Jones, staff, ADF&G Division of Subsistence

Plate 4-4.–Two pan-size rainbow trout and a Dolly Varden harvested by ice fishing, Iliamna, March 2014.

or confused with any other species in 2012 or 2013, but it is unclear as to which species are being referred to when the more general term "trout" is used.

Two Igiugig elders said that they like to dry or "half-dry" rainbow trout, although they were most often consumed fresh due to a particular undesirable taste that they said the trout take on when dried. It was also pointed out that the oil in rainbow trout that were half-dried would "go rancid if you keep them too long." One Igiugig elder said that he preferred to eat dried rainbow trout after boiling them. Fresh rainbow trout were also consumed after boiling. A Newhalen resident said she would sometimes freeze rainbow trout. When speaking about rainbow trout, a resident from Newhalen said that she preferred to eat "pan-sized ones," less than 1 foot long, and described her preparation process for these favored-size fish in the following way:

> I gut them first and then if they are small enough, I'll cut little slits through it, then fry it whole, and you can eat the bones too if they're small enough. I like frying them up so that they are nice and crispy. My son would say, "Mom, are you crispy crittering?"

Pedro Bay key respondents noted they often prefer to catch smaller rainbow trout because they fit in the skillet and do not need to be filleted. Seven or 8 of the smaller individual rainbow trout are needed to make a meal.

Brook Trout and Mountain Trout

Brook trout are not known to inhabit the waters of Bristol Bay and associated watersheds; as such, fish referred to locally as brook trout (also known as mountain trout) are likely misidentified. In 2003, an elder from Igiugig referred to the fish species in question as mountain trout, brook trout, or small rainbow trout (Krieg et al. 2005).

Respondents involved in this study reported harvesting a fish referred to as brook trout in some communities (Igiugig and Iliamna) and mountain trout in another (Nondalton). During the community review meeting for this study conducted in late 2014, a local resident provided Division of Subsistence staff with a frozen sample of what she called mountain trout. Biologists with ADF&G in Anchorage subsequently identified the fish as a juvenile Dolly Varden. For the purpose of calculating estimated harvests, any reported brook or mountain trout harvests were reclassified as Dolly Varden–fingerling.

Lake Trout

Residents of the study area often applied the term "trout" or "trouts" to a group of fish that includes lake trout, rainbow trout, and Dolly Varden.

For this study, 2 active Nondalton fishers reported that they were very successful at harvesting lake trout with the use of setlines in the past. Recently, however, residents reported a decline in lake trout abundance: "Go one night and almost every hook will have them [lake trout, in the past]. And last year and this year we never caught no lake trout for 2 years." However, other Nondalton residents thought the lake trout population was on the rise. Two active Nondalton fishermen stated that the lake trout population was on the rise because of their success at preying on whitefishes.

One elder in Iliamna said that he saved salmon eggs from the summer harvest to use as bait to catch lake trout at other times of year through the ice. Another resident thought lake trout were eating other small nonsalmon fish.

A resident of Nondalton thought lake trout often fed on whitefishes and were responsible for a perceived reduction in the number of whitefishes in the area. Another person from Nondalton thought that it was not only whitefishes that were being eaten by lake trout but also any kind of small nonsalmon fish.

Dolly Varden and Arctic Char

It is important to note that many subsistence harvesters in the region do not differentiate between Dolly Varden and Arctic char and do not ascribe meaning to subtle biological differences between the 2 species (Krieg et al. 2005:59). Many people have difficulty differentiating between Arctic char and Dolly Varden after they are harvested or do not see a need to do so. In a previous study conducted by the Division of Subsistence, people of the Togiak, Igushik, and Wood river drainages referred in Yup'ik to both Dolly Varden and Arctic char as *yugyaq* (Fall et al. 1996:17) Biologists rely on tests involving careful analysis of gill rakers to differentiate between the 2 species and identify a given fish as an Arctic char or a Dolly Varden. Consequently, we have recorded harvests of Arctic char and Dolly Varden as reported by the resource harvesters themselves. Some fish harvests recorded as Arctic char may in fact be Dolly Varden and vice versa. Species identification cards were made available to respondents during surveying and key respondent interviews to aide in clarifying recorded harvests of the various species found in the area. Discussions about these species are grouped together in this section to reflect biological and ethnographic similarity.

The report for a study conducted for 2003 included mention of the use of a fish trap[1] to harvest Dolly Varden as well as whitefishes in Kaskanak Creek up until around 1998 (Krieg et al. 2005:61). No fish traps were used during this study in Igiugig; most people associated Dolly Varden with ice fishing on Iliamna Lake during the winter months.

One Iliamna elder remembered harvests of Dolly Varden being higher during the 1960s when local harvesters were able to collect a bounty on Dolly Varden tails as part of salmon conservation measures. When asked about spawning, an elder from Iliamna thought Dolly Varden spawn in late spring since she had harvested some in early spring that still had eggs inside them. Another respondent from Iliamna reported an abundance of Dolly Varden in the area during the winter and described ice fishing for a significant amount of fish in a single day.

Nondalton residents refer to Dolly Varden as "Dollies" or by the Dena'ina term *łiq›a k›qen* (Stickman et al. 2003:11).

One resident of Newhalen said that she made use of a vacuum sealer before putting her catch of Dolly Varden in the freezer for use at a later date.

Residents of Newhalen mentioned air-drying, freezing, and canning char to preserve harvests and others said that they usually eat the fish fresh. Residents also mentioned frying Dolly Varden and using the fish in akutaq, a local favorite. When a Newhalen resident was asked how she makes this frozen delicacy, she shared the following recipe:

1. Under current regulations, this gear type is referred to as a fyke net.

> Let's see. I boil up the fish with no salt in it. Once it's boiled up I peel off the skin and take out the bones and squeeze the fish as dry as I can. Then I put it in a bowl and mix it with shortening, olive oil, and sugar. Then I put raisins and whatever berries I have, blueberries, blackberries [crowberries], cranberries. Sometimes salmonberries. And I mix it all up. And it's tasty!

When asked about the process of catching and preparing a Dolly Varden she harvested through the ice in the following way, the same resident said:

> When you catch the fish, you want to kill it right away because that way it does not suffer. But that's what my mom had always done. She'd always, as soon as she pulled the fish out of the ice through the fishing hole, she'd always club it to death. And it was because she did not want to suffer. So that's what I have always done. When I bring it back here I fillet it and fry it up for dinner. I always try to catch just enough for dinner. If I do get extra, then I will fillet them and freeze them.

Pedro Bay: Unspecified Trout and Char

In this study, Pedro Bay residents often referred to "trouts" as a category of fish that locally include all 3 species of char (Arctic char, Dolly Varden, and lake trout), and rainbow trout (sometimes locally called "brook trout"). Krieg et al. (2005:66) reported "trouts" was a general term used in the community to describe lake trout, Dolly Varden, and Arctic char, but one of the 2003 study key respondents said trout included both rainbow trout and Dolly Varden and "the word is used interchangeably for both species" (Krieg et al. 2005:72). This categorical reference to trout is confusing not only due to local taxonomies, but also because lake trout and Dolly Varden/Arctic char are actually char.

During this study, people sometimes spoke of brook trout as a species that they frequently harvested in the past; however, brook trout *S. fontinalis*, as defined by the Western taxonomical structure, was introduced to Southeast Alaska between 1917 and 1950 and is not known to occur naturally in Alaska nor to have been introduced to the Bristol Bay drainages. Whether the fish referred to as brook trout in Pedro Bay is *S. fontinalis* remains unclear, but it is unlikely. A survey respondent for study year 2012 stated brook trout have black skin, their meat color is very pale, and they taste like rainbow trout. Based on the findings of this study, it is likely any brook trout harvested in the area are in fact Dolly Varden.

Two key respondents indicated local populations of trout have declined substantially over time. One mentioned she used to see a lot of trout in April and May when they were mixed in with migrating salmon, but that they are seen less frequently today. She said that even though trouts are declining, she still makes an attempt to harvest them. In the last 10 years, she has increased her salmon harvest to ensure the availability of fish through the winter months. Another respondent stated that several people he has talked to have concurred that trout populations have declined and fishing on the "sand beach" is no longer very productive. A decline in local trout populations was also noted by a Pedro Bay respondent for the 2003 study (Krieg et al. 2005:63).

For this study, one of Pedro Bay's key respondents described observed declines in the size of trout over time. She indicated that a decade ago very large trout could be caught in Edna Bay, and large holes needed to be made when ice fishing to get these fish to the surface. She remembers putting many of these fish in buckets and seeing the tails sticking out of the top. Now, she says, "We're lucky to get one bigger than this [8 inches]." Many people prefer to harvest smaller "pan-size" trout since they are easier to prepare, but she preferred the larger ones because they taste different and perhaps seem to have greater oil content and are easy to eat after being filleted.

A key respondent in Pedro Bay indicated that while many people prefer to harvest small trout, those that are too small are returned to the water to help ensure that they come back.

A key respondent in Pedro Bay freezes trout and does not smoke or dry them. She throws away the bones and skins, but not in the garbage. She puts them out for the birds or for someone else to find them. A survey

Photo by Yoko Kugo, intern, ADF&G Division of Subsistence

Plate 4-5.–Local resident holding a "trout," Pedro Bay, March 2013.

respondent in 2012 stated that she discards bones on the shore to feed other fish and to attract them to the area. She said other residents discard fish remains in deeper water to avoid attracting bears.

In the 2003 study year, a key respondent indicated all the trout she catches are eaten fresh. She mentioned there is not a tradition of freezing trout (presumably those caught during the warm months of the year) because electricity was not available in Pedro Bay in the past. Trout were dried and stored in underground caches rather than frozen (Krieg et al. 2005:75). For this study, a respondent mentioned that he does not preserve trout because they are readily available at the beach in the winter. Two key respondents in Pedro Bay indicated they prefer to fry their trout. One of these respondents prefers to roll the fish in batter and deep-fry them.

Arctic Grayling

Ice fishing is historically the preferred method for harvesting Arctic grayling and continues to be the favored method. One resident in Igiugig mentioned that Arctic grayling tend to be found farther away from the village and farther upstream in the Kvichak River. One Igiugig elder said that he preferred to go 50 miles up Kaskanak Creek to harvest Arctic grayling, where, he said, they are more plentiful. These observations are supported by the 2003 study by ADF&G (Krieg et al. 2005:36).

A Nondalton elder stated that she felt the Arctic grayling population was on the decline in recent years and a participant in Nondalton's 2014 Culture Week said he thought that there are fewer Arctic grayling than in the past and that this decline has been gradual.

A resident of Nondalton shared his observation that Arctic grayling found in the Pickerel lakes "are a little bigger" than ones he has seen in Sixmile Lake. He also thought grayling harvested from Pickerel lakes had a sweeter taste than those found in Sixmile Lake.

Respondents from Igiugig did not outline any particular seasonal movement of Arctic grayling other than a general pattern of moving out of lakes after the winter and into the streams of the area.

A Nondalton resident stated Pickerel lakes and Pickerel Creek are "full of grayling in May, so packed that you can stand in the lake and pick one up."

Biologists think Arctic grayling spawn in May in the Bristol Bay area (Russell 1980:57). An experienced subsistence fisherman from Nondalton confirmed this during Culture Week in Nondalton in 2014. Another Nondalton resident reported harvesting Arctic grayling in April that "had eggs in 'em." Two elders from Nondalton said Arctic grayling spawn in May in Pickerel Creek.

A knowledgeable Newhalen resident thought that Arctic grayling might spawn in April in Sixmile Lake and Lake Clark. She thought that this was the case, "Because when you catch them, they will be really dark and really bright. They have the spawning color signs. Grayling are much darker, their spots are brighter [when they spawn in April]."

With regard to fishing activity, a resident of Iliamna said that he uses salmon eggs preserved with salt as bait when attempting to harvest Arctic grayling.

In Igiugig, Arctic grayling were caught incidentally while other fish, such as Dolly Varden, were being targeted for harvest through the ice.

A resident of Nondalton reported Arctic grayling are often used as bait to catch northern pike and burbot. The whole grayling is used for bait, including the head and the tail.

In Port Alsworth, Arctic grayling were caught while residents were out rod and reel fishing for "trout" in general.

One resident mentioned that he would not overharvest whitefishes since there is a prohibition against doing so according to local custom. He said that if a species of fish was not abundant then he would target other species such as Arctic grayling that are usually abundant in the area.

Residents from the study communities reported that Arctic grayling are best consumed fresh since they do not freeze well. Because most Arctic grayling are consumed fresh, these fish are less likely to be shared between villages but may be shared within a village. Residents indicated the preferred preparation is to fillet and pan fry Arctic grayling, although an Iliamna elder said that she used Arctic grayling in fish akutaq.

One resident of Newhalen told the following story when asked about preservation and consumption of grayling and other nonsalmon fishes:

> All I remember was, I was eating a piece of fish and I put the backbone on my plate and one of the elders came to me and said, "You need to break those bones." And he didn't say why but he broke them up for me. I'm not sure what the significance of that was, so after that, … after cutting the meat off the bones. I break up the bones. I do the same thing when I fillet my rainbows, Dollies and grayling. I break up the bones before I throw them away. But he has never told me why I had to do that, he was mad because I did not break up the bones! But, he broke them for me, and I didn't ask why because when an elder gets angry with you don't say anything back to them.

Rainbow Smelt

Only Igiugig residents harvested a small amount of rainbow smelt in both study years. Based on information from a previous study, rainbow smelt do not occur locally near the other study communities (Krieg et al. 2005).

Alaska Blackfish

During this study limited harvests of Alaska blackfish were estimated (Table 3-19). However, when 2 members of the Division of Subsistence team were at the Igiugig school during fieldwork for this project during winter 2014, staff were informed prior to talking to the schoolchildren about subsistence practices that the students had recently completed a unit on the Alaska blackfish. Researchers were told that the children and their teachers harvested 50 blackfish in January 2014 in a fish trap near the school. They kept 25 blackfish for study and returned the others to the water. Some of the fish retained were redistributed to elders in the community as what they called "weather fish." These weather fish were said to have the ability to predict the weather according to their position in the tank, rising when the weather was better and sinking when the weather was turning for the worse. An Igiugig elder reported during an earlier study that his grandfather used to harvest blackfish, much like the schoolchildren did, by setting a fish trap in creeks around Igiugig (Krieg et al. 2005:40).

In general, Alaska blackfish were not widely harvested. In considering the past, an elder from Newhalen shared the following recollection about his grandfather and eating Alaska blackfish:

> [My grandfather] would say, "No don't you ever throw the blackfish away. Take care of them the best you can, that blackfish will save you." You can eat them raw, eat them dry. So I never used to eat those, and my grandfather would see one and say, "Eat." Not dried, raw blackfish.

Northern Pike

One Igiugig resident claimed that while still available in the area, the northern pike population was declining. However, northern pike still played an important role in the diet of Igiugig residents. In prior research, an elder spoke about harvesting northern pike in a fish trap with his *uppa*, or grandpa (Krieg et al. 2005:48).

An Iliamna elder said that he usually harvested around 50 northern pike in a year, some of which he would share with his mother-in-law in another village. However, during 2013 he was only able to harvest 4 northern pike. He described the decline in the following way:

> So where is the pike? I'm not sure. We have not had as much luck with pike this year as we had. I think that they are just coming in later. By the time we started fishing them, the lake will be gone because the ice was not that thick … .
>
> We increased our effort this year. But it's just they have not been biting. So, they are not there. I try to go out every evening. My daughter goes out every evening. We catch 1 sometimes 2. Only mine we keep. She brings hers down to the elders.

During this study's survey efforts, a resident of Newhalen noted that there were more northern pike in Alexcy Lake in 2013 than there had been the year before.

A previous study conducted in Nondalton reported relatively stable harvests of northern pike between 1998 and 2000 (Stickman et al. 2003:53). A resident elder reported what he perceived to be an expansion of the northern pike population from the area of the Chulitna River drainage where they were once concentrated, to a much larger area: "Two examples he offered were a little lake right off Macfal Bay that pike had moved into in recent times and a nearby creek that used to host only spawning salmon, now containing pike also" (Krieg et al. 2005:52). Today there is not a consensus among residents of Nondalton as to the abundance trend in the northern pike population; most participants in the study suggested that the population was healthy if not expanding. An experienced Nondalton fisherman said that he had caught lots of northern pike with a setline in the past, but in the last couple of years (2012 and 2013) he has not been as successful. However, another active fishermen thought that there was an increase in the northern pike population and that the northern pike were feeding on whitefishes.

A key respondent in Pedro Bay mentioned fishing with her brother for northern pike in Foxy Lake as a child. They would catch mice in can traps to use as bait on birch poles. She remembers catching one fish that was at least 5 feet long and dragging it along the ground all the way home to show her dad. By the time

she and her brother got it home, the fish was "worn out." Her dad removed the bad parts, cut the head off, and cooked it that evening.

In 2012 at Port Alsworth, no residents ice fished for northern pike because the lake did not freeze enough to reach the preferred fishing spots. One Port Alsworth resident said northern pike have decreased in abundance and size in the Lake Clark area. In prior research, knowledgeable Port Alsworth residents described harvesting northern pike from most of the Chulitna River watershed, the southwest corner of Pike Bay, Hardenberg Bay, Miller Creek, and the outlet of the Tlikakila River (Krieg et al. 2005:51).

An Iliamna elder thought that the northern pike were getting smaller in size over the last 10 years or so. This observation is congruent with that of another resident from the same community who reported in 2003 that the northern pike found in Iliamna Lake were smaller than in the past (Krieg et al. 2005:52).

Two Pedro Bay respondents mentioned northern pike have been known to cross small stretches of land to reach bodies of water. One respondent claimed this as the means by which northern pike were introduced to a lake near the mouth of the Iliamna River. The northern pike in this lake are said to be exceptionally large.

> At the mouth of the Iliamna River, there is a lake that is very high, and there are pike in there. My great uncle told me that long ago they said that the pike got there because they could walk on their fins from the other side and they ended up in the lake [Pike Lake]. And they were too tired when the got there, and couldn't get all the way to Iliamna Lake. They are very big pike.

Another key respondent in Pedro Bay mentioned that northern pike lie in shallow water next to the beach during sunny, hot summer days. They are very visible at this time, and it is a good way to see large fish.

One elder in Iliamna identified Alexcy Lake and Stonehouse Lake as northern pike spawning areas, "I mean if you go there now [April], and if you catch a pike, sometimes you get a male, sometimes a female, you open the female and some of them are all ready to spawn, and there are some that haven't even got close to spawning." This elder indicated spawning is occurring earlier than usual; typically northern pike spawn in May. He also reported the following:

> I know they spawn up in Alexcy Lake. And I have known that since my gran told me. Stonehouse is another one they spawn at.

During 2013, one resident from Nondalton thought northern pike spawn in the wintertime in Lake Clark due to the fact that he caught some in the lake with eggs inside them during the late fall. The same elder thought that northern pike spawn twice a year.

An Igiugig elder stated that he often caught northern pike in his net while fishing for whitefishes in the spring.

One elder in Iliamna said that residents stopped setting nets under the ice for whitefishes and other nonsalmon fish about 7 years ago because of northern pike. As he explained:

> We got a pike that was about 6.5 feet [in the net] and we could not get it out. It took a chainsaw to cut all the ice out! It ruined our net! A little trout net. All it is is a little chop net underneath. It is not a salmon net, which could hold a pike, but one wrapped it up so bad that it ruined our net. So that is just 350 dollars down the drain. For one pike! So we are not going to waste money like that.

An elder shared a story during a discussion about how northern pike interact with other species in the region. She said that she thought that the northern pike were eating other nonsalmon fish, including whitefishes, and that this may have something to do with the limited whitefish populations in the area. She said:

> You know, one time my husband and [names another man from the village] was going fishing for pike up near Whitefish Lake, near the Kuskokwim, way past Nondalton. That was a long time ago. They caught a pike. It was about four feet long. And when they brought it in, it had five little whitefish in his stomach and one was sticking out of its mouth. Huge. They went by skiff. So it would be up nearby Chulitna.

During the course of this study, northern pike were also commonly reported by Nondalton residents as having eaten whitefishes and other nonsalmon fish, such as Arctic grayling.

Northern pike are known by Pedro Bay residents to be aggressive predators. One key respondent noted that northern pike will eat anything, including trout, ducklings, and other northern pike. Another respondent heard a story about a northern pike eating a fox that had been lapping water from the edge of Iliamna Lake.

The people of Nondalton speak of *ghelguts'i* when referring to northern pike in Dena'ina (Kari 2007; Stickman et al. 2003).

Two elders from Nondalton stated the practice of catch and release was not part of the Dena'ina tradition. They pointed out such activities by sport anglers in the area as traditionally considered bothersome or harmful to the fish. One of these elders put the contrast between traditional Dena'ina activity and that of the sport anglers plainly: "We [Dena'ina subsistence fishermen] don't do that [catch and release] up here. If we catch a fish we're going to eat it."

Photo by Sarah M. Hazell, staff, ADF&G Division of Subsistence

Plate 4-6.–Northern pike drying on a rack on the side of a house in Newhalen.

Residents from Igiugig, Iliamna, and Newhalen mentioned air drying or freezing northern pike if they were not consumed immediately by pan frying at home or at a fishing location. In Iliamna in 2014, researchers found northern pike being dried on a rack on the side of an elder's house (Plate 4-6). Another elder from Iliamna said that he preferred to eat northern pike fresh, cooked over the fire on the shore of the lake that it was harvested from.

A member of the Newhalen community noted that she and her family would, "Eat their eggs, like caviar. No salt though. And if I remember, we used to eat the stomachs too, raw. But we used to eat the raw eggs out of the pike, grayling, and the whitefish."

Families in Nondalton were reported to have dried northern pike in the past both for human and canine consumption (Behnke 1982:31). The practice of drying northern pike was also recorded during the 2003

study (Krieg et al. 2005:51). During this study, Nondalton residents continued to dry northern pike, thus demonstrating continuity with the past even after the widespread introduction of electric freezers in the community in the early 1980s. One elder from Nondalton stated his family received nonsalmon fish from a family in Iliamna in exchange for northern pike.

Northern pike were boiled, deboned, and the flesh was used to make nivagi. Another Nondalton elder pointed out that northern pike was a good fish to use for nivagi because, due to the large size of northern pike in the area, a person could produce enough of the local delicacy for a large group of people with a single northern pike. Other elders recounted the use of dried northern pike skins in the sewing of rain gear such as rain hats and raincoats. Northern pike skins were said to be preferred for such a purpose due to their relatively large size.

In Pedro Bay, a key respondent mentioned that the head of a northern pike is always removed due to the presence of a sharp bone that cannot be eaten. She also noted that northern pike was not dried or frozen but eaten straight away fresh. This was because getting a northern pike was not common and having one fresh would be a treat.

Longnose Sucker

An elder from Iliamna said that longnose suckers were harvested by the "net full" and fed to dogs when she was younger. She said that they were harvested in the spring when they were most plentiful.

Residents of Newhalen commonly referred to longnose suckers as starvation fish. These fish were thought to be special in that they could survive when other fish could not. One resident mentioned that longnose suckers have bones in their head that can be used to tell stories. She spoke of the longnose sucker in the following way:

> I don't eat them. Who would want to eat ugly fish? Old people eat the heads, cut them off. They are the only fish when they had starvation a long time ago. Those suckers. They lived a long time. They eat the head and boil them. They said they're good strong fish and tasty. They are storied. To their heads, everything to their bones is a story in their head. That's the fish that has stories in it, in their head.[2] They're the strong fish that survived when there was starvation … 1940s, 1942, the Depression years. Remember when they had WWII? Everybody was starving all over. My ancestors tell me like this, 'The hunger is worse than sickness.' Don't ever want to go through a hungry life. They say that it is worse than sickness when your stomach is growling.

During this study, residents of Nondalton did not express any concern about the health of the longnose sucker populations in the area, but one respondent did note that the harvest had declined from previous years when there were a number of dog teams in Nondalton and longnose suckers were harvested in greater numbers in order to feed these animals.

In Nondalton, longnose suckers were often referred to by the Dena'ina term *duch'ehdi* (Stickman et al. 2003:11). During a survey for this project during Culture Week 2014 in Nondalton, a respected elder referred to the longnose sucker as "medicine man's daughter."

Burbot

In Igiugig, it was noted that harvests of burbot had declined over the past 10 years. One Igiugig elder noted that his father-in-law fished for burbot with a fish trap more than 10 years ago in Kaskanak Creek. Another Igiugig resident noted that the use of the trap was the only way that he could remember anyone harvesting burbot in the past. These findings are consistent with those from a study for 2003 during which an Igiugig elder shared the following about burbot and the use of fish traps:

> [In Yup'ik] When my ap'a [grandfather] is going to set manignaaq traps, he used to examine the water current, where the current flows, using a blade of grass which was not too long by tying it to the end of a long willow branch. Then [he] lowers it in the water to

2. Longnose suckers and the bones in the head of these fish are tied to transmission of oral knowledge.

> check the current, and if the blade of grass swivels around every which way, the location is not good…but if the blade of grass sits straight and still, that indicates the path of the ling cods… . (Krieg et al. 2005:41)

One Iliamna resident said that when her children were younger her brother harvested burbot with a setline, but she has not seen any in recent years. During participant observation in 2014, ADF&G staff ice fished for nonsalmon fish with a young man from Iliamna who said that he had been "setting hooks" for burbot in Roadhouse Bay during that winter. He had not yet successfully caught burbot this way, but planned to continue to attempt the harvest. Another resident from Iliamna described how to "do sets" to harvest burbot:

> We do sets, but the key of it is to make sure you have a strong enough line. Otherwise , you don't have it [laughs] … We just have, what you call, one line. And then you set hooks off it every so far apart, and bait it … . It's weighted. What I usually do when I do a set is I'll make it, sometimes fifteen feet. So there is one a hole, and another hole, as I'm working the sets, going back. So I try to start from the deepest part and work my way back. It's interesting … . Very effective. But not as much fun … I use halibut hooks. Because they get some pretty big lingcod. I remember a six foot, they are some pretty good size.

Other residents of the study area said burbot today are harvested primarily by rod and reel in open water, or by ice fishing. Those who harvested burbot were happy to have them.

The people of Nondalton commonly refer to burbot as lingcod. They also refer to this fish using the Dena'ina term *ch'unya* (Stickman et al. 2003:54).

5. FACTORS INFLUENCING RESIDENTS' ABILITY TO HARVEST NONSALMON FISH

Study participants at each community identified factors that have influenced their ability to fish for and successfully harvest whitefishes and other nonsalmon fish. This chapter presents a summary of the feedback, the contents of which are grouped by topic and then community, with the exception of Port Alsworth. A limited scope of information was gathered from Port Alsworth residents, therefore all information for this community is compiled directly below.

Harvest Factors: Port Alsworth

Whitefish species are not widely used in the community of Port Alsworth, with only 29% of households using whitefishes in both study years. Many households that did harvest whitefishes during the 2 study years commented that the whitefishes they did catch were not targeted, but were caught incidentally and therefore used in the households so as to not waste the fish. Other households commented that they enjoy eating whitefishes, but they are either too busy to go out and harvest the fish due to working long hours, or that they are too elderly to go out and fish.

A few households in Port Alsworth commented that even though their households do not use whitefish, they think it is very important that whitefishes are available to the people of the area. Other households commented that they do not use whitefishes in their households, but they notice that the whitefishes they see in the area seem to be abundant and healthy.

Environmental Factors: Igiugig

High Water

Many residents of Igiugig identified high water levels in 2012 and 2013 as a factor that negatively influenced their ability to successfully harvest nonsalmon fish (particularly humpback whitefish). One experienced Igiugig fisherman attributed his lack of success in harvesting whitefishes to high water levels that he associated with a large amount of rain in the Igiugig area during 2012. This assertion was echoed by another elder from Igiugig who also suggested that reduced harvests of humpback whitefish were due to high water levels that caused these fish to swim under the nets that were set out in the hopes of harvesting that species. A resident of Igiugig suggested that high water levels during 2012 resulted in increased effort expended to locate whitefishes in places outside of areas that were usually targeted. Another Igiugig resident summed up local frustration with high water levels in the following way, "Effort? High water last year [2012] so it was bum for fishing in the fall."

During the 2013 survey a member of one household said that water was high in the fall for catching humpback whitefish—2 feet higher than ordinary (the highest he had ever seen), "So much rain." He also said that the water was too deep for catching fish because the fish would go under the net.

High Winds

One elder from Igiugig noted, "Weather, too, especially they [whitefishes] don't like the East Wind much. The East Wind is bad wind for fish … . Because it makes it too rough, on the lake." Another Igiugig resident who identified the high waters as a factor that influenced the ability to harvest whitefishes also said that the high winds might have affected the movements of the fish.

Most years the water flowing out of Iliamna Lake is so swift at Igiugig that the section of the river there does not freeze over from bank to bank. An elder was asked if the Kvichak River by Igiugig ever freezes over. His description of wind and ice dynamics at the mouth of the Kvichak River is informative:

> It [the Kvichak River] stays open here [by Igiugig] but when the lake [Iliamna Lake] freezes first in late November maybe 4 or 5 inches, not even that much about 3 or 4 inches and we get a heavy East Wind and it'll break up and it'll be cold and the river freezes down there [downstream], then [the East Wind will blow the ice into the river and] it will plug up the whole river with broken ice. That's how it freezes, and it will back up all the way into the lake. Sometimes it is pretty thick ice, it's over 6 to 8 inches you know, and it will hold for maybe 2 months and then it will open back up again. It don't stay froze very long. I haven't seen it now in about 3 years now [prior to interview in April 2013], it's been open here.

Of note is the fact that the long axis (approximately 70 miles) of Iliamna Lake is generally oriented east–west. A wind blowing out of the east across the lake has no geographical features to stop it until it hits the west shore. The buildup of pressure on the ice or resulting wave action in open water from an east wind pushing west is intensified at the west end of the lake where Igiugig is located.

Warmer Winters

Many Igiugig residents identified a warming trend that had resulted in warmer winters in recent years. The warmer winters affected ice conditions and sometimes made it harder for people to access nonsalmon fish resources since ice conditions changed often and made travel on frozen waterways unsafe. Warmer winters were associated with a higher degree of risk during travel or nonsalmon fish harvesting. One Igiugig elder clearly articulated the perceived risk: "When the [Kvichak] river is frozen and ice is thin, nobody goes anywhere until it gets thick. For safety."

Habitat Disruption and Pressure on Fish Populations

Knowledgeable and experienced fishers in Igiugig suggested that their ability to successfully harvest nonsalmon fish was being hampered by activities of sport anglers in the area. There was concern that increased jet boat traffic in the area was disturbing spawning areas of nonsalmon fish and therefore negatively impacting fish populations. When asked why he thought that there were fewer whitefishes in the Igiugig area than in the past, an elder had the following to say:

> It could be interference with the spawning, you know, killing the spawning. And that's why. There is a lot of interference from the sports fishermen and the guides, and all these lodges coming up. Since they started, all the fish species are declining. Because they are killing off a lot. Even the catch and release, after the sport fishing starts, about a week or 2 later, we go down the river and there are lots of dead fish down in the bottom. The rainbows they catch and release. They bleed to death when they tear that hook out.

Another elder concurred: "This Kvichak is used all the way from Naknek … . Years ago they use to have those little putt-putt motors, now they have these jet boats. I am sure due to that it's tearing down where they [the fish] lay their eggs or feed. It's getting eroded."

Igiugig residents shared the opinion that the decline in nonsalmon fish harvests was related to increased pressure on the resources at the hands of sport anglers. One Igiugig resident stated that he needed to expend more effort harvesting nonsalmon fish because he had to relocate his net from a favored location offshore from the community to an area father away from home on Kaskanak Creek as a result of increased boat traffic to lodges in the area. He also added that these boats never slow down. One elder differentiated between traditional management of nonsalmon fish and the activities of sport anglers in the following way:

> … seems like the [sport anglers] fish from morning until late evening. They don't stop like us. Sometimes I think, "Jeeze don't they get tired from all that fishing?" When you get a limit, sometimes then they just go down to the beach and catch it [fish]. They let it go and it dies.

This same elder spoke more than once about sport angler behavior:

> Even if they have a limit, they are still playing with the fish. Let it go, put them on the beach, kick them up the beach. I don't like that, but anyways they do it. … We've seen them do it at this new lodge over. When I was splitting my fish down on the beach.

One elder in Igiugig thought the presence of beaver dams in the area was interfering with nonsalmon fish spawning and recalled that ADF&G had dismantled or destroyed beaver dams in the past.

In discussing factors that may have contributed to the perceived decline in the number of fish available to be harvested in the Igiugig area, one elderly couple stated that they had observed a large number of river otters living along the shore of the Kvichak River near Igiugig and believed that these otters may be eating or chasing fish from the river or the sloughs that are popular fishing spots adjacent to the village.

Environmental Factors: Iliamna

Water Levels

Variations in water levels associated with warmer winters, less snow, and warmer, wetter summers were said to affect harvests of whitefishes and other nonsalmon fish. The people of Iliamna stated that receding water levels in some bodies of water were impeding the harvest of whitefishes and other nonsalmon fish. One elder identified a place known as Sucker Lake, located just south of Schoolhouse Lake, as being a deep lake in the past and said that it was a favorite harvest area for northern pike. She stated that many people used to go to Sucker Lake to get longnose suckers and northern pike, but starting in 2012, the water level had been so low that people stopped going there to fish. Another Iliamna resident also observed low water levels in features around the community in 2012 and worried not only about nonsalmon fish being able to reach spawning grounds but also about the ability of salmon smolts to reach their spawning beds. The lower water levels were associated with warmer winters and a lack of snow in the area. These concerns over low water are not new in Iliamna. A lifelong Iliamna resident told researchers conducting a 2003 study that the water level in Iliamna Lake was lower and the water was warmer than it had been in the past (Krieg et al. 2005:53). In contrast to 2012, high water levels in 2013 were said to have impeded whitefish harvests by an Iliamna resident who usually attempts to harvest whitefishes from Lake Clark. He had the following to say about the negative impact of high waters and the ineffectiveness of setting a net for whitefishes in such conditions:

> This last year [2013] the fall time, we could not fish whitefish because the water was too high and it wasn't frozen. Usually by the end of October, first week in November, we can do a set. And you get 30 or 40 in one set. But the water was too high … . The whitefish are on the bottom, no matter how you look at it. They're not on top. They are bottom fish.

Another resident said that he was concerned about the amount of sediment running into the Newhalen River as a result of high water, habitat disturbance, and erosion. Changes in water level, temperature, and sediment levels were thought to lead to changes in fish movements and activity, which presented additional challenges to harvesters attempting to locate and catch the fish.

High Winds

Residents of Iliamna spoke of high winds being a deterrent to fishing, particularly in the colder months while ice fishing. At the community review meeting for this project conducted in Iliamna, one resident said he thought the whitefish populations were strong and that the species may be abundant in the area during

the winter but were not harvested by local residents because it was too windy and cold to do so at that time of year. According to him, the high winds experienced in the area were part of a changing pattern in the weather: "We have a lot more wind here in Iliamna, more southwestern wind."

Warmer Winters

Many residents of Iliamna noted a warming trend that was experienced most acutely during the winter months. This trend was said to have resulted in less snow and ice that made travel to whitefish and other nonsalmon fish harvesting locations much more difficult for the people of Iliamna. One elder expressed the following in relation to the warming winters and the effects on subsistence during the colder months of the year:

> I think there has been a big change. We don't get snow, hardly any snow. Our winters are a lot warmer. We used to get like 20 or 30 below. We don't see that anymore. Maybe the coldest we get is 10 or maybe a little less than that for 1 or 2 days. But most of the time it's hardly any cold weather … . The lakes don't freeze, the river doesn't freeze … it [Iliamna Lake] stays open. It just froze over in February for a little while, but not much ice. Can't even travel on the lake. Can't do it no more … . Over the years when I grew up there used to be a lot of snow. We used to travel all over with dogs. You can't even drive dogs anymore, no snow. We used to have carnivals; we can't plan carnivals because there is no snow. Nobody has dogs anymore. There is no snow. People can't afford to buy gas and travel.

Another elder from Iliamna also mentioned changes in winter conditions and variations in the amount of snow and the timing of freeze-up. When asked if he attributed these changes to climate change he had the following to say:

> Yes it is. It definitely is— I mean we have stuff here that has changed so much in the last, probably 30 years that is just not the same. A good example would be the time of year that it freezes now. We don't get the freeze-up like we used to. … And it does not freeze as deep. And the snow varies.

Several people from Iliamna shared the understanding that a warming climate delayed, or made impossible, the successful harvest of nonsalmon fish through the ice. The changing ice conditions not only made planning more difficult but also resulted in harvest attempts later in the year at a time when many thought the fish were less interested in taking hooks or were moving out of the area. In the words of one experienced fisher:

> This area, seemed like the last 5 to 10 years, the lake will freeze and then it will open up again. The ice will go out like at least 7 times. You'll go fishing and then it [the ice cover] is gone with a good East Wind storm. Like I wasn't able to fish. I tried earlier this fall and there wasn't the conditions for it and now, when there is, seems like the trout aren't hungry like they are in the early fall.

Another community member echoed these sentiments and said "it was too dangerous" to go out on the ice.

Pressure on Fish Populations

Many Iliamna residents expressed concern over a perceived decline in fish populations and increased pressure on existing populations of nonsalmon fish from both human and nonhuman predators. During the community review meeting for this project held in Iliamna in fall 2014, those in attendance agreed that there has been increased pressure on nonsalmon fish stocks at particular places that have become popular harvest areas. One resident shared his view on a popular harvest location in the following way:

> There has been increasing pressure on the fish up at the Chulitna Bay [in Lake Clark], there are lots of people. Used to be 1 or 2 [local] families, now there is like 20 or 30 fishing up there.

Beavers were also mentioned in conversations about animal populations affecting nonsalmon fish. Beavers and the dams they build were said to disrupt the movements of whitefishes and other nonsalmon fish to spawning grounds. This was said to be less of a problem in the past when trapping pressure on the beavers alleviated this issue. An Iliamna resident had the following to say about the impact of beaver dams during a previous study conducted in Iliamna for 2003: "The beaver are worse now as nobody breaks up the dams anymore" (Krieg et al. 2005:53).

Environmental Factors: Newhalen

Warmer Winters

Many residents of the community of Newhalen commented on what they perceived to be a warming trend of the climate of the region. They consistently commented on this trend resulting in warmer winters with less ice and snow. Smaller amounts of snow and snow melt were associated with variations in water levels of area lakes that limited the ability of families to harvest nonsalmon fish during 2004–2005 (Fall et al. 2006:74). During this study, one elder spoke of this warming trend as being foretold by her elders:

> The elders used to say that there is going to be a time when the winters are going to change. It's going to be winter more down in the Lower 48 and it's gonna not freeze so much up here. And what they said is coming true now. And how they know I don't know … the elders used to get together and they would start talking about things like that. They said that it would change and now it has.

The warming trend was associated with variable ice conditions. These conditions were said to present challenges to those community members planning a subsistence harvest outing or those attempting to travel to harvest areas on snowmachine or ATV. The later freeze and earlier breakup of creeks, rivers, and lakes in the region, coupled with open waters in the winter months, led subsistence users to change their travel means and routes since waterways could no longer be counted on to provide easy and safe travel routes. One resident of Newhalen recalled when she first experienced a winter in which the Newhalen River did not freeze over to allow for travel and harvest of nonsalmon fish through the ice:

> That would be before I left for high school. Which was back in 1970 or 1971. That was the first time that I ever saw the river not freeze, was back around then. And then it would, as winter progressed, if we had a nice cold winter it would freeze. But this year [2013] I was looking at the river, and it had frozen but there was a channel that had remained open for a long time, and then it froze. Then a couple of people went across. Then the river warmed up again and it opened. Then it froze again. Then it opened up and stayed open … . Yeah, the winters are pretty sporadic now ... weather change.

When this elder was asked if these changes were due to climate change or global warming, she responded affirmatively.

The lack of solid ice on the Newhalen River and Iliamna Lake was said to be a strong deterrent for subsistence harvesting of nonsalmon fish during both study years. The head of one household put the problem in simple, straightforward terms: "The lake [Iliamna Lake] has not frozen for the last 2 winters so we can't travel to get fish." Another Newhalen resident said that the lack of ice had limited her access to those harvest locations on the Newhalen River that she and her family liked to use in the past.

Beaver Dams

An experienced fisherman from Newhalen said that the increased presence of beaver dams in the area could be negatively affecting the health of nonsalmon fish populations by interfering with seasonal movements and spawning of these fish. Like residents from Igiugig and Iliamna, he associated the increase in the number of beaver dams in the area with a reduction in the number of beavers trapped each year by area residents.

Environmental Factors: Nondalton

Warmer Winters

During participant observations, many Nondalton residents spoke about warming weather throughout the year—particularly during the winter. Such warming made travel to and planning of harvest activities more difficult and involved a greater degree of risk for subsistence harvesters of nonsalmon fish. This is not the first time observations of a warming trend have been articulated by Nondalton residents. Over several generations, Dena'ina oral history and tradition has included accounts of freeze-up occurring later in the year and breakup happening earlier in the spring than in the past. Reports by Nondalton residents of shorter, warmer, and wetter winters during the course of this study are consistent with past accounts of similar patterns identified in existing literature on Nondalton (Ellanna and Balluta 1992:21; Stickman et al. 2003:27–30). One elder from Nondalton described the decline in snow levels in 1980 in the following way: "We don't even have snow now. Years ago, we used to have a lot of snow. Sometimes 6-7 feet of snow, and now most of the snow is 4 feet, 3 feet, not a long time" (Ellanna 1986:A-44). A Nondalton resident recounted the effects of a warming climate during a previous study:

> [In the] summertime water is warmer and in the wintertime it is not cold like it used to be and that's why we're losing our berries and our fish. Probably be warmer this year and no water cause there's no snow on the mountain. When I went through the pass there's just a little bit [of] snow. I don't think we're going to have much water this summer, lack of snow, it did change a lot. (Fall et al. 2006:184)

A study conducted in Nondalton during 1980 put the timing of breakup around late May or early June (Behnke 1982:31). During 2014, breakup on Sixmile Lake and Lake Clark was apparent during fieldwork for this study in mid-April.

Declining Fish Populations

There is a perception of population decline for whitefishes. The words of one Nondalton elder were consistent with the general concern for declining whitefish populations: "Seem like long ago there was more [whitefishes]. Remember when we were in grade school, there were lots right out here [in Sixmile Lake], and we used to fish through the ice, but seem like now there's not that much. What I am thinking could be happening is the lake trout and pike are eating them up, too." While harvests by usable weight of all whitefishes increased significantly between the 2 years of this study, widespread perception of declining populations had many users worried.

Beaver Dams

One explanation provided by the residents of Nondalton for a decrease in nonsalmon fish populations was the increased presence of beaver dams in the area. This increase in the number of beaver dams that are said to interfere with nonsalmon fish migrations and spawning events also interferes with human boat traffic along rivers and creeks while traveling to harvest areas. The widespread presence of beaver dams is not a new phenomenon but is still a persistent problem for both nonsalmon fish and those humans that rely on them for subsistence. One resident of Nondalton described this state of affairs almost 10 years ago: "Before,

they used to open up the beaver dam so the fish could go up to the lake and spawn and now nobody does that anymore, nobody even traps beaver, hardly, anymore" (Fall et al. 2006:183).

Availability of Other Resources

A decline in the local abundance of large land mammals, such as moose, was putting pressure on nonsalmon fish resources because of increased fishing efforts to obtain subsistence resources. One elder couple from Nondalton who are active subsistence harvesters described the lack of moose in the area in the following way:

> [Respondent A] I was concerned this winter [2013] when [person's name] came in to go hunting for moose, we like to get our moose during the winter season, in December opening. And [person's name] and [person's name] took off with the snowmachine when we did have snow, that was the only time we used the snowmachine that winter, and they went toward Long Lake, and they came back and they said, "We did not see one track." Not one animal, not even a fox track.
>
> [Respondent B] Not even a track!
>
> [Respondent A] All the way down to Long Lake and all the way back.
>
> [Respondent B] All winter I looked up there, and I saw one set of moose tracks. That was it!
>
> [Respondent A] And how many wolves left?
>
> [Respondent B] About 3 sets of wolf tracks.
>
> [Respondent A] Every year we see a pack of wolves go by, we can see their tracks.
>
> [Respondent B] And the flats, I told you about the Chulitna Flats at that lookout? You used to go there and find them, the moose, and you could take your pick of moose, they were like cattle out there. Now, last year one guy got moose, that was it. Three days after moose season, down by that big birch, looking out there, there was a big bull walking. Walking really slow, I could have just opened the window and shot him. She [his wife], took a picture of it.

While a decline in the availability of moose caused harvesters to put additional pressure on nonsalmon fish stocks, an increase in local bear activity may have been a deterrent to nonsalmon fish harvesting activities. According to knowledgeable Nondalton harvesters:

> [Respondent A] Right in fish camp. We see bears in the village, walking through. They never used to.
>
> [Respondent B] They never used to be there. Even when I was growing up, in the day time, bears, in the fall time, October, the full moon they used to go up the Kvichak, and they would go in the water, walk in the water. They used to say, don't even touch grass, the bear will smell it … . Now the bears are used to people around here … . They never used to come around people, because they were afraid. But now they are used to all the noises and—you just be quiet for a long time, because they used to go up with just a little motor. Not airplanes flying, there were hardly any airplanes.

Environmental Factors: Pedro Bay

Changing weather was affecting people's ability to harvest fish in Pedro Bay. Survey respondents requested that this report address concerns of warming of the Arctic. "I wondered about this … with the weather changing and all the climate change and everything." Many key respondents and survey participants noted winters seem to be warmer, which made traveling to fishing sites, and ice fishing, more dangerous. A

Pedro Bay resident said, "I guess it has been quite a bit different. Especially the winters—hardly any more winters—winter, it's just barely nothing."

Physical risks were mentioned as a factor when choosing where to harvest fish in the winter/spring. "In the end of April, the ice is good and rotten, we don't go out on the ice here [outside the bay], we go ice fishing in the bay [Pedro or Knutson]. The ice is too thin and the water is too deep if we fall through."

Additional issues with local fauna were that birds, insects, muskrats, moose, caribou, and other animals were not present in the vicinity of Pedro Bay and seemed to be declining or moving into other areas. Salmon and other fish were also noted as becoming less abundant. One respondent noted this beginning approximately 5 years ago (from 2012): "There used to be a lot more salmon in the lake, part of their [nonsalmon fish] food chain." These shifts in other animals' conditions were thought to be contributing to or corresponding with the decline in nonsalmon fish, which was making it difficult for people to successfully harvest. Invasive species encroaching because of weather changes and killing off native species was seen as an additional possible influence on harvests.

Ice conditions were a very significant environmental factor most people in Pedro Bay mentioned as impacting their winter/spring fishing efforts. "I don't know what changed, if it's the weather. You know ice conditions seemed to have changed. We have colder summers and warmer winters." The change in lake ice was illustrated in 2012 when neither Lake Clark nor Iliamna Lake froze completely over. Some people mentioned during fieldwork this had never happened before, while another reported this has only happened 3 times in memory. In 2013, the ice did freeze over, but snow levels were very low, which were thought to contribute to habitat damage for fish (because of a lower water table). "This time of the year normally we should have like maybe 5 or 6 feet of snow and a frozen crust on top, you know, you can drive all over—cruise the woods— and that's the way it should be."

Northern pike was identified by a few key respondents as a species of fish to be avoided due to mercury concerns, although they mentioned they had never harvested much pike and still do not today.

Regulatory Factors: Igiugig

Rainbow Trout Harvest Restrictions

When asked what he would do differently if whitefish harvests continued to decline and he did not get as much as he needed, an Igiugig elder had the following to say about regulations and his ability to ensure food security for his family: "Well, there is Dolly Varden and grayling. And rainbows. They [ADF&G] are trying to cut off the rainbow fishing now. It's only catch and release. They are already doing that. But when we want a fish we go fishing. We catch it and we eat it. And even the State cannot stop us from doing that. It's our food."

Oversight and Enforcement of the Sport Fishery

Several residents of Igiugig reported they felt that there was a need for the Division of Alaska Wildlife Troopers to spend more time and effort checking the fishing licenses and fishing practices of sport anglers who come to the area to harvest nonsalmon fish. They felt sport fishing was negatively affecting the nonsalmon resources upon which the community of Igiugig depends for subsistence.

Regulatory Factors: Iliamna

Enforcement

Many Iliamna residents expressed concern over the regulatory frameworks restricting their subsistence practices. Some residents expressed frustration with what they viewed as limits enforced by the State

of Alaska on their ability to feed their families. Most of this frustration was focused on regulations for rainbow trout in the Newhalen River; this included subsistence regulations that prohibit targeting rainbow trout for subsistence but allow retention of incidentally-caught rainbow trout, and sport fishing regulations that close the Newhalen River for part of the year to rainbow trout fishing and requires catch-and-release fishing of rainbow trout. In the words of one elder who complained that she was somewhat confused by said regulations: "Fish and Game would say that it [the Newhalen River] is closed so we do not go down there anymore [to fish]." Another resident said regulations have changed which nonsalmon fish are most important to her family by limiting her ability to catch her preferred nonsalmon fish. She had the following to say: "The Dolly Varden—because Fish and Game won't let us fish any more rainbows, they say we can't catch no rainbows." Other people spoke to harvest changes being the result of a wildlife trooper being resident in the area. When an elder was asked why she thought people had largely stopped attempting to harvest whitefishes and other nonsalmon fish with a net set under the ice she had the following to say:

> They probably don't know how to make jiggers. They used to use ice jiggers but Fish and Game is always watching you, what you do. It's not like before. When you got Fish and Game living right here, you have to watch what you do … . We have Fish and Game, he's a trooper but he is Fish and Game, too. Some village I heard just a little while ago, some went into Kokhanok and a woman had dry meat drying and they arrested her and got rid of the dry meat. That just seems wrong to me. I don't think they should have done that.

Catch-and-Release Fishing

Many Iliamna residents took issue with the catch-and-release practices of sport anglers and the sport fishing regulations that require catch and release of rainbow trout. One experienced fisherman and long-time resident of Iliamna had the following to say about the practices of sport anglers in the area and the negative effect that such practices had on nonsalmon fish, which he understood as resulting in a high mortality rate associated with catch-and-release fishing:

> Then in the summertime … . That is when we get a lot of sports fishermen out here. Grayling is probably the biggest one that they tackle a lot of times. I've seen people go out with fly hooks and use the ones with barbs, and they kill more than they let go … I would rather see them use barbless, but they don't … . Well they do it, just to play with it on a fly hook. I've watched them, then they let it go. So, I call it waste. But that is not what the state says. They make money off it so I can see why they charge what they do.

Another elder directly connected the practice of catch-and-release fishing by sport anglers and mortality of nonsalmon fish. When asked about the importance of whitefishes and other nonsalmon fish during the springtime she had the following to say:

> Yeah, you know the sport fishermen come in here in April. And they'd catch a lot of fish. That is how we used to make our money in the springtime, all those sportsmen. But we told them that they had to share because they were finishing all our fish. Our fish was getting less and less … . 'Cause you know, hook and release, hook and release. It's not good once you catch them, they don't usually survive. Catch them somewhere on the mouth or the body, they get infection right away. We still get fish but we do not get as much as we used to.

Regulatory Factors: Newhalen

Sport Fishing Regulations

Many people from Newhalen mentioned the fact that they abided by and supported the closure of the Newhalen River to sport fishing for rainbow trout during spawning times. Some people thought the presence of sport fishermen on the rivers and lakes of the region was to blame for a perceived decrease in

the number of nonsalmon fish available for subsistence harvest by the people of Newhalen. An elder from that community spoke of the effects of sport fishing in the area, which he said were discussed by his elders:

> A lot of old people in those days used to tell me about all those. Someday, other fish are going to start disappearing. And they told me, "There will be a lot of sport fishermen coming from outside. Start making lots of sound way out on the lake." Which is right up to this day. Since then, all of the fish are disappearing … . There are a couple of lodges over there [on Iliamna Lake], maybe 3 or 4, then they play with fish. Now they are disappearing.

Regulatory Factors: Nondalton

Catch-and-Release Fishing

Current concerns in relation to sport fishing activities in the area are not new. In a previous study, a Nondalton elder attributed fish mortality to catch-and-release practices allowed by regulation: "You see dead fish floating down in Newhalen (River) from sportfishing. The fish don't die just because they want to. I notice that quite a bit. […] When they catch and release, a lot of them die." (Stickman et al. 2003:34). Many members of the Nondalton community felt a particular aversion for or opposition to regulations that require catching and releasing certain species, such as rainbow trout. Many felt that the practice was disrespectful to the fish and was contrary to tenets of traditional or customary management. A respected elder from Nondalton shared her thoughts on regulation of nonsalmon fish harvests in the area during this study:

> [Respondent A] Oh, I, you know, for the last couple of years I never been out, but some people been complaining. I don't know, the complaints are there, complaining about them [regulations].
>
> [Respondent B] You know, nobody does catch and release. I wouldn't do that, but I don't know what's your limit either or any kinds of fish regs. I been down the river when it was good fishing for rainbow. I saw Fish and Game and I would hide my thing but you know, I am not wasting any fish. I'm catching it to eat, but feel like I was harassed then, but when I am out fishing it is my time out there. But I don't know if Fish and Game would stop me, but sound like he did stop couple people for salmon and asked other things like that, your license.

Two respected elders from Nondalton expressed displeasure with sport fishing regulations in the area and complained about the actions of sport anglers, which they thought were harmful to nonsalmon fish in the area. This displeasure was expressed in the following exchange:

> [Respondent A] I found a dead one [fish] that looked like … someone grabbed the eyes.
>
> [Respondent B] To take the hook out they grabbed the eyes.
>
> [Respondent A] I found some dead one [fish] infected.
>
> [Respondent B] I think that they [sport anglers] should use rubber gloves, not their hands. If they want to pick up the fish and look at it, and touch it, and put it back, they should use rubber gloves. Because the fish are getting diseases, from touching them.
>
> [Respondent A] It's always on TV, even down south. What kinds of lures they use and take fishing, putting them back in the water. We don't do that up here. If we catch a fish we are going to eat it.

Restrictions on "Chumming"

Nondalton residents also took issue with regulations that curtailed the traditional practice of cleaning fish on or near water bodies and disposing of fish waste in the water. According to State of Alaska regulations, this is considering "chumming": the discarding of fish entrails or eggs to attract nonsalmon fish. Two active Nondalton fishers had the following to say about their frustration with not being able to successfully harvest nonsalmon fish and being accused of illegally chumming the waters from which they harvest salmon:

> [Respondent A] Is that true, can we stand on our dock and fish for whitefish, rainbows, Dollies—they call it chumming. They say "You're chumming," if you're cutting fish and throwing slime in the river. That's chumming, and we could not fish off our dock anymore. It makes me angry … 'cause I am going to catch my whitefish. When I want to, when I need it.
>
> [Respondent B] That's part of my subsistence, you know when I want to eat whitefish I go fish for it.

Regulatory Factors: Pedro Bay

The biggest concern residents had regarding regulations was the effect fishing lodge businesses have on fish abundance. Many people in the community felt that the lodge guides are responsible for lower numbers of rainbow trout in that part of the lake and also up the Iliamna River. They also felt the area was being overcrowded with people. "Some [people] would go up there and catch a few fish, but then they started lodges, and fishermen. They took the best spots, so no one even bothers going up there anymore. It used to be really good fishing." Fishing near Old Iliamna and up the Iliamna River used to be common. However, many people cannot afford to spend time and money on a harvest trip yielding few fish. A Pedro Bay resident described how he has reduced his area for subsistence fishing:

> I rarely go up there anymore. But I have an airplane, even back then, and boats. So I wasn't stuck here. It was nothing for me to fly down to Lower Talery [Lower Talarik Creek] or up Long Lake and fish pike—the regulars, subsistence fishermen [they don't have that option].

Subsistence, Nonsalmon Fish, and the Wilson Family

Photo by Theodore M. Krieg, staff, ADF&G Division of Subsistence

Whitefish, pike, and Dolly Varden drying with a net to protect them at George and Annie Wilson's property in Igiuigig, October, 2014.

George and Annie Wilson both have family roots in Levelock and Igiugig and are known for their active subsistence lifestyle. In 1976, they established a home in Igiugig where they raised their 3 children. George is originally from Levelock and grew up there. Starting in 1956, Annie's family (Apokedak) moved annually from Igiugig downstream the Kvichak River to Levelock in August so she and her siblings could attend school. In May, when the school year finished, the family would return to Igiugig. This pattern of movement was not unusual for many residents of the region. Igiugig did not have a local school and rural residents were forced to seasonally relocate so their children could attend regional schools. Residency was also influenced by the subsistence lifestyle and summer subsistence and commercial salmon fishing activities that required travel. During her early years, Annie's family had a winter house in Igiugig and a summer house at Kaskanak Creek. Both George and Annie have early memories of going to Kaskanak Creek to catch humpback whitefish and other nonsalmon fish.

Upon establishing their own household and seasonal subsistence patterns, when it was time to catch whitefishes, George would go to Kaskanak Creek by himself to set a net in the morning and then go back and pick up the net later in the day. On weekends, the couple would take their kids to Kaskanak Creek to set a net for whitefishes. Depending on the hunting season open at the time, while the net was set, they would hunt ducks and occasionally moose or caribou. Sometimes, when they wanted fresh whitefishes, they would go down "early" in August after they got their subsistence harvest of sockeye (red) and coho (silver) salmon and set the net. They would boat up Kaskanak Creek and do some berry picking or cut wood for the steam bath for a few hours and return to pull the net and head home. On these trips they could catch 6 to 7 humpback whitefish—sometimes more.

When their son was young, George would take him and his friend out hunting after school. Annie has observed that now the son of this friend is 15 years old and is an active subsistence hunter that shares his catch with others—a recent example of the intergenerational transmission of knowledge and importance of social and subsistence networks. Annie said: "We always talk to our kids and grandkids and encourage them to continue with whatever they were taught growing up. But they all grew up here. They all do a lot of subsistence stuff."

George added to this:

> And we tell them, you got to pass this on to your children now, whatever you learned from us. That's what I like to see, that it carries on from us to our children to their children. That's the way of survival and it's really healthy to live off the land. You're out, you're doing stuff, you're working. It takes a lot out of you, you know, to go out and do stuff like that. It builds your body up.

Annie described air drying whitefishes in the springtime to send to their son to eat when he commercial fishes in Bristol Bay:

> He uses them—you know—just like people eat potato chips or something, he likes his Native food and he'll have dried whitefish and pike and sucker and moose dry-meat, caribou dry-meat, that kind of stuff.

George and Annie feel a close connection to the land and waters around Igiugig and are quick to point out how important nonsalmon fish are to them. In the words of George, "That's what we live off! Subsistence is our food. All the food from the natural land is what we survive by."

Generational Shifts

Many Igiugig residents spoke of a generation gap, or a generational shift that was taking place in the community resulting in fewer people being interested in harvesting nonsalmon fish. The people of Igiugig, particularly the elders, pointed out that traditional knowledge related to the harvest of whitefishes and other nonsalmon fish was literally dying off as members of older generations in the community passed away. One elder put the challenge in the following way: "Yeah they [members of older generations] are dying off. The older people are all, you know the ones, the ones that used subsistence food year-round. The children, they're not taking up what their parents used to do a lot now, they are just, you know, not even trying to get married and put up family [raise a family] and it is just way different now the generation gap." Igiugig elders also identified changes in the younger generation's fishing effort compared to the past. The same elder summed up what he perceived to be the change in the following way:

> Too much computer, and what are those call, game boards. That's what they see now. They don't want to go out with you and go hunting and fishing and trapping. Trying to get food. That is what I see … . It doesn't bother me if they don't want to go. I just say, "Well, we're going anyway." You can do whatever you want. You can stay here and do your computer.

When asked why there are fewer younger people engaging in nonsalmon fish harvesting, one Igiugig elder answered thus: "I think it's because people are getting lazy. Nobody wants to work. Too much TV has ruined them … . These days, it seems like the younger generation don't know nothing these days now. Nobody taught them how, that's why. Too much stuff on TV. My ap'a's stories died. My ap'a used to tell us … ." One elder contrasted her youth to the experiences of Igiugig's youths today while discussing the need for the older generations to teach the younger ones about the natural resources of the area: "Even when I was growing up, everything was oral. Nothing was written. So what we learned when we were growing up, just like old folk telling at night when the gas lamp goes out, they tell you a story and I don't even hear the end of because it is always long."

Others acknowledged the generation gap and spoke of the need to attempt to bridge the gap. One elder couple shared the following about their efforts toward this goal:

> [Respondent A] We always talk to our kids and grandkids and encourage them to continue with whatever they were taught growing up. But they all grew up here. They're all, they do a lot of subsistence stuff.
>
> [Respondent B] And we tell them [their kids and grandkids], you got to pass this on to your children now, whatever you learned from us. That's what I like to see, that it carries on from us to our children. That's the way of survival and it's really healthy to live off the land. You're out, you're doing stuff, and you're working.

In speaking of the need to transfer traditional knowledge to the younger generations, one elder shared the following from her own experience:

> I told them [children], you can learn, you got to do like us! You can't learn it sitting; you got to do like us. You can't learn anything sitting still, you got to do it, then you learn it. And the interesting way to do, it's interesting to learn how to do like us. I told them, "Someday we might not have grocery like that, they might even disappear. And we have to be our own fridge or something like that."

The same elder spoke further on the topic:

> Yeah, that's how I learned from my parents, they tried to pass it down to the young guys. I always tell them [children], sometimes, those young guys they don't hardly hear anyone tell them, they think we bail them out. But I told them, "I am not bailing you out

> when you get old." You have to think about it. They [teachings] come back to you, right now they are not on your mind yet … . But then you think about it and all of a sudden, oh yeah, [elder] told me this and that. My grandma told me this and that, I remember now. They think about it when they get old like me. I never used to think about it. The older I get it is just like a book in front of you.

Another Igiugig resident also pointed out that younger residents of the community were not sharing their harvests of nonsalmon fish as much as was customary in the past and suggested that the practice of sharing resources between households or between communities was also in jeopardy.

Social and Cultural Factors: Iliamna

Generational Shifts

Many people in Iliamna lamented what they saw as a lack of interest in subsistence activities—particularly nonsalmon fishing—among the youth in Iliamna and across the region. The lack of interest among younger people was said to have its roots in economic, social, and technological change as they are experienced in Iliamna and its surrounding environs. Changes in Iliamna have occurred as described by one experienced fisherman:

> And you sit down with the few elders we do have left, and they will tell you stories that will make you think. Even if you spent 2 or 3 days with them, you would never be able to know all the stories they have. In our past, when I was younger we had circles. The elders, the middle aged, and the youth. And we had interpreters. That was the way that we spent our weekends as we grew up. And out of that, they all just pass on generations and generations of stories. Whether it be caribou or moose, fish. They would tell us the times, they would tell us stories about different villages … . There are some stories that we have that date back to the 1840s.

When asked to identify factors that have influenced harvests of whitefishes and other nonsalmon fish in Iliamna, a long-time resident and elder tied the lack of interest to a change in diet. He said:

> A lot of older people eat fish. But not so much the young people. I know some of my grandkids eat fish but not all of them.

He also said that people do not go fishing as much as in the past:

> Well, we don't go fishing number one. We used to go out every day but we don't do that anymore. But if you fish, you get different types of trout. But we don't go fishing as much. People used to go out there and fish all day….they don't go out … well some of them do, some of the young kids, but not everybody … .

Other residents expressed concern about the future of subsistence in Iliamna but pointed to what one leader termed "a resurgence of interest" among the youth of Iliamna in subsistence fishing for nonsalmon fish, particularly through the ice. He said that concern about the attitudes of the younger children toward subsistence fishing and a lack of physical activity among the youth was not a new concern of the community. However, he pointed out that interest among the younger children of the area in subsistence fishing and nonsalmon fishing was on the rise, and more people were making an effort to get their children involved directly in such harvests.

Changes in Technology

Technological change was one of the drivers identified by the residents of Iliamna in shifting patterns of subsistence in the area. Many suggested that improvements in transportation technologies and the introduction of reliable motors had allowed members of the community to reach harvest areas faster,

reduced the need to camp out when harvesting resources, and made it possible for them to travel farther to harvest resources. These changes have made it possible for those who have limited time, such as those who have employment or those who are visiting family in the community for a short period of time, to get out and harvest nonsalmon fish. At the same time, some felt that the introduction of such technologies has made harvests too easy and has resulted in increased overharvest of subsistence resources in the area. In the words of one Iliamna resident, "There are just too many people, and everybody has snowmachines now or a 4-wheeler. So people are getting around faster and are able to do it. And it is just a great life, but I think there is abuse, too."

The introduction of motorized transportation and its widespread application to subsistence activities has also resulted in a reduction in the number of dog teams kept by residents in Iliamna and across the region. Nonsalmon fish were a key element of dog food in many instances, and the reduced number of dogs to feed has had a concomitant reduced need for nonsalmon fish, which may help to explain declines in harvests of nonsalmon fish through time in some households.

Entertainment technologies—such as television, video games, and the Internet—were identified as being in competition with subsistence activities for the attention of the youth in the village. Some residents pointed out the great benefits that such technological advances bring to the community, such as increasing their ability to communicate with friends and relatives outside of the region as well as improving their recreational options and even their health and education through the delivery of products and services. Advances in telecommunications and the introduction of smartphones were seen as a distraction as well as a tool for young people. Young people were not the only ones who were said to be benefiting from the introduction of cellular technology; one resident pointed out that it was not uncommon to hear of "an old grandma sitting on the ice with the cell phone telling others when she is getting bites on the line so others come down and make holes and try for themselves."

Social and Cultural Factors: Newhalen

Generational Shifts

Residents of Newhalen consistently noted that there were few younger people engaging in subsistence harvests of whitefishes and other nonsalmon fish than there had been in the past and pointed out that the most active harvesters of these fish tended to be elderly. The following observations of one community member is illustrative of a common understanding echoed many times over during the course this study:

> I don't see any kids fishing, except my grandkids. I take them out and they love that. Enough to catch for them to eat. So I can bring it home and fry it for them or something … . So that they will continue to fish in their lifetime. And when they have a family they will know what to do, how to catch it, where to go. That's our traditional life, all over Alaska. You show the kids and the grandkids what to do and they'll know what to do when they grow older. They will know where to go and catch the fish … . When the lake is good. In March month. If the lake is frozen good, we'll go run over and catch lots of little ones that are good to cook. We'll bring them back and cook them.

When asked why the younger generation was no longer interested in or participating in subsistence harvests of nonsalmon fish, one common response from members of the Newhalen community was that there has been a change in diet and taste or personal preference that has resulted in many younger people preferring to eat store-bought food rather than subsistence foods. In the words of one elder from Newhalen:

> This generation only goes for fast food. The people that used to have it [subsistence food] still get it but not the younger generation. About the last 40 years they started just having fast food. They just keep getting less and less [subsistence food]. Very few people change fast food for the food that we like and it's getting less common. I still like my Native foods and I do lots of trading with the people up north … . Nowadays they [the

> youth] don't care. Fast food is the only thing that they want. The younger generations don't even want to go fishing. They only have one way of talking and they do not want to listen to us.

In speaking about attitudes toward whitefishes and fishing for these fish, an experienced fisherman from Newhalen had the following insights about changes and his attempts to get the children interested in subsistence practices:

> There aren't too many uses for them [nonsalmon fish] now. The use is not being passed down. And the use is dropping. People aren't using them because the only people eat it right now are a select few, the elders. The younger generation now, even their meat use is different … . I grew up doing this and kids nowadays tend to stay in more. There are some kids that do not even know how to start a fire. Right now, I could go out and get dropped off anywhere on this lake area and make a steam bath. My brother and I showed them how to do subsistence. But it takes them a lot of effort to do that … . It's not how to do it, it is getting the interest back into it. Most kids these days are attached to the phones or computers and they are staying inside. Trying to get the interest back into fishing is difficult … . The guys in their teens and twenties are staying home … . My time and my kids' time is different. When I was young we used to have visitors that would sit there and tell stories all night long. That was our entertainment. I would sit there under the table with my cousins and listen when my mom's friends came over. Sometimes I miss that. There's not much communication now.

In contrast, a man in his forties thought that one of the changes he had seen in his lifetime was that there was a renewed interest in subsistence activities among the youngest community members in Newhalen. He pointed to the need for parents and grandparents to pass down knowledge of subsistence resources and their harvest methods to the younger generations by taking them out on the water to fish themselves. In speaking about his children and their schoolmates he had the following to say:

> They love to go fishing. But I would say 1 out of 10 would do it on their own while the others will wait to get taken. Most won't be independent like that. Kids are more into computer stuff now. I tried to get my brothers to go hunting and fishing but they want to play computer games. I go anyway. I would like to show my kids. I would say that whitefish are the hardest to catch, they don't like shadows or sounds.

Reflections on Sharing Traditional Ecological Knowledge by a Newhalen Resident

Key respondents from Newhalen who shared their traditional knowledge during this study uniformly stated that they learned how to fish for whitefishes from their older family members. As an example, one resident shared her earliest memories of nonsalmon fishing with her mother:

> I might have been 2 years old. It was through the ice. My mom was fishing. I must have been about 2 because I remember my mom fishing through the ice. And I remember slipping and I scared her because she thought I was going to fall through the fishing hole. I must have been little then! ... We probably got Dolly Varden, rainbow [trout]. If there were any whitefish they would have been a kind of bycatch that you would—so it wasn't necessarily for whitefish … . I would go out fishing with my mom. Because we lived across the [Newhalen] river and she didn't have a babysitter. So anytime she went out there she brought us with her… . She'd boil it up with salt and water. Braising? She very seldom fried anything. It was almost like she'd cut it up and put it in salt and water. So we'd eat the fish along with the broth.

Photo by Bronwyn Jones, staff, ADF&G Division of Subsistence

Newhalen resident ice fishing in Northeast Bay, March, 2014.

Photo by Bronwyn Jones, staff, ADF&G Division of Subsistence

Newhalen resident and teacher ice fishing in Roadhouse Bay, March. 2014.

When asked about what else she does when she fishes for nonsalmon fish, the same resident expressed that she is very serious about spending her time fishing:

> When I'm fishing, I'm focused on fishing. Everything else could disappear. No, I don't [do other things when I'm fishing]. I just go fishing.

Like her mother, this key respondent is also passing on her experiences and knowledge with her family members.

> I also, my nephew and I, we go fishing down at the point, like in late July and August up until September we go down to the point and go fishing off the beach, at the mouth of the river. [Shows location on map] He thinks that we've been catching steelhead trout. He said, "'cause they have sea lice on them." He thinks the migrate up this way, to lay their eggs. And I've caught one silver salmon and it was late August. I totally didn't expect it. It actually scared me because it was so big.

Generational Shifts

Many Nondalton residents expressed concern over what they view as an aging generation of people who use nonsalmon fish resources. Many older residents said they were no longer able to fish for nonsalmon fish due to physical infirmness, lack of access to fishing equipment, or lack of adequate financial resources needed to engage in subsistence activities. At the same time, many of these people lamented what they identified as a lack of participation or interest in subsistence fishing among the younger generations in the area.

Nondalton residents spoke about a breakdown in intergenerational communication that has negatively impacted the ability and interest among younger people to engage in subsistence harvests of nonsalmon fish, among other resources. Some elders pointed out that it is not hard for younger people to forgo putting effort into transmission of knowledge from their elders—youths are opting to interact more with technology. They also pointed out that responsibility for teaching the children about subsistence and passing on traditional knowledge was the responsibility of members of both older and younger generations. Many people fondly recounted hearing stories, or *sukdu* (Dena'ina term for oral story), from their parents or grandparents and lamented the loss of these stories and the lack of communication of traditional knowledge related to subsistence activities among some families. One elder from Nondalton expressed her feelings about the need for transmission of stories and other traditional knowledge from older to younger generations in the following way: "I want them to continue. I don't want them to stop. If they stop for sure they'll starve for fish."

Many residents asserted that younger people in Nondalton are not very interested in participating in subsistence activities, such as harvesting nonsalmon fish. A local teacher who spends a lot of time with young people shared his impression that younger people are not learning how to fish from members of older generations and it was only older members of the community who were actively harvesting nonsalmon fish. Other people who shared the same concern thought it had to do with the increase in competition for the attention of young people brought about by the introduction of entertainment technologies such as television, the Internet, and video games (Shaw 2013). In the words of one elder:

> The young people are playing their games. They're not thinking about fishing. All of this modern stuff there. When I was growing up, they weren't dealing with such things like this. You go out and do your chores. Go out and cut wood. And we had to chop it. You would help with the dogs. I remember that was my job. Everybody would go down, the men go down to the bay to fish.

This appears to be a continuing trend supported by accounts from a previous study:

> It used to be that we had to [actively engage in subsistence activities], now it seems like there is a choice in the matter, somehow. They [the youth] are not as involved, but there are a few. Just not as many [kids fishing] as long time ago. If we never packed the house, the smokehouse, then we weren't allowed to swim. (Stickman et al. 2003:44–45)

One concern identified by Nondalton community members was an increased dependency on nonsubsistence resources and benefits issued by the state and federal government among the younger generations in the area. Two respected Nondalton elders shared their concerns during an interview:

> [Respondent A] The future, another thing that scares me is that we are depending on electricity. We are depending on the Internet and our computers, and everything is on the cell phone.
>
> [Respondent B] We're depending on our government. If the government took everything back from this village, where would these people stay. They don't have nothing.

> [Respondent A] There are very few homes this village that are built by themselves, without the help of the government. The government came here and built these homes and said you can live in them … .
>
> [Respondent B] The whole village! But a few, they give them money for food and they don't have to work. Somebody else is paying for them, food stamps and welfare and whatever.
>
> [Respondent C] Makes people more dependent.
>
> [Respondent B] Right, exactly. People just know that someone is going to help them … .
>
> [Respondent A] Welfare and energy systems [assistance]. Like if they lost the use of the computer, the cell phone, what then? How are they going to survive?
>
> [Respondent B] I remember when there was only 1 phone in the village. You had to stand in line and wait, and everybody behind you would say, "Hurry up! Hurry up!" Getting mad. I remember when there was nothing here, no gas lamps, no TV, no electricity. But it seems like everyone was happy. They went and visited one another, they had stories to tell. Now you see people, they don't even visit.
>
> [Respondent A] They are too busy sitting here.
>
> [Respondent B] You go into someone's house and never talk!
>
> [Respondent A] They got their iPhone and their games.
>
> [Respondent B] Remember when they used to go hunting for duck? They used to go for a week. Maybe 5 or 6 teams would go out. That's where I would hear a lot of stories, growing up, too, hunting camps. Sitting around and eating, they were always telling some kind of story.
>
> [Respondent A] Families would go together, doing it as a family. They don't do that anymore … .
>
> [Respondent B] Even I don't do that anymore … . I want to get me a smartphone so I can be smart like other people [laughs].
>
> [Respondent A] We live in an era of smartphones and stupid people.

A respected elder expressed his anxiety about the future and dependency on technology among younger generations:

> Well, if something ever happens to our society and we don't get no more help from the white mans from outside and everything comes to a screeching halt. We're going to have to live off the land, the old-style ways, and if they don't know how to live off the land and fish like how we are fishing they are going to be stuck.

There was also concern youth were not interested in eating subsistence foods and that having a reliance on store-bought food increased dependency on the outside world, as well as jeopardizing the health of the youth in the community. In the words of 2 elders:

> [Respondent A] I am really worried about our children and grandchildren and great grandchildren because you know, they are not eating the foods that we eat, that we grew up with, that we like to eat. We like to eat fish. We like to eat dried fish, we like to eat beaver and porcupine.
>
> [Respondent B] Yeah. You put some on the table, they won't eat it.
>
> [Respondent A] Yeah. They will look at it and say "Uhhh," and they will eat their pizza or Hot Pockets or something that you put in the microwave—that's all they eat today. Junk food. Chips and pop—drink your water! Don't drink that pop or energy drinks. You

> know, water will give you energy. That is the only thing that I worry about, our younger generations.

Other residents acknowledged that there are challenges facing Nondalton youth and knowledge transmission but pointed to what they saw as a revitalization of interests in traditional knowledge and subsistence activities among the younger people of Nondalton. During the course of this study, Culture Week was a great success in Nondalton: many looked to scale up this success and bring the positive momentum into the future. Many residents suggested the community could capitalize on this interest by "integrating it [subsistence and traditional knowledge] into their education, making it part of their school day … . I think things like this Culture Week at school and then the tribal culture camp, more activities like that would be really good for the kids." As part of Culture Week, schoolchildren from Nondalton were brought out to a net set under the ice to see how this type of harvest takes place and to ask questions of those responsible for distributing whitefishes and other nonsalmon fish from the net to households in the community that asked for fish. Others thought perhaps an annual nonsalmon fish derby might help to pique the interest of the youth in Nondalton. Many Nondalton residents also expressed the desire for themselves and their children to have access to Dena'ina language classes as part of what may be termed a cultural revitalization movement in Nondalton.

Social and Cultural Factors: Pedro Bay

Generational Shifts

A factor many people in Pedro Bay commented on as influencing harvest efforts of nonsalmon fish was the perceived generational gap between older knowledge systems and younger generations. This gap of knowledge was perceived less in the very young generations and thought to exist more among millennials.[1]

> They would rather be inside playing their games. They needed to be more taught and educated. Considering in Pedro Bay there are only 4 kids—and they are taught from their parents. But the older kids in their twenties and stuff, they were not taught anything. Those poor kids don't know how to do anything. That generation fell through the cracks or something. And they don't want to learn.

One respondent felt knowledge about harvesting fish was not valued by younger generations who "think we don't know what we're talking about, so they don't listen to us." This quote was said in the context of value being attributed only to Western knowledge systems by the younger generations and local indigenous knowledge systems losing value.

The impact of more easily available goods was also seen as a cultural shift spanning generations. Respondents remarked that today most people were buying food rather than depending on wild food resources.

> We didn't have a lot of money when we were kids, so we had to fish and hunt in order to eat. A lot of younger generations, they don't. It's easier for them to buy food. They just order food from different companies and it's very expensive. It is cheaper to go out and fish, but it is too convenient for them [to buy it]. Now, the younger ones are not being taught how to hunt and put food away, which is very sad.

This perceived lack of enthusiasm affected how some harvesters fished, since they liked to go with other people. A key respondent noted when he was young, he was never "told" what to do, but rather learning came from observing adults and watching what they did during harvesting. Key respondents and some survey respondents attribute the combination of these socio-cultural factors as a main reason for lower nonsalmon fish harvest efforts in the community. Another possible contributing factor could be the lack of dog teams has reduced demand for nonsalmon fish.

1. A millennial is a person born in the 1980s or 1990s.

Economic Factors: Igiugig

Availability of Paid Employment

Some Igiugig residents claimed they did not fish as much as they could have due to constraints on their time, including holding employment. Those with paying jobs were able to supplement subsistence activities when they did have time, including harvesting nonsalmon fish, with food purchased from a store. While employment of a potential harvester may have reduced fishing effort at the household level, many of those who said that they did not have time to fish did receive some nonsalmon fish from other households.

Cost of Gear

Many residents pointed to a lack of access to equipment, such as boats, and the expense of maintaining equipment as factors limiting their ability to access and harvest nonsalmon fish. Even when ice conditions allow for the potential to catch nonsalmon fish while ice fishing, basic items like warm clothes that require money to purchase are needed. While a gas-powered ice auger may not be necessary, a metal hand tool also comes with a price tag. One elder in Igiugig stated that his ice chipper used to make ice fishing holes was welded together from 2 old pieces of metal that originally served other purposes.

Cost of Groceries

While the availability of store-bought foods may be a factor in the declining harvests of nonsalmon fish in Igiugig, the cost of these foods may be one incentive that drives continued harvests. When asked what they might do if whitefish populations continue to decline (as residents themselves predicted), a married couple with many years of fishing experience in the area had the following response:

> [Respondent A] We'll fish them until the state tells us we can't. We'll catch fish and eat them. That's what we live off! Subsistence is our food. All the food from the natural land is what we survive by. Otherwise we will have to go to the store, and we don't have enough money to go buy stuff, a nice big T-bone steak is about 15 or 20 dollars?
>
> [Respondent B] Moose steak is better anyways.
>
> [Respondent A] Yeah!

Economic Factors: Iliamna

Availability of Paid Employment

Many residents of Iliamna said that they reduced their whitefish and nonsalmon fish harvest efforts because they took on full-time, part-time, or seasonal work. Gainful employment not only increased involvement in the cash economy but also often had related costs such as less time to engage in subsistence activities. Many people spoke of the benefits of having access to regular cash income and the drawbacks associated with less free time and flexibility to take advantage of environmental conditions that allowed for harvest opportunities. When asked why she did not harvest as many whitefishes and other nonsalmon fish as she had in the past, one resident shared the following insight:

> Well, I think my life probably changed more because I went from an 8 to 5 job with weekends off to running my own [business] which then you're stuck there, so it seems like I missed out—but in the fall time, when the ice is freezing and the ice fishing is really good, I take even an hour and go down ice fishing.

Other people said that they were not able to make the time to fish due to demanding work schedules. One elder talked about the challenges of entering the workforce and maintaining familial subsistence patterns. When asked if she ice fishes with her children one elder had the following to say:

> Oh yeah, we used to take them fishing and everything. … We took them out and showed them everything. But they never do that, you know, they work. Different jobs. If you have a job you have to do it every day. You don't have time to go out and subsist. You have to be doing what you're doing. Nowadays, it's either go work or stay at home and do nothing. A lot of the older people, they never worked like that, they don't know how to or have the education. And they see that, but the young people are educated nowadays. There is a difference. … It's a job. But it doesn't stop people. You know people can't go out and do it except on their time off. Then they take the time to do it. You know I worked, he [her husband] worked, we all worked, but we didn't have time to do things like that because we were always working. Whatever job we could find to make money for our kids. A lot of people sit back and talk about subsistence, and the sports fishermen are pushing it and they don't know whatthe people are up against. They have to work to live. You got to buy fuel, you got to buy gas, you got to buy food, plus you got to have a car … . When you live here, you can see … the difference. People working. … That's the way it is.

Some residents spoke about the availability of paid employment in the area being tied to the development of the Pebble mine project. Proponents of the development spoke of the jobs generated by the project and pointed out how money generated by the project had been used by local employees to buy gear and equipment used to harvest subsistence fish resources. Opponents of the project often spoke of their concerns about the realized and potential environmental impacts of the project. One resident of Iliamna spoke about the divisive nature of the project and shared some thoughts on how the uncertain future of the project[2] had affected subsistence:

> I think that, and I feel this community probably now, there is a lot of anger here. You've probably sensed it with Pebble dropping out. You know, people had jobs, and there was money. And it just seemed so much more positive which I am so glad to see, because I know what being poor is. And people work hard and then just to have things cut right from you … right now it is hard. I hear that there is just really bad feelings even in families. So I am hoping that it will pass. So I think in the future there will always be fishing. But I am thinking that people will learn, too … the battle that has been waging because of the gold mine, it's going to calm down and things will get back to normal.

Cost of Gear and Fuel

People in Iliamna also talked about the cost of gear, fuel, and equipment being a limiting factor on their subsistence patterns. Residents of Iliamna mentioned not having equipment such as a jigger board to set a net under the ice to target whitefishes or other nonsalmon fish, or lack of access to a boat or ATV, or not having the capital needed to purchase such equipment. In the words of one resident, "You have to have money. To buy the hooks and everything to go fishing. You still have to pay for it. Nothing is free. You use to just have a string and go fishing. People don't do that anymore. They hook the fish and have eggs and everything." Several people also mentioned northern pike destroying their "trout nets" and not replacing them due to the cost of doing so.

Cost of Groceries

Many Iliamna residents spoke to the challenges of living in a mixed cash–subsistence economy. They articulated a need for cash and the employment that generates that cash in order to meet household needs

2. During fieldwork for the project undertaken in 2014, the Pebble mine project was on hold due to financial and regulatory challenges, and only a handful of local people were still employed with the project, which had its operational base in Iliamna.

and to engage in subsistence. They also expressed concern over the high cost of store-bought foods and pointed out the role that subsistence foods played in the diets of their households. One lifelong resident of Iliamna spoke to these challenges:

> Living in the 1990s on, with electricity and everything else in the modern age, you can subsist but then you have the opportunity to go out and buy beef and stuff. But the price is so high that you have to have a cash economy to live off of the white man's world. I still, probably 80% of what I live off of is subsistence. When you have pork chops, a steak, or chicken … . I would rather have moose; I would rather have caribou; I would rather have fish.

It is not just personal preference that is driving subsistence harvest and consumption of whitefishes and other nonsalmon fish in Iliamna. During the community review meeting held for this project in fall 2014, as part of a discussion on the cost of living in the area, an active fisherman pointed out the following: "Store-bought food is getting too expensive and we are starting to fish to supplement our meals."

Economic Factors: Newhalen

Cost of Gear, Fuel, and Food

Many residents of Newhalen mentioned the high cost of gear needed for nonsalmon fishing as a limiting factor in their ability to successfully harvest whitefishes and other nonsalmon finfish. While some members of the community did have access to seasonal or year-round employment that provided their households with cash, the high cost of store-bought food and heating fuel often meant that households had to make careful choices as to how to spend limited monetary resources. In the words of one experienced fisherman who had a cash income, "It costs a lot of money to go down there [to a particular place on Kaskanak Creek, a popular spot for harvesting nonsalmon fish with a net] with a boat. The commute really affects fishing efforts."

Economic Factors: Nondalton

Availability of Paid Employment

Many residents of Nondalton stated that they do not engage in as much subsistence harvesting of nonsalmon fish resources due to constraints placed on their time by full-time, part-time, and seasonal employment. Some residents suggested that the harvest of nonsalmon fish was important to them since they could access such resources at times that did not conflict with other economic activities, such as commercial salmon fishing in Bristol Bay.

The high cost of store-bought food was also a factor in the decision of many families to harvest nonsalmon fish resources. However, the ability to work for cash also allowed some families in the community to rely heavily on store-bought foods, which replaced subsistence foods. Importantly, many of the households that did not engage in subsistence harvesting of nonsalmon fish did receive at least some of the resource from those that did, as evidenced by sharing estimates from the survey results.

Cost of Gear

Gear and other resources needed for harvesting nonsalmon fish are expensive for the people of Nondalton. During the 2 years covered by this study, there was no store or outfitter in Nondalton to serve the needs of subsistence harvesters. Reliance on air freight added significant costs to items such as fishing nets, winter outerwear, ATVs, or boats. Fuel is locally available in Nondalton but also is sold at an inflated price.

Economic Factors: Pedro Bay

Costs associated with traveling have affected how people in Pedro Bay harvest nonsalmon fish. One key respondent said that he traveled in the past all over the lake and as far as Iliamna Bay, but recently he stopped and he has not been out that far for a few years. The low return of fish was not worth the investment of time and money. Instead, this respondent's family fished outside their house and occasionally on the Iliamna River near Old Iliamna. This cost–benefit issue is directly related to fish abundance, time off from work, and rising fuel costs.

6. DISCUSSION AND CONCLUSIONS

The previous chapters have documented the harvest and use of whitefishes and other nonsalmon fish, as well as the traditional ecological knowledge of these species shared by residents of Igiugig, Iliamna, Newhalen, Nondalton, Pedro Bay, and Port Alsworth. The following sections will summarize project findings concerning whitefishes, including factors that could be influencing local residents' ability to harvest and use whitefishes. Additionally, feature information about the project's main education and outreach component, Culture Week 2014 in Nondalton, highlights some of the activities in which students participated, such as learning to make and use a traditional fish trap. Lastly, the chapter ends with a list of recommendations based on the study findings for potential further research.

Overview of Findings for Whitefishes

The physical characteristics of whitefishes, in particular their lack of teeth and small mouths, make them difficult to harvest with methods other than a net. One resident from Newhalen described fishing for whitefishes this way:

> You have to use a single hook, with a little bit of bait and no sinker. They are hard to catch because they are cautious and don't have teeth so you have to be careful reeling them in. I have only caught them on salmon, salt fish; usually using a hook and line. We don't let them go I'll tell you that.

This was echoed by another Newhalen resident who said:

> Sometimes I put a net out, you know they don't bite. Sometimes with a snag. But Fish and Game don't like, but we can snag our fish like that, because we are going to eat them. We're not gonna waste, I know for sure I am going to eat it guts and all.

Residents from Iliamna, Newhalen, and Pedro Bay commented on the use of seines, traps, and nets to harvest whitefishes in the past. Given the physical attributes of whitefishes, these methods provide for greater harvest success than a hook and line. Discontinued use of nets in these communities has likely contributed to decreased harvests of whitefishes over time. However, residents of Iliamna, Newhalen, and Pedro Bay do not believe whitefishes have ever been particularly abundant in the vicinity of their communities.

Culture Week 2014

Staff from ADF&G, NPS, BBNA, and NTC worked closely to devise and implement educational and novel ways to involve youth and students in "Culture Week 2014." Nondalton School serves pre-kindergarten through grade 12 students. In spring 2014, there were 43 students at Nondalton School, which annually has a "Culture Week" that typically occurs in May as part of the school's existing curriculum. Project partners coordinated with Nondalton School to arrange for Culture Week in 2014 to revolve around the theme of whitefishes. Project partners developed a curriculum with activities to highlight the value of whitefishes locally and different ways of knowing: specifically, indigenous (Dena'ina) knowledge systems (including observation, interaction, and resource management) and Western knowledge systems (including science and resource management). The underlying purpose of the educational program was to focus on the integration of the 2 knowledge systems. The main focus of the curriculum was to provide students information and hands-on activities highlighting their heritage and culture with a focus on traditional activities involving whitefishes, providing activities connecting students to the natural environment by use of the outdoors for the classroom, and to promote sharing and understanding of Dena'ina knowledge. Through these activities the students gained an understanding of traditional practices and the role of Western science supporting resource management and subsistence regulations.

Project partners met monthly over the course of a year to develop curriculum activities that are outlined in more detail in the remainder of Appendix A. Dena'ina elders were consulted and contributed lesson plans to the curriculum. Their presence, contributions, and participation in Culture Week were instrumental to the program's success. Project staff worked with Nondalton School to develop a schedule that included teaching classes daily. Students spent the week learning from Dena'ina elders, teachers, local community members, and researchers from BBNA, NPS, and ADF&G. As a brief summary, the curriculum included: cultural activities involving traditional knowledge about, harvesting methods of, and uses of whitefishes; hands-on craftsmanship of harvest gear; Western knowledge of whitefishes; and fisheries management. Culture Week occurred between April 28 and May 2, 2014.

Photo by Theodore M. Krieg, staff, ADF&G Division of Subsistence

Nondalton students at Culture Week 2014.

Revitalization of Traditional Fish Traps in Nondalton

Karen Evanoff, project partner, cultural anthropologist for the Lake Clark National Park and Preserve, and Nondalton community member, has been working closely with residents of her hometown and other Dena'ina communities in recent years to foster and promote cultural awareness and revitalization, with a particular focus on the use and knowledge of subsistence resources. In fall 2013, Karen Evanoff organized an activity— Beaver Camp—that occurred in Lime Village. Participants included elders and community members from Nondalton, ADF&G staff, and local Lime Village residents. At this camp, a local resident set a fish trap in a nearby creek to harvest whitefishes. The practice of using fish traps by Dena'ina groups has declined over time due to the introduction of gillnets. In the past, people from Nondalton harvested fish from traps set in the creeks of the area (Stickman et al. 2003).

To reintroduce knowledge of fish trap operation and building to Nondalton residents, Helen Dick, an elder from Lime Village, and her husband, Alan Dick, worked with Culture Week 2014 participants in Nondalton to discuss the construction and use of a number of different types of fish traps used by people of the region. Schoolchildren and adults worked together to build 3 types of fish traps. This project was a great success for everyone involved. Below is a description by Alan Dick about how to use the fish traps.

Note—at first, Mr. Dick spoke to the audience about how he learned to build a fish trap and when the best time is to harvest fish.

> Years ago I came to Alaska in 1966. Helen and I got married in 1969. We've been married 45 years. Years ago all the elders said, "Someday all the stores are going to be empty, and you're going to need to know how to live off the land." While all my peers were going out, I was building fish traps and chasing caribou, building fish wheels, and dog sleds. So I learned how to do this from Helen's dad, Pete Bobby, and Nick, too. What happens if you'll picture in your mind, here's the lake over here and a creek here that goes down to the river. Now in my village at least the lakes behind the village are shallow. The whitefish know that they're going to get trapped in and frozen down. So they go in, in the summer, water warms up, lots of bugs, lots to eat. Fall time they need to know how they're going to get out. So that's when they'll head down the creek. When I first did this, Pete, Nick, and myself, they left me to man the fish trap, and I said, "When do the fish come." I didn't know, the moon, the sun, what determines when the fish get down the creek. The answer was water temperature. When the water temperature gets to a certain point they know, "Whoop, we got to get out of here before we get frozen down." That's when they come down the creek. Now again the current's going this way. You have to watch in the fall time, a lot of times if the wind is blowing, a lot of grass comes down the creek. That's why we clean a lot of these slats. All of the high school students did this. We had cleaned the slats, because when you clean them, you're in the water and it's icy cold water. You don't want to get splinters when you're cleaning the grass off. Because if the fence gets full of grass, it'll act like a dam, and wash out. The fish will go underneath, instead of into your fish trap. So we're always cleaning the fence. The fish come down, they hit the fence, they come around here, and they go down here. So what we do. Let me explain this first. That kind of fish trap is good because you can go away. You can go hunting and you can come back

Photo by Cameron Welch, staff, ADF&G Division of Subsistence

Alan Dick demonstrates to community members how to harvest fish from a weir, hchił, with a handmade net, Nondalton Culture Week, May 2014.

and there's fish there. They got caught in the puddle. But sometimes they're wild to the wind, they don't like that narrow funnel.

Photo by Theodore M. Krieg, staff, ADF&G Division of Subsistence

Whitefish trap, hulegha taz'in, made by Helen and Alan Dick, Nondalton Culture Week, May 2014.

Mr. Dick continued his demonstration by talking about how to catch whitefishes in a *hchił*, or fish weir (Jones et al. 2013):

> So this is the kind of fish trap you can build if the fish are wild when they come down [hchił—depicted in photograph at right]. So what we'll do is I'll be hiding off a little bit farther away. The fish will come in, they'll come in, they'll come in. Then all of a sudden when I think it's gotten enough I'll pull on the string. There we'll go, they're trapped. Then that's when we come in with the dip net and you can just dip them out the long way. You dip the fish out here and put them back in the bank. Sometimes there 14 to 16 [in a net], so heavy you can't even lift. When the whitefish come out of the lake in the fall, they're really fat. You cut them open, and their guts are just like a white cigar. There's so much fat. There's suckers coming down too, and suckers coming out of the lake are really really good food. We don't eat them much on the river, but coming out of the lake they're really really good. So that's this kind of trap. The first trap had a funnel in the front here. We didn't have time to make that one. So that's type number 1, type number 2.

Lastly, Mr Dick spoke to community members about the best place to put a fish trap:

> Let me talk just for a minute about where you would put a fish trap. You can't put it anywhere in the creek. If you put it too close to the mouth, the fish will come see it then they'll, "Uh I don't like that," and go back up. You want it down away from the mouth a little ways. If it's silty bottom, it's easy to drive your poles in the bottom, but it'll wash out underneath easily. What we did, is we put moss along the bottom, so it wouldn't wash out. You want a place, if it's too swift, then if you fence those up with grass it'll wash out too. So you have to pick the place. All the old timers knew the place. You're looking for a place that has good ground on the bottom. Not too swift, not too deep, you don't want to be up to here. So you're looking for the perfect place to put your fish trap.

Photo by Theodore M. Krieg, staff, ADF&G Division of Subsistence

Helen and Alan Dick with community members posing with conical fish trap and fish trap fences, Nondalton Culture Week, May 2014.

In this study, Igiugig and Nondalton harvested the most whitefishes of the study communities. Based on interviews with many residents, areas surrounding Igiugig and Nondalton have always been rich in whitefish resources. Residents of these communities also continue to employ nets to harvest whitefishes, which are not typically used in the other study communities. In Igiugig, setting nets occurs in the fall in the Kvichak River and in Kaskanak Creek. In Nondalton, a net is set under the ice on Sixmile Lake in the spring and monitored by a number of families. The use of nets by these communities has contributed to successful yearly harvests of whitefishes locally, and many residents from the other study communities reported receiving whitefishes from Igiugig and Nondalton households.

During this study, community members generally agreed the most abundant whitefish resources were located near Igiugig, in the Kvichak River and Kaskanak Flats and Creek, and near Nondalton in Sixmile Lake. Residents of the study communities consistently spoke about the differences between humpback whitefish harvested from areas in the vicinity of Igiugig versus those caught farther to the north near Sixmile Lake. Specifically, humpback whitefish harvested near Igiugig are always described as "larger" or "huge" in comparison to humpback whitefish harvested near Nondalton. Some residents suggested these physical differences can be attributed to the distances that humpback whitefish are traveling in an annual cycle. Residents indicated Igiugig humpback whitefish are bigger and stronger because of their migration from Bristol Bay each year to spawn in the Kaskanak Flats or just downstream from the mouth of the Kvichak River. In comparison, humpback whitefish harvested near Nondalton are described as being smaller, and their flesh "mushy"; some residents suggested this was because the fish had lost a lot of their mass migrating from Bristol Bay to reach spawning areas in the vicinity of Sixmile Lake. The uniform reports describing sizes of fish in both of these areas (i.e., big versus small) may indicate a life cycle involving fry/smolt residency in the Sixmile Lake area before migrating to the Kvichak River and further downstream post-maturation, followed later by a return to natal grounds for spawning (i.e., vicinity of Sixmile Lake).

Alternatively, humpback whitefish in this study may represent 2 distinct groups or populations: an anadromous or amphidromous humpback whitefish population that migrates to Bristol Bay or estuaries of the Kvichak River for some period of the year and returns to the vicinity of Igiugig to spawn in October and November, and a separate resident population of Sixmile Lake and Lake Clark that migrates annually to the Pickerel lakes to spawn. It is unclear the time of year the Sixmile and Pickerel lakes population spawns but some residents from Iliamna and Nondalton suggest it is in the spring, which is unusual for whitefishes, which typically spawn in the fall (Alt 1979; Morrow 1980; Reynolds 1997). Recent telemetry and otolith research by biologists of the LACL supports the existence of a resident Lake Clark/Sixmile/Pickerel lakes population that does not have a strong signature for anadromy (Woody and Young 2006). Anadromy is less clear for humpback whitefish of the Kvichak River/Kaskanak Flats and Creek (Daniel Young, Fisheries Biologist, National Park Service, Lake Clark National Park and Preserve, personal communication, May 2015). Limited data for Kvichak River/Kaskanak Flats humpback whitefish indicate these fish may migrate to saltwater.

Residents of the study communities consistently reported weather and climate as playing a significant role regarding their ability to harvest whitefishes and other subsistence resources. Specifically, members of the communities expressed concern about unpredictable weather patterns that affected ice conditions, distribution and amount of snow, and water levels. The effects of a changing climate affected their ability to plan important subsistence harvesting activities and, in many cases, their ability to harvest resources entirely. When an elder from Iliamna was asked how he felt about the future stocks of whitefishes and other nonsalmon fish, he thought populations would decline within a 10-year period. He identified climate change as a driver of this potential decrease. In his own words:

> I'll probably say they [whitefishes and other nonsalmon fish] decreased. Not only in use, but also just a decrease. I think it's because they are going to move north. And the reason I see that is as you watch the climate change, it's already hitting the southwest area. And as it warms, the caribou are gone north, moose are more up in Bethel area now … . I don't see it improving any.

Conclusion

This study has documented the historical and continued importance of subsistence harvests of whitefishes and other nonsalmon freshwater fish for the residents of the southwest Alaska communities of Igiugig, Iliamna, Newhalen, Nondalton, Pedro Bay, and Port Alsworth. Harvest surveys, key respondent interviews, and participant observation conducted in each of these communities highlight the central role played by nonsalmon fish in the seasonal round followed by residents in the region. Nonsalmon fish resources are particularly vital to residents in the spring and fall when salmon and other resources are not available in abundance. Most households in the study area harvested and used one or more nonsalmon fish species during 2012 and 2013. Local residents also participated widely in exchange networks through the giving and receiving of freshwater nonsalmon fish resources. While some community harvests decreased over time, residents consistently conveyed their desire to have access to subsistence-caught whitefishes and other nonsalmon fish. This study also documents the area's rich traditional knowledge base related to whitefishes and other nonsalmon fish resources. This knowledge illustrates local self-management and informs understandings of the past, present, and future.

This report demonstrates variation in harvest, health, migration patterns, and use of whitefishes and other nonsalmon fish over time. While harvest locations remained relatively stable, local adaptations to changing weather patterns, ice conditions, and temperatures resulted in shifts in harvest timing and gear type used. While many nonsalmon fish stocks were reported to be generally healthy, there is local concern over rainbow trout and other species that have been targeted by sport fishermen and subjected to catch-and–release practices.

Technological change and modernization have also altered residents' ability to access and use nonsalmon fish resources. Changes in transportation technologies have caused replacement of dog teams by snowmachines and ATVs. While snowmachines and ATVs require fuel and maintenance that come at a monetary cost, they provide users with the ability to travel farther and more quickly to access harvest areas than was once possible. Entertainment technologies have provided more choices to the people of the study communities. At the same time, availability of these technologies—such as video games and television and video recordings—has been said to have affected the attitudes of some residents, of youths in particular, toward subsistence activities and the harvest of nonsalmon fish. Some community members suggest this has resulted in fewer young people engaging in subsistence activities.

This study has identified several factors influencing harvesting opportunities and fishing methods used by area residents who use whitefishes and other nonsalmon fish—factors include climate change, technological change, economic pressure, and generational differences in subsistence knowledge and participation. A warming trend is evidenced by accounts from survey participants that lakes are not freezing sufficiently. The warming trend has resulted in shifts in harvest patterns of many whitefish and nonsalmon fish species. Water bodies are freezing up later in the year and breaking up earlier in the spring, reducing the ability of local residents to harvest whitefishes and other species through the ice. Deteriorated ice conditions have hampered the ability of locals to travel by snowmachine to harvest areas in the spring and fall. Many residents expressed concern over what they perceive to be an increased physical risk to themselves and their families as a result of climatic conditions and less predictable weather patterns.

Economic factors such as the availability of paid employment and the cost of subsistence equipment and fuel also highlight a set of factors that impede local use of whitefishes and other nonsalmon fish resources. In addition, many study participants identified generational differences in attitude toward subsistence activities and a widening generational gap in their communities. Some study participants are worried about the future of subsistence knowledge and practices in their communities as a result of technological change. In the face of these and other forces, many residents remain committed to practicing and teaching a subsistence way of life that includes the harvest and use of whitefishes and nonsalmon freshwater fish.

This study has demonstrated the vital role of whitefishes and other nonsalmon freshwater fish in the seasonal subsistence patterns of communities of the Lake Clark and Iliamna Lake watersheds areas. These practices link the community members to one another and to the land and waterways that provide

nonsalmon fish resources. Local insistence on sustainable management and harvest practices are based on a shared understanding of the importance of these resources for the continued health and vibrancy of the communities and the region. This report aims to assist the study communities with identifying ways to work toward their individual and collective goals of sustaining their ways of life amid climatic, social, and economic change.

Recommendations

1. Given declining harvests of nonsalmon fish in many villages of the study area and the important role that these fish play in the subsistence patterns of local residents, there is a need for continued assessment of these fisheries. Such regular assessments are necessary in order to identify trends and assess those trends. Full support for such efforts should come from tribal and local governments, community leaders, advisory committees and the Alaska Department of Fish and Game, as well as relevant federal agencies. Further studies should be interdisciplinary, include additional participant observation of nonsalmon fish harvests, and pay particular attention to species identification.

2. Local sport fishing lodges and guiding activities are important to the local economy and provide excellent fishing opportunities for those who participate. That being said, it is important that the effects of such activities, both on nonsalmon fish and the people who rely on the fish resources, be better understood by developing working groups, opening lines of communication, and increasing understanding between members of various user groups, as well as studying fish mortality associated with catch-and-release sport fishing.

3. Local residents of the area and their leaders are active in fish and wildlife regulatory processes. This includes participation in advisory committees, regional councils, and in the regulatory board process to ensure that their concerns, observations, experiences, and knowledge of nonsalmon fish are brought to bear on regulatory decisions. Effective management of fish and realization of subsistence fishing opportunities depends on the involvement of those people who have direct knowledge of these resources and their habitats. This knowledge should be included in management decisions.

4. This study has highlighted the existence of self-management practices that have been at work and continue to be pursued in the nonsalmon fish subsistence fisheries of the study area. These practices facilitate not only sustainable harvests of nonsalmon fish resources but also the sharing of these resources within villages and across the region and beyond. Sharing increases food security and human health as well as strengthens social ties and community well-being. Such practices should be better recognized by state and federal agencies. Such practices work because residents of the study communities share an understanding that the future of their way of life and the traditions that help to shape their mixed economies depend upon healthy populations of nonsalmon fish, and they are willing to work to conserve this important set of resources.

5. This study has demonstrated many of the challenges that the communities of the Iliamna Lake and Lake Clark areas are presented with in the face of rapid social and technological change. Many community members have expressed concern about the breakdown of intergenerational knowledge transmission. The future of the nonsalmon fisheries of the area depends on continued

and increasing youth participation in activities related to subsistence. Participation will allow youths to gain knowledge and understanding that are key to developing their abilities to successfully and sustainably use nonsalmon fish resources in the future. The success of the Nondalton Culture Week should be further developed over time to bridge generations by offering more activities that focus on intergenerational communication. State and federal bodies should do whatever is feasible to support localized efforts to provide opportunities for community members to come together to share with youth the history, knowledge, and skills related to subsistence harvests of nonsalmon fish.

6. This project documents the strong reliance on the sharing of subsistence nonsalmon fish resources within and amongst the communities of the Lake Clark and Iliamna Lake regions of Bristol Bay. Project results and conclusions demonstrate the dependence of non-fishing families who receive nonsalmon fish resources through customary trade and bartering, as well as gifting of these resources from high-harvesting households within the area. Resource harvesting and sharing patterns presented here compose the components of a social network. The research presented here clearly documents rural residents' reliance upon a strong and healthy social network of harvesting and sharing whitefishes and nonsalmon fish in the project area. The strength and durability of this social network will support community resiliency and ensure food security in the Lake Clark and Iliamna Lake regions in the face of changing climate conditions over time. Further research to document and understand the social networks of harvesting and sharing subsistence resources in rural Alaska will provide important information for resource managers and decision-makers to incorporate into management.

ACKNOWLEDGMENTS

The authors would like to thank and acknowledge those who made this research possible. A special thank you is extended to all of the community members from Igiugig, Iliamna, Newhalen, Nondalton, Pedro Bay, and Port Alsworth who participated in the project. We would also like to thank tribal council administrators, council members, and local municipal officials for their support of the project and facilitating project awareness in the communities. This project would not have been possible without all of the local research assistants—thank you. We would like to thank all of the staff, students, and community members of Nondalton, and also visitors from other communities, who made Culture Week 2014 such a great success. A special thank you to key respondents and elders who shared their experiences and knowledge to provide a deeper understanding of the issues examined in this study. We would also like to acknowledge the Bristol Bay Subsistence Regional Advisory Council for assisting the identification of wild resource priority information needs as well as advocating for the funding for this project. We appreciate the assistance of Charlotte and Liz Balluta of Nondalton, as well as Helen Aderman and Mariano Peters of Dillingham for their help identifying locally used Dena'ina and Yup'ik whitefish and other nonsalmon fish species names. We especially thank our project partners at the Nondalton Tribal Council, Bristol Bay Native Association, and the Lake Clark National Park and Preserve. Finally, thank you to the Office of Subsistence Management of the U.S. Fish and Wildlife Service for providing the funds to conduct this research.

REFERENCES

Alaska Department of Labor and Workforce Development. 2014. *Alaska population estimates by borough, census area, city, and census designated place (CDP), 2010–2013*. http://laborstats.alaska.gov/pop/popest.htm

Alt, K.T. 1979. *Contributions to the life history of humpback whitefish in Alaska*. Transactions of the American Fisheries Society 108(2), pages 156–160.

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.

Atwater, B.J. 2014. *Walter's story: Pedro Bay, Alaska -- past, present, and distant memories*, 1st edition. Publication Consultants: Anchorage. ISBN 978-1-59433-308-8.

Balluta, A. 2008. *Shtutda'ina da'a sheł qudeł = My forefathers are still walking with me: verbal essays on Qizhjeh and Tsaynen Dena'ina traditions*. Lake Clark National Park and Preserve: Anchorage. ISBN 0-9749668-9-4.

Behnke, S.R. 1982. *Wildlife utilization and the economy of Nondalton.* Alaska Department of Fish and Game Division of Subsistence, Technical Paper No. 47: Dillingham. http://www.adfg.alaska.gov/techpap/tp047.pdf

Branson, J.B. 2012. *The life and times of John W. Clark of Nushagak, Alaska, 1846–1896,* Research/resources management report NPS/AR/CRR-2012-77. Lake Clark National Park and Preserve: Anchorage. ISBN 978-0-9796432-6-2.

2014. *A 20th-century portrait of Lake Clark, Alaska, 1900-2000*. U.S. Dept. of the Interior, National Park Service, Lake Clark National Park and Preserve, Alaska Association for Historic Preservation: Anchorage. ISBN 978-0-692-20489-4.

Burns, J.M., J.M. Van Lanen, D. Withrow, D. Holen, T. Askoak, H. Aderman, G. O'Corey-Crowe, G. Zimpelman, and B. Jones. 2013. *Integrating local traditional knowledge and subsistence use patterns with aerial surveys to improve scientific and local understanding of the Iliamna Lake seals*. Report to the North Pacific Research Board Project 1116 Final Report: n.p. http://s3.nprb.org/projects/a42b7368-eca2-4819-b249-6eb4209de5bc/1116_fianl%20report_May14.pdf

Cochran, W.G. 1977. *Sampling techniques*, 3rd edition. John Wiley & Sons: New York.

Coffing, M.W., L. Brown, G. Jennings, and C.J. Utermohle. 2001. *The subsistence harvest and use of wild resources in Akiachak, Alaska, 1998.* Alaska Department of Fish and Game Division of Subsistence, Technical Paper No. 258: Juneau. http://www.adfg.alaska.gov/techpap/tp258.pdf

Ellanna, L.J. 1986. *Lake Clark sociocultural study: phase I*. U.S. National Park Service, Lake Clark National Park and Preserve: [Anchorage].

Ellanna, L.J. and A. Balluta. 1992. *Nuvendaltin Quht'ana: the people of Nondalton*. Smithsonian Institution Press: Washington. ISBN 1-56098-118-0.

Evanoff, K.E. editor. 2010. *Dena'ina Ełnena: a celebration, voices of the Dena'ina*. U.S. Department of the Interior, National Park Service, Lake Clark National Park and Preserve: Anchorage. http://www.nps.gov/lacl/historyculture/upload/Elnena_Complete_reduced.pdf

Fall, J.A. 2014. *Subsistence in Alaska: a year 2012 update.* Alaska Department of Fish and Game Division of Subsistence: Anchorage. http://www.adfg.alaska.gov/static/home/subsistence/pdfs/subsistence_update_2012.pdf

Fall, J.A., C.L. Brown, N.M. Braem, L. Hutchinson-Scarborough, 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. http://www.adfg.alaska.gov/techpap/TP371.pdf

Fall, J.A., M.B. Chythlook, J.C. Schichnes, and J.M. Morris. 1996. *An overview of the harvest and use of freshwater fish by the communities of the Bristol Bay region, Southwest Alaska.* Alaska Department of Fish and Game Division of Subsistence, Technical Paper No. 166: Juneau. http://www.adfg.alaska.gov/techpap/tp166.pdf

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. http://www.adfg.alaska.gov/techpap/TP%20352.pdf

Fall, J.A., D.L. Holen, B. Davis, T. Krieg, and D. Koster. 2006. *Subsistence harvests and uses of wild resources in Iliamna, Newhalen, Nondalton, Pedro Bay, and Port Alsworth, Alaska, 2004.* Alaska Department of Fish and Game Division of Subsistence, Technical Paper No. 302: Juneau. http://www.adfg.alaska.gov/techpap/tp302.pdf

Gaul, K.K. 2007. *Nanutset ch'u Q'udi Gu before our time and now: an ethnohistory of Lake Clark National Park & Preserve*. U.S. Dept. of the Interior, National Park Service, Lake Clark National Park & Preserve: Anchorage. ISBN 978-0-9796432-3-1.

Holen, D. and T. Lemons. 2010. *Subsistence harvests and uses of wild resources in Lime Village, Alaska, 2007.* Alaska Department of Fish and Game Division of Subsistence, Technical Paper No. 355: Anchorage. http://www.adfg.alaska.gov/techpap/TP355.pdf

Holen, D.L., T. Krieg, R. Walker, and H. Nicholson. 2005. *Harvests and uses of caribou, moose, bears, and Dall sheep by communities of Game Management units 9B and 17, western Bristol Bay, Alaska 2001-2002.* Alaska Department of Fish and Game Division of Subsistence, Technical Paper No. 283: Juneau. http://www.adfg.alaska.gov/techpap/tp283.pdf

Holen, D.L., W.E. Simeone, and L. Williams. 2006. *Wild resource harvests and uses by residents of Lake Minchumina and Nikolai Alaska, 2001–2002.* Alaska Department of Fish and Game Division of Subsistence, Technical Paper No. 296: Juneau. http://www.adfg.alaska.gov/techpap/tp296.pdf

Jacobson, S.A. 1984. *Yup'ik Eskimo Dictionary*. Alaska Native Language Center, University of Alaska, Fairbanks: Fairbanks.

Kari, J. and J.A. Fall. 2003. *Shem Pete's Alaska: the territory of the upper Cook Inlet Dena'ina*. University of Alaska Press: Fairbanks.

Kari, J.M. 2007. *Dena'ina topical dictionary*. Alaska Native Language Center, University of Alaska Fairbanks: Fairbanks. ISBN 978-1-55500-091-2.

Kari, P.R. 1983. *Land use and economy of Lime Village.* Alaska Department of Fish and Game Division of Subsistence, Technical Paper No. 80: n.p. http://www.adfg.alaska.gov/techpap/tp080.pdf

Karl, T.R., J.M. Melillo, T.C. Peterson, and S.J. Hassol editors. 2009. *Global climate change impacts in the United States*. Cambridge University Press: New York. ISBN 978-0-521-14407-0.

Kenner, P.C., M.B. Chythlook, J.A. Fall, L. Brown, and C.J. Utermohle. 1999. *Harvests of fish other than salmon by the communities of Pedro Bay and Levelock, Southwest Alaska, April 1996–March 1997.* Alaska Department of Fish and Game Division of Subsistence, Technical Paper No. 247: Anchorage. http://www.adfg.alaska.gov/techpap/tp247.pdf

Krieg, T., M. Chythlook, P. Coiley-Kenner, D. Holen, K. Kamletz, and H. Nicholson. 2005. *Freshwater fish harvest and use in communities of the Kvichak watershed, 2003.* Alaska Department of Fish and Game Division of Subsistence, Technical Paper No. 297: Juneau. http://www.adfg.alaska.gov/techpap/tp297.pdf

Krieg, T.M., D.L. Holen, and D. Koster. 2009. *Subsistence harvests and uses of wild resources in Igiugig, Kokhanok, Koliganek, Levelock, and New Stuyahok, Alaska, 2005.* Alaska Department of Fish and Game Division of Subsistence, Technical Paper No. 322: Dillingham. http://www.adfg.alaska.gov/techpap/TP322.pdf

LaVine, 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. http://www.fws.gov/uploadedFiles/Region_7/NWRS/Zone_2/Togiak/PDF/Togiak%20TEK%20report%2004-351%20Book.pdf

Lochner, M. 2008. *Bristol Bay village project grows with competition*. Juneau Empire. http://juneauempire.com/stories/101208/sta_343196174.shtml (Accessed January 7, 2015)

McVehil-Monnett Associates, Inc. 2006. *Site climatology for the Chuitna coal project*. Prepared for Mine Engineers, Inc., Cheyenne, Wyoming by McVehil-Monnett Associates, Inc.: n.p. http://www.chuitnaseis.com/documents/projectdocs/Site-Climatology-McV-Monnett-06-06.pdf

Metsker, H. 1967. *Iliamna Lake watershed freshwater commercial fisheries investigation of 1964*. Alaska Department of Fish and Game Division of Commercial Fisheries, Informational Leaflet 95: Dillingham. http://www.adfg.alaska.gov/FedAidPDFs/afrbil.095.pdf

Morris, J.M. 1986. *Subsistence production and exchange in the Iliamna Lake region, Southwest Alaska, 1982-1983*. Alaska Department of Fish and Game Division of Subsistence, Technical Paper No. 136: Juneau. http://www.adfg.alaska.gov/techpap/tp136.pdf

Morrow, J.E. 1980. *Freshwater fishes of Alaska*. Alaska Northwest Publishing Company: Anchorage.

Oleksa, M. 1992. *Orthodox Alaska: a theology of mission*. St. Vladimir's Seminary Press: Crestwood, NY. ISBN 0-88141-092-6.

Osgood, C. 1937. *The ethnography of the Tanaina*, 16th book in the Anthropology. Yale University Publications: New Haven, Connecticut.

PB Consult, Inc. 2004. *Southwest Alaska transportation plan, revised: a component of the Alaska Statewide Transportation Plan*. Alaska Department of Transportation and Public Facilities: Anchorage. http://www.dowlhkm.com/projects/SWAKTP/new_website/docs/swatp%202004.pdf

Petroff, I. 1892. "*Population and resources of Alaska*" [in] *11th U.S. Census report, 1890*. Government Printing Office: Washington, D.C.

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. http://www.adfg.alaska.gov/techpap/TP356.pdf

Reger, D.R., N.K. Stranger, K. Jensen, and Pedro Bay Village Council. 2005. *Prehistory at the Pedro Bay site (ILI-001), Alaska: report to the Pedro Bay Village Council and the U.S. National Park Service*. Alaska Pedro Bay Village Council: Pedro Bay, Alaska.

Reynolds, J.B. 1997. "*Ecology of overwintering fishes in Alaskan freshwaters*" [in] A.M. Milner and M.W. Oswood, editors *Freshwaters of Alaska: ecological syntheses*. Springer: New York. ISBN 0-387-94379-X.

Russell, R.B. 1980. *A fisheries inventory of waters in the Lake Clark National Monument area*. Alaska Department of Fish and Game Division of Sport Fish and the United States Department of the Interior National Park Service: [Alaska].

Salmon, A. 2008. *Igyararmiunguunga: Qallemciq Nunaka Man'I Kuicaraami-llu (I belong to Igiugig: The Story of My Home on the Kvichak River)*, (undergraduate honors thesis). Dartmouth College, Department of Anthropology: Hanover, NH.

Shaw, J.L. 2013. *Navigating at a crossroads: the role of subsistence culture in the subjective wellbeing of Dena'ina Athabascan youths in Alaska*, (PhD thesis). Case Western Reserve University: Cleveland, OH.

Sprules, W.M. 1957. *The "prairie ice jigger."* Polar Record 8(56), pages 441–444.

Stickman, K., A. Balluta, M. McBurney, and D. Young. 2003. *K'ezghlegh: Nondalton traditional ecological knowledge of freshwater fish*. U. S. Fish and Wildlife Service Office of Subsistence Management, Fisheries Information Services, Final Report (Study No. 01-075): Anchorage. http://kuskokwimcouncil.org/documents/TEK/TEK%20Nondalton%20indians%20on%20freshwater%20fish.pdf

Tenenbaum, J.M. editor. 2006. *Dena'ina sukdu'a: traditional stories of the Tanaina Athabaskans*, 3rd edition. Alaska Native Language Center, University of Alaska Fairbanks: Fairbanks. ISBN 1-55500-090-8.

Townsend, J.B. 1965. *Ethnohistory and cultural change of the Iliamna Tanaina*. University of California: Los Angeles.

1970. *Tanaina archaeology in the Iliamna Lake region, Alaska*. Bulletin (2), pages 33–41.

Unrau, H.D. 1994. *Lake Clark National Park and Preserve, Alaska : historic resource study*. U.S. Dept. of the Interior, National Park Service: Anchorage.

U.S. Census Bureau. n.d. *2010 Decennial Census and American Community Survey data*. U.S. Census Bureau American FactFinder Homepage: Washington, D.C. http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml

2011. *2010 census*. U.S. Census Bureau: Washington, D.C. http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml

2014. "*Chapter 7: data collection and capture for housing units*" [in] *American Community Survey design and methodology (January 2014)*, Version 2.0 edition. U.S. Census Bureau: n.p. http://www2.census.gov/programs-surveys/acs/methodology/design_and_methodology/acs_design_methodology_report_2014.pdf

VanStone, J.W. 1967. *Eskimos of the Nushagak River: an ethnographic history*. University of Washington Press: Seattle.

1971. *Historic settlement patterns in the Nushagak River region, Alaska*, Fieldiana: Anthropology, Volume 61. Field Museum of Natural History: Chicago.

1984. "*Mainland Southwest Alaska Eskimo*" [in] W.C. Sturtevant, editor *Handbook of North American Indians*, 5: Arctic. Smithsonian Institution Press: Washington, D.C.

VanStone, J.W. and J.B. Townsend. 1970. *Kijik: an historic Tanaina Indian settlement*, Fieldana: Anthropology, Volume 59. Field Museum of Natural History: Chicago.

Woody, C.A. and D. Young. 2006. *Life history and essential habitats of humpback whitefish in Lake Clark National Park, Kvichak River watershed, Alaska*. U.S. Fish and Wildlife Service Office of Subsistence Management, annual report for study FIS 05-403: Anchorage.

Zagoskin, L.A. 1967. *Lieutenant Zagoskin's travels in Russian America, 1842–1844*. University of Toronto Press: Toronto.

APPENDIX A–NONDALTON CULTURE WEEK 2014 CURRICULUM

Learning about Whitefish: Dena'ina and Western Methods

April 28 – May 2, 2014

Nondalton School Culture Week

Nondalton, Alaska

'Just getting them started like that you know, like, in the spring time after school is out just make maybe one week at a time to get the kids out there and just go and work with them, teaching them the cultural things.' Elder, Nondalton (April 2013)

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TABLE OF CONTENTS

1) Curriculum Overview

2) Curriculum and Unit Descriptions

3) Unit Materials

4) Certificates/Awards

5) Whitefish Identification Guides

CURRICULUM OVERVIEW

Purpose of program including goals and objectives:

Purpose: The underlying purpose of the educational program is to focus on the integration of two knowledge systems: indigenous knowledge systems, including resource management and science (Dena'ina) and western science and management. The focus of the curriculum is to provide students information and hands-on activity that highlights their heritage and culture with a focus on traditional activities involving whitefish, provide activities that connect students to the natural environment by use of the outdoors for the classroom, and promote sharing and understanding of Dena'ina knowledge. Through these activities the students will gain an understanding of traditional practices and the role of western management in subsistence.

Goals: Students will spend a week learning from Dena'ina elders, teachers, local community members and researchers from Bristol Bay Native Association, the National Park Service, and the Alaska Department of Fish and Game of the Division of Subsistence. A summary of the curriculum includes: cultural activities involving traditional knowledge, harvesting, and use of whitefish, hands-on craftsmanship, western knowledge of whitefish, and fisheries management.

Objectives:
Work with the Nondalton school to involve students in participant observation for spring ice fishing.

Provide students information that enhances their understanding of traditional patterns of fishing and understanding the role of state management in subsistence.

Provide an opportunity for students to take the lead in coordinating research tasks with the local NTC researcher.

Have students assist with interviewing elders for the project.

Dena'ina history through Archaeology.

Learn about other Dena'ina traditional knowledge and materials relating to fishing, hunting and land use.

Student will:
Understand why knowledge of their traditional fishing methods is important.

Be able to analyze the difference between contemporary fishing methods and traditional methods.

Be able to identify the biological parts of a whitefish and how those parts could be used to make art or clothing.

Understand the life cycle of a whitefish and how they survive.

Understand how a subsistence lifestyle strengthens a community.

Become familiar with maps of their local area and be able to identify watersheds in the Dena'ina language and in English.

Understand the relationship between state government and local people and how they work together.

Be introduced to traditional art and craftsmanship and how to use them (fish traps, squirrel snares).

Students will understand how archaeology can provide insight on traditional subsistence living.

CULTURAL BACKGROUND

Nondalton has a school that serves 43 students Kindergarten through 12th grade. The majority of these students are Dena'ina Athabascan. Whitefish are the most important non-salmon fish for local subsistence harvests in the surrounding area of Nondalton. Whitefish are harvested mainly in the spring, summer and fall. In the spring, whitefish are caught by ice fishing or by setting a net under the ice with a jigger board. During the summer, whitefish are caught with fish hooks at fish camps. The whitefish are dried along with the salmon processed and made into *nivagi* (Indian ice cream). In the fall, fishing is also done with hooks or nets. The purpose of this program is to connect students with the tradition of harvesting whitefish and provide an understanding of Dena'ina science and western science and an understanding of the State's role in subsistence management.

Profile of students:

Nondalton has a school that serves 43 students Kindergarten through 12th grade. The majority of the students are Dena'ina Athabascan.

Qualifications of Instructors:

The instructors of the educational sessions are local Elders, community support and researchers from the various partners involved in the project. The local Elders have centuries of first-hand experience including observations, survival skills and oral documentation. The research team has experience in studying whitefish and working with Alaska rural communities to document the importance of subsistence resources through interviews, participant observation, surveys and mapping. The instructors include:

Steve Jr. (Butch) and Pauline Hobson
Nondalton Elders

Alan and Helen Dick
Lime Village Elders

Karen Evanoff
Lake Clark National Park Service

Danielle Stickman
Bristol Bay Native Association

Gelsey Carmichael,
Bristol Bay Native Association

Theodore Krieg
Alaska Department of Fish & Game

Cameron Welch
Alaska Department of Fish & Game

Sarah Evans
Alaska Department of Fish & Game

TEACHER INFORMATION SUMMARY AND UNIT DESCRIPTIONS

Unit I: Subsistence Sharing Game

Purpose:

Students will learn the importance of sharing and analyze roles in the community to provide a more in-depth understanding of how members of the community are connected.

Summary of Unit:

Students will be broken up into 5 groups and assigned a household group. Members of the group will decide what their subsistence needs are and discuss with each other their various needs. Then, the students decide what their subsistence consumption should consist of for an entire year. Next, students will be provided a ball of yarn and while holding onto a section they will toss to other groups that they share foods with to create a spider web.

Values:

• Sharing

• Community

Knowledge:

• How we use and share subsistence foods

• The importance of subsistence foods

GAME

Students are divided into groups of two or more (depending on class size, we need at least five groups) and a member of each group picks a card. Each card will have a household category group lives in; teacher, fishermen, high harvester, elder or small family.

We will talk about the different user groups with the class;

Teachers are usually new to the area, and/or leave in the summer so they don't harvest as much as others in the community.

Fishermen will bring home lots of fish to the community and share with other households.

High harvesters are people who harvest everything… ducks, geese, have a trap line, fish, moose, and seals, gather berries and bird eggs, etc. And then share with the community.

Elders will harvest berries and plants, but aren't able to go out and harvest as much as they use to.

Small families are households with single parents, or haven't started a family yet so they don't harvest very much because they are busy.

After we discuss this the groups are handed envelopes containing pictures of different types of subsistence foods; berries, moose, ducks, walrus, salmon and whitefish. Depending on what user group they are in their pictures of foods will vary. Example, high harvesters will have a lot of everything, and elders will mostly have berries and a few fish. This envelope is what the household harvested over an entire year before sharing with others.

A ball of yarn will be handed to a group and we will ask them to think about who their household usually gives subsistence foods to, and they may say their grandparents, so then holding onto one end of the yarn they bring the ball of yarn over to a group of "elders" and hand them a picture of a type of subsistence food they would share with them. The elders would then do the same thing and so on.

In the end we see the sharing yarn and subsistence foods have created a spider web, and all the subsistence foods are now more equally shared throughout the "community."

In the end we can have a discussion with the students about the importance of sharing, and helping their families when it comes to harvesting wild foods. The idea of the game is to visually show students how important and special sharing subsistence foods are within their community. It also helps to get them excited about helping their parents or grandparents harvest wild foods.

Unit II: Biology (Units II and III are taught in one class)

Purpose: This exercise allows students to learn Dena'ina and English terms for whitefish anatomy, and to understand how traditional clothing could be made from whitefish. It also engages students in artistic expression.

Summary of Unit:

Students will be given pictures of whitefish with parts labeled in Dena'ina and in English. Whitefish will be provided for the students to dissect and analyze using the provided diagram. Elders will help the students pronounce the Dena'ina names correctly. Students will take their diagram home to study for a quiz at the end of the week. Then, students will study the life cycle of a whitefish and discuss how they survive.

Values:

• Speaking in Dena'ina

• Utilization of fish and resources

Knowledge:

• Dena'ina whitefish terms

• English whitefish terms

• Whitefish anatomy

• Traditional clothing

• Life cycle of whitefish

Skills:

• Linguistics

• Fish biology

Each student will be given a sheet with a blank diagram of a fish that we will fill in with Dena'ina and English names of each body part (an elder will be present to make sure we are saying the terms correctly in Dena'ina). They will study the parts all week and have a test at the end of the week. The student with the most correct answers (either Dena'ina or English) will win a prize.

We will also go over the water cycle and the life cycle of whitefish using the salmon cycle as a model to compare and contrast.

The 'hands on' dissection of whitefish will come later after the students have studied and understand what each body part does and what the name is. We will cut open the stomach to see what the whitefish ate for dinner. Then follow the path food goes in the digestive system from the mouth all the way to the large intestine. Have a discussion of comparing fish anatomy to human anatomy.

The students will have homework to go home and ask their parents or grandparents; "What else can whitefish be used for?" "Did you make clothes, jewelry, and tools out of whitefish?" etc. Each student will come back and share with the class what they have discovered.

Below are some options of fish diagrams as well as the Dena'ina terms from Jim Kari's Dena'ina Topical Dictionary.

Unit III: Whitefish Art

Purpose: This activity will allow students to engage in artistic expression.

Summary of Unit:

As a follow-up to the Biology unit, students will be able to make acrylic prints of whitefish. Students will also be given t-shirts with prints of whitefish anatomy and will have an opportunity to learn how to tie dye their t-shirts.

Values:

• Artistic expression

• Information Retention

Skills:

• Painting

• Artistic Design

Unit IV: Dena'ina Traditional Knowledge

Purpose: This activity will permit students to evaluate what they know about the geographical area in which they live and how they could use that knowledge to engage in subsistence activities. In addition, students can practice speaking their native language and learn what areas were traditionally named. It also serves as a discussion forum so students can understand the problems facing their society and how they could possibly solve those issues.

Summary of Unit:

Students will share knowledge about the Nondalton area in respect to lakes, rivers and habitats, and label maps in Dena'ina and in English. The students will also review interview transcripts and respond to questions about the transition of lifestyle in their community how that has affected the fish. Specifically, how methods of fishing and transportation have changed and how that could affect fish populations. Students will also learn about how western science can be applied to learn more about the fish, and what is required to sustain an abundant fish population. Solutions to local issues concerning subsistence lifestyles will be discussed and analyzed.

To incorporate whitefish into this activity, students will be asked what they know about whitefish, to identify what they can learn about whitefish, how they would go about getting information about whitefish, what kind of questions do they have about whitefish (what is important to know about them), and together as a class, come up with ways to answer all of their questions.

Values:

• Speaking in Dena'ina

• Artistic expression and creativity

• Sharing

Knowledge:

• Geographic Dena'ina terms

• Geographic English terms

• Traditional subsistence

• Modern-day subsistence

• The importance of western and Dena'ina knowledge systems

• Whitefish habitat and place names

Skills:

• Dena'ina Language

• Connecting with local knowledge system

• Geography and place names

• Traditional knowledge and changes

What do you know about the natural environment in the area?

This class will begin by collecting the knowledge students bring regarding: the watershed and surrounding land; fish and wildlife; key areas that are important to them and their relationship to these areas (how area is used, time spent there, etc.). This information will be incorporated unto maps, labeled in Dena'ina and in English.

Students will then be asked:

What additional information do you think is important to know or that you would like to learn about? A list of questions will be developed.

Where can you find the answers to these questions? A list of answers will be developed.

What do you know about whitefish?

An overview of the whitefish project will be provided. The students will be asked several questions regarding whitefish and the project (answers will be documented):

What do you know about whitefish?

How can you learn more about whitefish?

What do you think is important to know about whitefish?

Why do you think this project is important?

Answers will be documented and information will be added to the maps.

The importance of Local and Traditional Knowledge:

We will build upon this knowledge base by reviewing and discussing interview transcripts from the white fish study. Students will identify what they think is important in the transcripts and key themes will be compiled. Follow-up discussion on local and traditional knowledge and interview themes will be conducted. Based on this discussion we will add to our 'Tree of Wisdom'. As time permits we will go outside and identify important fishing sites around the village area.

Tree of Wisdom: Nundaltin Dena'ina Hqeldihch' 'Nondalton Dena'ina education (learning)'

Samples of artistic tree drawings will be provided for the students. Based on what the students have learned from the class they will draw a tree that highlights the wisdom of Dena'ina knowledge. Beginning at the roots will be the knowledge they have learned. The trunk will be what the students know. The branches and leaves will be what the students learned, resources they can learn from (including western science), evolving knowledge and why this is important. We will incorporate this information into a large poster size Tree of Wisdom.

Products:

1) Maps of the watershed and area compiled by the students

2) List of questions and answers compiled by the students

3) Color-coded Tree of Wisdom from students

4) Poster of Tree of Wisdom compiled from all students

Unit V: Show and Tell

Purpose: This unit highlights the importance of whitefish to Nondalton residents and how this wild food has historically been significant and continues to be for community members.

Summary of Unit:

Students will be asked ahead of time to gather either traditional information about whitefish (this could include whitefish folklore, a story about fishing for whitefish, or about migration patterns, etc.), pictures of their families engaging in whitefish activities, or a traditional artifact that was used to harvest whitefish. The students will then share what they gathered with the rest of the class.

Values:

• Documenting the historical and current use of whitefish.

Knowledge:

• Traditional subsistence methods

• Stories

Skills:

• Oral Presentation

Unit VI: Survey

Purpose: To gather information on the subsistence use and methods of the community of Nondalton.

Summary of Unit:

A survey will be given to the students to take home to their parents to gather data on the types of whitefish and methods and times that whitefish were harvested in 2013. The surveys will be brought back to school and compared with other students.

Values

• Accurate reporting

• Importance of surveys and gathering data

Knowledge:

• Fish count estimate

• Stories

Skills:

• Family communication

Products: A survey completed by each student

Unit VII: Lake Clark Archaeology

Purpose: This exercise will expose students to the prehistoric tools used by their ancestors. It emphasizes how the land around them can give insight about their heritage.

Summary of Unit:

Students will watch a PowerPoint presentation on ice patches and prehistoric hunting tools that could be found around their area. Students will discuss what they think about the information presented, e.g. why it is hard to find tools or the methods hunters used to hunt, etc. Students will be able to look at photos of artifacts and excavation photos and discuss their importance.

Values:

• Importance of history through archaeology

• Being respectful of the land

Knowledge:

• Traditional tools and practices

Skills:

• Paying attention

• Analyzing evidence (photos)

Introduction – Based on my archeology work at Lake Clark last summer (2013) especially the “ice patch survey”. (No direct whitefish connection)

Present a PowerPoint with photos and a map of ice patch locations.

In recent years ice patches in Lake Cark National Park near Turquoise Lake and Telaquana Mountain were checked for prehistoric tools. Ice patches were used by caribou in the summer to seek relief from the heat and bugs. For this reason they were reliable places for hunters to find caribou. As ice patches melt older layers of snow that may contain artifacts are exposed. How does that relate to global warming? One of the ice patches that we checked the summer of 2013 had completely melted since the last visit (1 or 2 years before). Tools previously found were projectile points made of antler some dating to almost 2,000 years ago. No stone tools (projectile points - spear or arrow points) were found during the surveys - looking at a photo of jumbled angular rocks that were once beneath the snow of the “ice patch” why do you think it might be hard to find a stone point? Old antlers and caribou dung that had melted out of the snow were observed. A prehistoric site is located at Telaquana and may have been one summer locations where the hunters that visited the ice patches lived. It would be a good hike in rugged terrain 11 miles as the crow flies – no motors in those days! Looking at the photo of the terrain surrounding the ice patch how do you think the hunters were able to “catch” the caribou – did they sneak up? Did they hide and wait for the caribou to come to the ice patch?

Other Archeology (photos):

At Turquoise Lake – Northern Archaic point found with a small lithic scatter.

Hardenburg Bay excavation obsidian flakes found and dates from charcoal – excavation photos. Provenience – charcoal associated with obsidian – associated dates - charcoal in soil deposition layers above and below the obsidian help to confirm the obsidian date. Obsidian source is located nearly 400 miles north near Fairbanks.

*Composing the PowerPoint with the photos will help stimulate teachable points and hopefully the student will create a “Teachable moment” that can be expanded on.

Unit VIII: Fish Trap Movie (units VIII and IX are taught in one class)

Purpose: The movie will provide an introduction to the method of building a traditional Dena’ina fish trap.

Summary of Unit:

A short video about making a traditional fish trap will be shown to the students to help them understand what they need to do in order to make a productive fish trap.

Values:

• Introduction and steps for making a traditional Dena'ina fish trap

Knowledge:

• How to assemble a traditional fish trap

Skills:

• Listening and watching respectfully

• Knowledge of local craftsmanship and fishing methods

• Taking notes

Unit IX: Building Fish Traps

Purpose: The activity will allow students to learn about the traditional method of fishing and through hands on activity learn to carve and assemble a traditional fish trap. They will also learn about the Dena'ina methods of resource management by use of a fish trap.

Values

• Participating in traditional craftsmanship

• Respect

• Cooperating

Knowledge:

• How to assemble a fish trap through carving and crafting each part to fit

• Traditional method of fishing

• Understanding of local knowledge as science, creativity, waterways and use

Skills:

• Following directions

• Craftsmanship

• Teamwork

• Watershed geography for use of fish trap

• Dena'ina resource management

Unit XII: Building and Demonstrating a Traditional *Qunsha* 'Mountain Squirrel' Snare

Purpose: Demonstrate and work with students to build a traditional mountain snare. Introduce students to traditional methods and materials used for hunting small game.

Summary of Unit:

Build a mountain squirrel snare and showed students how it is used. He told traditional stories of mountain squirrel hunting and the proper way to hunt mountain squirrels including the importance of food and the fur for clothing.

Values

• Culture preservation

• Using subsistence for survival

Knowledge:

• Dena'ina stories and practices

Skills:

• Listening

• Teamwork

• Hands-on learning

• Traditional methods of snaring and hunting

PROGRAM ANALYSIS

Students are expected to attend and participate in every educational session with a positive attitude. Students will receive a certificate documenting their participation in Culture Week with a focus on whitefish. In addition, each student will receive an award based on their particular contribution to the program.

SUPPLEMENTAL MATERIALS

The following pages contain some of the activity descriptions and handouts that will be supplied to the students. They will be used as teaching aids and to help illustrate the topics discussed, such as the life cycle of a whitefish

Show and Tell Worksheet

Instructions: Talk with your family and bring something that interests you and that is related to your culture to school to share with everyone. It would be great if you could bring something about whitefish or subsistence but you could bring lots of different things. Some ideas are:

- Traditional fishing/hunting gear
- Old photographs of your family doing subsistence activities
- Even a story!

Remember, be creative and don't be shy to share!

1. What kind of item did you bring today? Who does it belong to?

_____

_____

2. Where did you get it?

_____

_____

3. How old is this item? Has your family had it a long time?

_____

_____

4. Where at home do you keep it?

_____

_____

5. Was it ever used for something? What was it made for?

_____

_____

6. How does this item relate to subsistence?

_____

_____

7. What makes this special to you?

_____

_____

FOR YOUNGER STUDENTS

Subsistence Whitefish Survey

1. Did your family fish for whitefish in 2013? (circle one) Y N

2. What kinds of whitefish did your family fish for? (circle pictures and write amounts in spaces below)

A. Humpback whitefish

How many? _____

B. Round whitefish

How many? _____

3. How did your family fish for whitefish? (circle the pictures below)

A

Ice fishing

B

Rod and reel

C

Net under the ice

D

Other (specify)

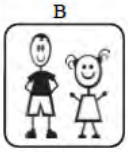
_____

4. Who did you go fishing for whitefish with?

A

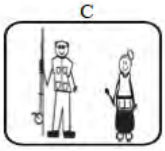
Parents

B



Siblings

C



Grandparents

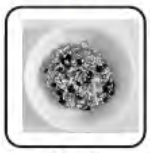
D

Other (specify)

_____

5. How does your family eat the whitefish?

A



Nivagi

B

Dried

C

Pan-fried

D

Other (specify)

_____

Thank you for participating!

What kind of music should you listen to while fishing?

A: Something catchy!

FOR OLDER STUDENTS

Subsistence Whitefish Survey

1. Did your family fish for whitefish in 2013? (circle one) Y N
2. In 2013, how many members of your family fished for whitefish? _____
3. What kinds of whitefish did your family fish for? (circle pictures and write amounts in spaces below)

A. Humpback whitefish

How many? _____

B. Round whitefish

How many? _____

4. How did your family fish for whitefish? (circle the picutures below)

A

Ice fishing

B

Rod and reel

C

Net under the ice

D

Other (specify)

_____

5. Did your family get whitefish from anyone in 2013? Y N
6. Did your family give whitefish to anyone in 2013? Y N
7. How does your family prepare whitefish?

Method	Yes or No (circle one)
Pan fried	Y N
Baked	Y N
Boiled	Y N
Dry	Y N
Smoke	Y N
Can	Y N
Freeze	Y N
Pickle	Y N
Ferment	Y N
Other (please specify) _____	Y N

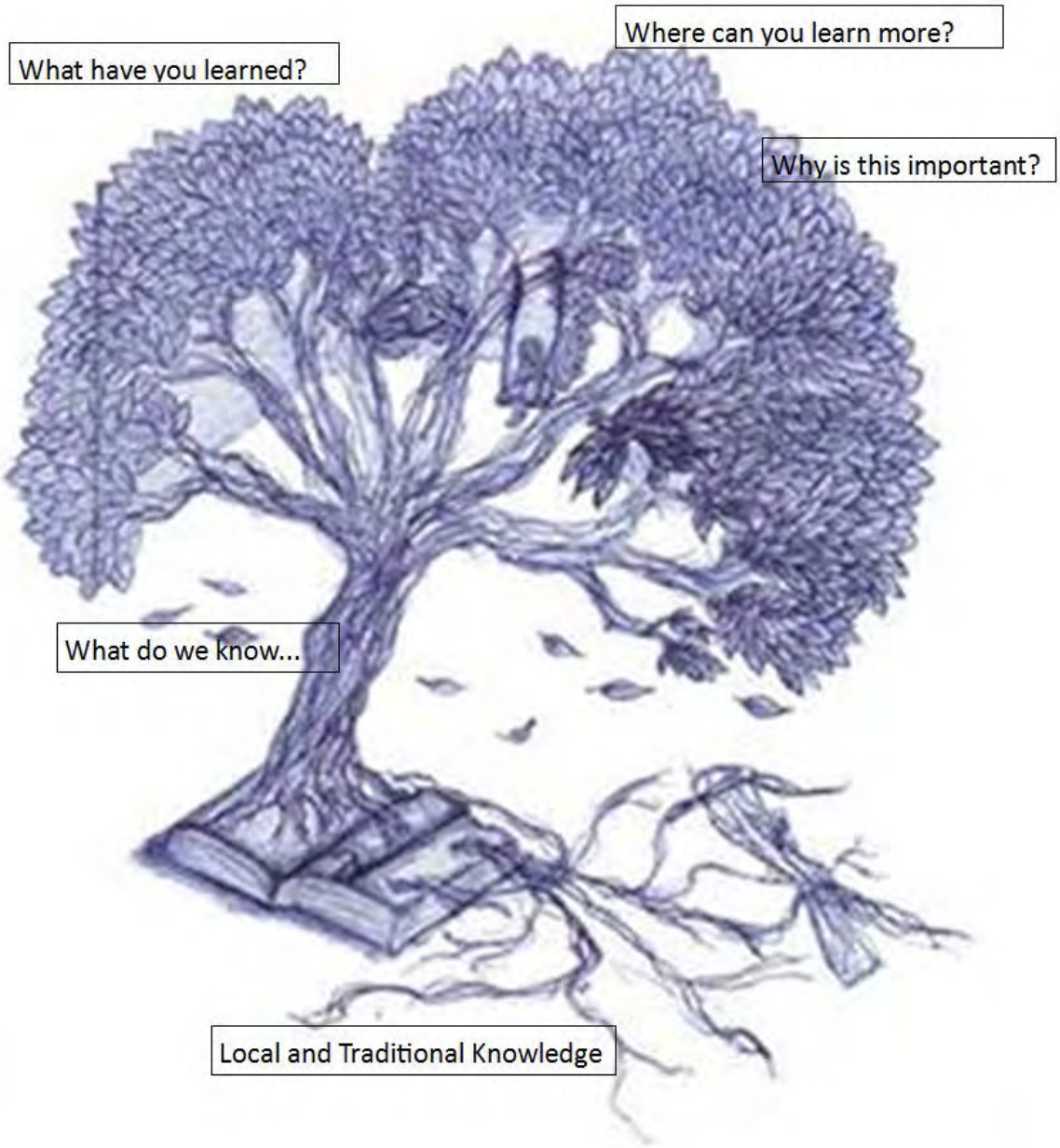
Thank you for participating!

What kind of music should you listen to while fishing?

A: Something catchy!

Nundaltin Dena'ina Hqeldihch'

Tree of Wisdom



CERTIFICATES AND AWARDS

Name of Student

is presented with the award for best

Attribute/Quality

For Nondalton Culture Week 2014

Bristol Bay native association

Nondalton Tribal Council

Signature Date

WHITEFISH IDENTIFICATION GUIDES

Alaska Department of
Fish & Game

Whitefish Species

Whitefish are the most abundant group of fish north of the Alaska Range, inhabiting almost every type of river and freshwater habitat in this section of Alaska. Whitefish are important in the food chain of the aquatic community, as they are a major food item for many predatory fish. They have potential as a sport fish, and a few small commercial fishing operations exist; however, their greatest use in Alaska is as a subsistence food for Natives and their dogs. The sheefish, or inconnu (genus *Stenodus*), is the largest species of whitefish. This paper deals with the seven smaller whitefish species belonging to the genera *Prosopium* and *Coregonus*.

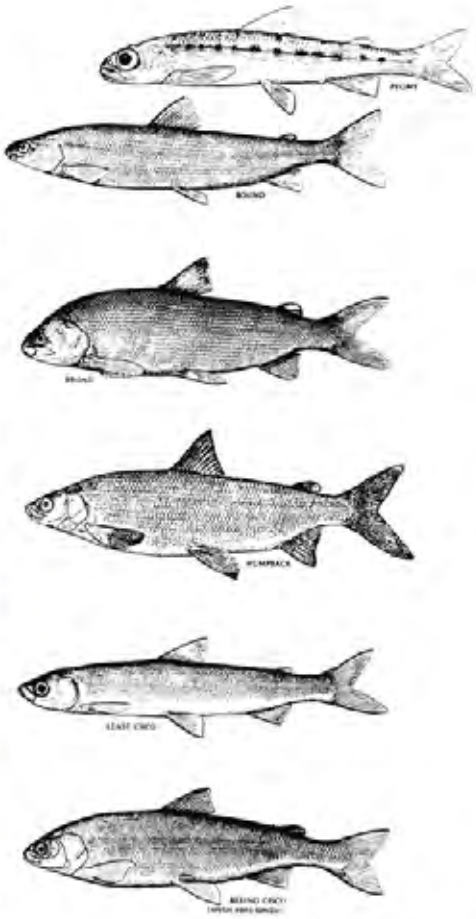
Whitefish in general are silver-colored with large scales, fleshy dorsal and adipose fins, no teeth, and a small fleshy appendage at the base of the pelvic fin called a pelvic axillary process.

Round and pygmy whitefish: Both the round whitefish (*Prosopium cylindraceum*) and the pygmy whitefish (*P. Coulteri*), have rounded cigar-like bodies with tiny, pointed snouts and single nasal flaps. In both species the upper jaw extends out over the lower so the mouth is underneath, or inferior. The young have parr marks, dark transverse bands, which disappear in the second year of life. The pygmy whitefish has a toothless mouth and large eyes. Round whitefish in most streams seldom exceed 16 inches in length, while pygmy whitefish rarely reach 8 inches.

Broad and humpback whitefish: The genus *Coregonus* contains the broad whitefish as well as three whitefish known as "ciscoes." The broad whitefish (*Coregonus nasus*) and the humpback whitefish (*C. oidschian*) are referred to as true whitefish. In both species the mouth is inferior, an adaptation for bottom feeding. Their diet consists mainly of small clams, snails, aquatic insects, larvae, and freshwater shrimp. In both species, the head is small and the body deep or wide from stomach to backbone. The broad whitefish can be distinguished from the humpback by its larger size, deeper head, shorter gillrakers, and short, blunt snout.

In Alaska the broad whitefish is found in the Yukon and Kuskokwim river drainages and in the Bering and Chukchi seas and Arctic Ocean drainages. Spawning occurs in the fall with most fish spawning over a gravel bottom. The humpback whitefish is distributed throughout all drainages north of the Alaska Range, as well as in the Copper and Susitna rivers, Bristol Bay drainages, and in isolated river systems farther south. They first spawn at 4 or 5 years of age and start their upstream migration during the summer and fall. Spawning occurs in the upper reaches of rivers in October, usually over a gravel bottom. As with other whitefish, the humpback digs no nest but broadcasts its eggs which lodge in the gravel. Growth varies from river to river, though humpback whitefish attain lengths of 22 inches and 5 pounds in eight years. Both the broad and humpback whitefish are important in the subsistence economy of Alaska Natives; they have commercial value as well as providing sport fishing opportunities.

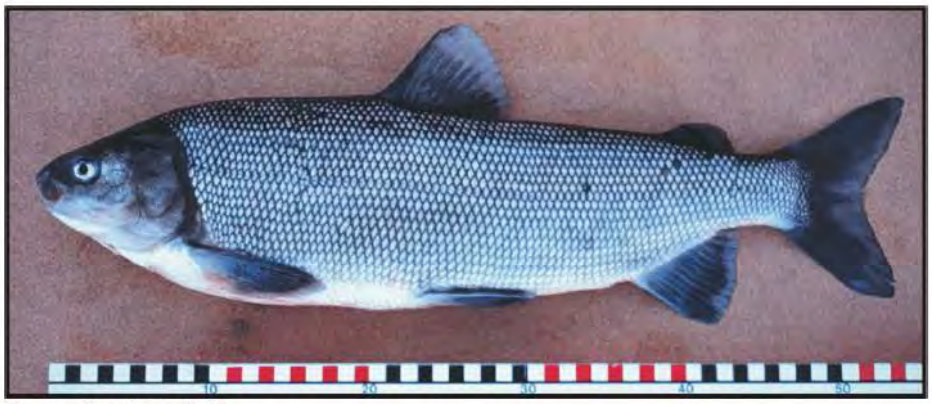
Least cisco: The least cisco (*C. sard*) sometimes erroneously called herring, is a slender herring-like fish with a superior mouth, which means a weak lower jaw projecting beyond the upper. Adults are brown to olive green and silvery below. The least cisco is found in lakes, streams, and estuaries of the Bristol Bay drainage. At the age of 4 to 6, mature least cisco migrate upstream in the fall to spawn in clear streams with gravel bottoms north of the Alaska Range. Spawning takes place in early October. Least cisco found in lakes seldom exceed 14 inches, while those in the Chatanika River in Interior Alaska reach 19 inches and 4.5 pounds. Least cisco are very important in the food chain, as they are eaten by predacious sheefish, pike, and burbot. A sport fishery on least cisco takes place in the upper Chatanika River during the fall; both spears and hook and line are used to catch them.



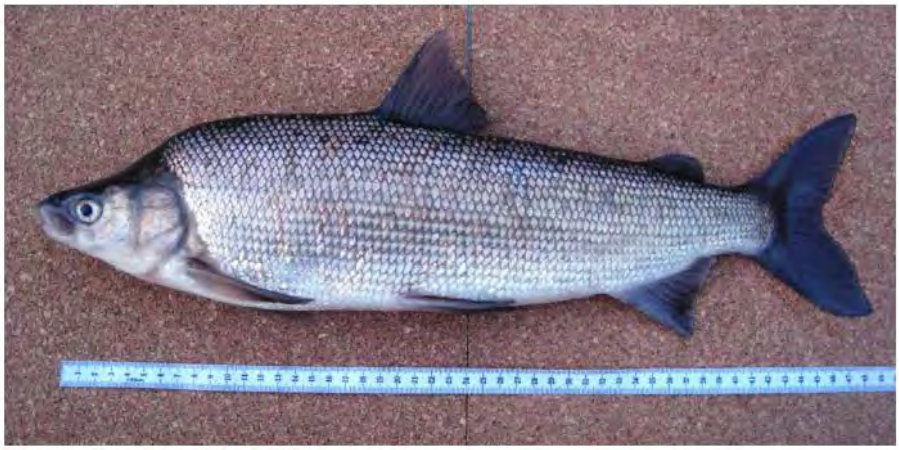
Courtesy of the Fisheries Research Board of Canada

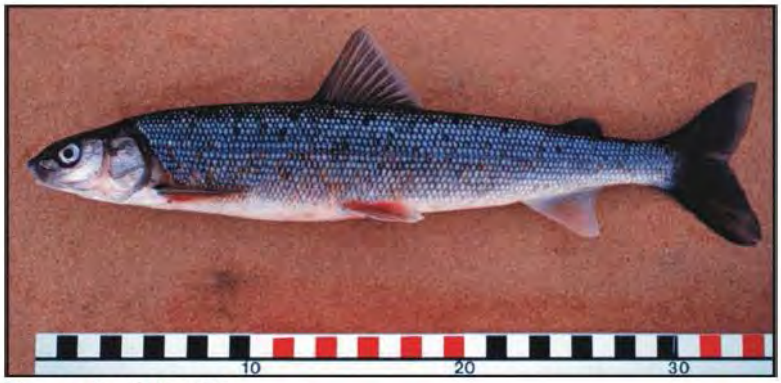
Arctic and Bering Ciscoes: The Arctic cisco (*C. autumnalis*) and Bering cisco (*C. Laurettae*) are similar in appearance. They are distinguishable from the least cisco by smaller eyes and scales, more silver color, white pectoral and pelvic fins, and terminal mouths (at the tip of the body). Both ciscoes feed on invertebrates and to a lesser extent on other fish. Little is known of the biology of either fish. They are tolerant of high salinity and are often found in estuaries. The Arctic cisco is found in arctic Canada and Siberia and from the Point Barrow area eastward along the Beaufort Sea coast to the Canada border. Bering cisco are found in the Bering Sea drainages of the Seward Peninsula, Norton Sound, and Yukon and Kuskokwim rivers. The Bering cisco is a notable migrator: spawning fish have been observed 1,200 miles up the Yukon River and 600 miles up the Kuskokwim River. They spawn in the fall at an average of 6 years. Bering cisco taken at Hess Creek in the middle Yukon River reach 17 inches and 3.5 pounds. Arctic cisco from the Colville River reach 14 inches, 1. 5 pounds, and may live 10 years. Both are much sought-after commercial fish and are sold as "white trout."

Text: Kenneth Alt
Illustration: Courtesy of the Fisheries Research Board of Canada
Revised and reprinted 1994



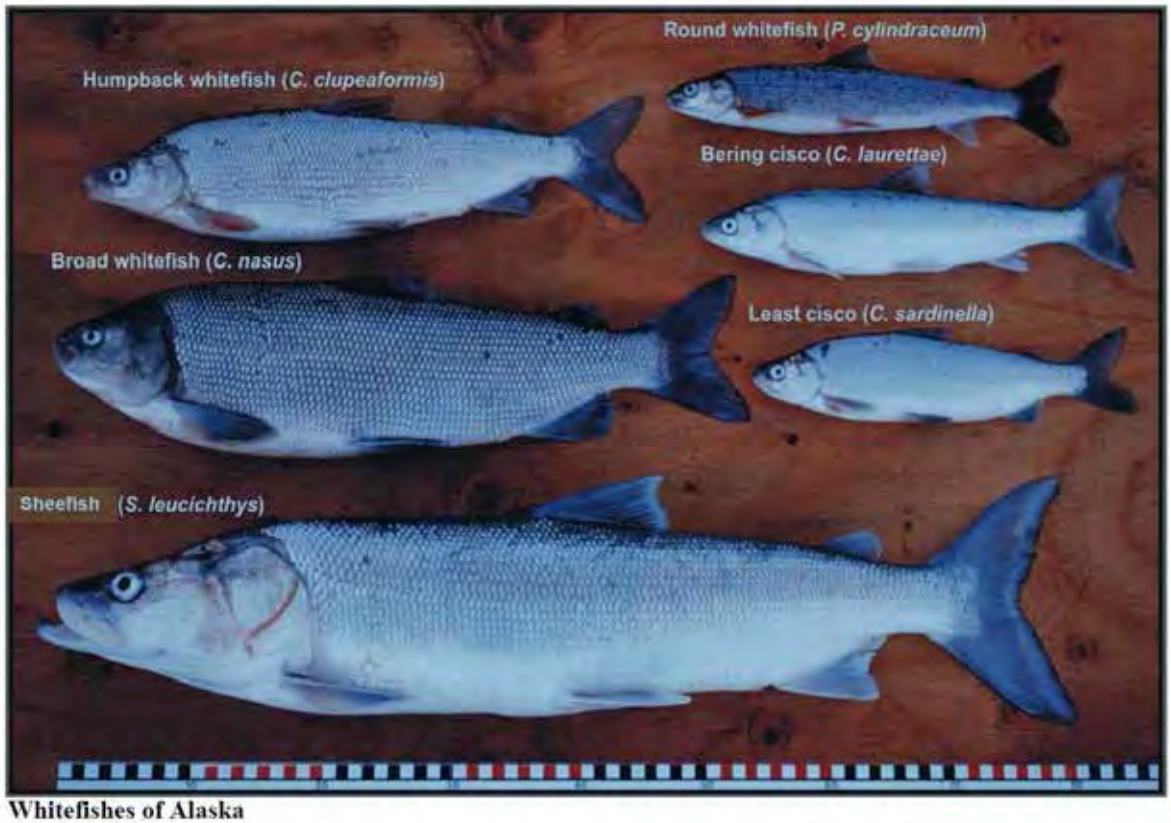
Broad whitefish


Humpback whitefish (Photo by David Runfola, ADFG)



Round whitefish

Sheefish



Whitefishes of Alaska

APPENDIX B–COOPERATIVE AGREEMENTS

COOPERATIVE AGREEMENT

COOP-13-069

BETWEEN

ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF SUBSISTENCE
333 RASPBERRY ROAD
ANCHORAGE, ALASKA 99518

AND

NATIONAL PARK SERVICE
LAKE CLARK NATIONAL PARK AND PRESERVE
240 WEST 5TH AVENUE
ANCHORAGE, ALASKA 99501

I. Authority

This agreement is made and entered into between the National Park Service (NPS), and the Alaska Department of Fish and Game (ADF&G). This project is funded by the United States Fish and Wildlife Service (USF&WS) through the Office of Subsistence Management. The USFWS document number for this award is F12AC00189. ADF&G enters into this agreement under authority of Alaska Statutes AS 16.05.050(12), AS 36.30.850(b)(20) and AS 36.30.850(c).

II. Project Description

Between 2013 and 2015, the Division of Subsistence will conduct a study to elucidate patterns i ı whitefish harvest and use of the Lake Clark communities: Nondalton, Newhalen, Igiugig, Pedro Bay, and Port Alsworth. This study will include a harvest survey, participant observation, and key respondent interviews with community members and active whitefish harvesters. This project is referred to as the Whitefish Trends in Lake Clark and Iliamna Lake.

Karen Evanoff is the cultural anthropologist for Lake Clark National Park and Preserve. Ms. Evanoff has over fifteen years of experience working to integrate native knowledge and Traditional Ecological Knowledge (TEK) into numerous projects and educational curriculum in Alaska. Evanoff will work principally in Nondalton. Ms. Evanoff will attend the scoping meeting, conduct the participant observation and key respondent interviews, participate in the community review meeting, and contribute to the final report. Ms. Evanoff will also assist in coordinating local researchers in Nondalton along with Fawn Silas.

Project Timeline

2013 - Scoping Meeting- February
Participant Observation and Key Respondent Interviews- April

2014 - Participant Observation and Key Respondent Interviews- April

2015 - Community Review- February

Financial Considerations

The total amount of this agreement is not to exceed $6,000.00. The NPS shall be compensated in accordance with the following budget. Payments shall be made upon submission of approved quarterly invoices. For billing purpose, the Tax Identification number for the Alaska Department of Fish and Game is 92-6001185. The Dun and Bradstreet number for ADF&G is 809387475.

ADFG&G shall provide funding in accordance with the following budget.

2013	2014	2015
$2,000.00	$2,000.00	$2,000.00

IV. GENERAL PROVISIONS

1. Nothing in this agreement shall obligate any party in the expenditure of funds, or for future payments of money, in excess of appropriations authorized by law.

2. Each party agrees that it will be responsible for its own acts and omissions including those of its officers, agents, and employees for damages to property or injury to persons occasioned by each party's own acts or omissions in connection with the terms of this agreement.

3. Both parties agree to comply with all applicable federal or State laws regulating ethical conduct of public officers and employees.

4. Each party will comply with all applicable laws, regulations, and executive orders relative to Equal Employment Opportunity.

5. Nothing herein is intended to conflict with federal, state, or local laws or regulations. If there are conflicts, this agreement will be amended at the first opportunity to bring it into conformance with conflicting laws or regulations.

6. Policy and position announcements relating specifically to this cooperative program may be made only by mutual consent of the agencies.

7. The effective date of this agreement shall be April 1, 2013.

8. The termination date of this agreement shall be June 30, 2015. However, either party may terminate its participation in this agreement by providing to the other party notice in writing 30 days in advance of the date on which its termination becomes effective.

9. A free exchange of research and assessment data among agencies is encouraged and is necessary to insure the success of these cooperative studies.

10. Any material published or data acquired as a result of this cooperative program may be reproduced with credit given to the agencies, or organizations responsible for the development of the material.

11. NPS and any agents or employees act in an independent capacity and not as officers, employees, or agents of the State in performance under this agreement.

12. This agreement may be amended by mutual written consent of the parties.

13. All parties shall provide and maintain, for all employees engaged in work under this agreement, workers' compensation insurance coverage as required by AS 23.30.045, and where applicable, any other statutory obligations including but not limited to Federal U.S. L.&H. and Jones Act requirements.

VII. Signatures

For the Alaska Department of Fish and Game

Hazel Nelson
Director
Division of Subsistence

8/27/13
Date

Sunny Haight
Director
Division of Administrative Services

9/3/13
Date

For the National Park Service

~~Joy Kucinski~~
~~Regional Chief of Contracting~~ AC
Adrianna Cahill
Chief of Administration
Lake Clark NP+P

8-16-13
Date

Date

COOPERATIVE AGREEMENT

COOP-13-070

BETWEEN

ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF SUBSISTENCE
333 RASPBERRY ROAD
ANCHORAGE, ALASKA 99518

AND

NONDALTON TRIBAL COUNCIL
P.O. BOX 49
NONDALTON, ALASKA 99640

I. Authority

This agreement is made and entered into between the Nondalton Tribal Council and the Alaska Department of Fish and Game (ADF&G). This project is funded by the United States Fish and Wildlife Service (USF&WS) through the Office of Subsistence Management. The USFWS document number for this award is F12AC00189. ADF&G enters into this agreement under authority of Alaska Statutes AS 16.05.050(12), AS 36.30.850(b)(20) and AS 36.30.850(c).

II. Project Description

Between 2013 and 2015, the Division of Subsistence will conduct a study to elucidate patterns in whitefish harvest and use of the Lake Clark communities: Nondalton, Newhalen, Igiugig, Pedro Bay, and Port Alsworth. This study will include a harvest survey, participant observation, and key respondent interviews with community members and active whitefish harvesters. This project is referred to as the Whitefish Trends in Lake Clark and Iliamna Lake.

The Nondalton Tribal Council is a full partner on this project. The Nondalton Tribal Council (NTC) administrator, Fawn Silas, and the NTC researcher are responsible for coordinating the key respondent interviews and participant observation activities. Furthermore, the NTC will select and contract hire a local research assistant (LRA) to facilitate and administer whitefish harvest surveys with ADF&G staff. Furthermore, the tribal administrator and researcher will be responsible for organizing and attending community scoping and review meetings. Because of the close ties between Nondalton and Port Alsworth, NTC staff will travel with ADF&G staff to Port Alsworth for participant observation of local whitefish harvest and key respondent

interviews. NTC will also facilitate participation of ADF&G staff at the Nondalton Culture Camp week held annually in May to provide learning opportunities for youth about the use and conservation of natural resources like whitefish. The NTC researcher will work with ADF&G staff on the final report.

Nondalton costs will cover coordination and participation by NTC staff in the outlined project activities, contract hiring an LRA, and travel to Port Alsworth with ADF&G staff.

Project Timeline

2013 – Scoping meeting – February
Participant Observation and Key Respondent Interviews- April
Culture Camp

2015 - Community Review-February
September-Final Report

Financial Considerations

The total amount of this agreement is not to exceed $25,738.00. The NTC shall be compensated in accordance with the following budget. Payments shall be made upon submission of approved quarterly invoices. For billing purpose, the Tax Identification number for the Alaska Department of Fish and Game is 92-6001185. The Dun and Bradstreet number for ADF&G is 809387475.

ADFG&G shall provide funding in accordance with the following budget.

Budget Category	**2013**	**2014**
Line 100- Personnel	$7,184	$2,694
Line 200- Travel	$2,820	$1,500
Line 300- Contractual	$3,300	
Line 400- Materials and Supplies	$2,500	
Total Direct Costs	$15,804	$4194
Total Indirect Costs	$4536	$1,204
Total Direct Costs	$20,340	$5,398

IV. GENERAL PROVISIONS

1. Nothing in this agreement shall obligate any party in the expenditure of funds, or for future payments of money, in excess of appropriations authorized by law.

2. Each party agrees that it will be responsible for its own acts and omissions including those of its officers, agents, and employees for damages to property or injury to persons occasioned by each party's own acts or omissions in connection with the terms of this agreement.

3. Both parties agree to comply with all applicable federal or State laws regulating ethical conduct of public officers and employees.

4. Each party will comply with all applicable laws, regulations, and executive orders relative to Equal Employment Opportunity.

5. Nothing herein is intended to conflict with federal, state, or local laws or regulations. If there are conflicts, this agreement will be amended at the first opportunity to bring it into conformance with conflicting laws or regulations.

6. Policy and position announcements relating specifically to this cooperative program may be made only by mutual consent of the agencies.

7. The effective date of this agreement shall be February 1, 2013.

8. The termination date of this agreement shall be September 30, 2015. However, either party may terminate its participation in this agreement by providing to the other party notice in writing 30 days in advance of the date on which its termination becomes effective.

19. Any material published or data acquired as a result of this cooperative program may be reproduced with credit given to the agencies, or organizations responsible for the development of the material.

10. NTC and any agents or employees act in an independent capacity and not as officers, employees, or agents of the State in performance under this agreement.

11. This agreement is governed by the laws of the State of Alaska. By signature, all parties acknowledge this governance and waive any and all implied or expressed sovereignty. All actions concerning this agreement shall be brought in the Superior Court of the State of Alaska.

12. This agreement may be amended by mutual written consent of the parties.

13. All parties shall provide and maintain, for all employees engaged in work under this agreement, workers' compensation insurance coverage as required by AS 23.30.045, and where applicable, any other statutory obligations including but not limited to Federal U.S. L.&H. and Jones Act requirements.

VII. Signatures

For the Alaska Department of Fish and Game

Hazel Nelson
Director
Division of Subsistence

4/15/13
Date

Sunny Haight
Director
Division of Administrative Services

4/16/13
Date

For the Nondalton Tribal Council

William Evanoff
President

4-11-13
Date

COOPERATIVE AGREEMENT

COOP-13-071

BETWEEN

ALASKA DEPARTMENT OF FISH AND GAME
DIVISION OF SUBSISTENCE
333 RASPBERRY ROAD
ANCHORAGE, ALASKA 99518

AND

BRISTOL BAY NATIVE ASSOCIATION
1500 KANAKANAK ROAD
DILLINGHAM, ALASKA 99576

I. Authority

This agreement is made and entered into between the Bristol Bay Native Association (BBNA) and the Alaska Department of Fish and Game (ADF&G). This project is funded by the United States Fish and Wildlife Service (USF&WS) through the Office of Subsistence Management. The USFWS document number for this award is F12AC00189. ADF&G enters into this agreement under authority of Alaska Statutes AS 16.05.050(12), AS 36.30.850(b)(20) and AS 36.30.850(c).

II. Project Description

Between 2013 and 2015, the Division of Subsistence will conduct a study to elucidate patterns in whitefish harvest and use of the Lake Clark communities: Nondalton, Newhalen, Igiugig, Pedro Bay, and Port Alsworth. This study will include a harvest survey, participant observation, and key respondent interviews with community members and active whitefish harvesters. This project is referred to as the Whitefish Trends in Lake Clark and Iliamna Lake.

Danielle Stickman is the Subsistence Fisheries Scientist for BBNA and is originally from Nondalton. Ms. Stickman holds a degree in Environmental Science. In addition to Ms. Stickman's experience working on fisheries issues in Alaska, she has many ties in the communities of Iliamna Lake and Lake Clark which facilitate communication, outreach, and education concerning the whitefish project. BBNA staff costs will include Ms. Stickman's attendance at scoping meetings, participation in fieldwork activities, including the collection of

whitefish harvest data, and attendance at the Nondalton Culture Camp. Ms. Stickman will also contribute to the final report.

BBNA staff costs also include an intern working out of the Dillingham office. Ms. Stickman is responsible for training and directing the intern who has been hired to assist with this project.

BBNA costs include travel for the intern to participate in the community scoping and review meetings and fieldwork activities.

Project Timeline

2013 – Scoping Meeting - February
Harvest surveys, participant Observation and key respondent Interviews- March and April
Nondalton Cultural Week- May

2014 - Harvest surveys, participant observation and key respondent Interviews- March and April
Nondalton Cultural Week- May

Financial Considerations

The total amount of this agreement is not to exceed $72,459.00. The NPS shall be compensated in accordance with the following budget. Payments shall be made upon submission of approved quarterly invoices. For billing purpose, the Tax Identification number for the Alaska Department of Fish and Game is 92-6001185. The Dun and Bradstreet number for ADF&G is 809387475.

ADFG&G shall provide funding in accordance with the following budget.

Budget Category	2013	2014
Line 100- Personnel	$15,150	$15,150
Line 200- Travel	$11,000	$11,000
Line 400- Materials and Supplies	$1,500	$2,500
Total Direct Costs	$27,650	$28,650
Total Indirect Costs	$7,936	$8,223
Total Costs	$35,586	$36,873

IV. GENERAL PROVISIONS

1. Nothing in this agreement shall obligate any party in the expenditure of funds, or for future payments of money, in excess of appropriations authorized by law.

2. Each party agrees that it will be responsible for its own acts and omissions including those of its officers, agents, and employees for damages to property or injury to persons occasioned by each party's own acts or omissions in connection with the terms of this agreement.

3. Both parties agree to comply with all applicable federal or State laws regulating ethical conduct of public officers and employees.

4. Each party will comply with all applicable laws, regulations, and executive orders relative to Equal Employment Opportunity.

5. Nothing herein is intended to conflict with federal, state, or local laws or regulations. If there are conflicts, this agreement will be amended at the first opportunity to bring it into conformance with conflicting laws or regulations.

6. Policy and position announcements relating specifically to this cooperative program may be made only by mutual consent of the agencies.

7. The effective date of this agreement shall be February 1, 2013.

8. The termination date of this agreement shall be June 30, 2014. However, either party may terminate its participation in this agreement by providing to the other party notice in writing 30 days in advance of the date on which its termination becomes effective.

19. Any material published or data acquired as a result of this cooperative program may be reproduced with credit given to the agencies, or organizations responsible for the development of the material.

10. BBNA and any agents or employees act in an independent capacity and not as officers, employees, or agents of the State in performance under this agreement.

11. This agreement is governed by the laws of the State of Alaska. By signature, all parties acknowledge this governance and waive any and all implied or expressed sovereignty. All actions concerning this agreement shall be brought in the Superior Court of the State of Alaska.

12. This agreement may be amended by mutual written consent of the parties.

13. All parties shall provide and maintain, for all employees engaged in work under this agreement, workers' compensation insurance coverage as required by AS 23.30.045, and where applicable, any other statutory obligations including but not limited to Federal U.S. L.&H. and Jones Act requirements.

VII. Signatures

For the Alaska Department of Fish and Game

Hazel Nelson
Director
Division of Subsistence

4/10/13
Date

Sunny Haight
Director
Division of Administrative Services

4/12/13
Date

For the Bristol Bay Native Association

Ralph Anderson
President/Chief Executive Officer

April 1, 2013
Date

APPENDIX C–SURVEY INSTRUMENT

SURVEY FORM FOR NONDALTON

STUDY YEAR 2013

WHITEFISH WILD FOOD HARVEST SURVEY

NONDALTON, ALASKA

January to December, 2013

This survey is used to estimate harvests of wild foods and to describe community subsistence economies. We will publish a summary report, and send it to all households in your community. We share community information with the Alaska Department of Fish and Game, the U.S. Fish and Wildlife Service and the National Park Service. We work with the federal Regional Advisory Councils and with local Fish and Game Advisory Committees to better manage subsistence and to implement federal and state 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:	**NONDALTON**	**252**
RESPONDENT ID:		
INTERVIEWER:		
INTERVIEW DATE:		
START TIME:		
STOP TIME:		
	DATA CODED BY:	
	DATA ENTERED BY:	
	SUPERVISOR:	

COOPERATING ORGANIZATIONS

BRISTOL BAY NATIVE ASSOCIATION
NATURAL RESOURCES DEPARTMENT
P.O. BOX 310
DILLINGHAM, AK 99576
907-842-6243

LAKE CLARK
NATIONAL PARK AND PRESERVE
240 W 5TH AVENUE
ANCHORAGE, AK 99501
907-644-3638

DIVISION OF SUBSISTENCE
ALASKA DEPT OF FISH & GAME
333 RASPBERRY ROAD
ANCHORAGE, AK 99518
907-267-2353

NONDALTON TRIBAL COUNCIL
PO BOX 49
NONDALTON, AK 99640
907-294-2257

HOUSEHOLD MEMBERS

HOUSEHOLD ID

Between JANUARY and DECEMBER, 2013…
…who lived in your household?

ID#	IS THIS PERSON ANSWERING QUESTIONS *ON THIS SURVEY?* *(circle)*	MALE OR FEMALE? *(circle)*	ALASKA NATIVE? *(circle)*	IN WHAT YEAR WAS THIS PERSON BORN? *(year)*	WHERE WERE PARENTS LIVING WHEN THIS PERSON WAS BORN? *(ak city or state)*	HOW IS THIS PERSON RELATED TO HOUSEHOLD HEAD 1? *(relation)*	HOW MANY YEARS HAS THIS PERSON LIVED IN NONDALTON? *(number)*
HEAD 1	Y N	M F	Y N				YRS
01							
Enter spouse or partner next. If household has a SINGLE HEAD, leave HEAD 2 blank.							
HEAD 2	Y N	M F	Y N				YRS
02							
Enter children (oldest to youngest), grandchildren, grandparents, brothers, sisters, or anyone else living full-time in this household.							
03	Y N	M F	Y N				YRS
04	Y N	M F	Y N				YRS
05	Y N	M F	Y N				YRS
06	Y N	M F	Y N				YRS
07	Y N	M F	Y N				YRS
08	Y N	M F	Y N				YRS
09	Y N	M F	Y N				YRS
10	Y N	M F	Y N				YRS
11	Y N	M F	Y N				YRS
12	Y N	M F	Y N				YRS
13	Y N	M F	Y N				YRS
14	Y N	M F	Y N				YRS
15	Y N	M F	Y N				YRS

PERMANENT HH MEMBERS: 01 **NONDALTON: 252**

FISHERY PARTICIPATION — HOUSEHOLD ID

WHITEFISH

Note: this section of the survey is meant to assess changes in the availability, abundance and use of WHITEFISHES, including SHEEFISH.

Do members of your household USUALLY fish for WHITEFISH for subsistence?..... Y N

Between JANUARY and DECEMBER, 2013 did members of your household FISH FOR WHITEFISH for subsistence?..... Y N

PARTICIPATION IN FISHERIES AND COMMUNITY

Does your household use WHITEFISH?..... Y N

How important is the use of WHITEFISH to your household **today**? Not-important important very important?

How important was the use of WHITEFISH to your household in the **past**? Not-important important very important?

If you cannot get the WHITEFISH you need, what do you do differently?

_____

_____

_____

Now we are going to discuss your Household's harvest effort of whitefish

Thinking about your WHITEFISH fishing this year, how would you compare your fishing **effort** to

… the past 5 years? L S M

… the past 10 years? L S M

Between JANUARY and DECEMBER, 2013 when did members of your household fish for WHITEFISH?

J F M A M J J A S O N D *(circle all that apply)*

Thinking about fishing 5 years ago, what months would members of your household usually have fished for WHITEFISH?

J F M A M J J A S O N D *(circle all that apply)*

Thinking about fishing 10 years ago, what months would members of your household usually have fished for WHITEFISH?

J F M A M J J A S O N D *(circle all that apply)*

Over the past 10 years, have you observed changes in the best time for catching WHITEFISH? Y N

If so, could you describe those changes?

_____

_____

_____

WHITEFISH: 06 — NONDALTON: 252

HARVESTS: WHITEFISH

HOUSEHOLD ID

IF household responded NO to the harvest AND use questions on the previous page, skip this page.

If WHITEFISH, including SHEEFISH were used or harvested, continue on this page…

Please estimate how many whitefish ALL MEMBERS OF YOUR HOUSEHOLD HARVESTED in 2013. INCLUDE whitefish you gave away, ate fresh, fed to dogs, lost to spoilage, or got by helping others. If fishing with others, report ONLY YOUR SHARE of the catch.

	IN 2013 DID MEMBERS OF YOUR HH…						IN 2013, HOW MANY _____ DID MEMBERS OF YOUR HOUSEHOLD HARVEST?													
	USE?	TRY TO HARVEST?	HARVEST?	RECEIVE?	GIVE AWAY?	GEAR USED ?	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	UNKNOWN	UNITS
	(circle)						*(enter number by month of take)*													*(ind)*
SHEEFISH	Y N	Y N	Y N	Y N	Y N	SETNET														IND
125600000						NET UNDER ICE														
						ROD & REEL														
						ICE FISHING														
						DIPNET														
						OTHER														
						SETNET														
						NET UNDER ICE														
						ROD & REEL														
						ICE FISHING														
						DIPNET														
						OTHER														
BROAD WHITEFISH	Y N	Y N	Y N	Y N	Y N	SETNET														IND
126404000						NET UNDER ICE														
						ROD & REEL														
						ICE FISHING														
						DIPNET														
						OTHER														
						SETNET														
						NET UNDER ICE														
						ROD & REEL														
						ICE FISHING														
						DIPNET														
						OTHER														
HUMPBACK WHITEFISH	Y N	Y N	Y N	Y N	Y N	SETNET														IND
126408000						NET UNDER ICE														
						ROD & REEL														
						ICE FISHING														
						DIPNET														
						OTHER														
						SETNET														
						NET UNDER ICE														
						ROD & REEL														
						ICE FISHING														
						DIPNET														
						OTHER														

Continue on next page

HARVESTS: WHITEFISH

HOUSEHOLD ID

... CONTINUED from previous page

Please estimate how many whitefish ALL MEMBERS OF YOUR HOUSEHOLD HARVESTED in 2013. INCLUDE whitefish you gave away, ate fresh, fed to dogs, lost to spoilage, or got by helping others. If hunting or trapping with others, report ONLY YOUR SHARE of the catch.

	IN 2013 DID MEMBERS OF YOUR HH...						IN 2013, HOW MANY _____ DID MEMBERS OF YOUR HOUSEHOLD HARVEST?													
	USE?	TRY TO HARVEST?	HARVEST?	RECEIVE?	GIVE AWAY?	GEAR USED ?	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER	UNKNOWN	UNITS
	(circle)						*(enter number by month of take)*													*(ind)*
ROUND WHITEFISH	Y N	Y N	Y N	Y N	Y N	SETNET														IND
126412000						NET UNDER ICE														
						ROD & REEL														
						ICE FISHING														
						DIPNET														
						OTHER														
						SETNET														
						NET UNDER ICE														
						ROD & REEL														
						ICE FISHING														
						DIPNET														
						OTHER														
LEAST CISCO	Y N	Y N	Y N	Y N	Y N	SETNET														IND
126406060						NET UNDER ICE														
						ROD & REEL														
						ICE FISHING														
						DIPNET														
						OTHER														
						SETNET														
						NET UNDER ICE														
						ROD & REEL														
						ICE FISHING														
						DIPNET														
						OTHER														
BERING CISCO	Y N	Y N	Y N	Y N	Y N	SETNET														IND
126406040						NET UNDER ICE														
						ROD & REEL														
						ICE FISHING														
						DIPNET														
						OTHER														
						SETNET														
						NET UNDER ICE														
						ROD & REEL														
						ICE FISHING														
						DIPNET														
						OTHER														

Continue on next page

HARVESTS: OTHER FISH (NON-COMMERCIAL)

HOUSEHOLD ID

Do members of your household USUALLY harvest OTHER FISH ?..... Y N

Between JANUARY and DECEMBER, 2013…
…Did members of your household USE or TRY TO HARVEST other fish?..... Y N

IF NO to both questions, go to the next harvest page.
If YES, continue on this page…

Please estimate how many other fish ALL MEMBERS OF YOUR HOUSEHOLD HARVESTED in 2013, including with a rod and reel. INCLUDE other fish you gave away, ate fresh, fed to dogs, lost to spoilage, or got by helping others. If fishing with others, report ONLY YOUR SHARE of the catch. Do not include fish caught and released

	IN 2013 DID MEMBERS OF YOUR HH…					IN 2013, HOW MANY _____ DID YOUR HOUSEHOLD…				
	USE?	TRY TO HARVEST?	HARVEST?	RECEIVE?	GIVE AWAY?	…HARVEST WITH GILL NET OR SEINE?	…HARVEST WITH ROD AND REEL?	… HARVEST WITH ICE FISHING	… HARVEST WITH OTHER GEAR?	UNITS
	(circle)					*(number taken by each gear type)*				*(ind, lbs)*
NORTHERN PIKE 125500000	Y N	Y N	Y N	Y N	Y N					LBS
BURBOT 124800000	Y N	Y N	Y N	Y N	Y N					IND
LAMPREY 122000000	Y N	Y N	Y N	Y N	Y N					IND
GRAYLING 125200000	Y N	Y N	Y N	Y N	Y N					IND
RAINBOW TROUT 126204000	Y N	Y N	Y N	Y N	Y N					IND
ARCTIC CHAR 125002000	Y N	Y N	Y N	Y N	Y N					IND
DOLLY VARDEN 125006000	Y N	Y N	Y N	Y N	Y N					IND
SUCKER 126000000	Y N	Y N	Y N	Y N	Y N					IND
HERRING 120200000	Y N	Y N	Y N	Y N	Y N					GAL
BLACKFISH 124600000	Y N	Y N	Y N	Y N	Y N					LBS
RAINBOW SMELT 120406000	Y N	Y N	Y N	Y N	Y N					GAL
LAKE TROUT 125010000	Y N	Y N	Y N	Y N	Y N					IND

These columns should include all the harvests: other fish HARVESTED by members of this household in 2013.

OTHER FISH: 06 **NONDALTON: 252**

COMMENTS

HOUSEHOLD ID

DO YOU HAVE ANY QUESTIONS, COMMENTS, OR CONCERNS?

INTERVIEW SUMMARY:

BE SURE TO FILL IN THE STOP TIME ON THE FIRST PAGE!!!!

COMMENTS: 30 **NONDALTON: 252**

APPENDIX D–FISH IDENTIFICATION GUIDE

Bering cisco* (Common in coastal areas from Pt. Barrow west, and south to Bristol Bay. Large spawning migrations in Yukon and Kuskokwim rivers. Very difficult to distinguish from Arctic cisco.)

Arctic cisco (Common in coastal areas from Pt. Barrow east into Arctic Canada. Large spawning migration in Mackenzie River. Very difficult to distinguish from Bering cisco.) (Photo by USGS)

Least cisco

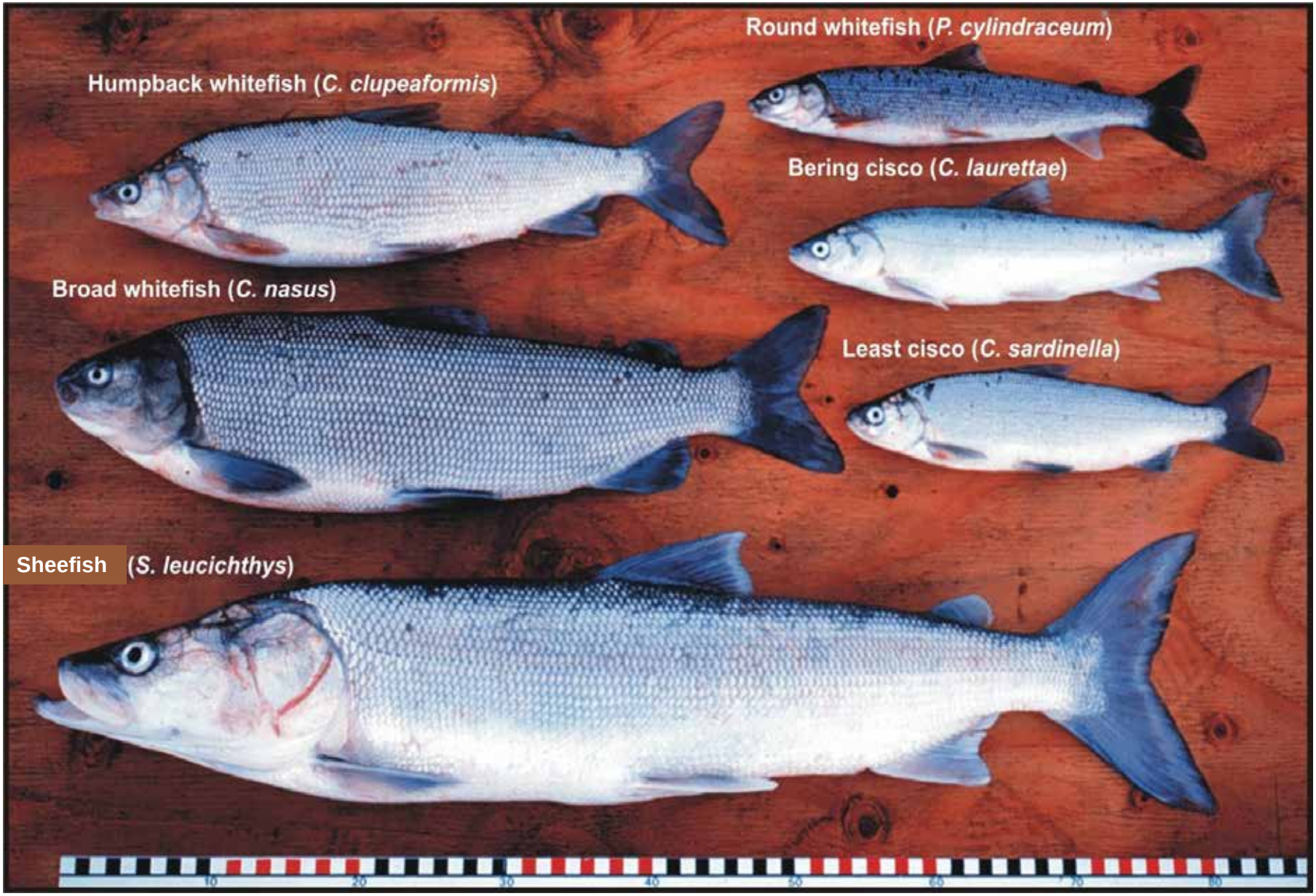
*All photos by Randy J. Brown, USFWS, except where noted otherwise.

Broad whitefish

Humpback whitefish (Photo by David Runfola, ADFG)

Round whitefish

Sheefish



Whitefishes of Alaska

APPENDIX E–KEY RESPONDENT INTERVIEW PROTOCOL: STUDY YEARS 2012 AND 2013

Lake Clark Whitefish
INTERVIEW PROTOCOL

Interviewer – This is a general list of questions. The interview can be as open-ended as you wish. The major questions that should be asked are marked with an asterisk. The rest depend on how the interview is going? Feel free to reword the questions. These interviews can be taped or you can just take notes, depending on how comfortable you and the interviewee feel with each method.

We are going to discuss whitefish fishing in your area. **Your answers to these questions are anonymous. If we use any quotes citing your name we will ask your permission first**.

DEMOGRAPHICS

*Date
*Researcher
*Name
*Age
*Parents Residence when Born
*Current Residence
*Years in Community

PAST to PRESENT

*When did *you* start fishing for whitefish in the area? Who did you fish with?

*Where did your family fish? Did you have a fish camp for whitefish? (Map fishing locations)

*Are there specific fishing locations that are known for an abundance of whitefish during certain seasons? Has this changed during your lifetime? (Map these and get local place names and/or known Dena'ina and/or Dichinanek' Hwt'ana names)

*What species of whitefish do you catch? What seasons? (get Dena'ina and/or Yup'ik names for the different whitefish species)

*How much whitefish did your family normally harvest each season? Has this changed? (Ask for a timeline covering any important changes over the years or decades)

*How do you catch whitefish? Does your technique differ by species? Has the fishing technology changed in your lifetime?

*Are there as many people fishing for whitefish as in the past? If there aren't as many why do you think this is?

(If applicable) Does commuting from the village to whitefish locations affect your fishing effort?

Do you know any traditional stories about whitefish? Are there traditional methods of whitefish management practiced?

Is there a size of whitefish you prefer? Any reasons to avoid whitefish if they are too small or too large?

Are there any times of the year when you would not harvest whitefish, or other situations where you avoided harvesting whitefish?

PRESERVATION AND STORAGE

*In what ways do you cut and preserve your whitefish (freezing, drying, smoking, canning)?

Is there a difference between how you preserve the different species of whitefish?

When you smoke fish what kind of wood do you use? How long do you smoke the fish for?

What do you do with the bones and skin of the fish? Why do you do this?

Was whitefish skin ever used for sewing/making things? If so, who does this?

ECOLOGY, TRANSITION, AND THE FUTURE

*Do you know where the different species of whitefish spawn? (Map spawning locations)

*What natural/environmental changes are affecting whitefish abundance? (For example, water levels, gravel bars, silting, beaver dams, weather patterns, map locations discussed)

*Has seasonal whitefish abundance changed over time? Has the month or week of harvest timing shifted over time? (Ask for a timeline covering approximately the last ten years).

*Are there streams or lakes that no longer have whitefish that used to have whitefish?

*Are whitefish populations declining? Why do you think this is?

Are whitefish influenced by interactions with other fish and wildlife species in your area?

Have you noticed a change in the size or health of certain whitefish species?

If whitefish populations continue to decline will you continue to fish?

If whitefish harvests have declined what resources do you use as a replacement? (Other wild foods or store-bought foods?)

What changes do you see among the younger generation in regards to fishing effort? If they don’t find much interest in fishing does this affect your personal effort (for people in their 30s and older)?

*How would you like your knowledge of fishing passed onto the next generation/s

Do you know where and when whitefish spawn?

Do you know about the whitefish migratory routes in the Lake Clark, 6 Mile Lake, or Iliamna Lake area?

Lake Clark Whitefish and Other Freshwater Fish
INTERVIEW PROTOCOL

Interviewer – This is a general list of questions. The interview can be as open-ended as you wish. The major questions that should be asked are marked with an asterisk. The rest depend on how the interview is going. Feel free to reword the questions. These interviews can be taped or you can just take notes, depending on how comfortable you and the interviewee feel with each method.

We are going to discuss whitefish and other freshwaterfreshwater fish fishing in your area. The focus of this project is to understand the importance of whitefish to your households overall subsistence harvest. We also understand that you may harvest other freshwater fish at the same time as you harvest whitefish so we will ask about all freshwater fish, but have some specific questions about whitefish. **Your answers to these questions are anonymous. If we use any quotes citing your name we will ask your permission first**.

- Do I have your permission to record the interview to an audio file?

DEMOGRAPHICS

- Date
- Researcher
- Name
- Age
- Parents Residence when Born
- Current Residence
- Years in Community

PAST to PRESENT

- Please tell me a little bit about your past and how you ended up here in this community.
- Did you fish for whitefish in the past and do you continue to do so today?

- Do others share whitefish with you?

- What is your earliest memory of whitefish and other freshwater fish harvesting?
- When did *you* start fishing for whitefish and other freshwater fish in the area?
- Who did you fish with?
- Where did your family fish?
- Did you have a fish camp for whitefish and other freshwater fish? (Map fishing locations)
- Are there specific fishing locations that are known for an abundance of whitefish and other freshwater fish during certain seasons?
- Has this changed during your lifetime? (Map these and get local place names and/or known Dena'ina and/or Dichinanek' Hwt'ana names and or Yup'ik)
- What species of whitefish and other freshwater fish did you catch when you were growing up and has this changed over time?
    - How did people process or consume whitefish and other freshwater fish in the past?
- Were whitefish and other freshwater fish often traded between families and or communities?
- What species of whitefish and other freshwater fish do you catch today? (Show guide, ask if they get the species)
- Which freshwater fish species do you prefer and why and when do you fish for them? (Get Dena'ina and/or Yup'ik names for the different whitefish and other freshwater fish species)
- When do you fish for whitefish and other nonsalmon fish and why is it important to try and catch whitefish and other freshwater fish at these times of year?
- Do you do any other subsistence activities at the same time that you harvest whitefish and other freshwater fish?
    - If whitefish and other freshwater fish numbers declined how would this affect those other subsistence activities?

- If you are not able to get whitefish and other freshwater fish at this time of year how would this affect your family?

- How much whitefish and other freshwater fish did your family normally harvest each season?

- Has this changed? (Ask for a timeline covering any important changes over the years or decades)

- How do you decide when you have harvested enough whitefish and other freshwater fish?

- How do you decide when to fish and what types of fish to target?

- Have these factors changed over your lifetime?

  What role does whitefish and other non-salmon fish play in the diet of your household? (How often do you eat it
- Are whitefish and other freshwater fish important to your household's subsistence?

- Have there been years when you did not get as much whitefish and other freshwater fish as you would have liked for your household? (If so why…?)

  - What kinds of impacts did the lack of whitefish and other freshwater fish have on your household?

- What do you do if you do not have enough whitefish and other freshwater fish?

- How do you catch whitefish and other freshwater fish? What types of gear and or methods?

- Does your technique differ by species?

- Has the fishing technology changed in your lifetime?

- Are there as many people fishing for whitefish and other freshwater fish as in the past?

- If there aren't as many why do you think this is?

- (If applicable) Does commuting from the village to whitefish and other freshwater fish locations affect your fishing effort?

- Do you remember anyone sharing any traditional stories about whitefish and other freshwater fish?
    - Can you tell me what you remember about those stories?
- Are there traditional methods of whitefish and other freshwater fish management practiced? (Anything that you remember during your lifetime that adults/elders/anyone showed/told you?)
- Is there a size of whitefish and other freshwater fish you prefer?
- Any reasons to avoid whitefish and other freshwater fish if they are too small or too large?
- Are there any times of the year when you would not harvest whitefish and other freshwater fish, or other situations where you avoided harvesting whitefish and other freshwater fish?

PRESERVATION AND STORAGE

- In what ways do you cut and preserve your whitefish and other freshwater fish (freezing, drying, smoking, canning)?
- How do you decide how to preserve and store the whitefish and other freshwater fish that you get?
- Is there a difference between how you preserve the different species of whitefish and other freshwater fish?
- When you smoke fish what kind of wood do you use? How long do you smoke the fish for?
- What do you do with the bones and skin of the fish? Why do you do this?
- Were whitefish and other freshwater fish skin ever used for sewing/making things? If so, who does this?

ECOLOGY, TRANSITION, AND THE FUTURE

- Do you know where the different species of whitefish and other freshwater fish spawn? (Map spawning locations)

- What changes have you seen in whitefish and other freshwater fish populations over your lifetime?

- What natural/environmental changes are affecting whitefish and other freshwater fish abundance? (For example, water levels, gravel bars, silting, beaver dams, weather patterns, map locations discussed)

- What non-environmental factors, factors other than the ones you just mentioned, limit your ability to harvest and use whitefish and other freshwater fish?

- Have seasonal whitefish and other freshwater fish abundance changed over time? Has the month or week of harvest timing shifted over time? (Ask for a timeline covering approximately the last ten years)

- Are there streams or lakes that no longer have whitefish and other freshwater fish that used to have whitefish and other freshwater fish?

- Are whitefish and other freshwater fish populations declining?

- Why do you think this is?

- Have you observed any climate related changes?

    - When did you start to notice these changes?

- Is climate change effecting whitefish and other freshwater fish?

    - Has climate change affected your whitefish harvest efforts?

- Are whitefish and other freshwater fish influenced by interactions with other fish and wildlife species in your area?

- Have you noticed a change in the size or health of certain whitefish and other freshwater fish species?

- If whitefish and other freshwater fish populations continue to decline will you continue to fish?

- If whitefish and other freshwater fish harvests have declined what resources do you use as a replacement? (Other wild foods or store-bought foods?)

- What changes do you see among the younger generation in regards to fishing effort? If they don't find much interest in fishing does this affect your personal effort (for people in their 30s and older)?

- How would you like your knowledge of fishing passed onto the next generation/s

- How would you explain the importance of whitefish and other freshwater fish in the past?

- How would you characterize the importance of whitefish and other freshwater fish today?

- What would you like to share with the younger generations about whitefish and other freshwater fish?

- If we came back here in ten years do you think that we would find any changes in the areas where you fish for whitefish and other freshwater fish?

APPENDIX F–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 gal of rainbow smelt, the quantity would be multiplied by the appropriate conversion factor (in this case 6.00) to show a harvest of 18 lb of rainbow smelt.

	Reported units	Conversion to pounds
Whitefishes		
Sheefish	ind	5.50
Broad whitefish	ind	4.00
Bering cisco	ind	1.40
Least cisco	ind	0.40
Humpback whitefish	ind	1.75
Round whitefish	ind	1.00
Other nonsalmon fish		
Rainbow smelt	gal	6.00
Arctic lamprey	ind	0.60
Alaska blackfish	lb	1.00
Burbot	ind	1.00
Arctic char	ind	1.40
Dolly Varden–freshwater	ind	1.40
Dolly Varden–fingerling [a]	ind	0.06
Lake trout	ind	1.40
Unknown char	ind	1.40
Arctic grayling	ind	0.70
Northern pike	ind	2.80
Longnose sucker	ind	1.50
Rainbow trout	ind	1.40
Unknown trout	ind	1.40
Unknown nonsalmon fish	ind	1.00

Source Unless otherwise specified, Community Subsistence Information System (CSIS) Conversion Factor Summary:
http://www.adfg.alaska.gov/sb/CSIS/index.cfm?ADFG=main.conversionFactorSelRes
a. Personal communication on April 16, 2015, with Jim Fall, Subsistence Program Manager, Alaska Department of Fish and Game.