Fishery Data Series No. 18-10

Upper Cook Inlet Personal Use Salmon Fisheries, 2013–2015

by

Kristine J. Dunker

April 2018

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

Symbols and Abbreviations

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

Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

Mathematics, statistics

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

FISHERY DATA SERIES NO. 18-10

UPPER COOK INLET PERSONAL USE SALMON FISHERIES, 2013–2015

by
Kristine J. Dunker
Alaska Department of Fish and Game, Division of Sport Fish, Anchorage

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

April 2018

ADF&G Fishery Data Series was established in 1987 for the publication of Division of Sport Fish technically oriented results for a single project or group of closely related projects, and in 2004 became a joint divisional series with the Division of Commercial Fisheries. Fishery Data Series reports are intended for fishery and other technical professionals and are available through the Alaska State Library and on the Internet: http://www.adfg.alaska.gov/sf/publications/. This publication has undergone editorial and peer review.

Kristine J. Dunker,
Alaska Department of Fish and Game, Division of Sport Fish,
333 Raspberry Road, Anchorage, AK 99518-1599, USA

This document should be cited as follows:
Dunker, K. J. 2018. Upper Cook Inlet personal use salmon fisheries. 2013–2015. Alaska Department of Fish and Game, Fishery Data Series No. 18-10, Anchorage.

TABLE OF CONTENTS

Page

LIST OF TABLES ii

LIST OF FIGURES ii

LIST OF APPENDICES iii

ABSTRACT 1

INTRODUCTION 1

Kasilof River 1

Kenai River 2

Fish Creek 4

Objectives 4

METHODS 4

Study Design 4

Data Analysis 6

RESULTS 8

Permits Issued and Returned 8

Estimated Harvest and Effort 10

- Kasilof River Set Gillnet Fishery 10
- Kasilof River Dip Net Fishery 10
- Kenai River Dip Net Fishery 17
- Fish Creek Dip Net Fishery 17

Characteristics of Permit Holders 19

- Residency of Permit Holders 19
- Household and Fishery Variation in Harvest 22
- Household Size 27
- Number of Days Fished, Fisheries Visited, and Harvest Rates 27

DISCUSSION 31

ACKNOWLEDGEMENTS 34

REFERENCES CITED 35

APPENDIX A: EXAMPLE OF AN UPPER COOK INLET PERSONAL USE PERMIT 37

APPENDIX B: HISTORICAL TRENDS IN UCIPU SALMON HARVEST, PARTICIPATION, AND HARVEST PER PERMIT, 1996–2015 39

APPENDIX C: SOCKEYE SALMON HARVEST BY DATE DURING THE UPPER COOK INLET PERSONAL USE FISHERIES, 2013–2015 41

APPENDIX D: EFFORT AND HARVEST TRENDS DURING THE UPPER COOK INLET PERSONAL USE FISHERIES, 1996–2015 47

APPENDIX E: TRENDS IN SOCKEYE SALMON HARVESTS RELATIVE TO TOTAL INRIVER SOCKEYE SALMON RUNS, KENAI RIVER, 1996–2015 55

APPENDIX F: HISTORICAL RESIDENCY TRENDS FOR PARTICIPANTS IN THE UPPER COOK INLET PERSONAL USE SALMON FISHERIES 57

LIST OF TABLES

Table		Page
1	Number of Upper Cook Inlet personal use salmon fishery permits issued by year, and number of permits returned by mailing and year, 2013–2015.	9
2	Estimated number of Upper Cook Inlet personal use salmon fishery permits that reported not fishing by year for 2013–2015.	9
3	Effort in the Upper Cook Inlet personal use salmon fisheries, 2013–2015.	11
4	Harvest of salmon in the Upper Cook Inlet personal use (UCIPU) fisheries, 2013–2015.	12
5	Effort and flounder harvests, standard errors, and relative precision in Upper Cook Inlet personal use fisheries, 2013–2015.	13
6	Percent of the total sockeye salmon harvest by Upper Cook Inlet personal use fisheries, 2013–2015.	16
7	Residence areas for Upper Cook Inlet personal use salmon fishery permit holders by year, 2013–2015.	19
8	Effort and harvest by residence of participants in the Upper Cook Inlet personal use fisheries, 2013–2015.	20
9	Summary of Upper Cook Inlet personal use permit holders by year, number of fisheries fished, number of days fished, and household size, 2013–2015.	23

LIST OF FIGURES

Figure		Page
1	Maps of Upper Cook Inlet personal use salmon fisheries	3
2	Total estimated salmon harvest for all Upper Cook Inlet personal use fisheries combined	14
3	Cumulative harvest timing for sockeye salmon during the Kasilof River personal use set gillnet fishery, 2013–2015.	15
4	Cumulative harvest timing for sockeye salmon during the Kasilof River personal use dip net fishery, 2013–2015.	15
5	Cumulative harvest timing for sockeye salmon during the Kenai River personal use dip net fishery, 2013–2015.	18
6	Cumulative harvest timing for sockeye salmon during the Fish Creek personal use dip net fishery, 2013–2015.	18
7	Proportion of salmon harvested in the Upper Cook Inlet personal use fisheries by residence of permit holders.	21
8	Mean harvest and days fished per permit by residence of participants in the Upper Cook Inlet personal use fisheries.	22
9	Percent of bag limits harvested by Upper Cook Inlet personal use salmon fishery permit holders, 2013–2015.	24
10	Average percent of bag limit filled by fishery, 2013–2015.	24
11	Percent of salmon harvest by fishery, 2013–2015.	25
12	Percent of permits participating in each fishery, 2013–2015.	26
13	Percent of permits, percent of total harvest, and average percent of bag limit filled by personal use salmon fishery and household size, 2013–2015.	28
14	Mean harvest per person in Upper Cook Inlet personal use fisheries by year and by fishery and year	29
15	Percent of permits, percent of total harvest, and average percent of bag limit filled by personal use salmon fishery and number of days fished, 2013–2015.	30

LIST OF APPENDICES

Appendix		Page
A1	Example of an Upper Cook Inlet personal use permit.	38
B1	Historical trends in UCIPU salmon harvest and participation and harvest per permit, 1996–2015.	40
C1	Sockeye salmon harvest by date during the Kasilof River set gillnet fishery, 2013–2015.	42
C2	Sockeye salmon harvest by date during the Kasilof River dip net fishery, 2013–2015.	43
C3	Sockeye salmon harvest by date during the Kenai River dip net fishery, 2013–2015.	44
C4	Sockeye salmon harvest by date during the Fish Creek dip net fishery, 2013–2015.	45
D1	Total household-days fished, household effort by days open, and household effort by permit during the Upper Cook Inlet personal use salmon fisheries, 1996–2015.	48
D2	Total sockeye salmon harvest, sockeye salmon harvest by days open, and sockeye salmon harvest by permit during the Upper Cook Inlet personal use salmon fisheries, 1996–2015.	49
D3	Total coho salmon harvest, coho salmon harvest by days open, and coho salmon harvest by permit during the Upper Cook Inlet personal use salmon fisheries, 1996–2015.	50
D4	Total Chinook salmon harvest, Chinook salmon harvest by days open, and Chinook salmon harvest by permit during the Upper Cook Inlet personal use salmon fisheries, 1996–2015.	51
D5	Total chum salmon harvest, chum salmon harvest by days open, and chum salmon harvest by permit during the Upper Cook Inlet personal use salmon fisheries, 1996–2015.	52
D6	Total pink salmon harvest, pink salmon harvest by days open, and pink salmon harvest by permit during the Upper Cook Inlet personal use salmon fisheries, 1996–2015.	53
E1	Trends in sockeye salmon harvests relative to total inriver sockeye salmon runs, Kenai River, 1996–2015.	56
F1	Historical residence areas for Upper Cook Inlet personal use salmon fishery participants.	58
F2	Historical salmon harvest by Region 2 residence area.	59

ABSTRACT

From 2013 to 2015, participants in the Upper Cook Inlet personal use salmon fisheries were required to record their harvest and effort on a free permit and return it to the Alaska Department of Fish and Game after the fisheries closed. Participation in these fisheries peaked in 2014 when 35,989 permits were issued. Permit response rate averaged 78% during this period. Returned permits were used to estimate total harvest and effort for the Kasilof River set gillnet, Kasilof River dip net, Kenai River dip net, and Fish Creek dip net fisheries. From 2013 through 2015, total salmon harvest averaged 21,744 fish for the Kasilof River set gillnet fishery, 92,130 fish for the Kasilof River dip net fishery, 382,149 fish for the Kenai River dip net fishery, and 12,170 for the Fish Creek dip net fishery. Most permits were issued to residents of Anchorage followed by residents of the Kenai Peninsula and the Matanuska–Susitna Valley. Most households did not fill their annual limit, and differences in their success varied with the number and types of fisheries they participated in and the amount of effort spent fishing.

Key words: Kenai River, Kasilof River, Fish Creek, personal use, dip net, set gillnet, subsistence, sockeye salmon, coho salmon, Chinook salmon, pink salmon, chum salmon, flounder, permit

INTRODUCTION

Subsistence and personal use fishing in Cook Inlet, Alaska, has undergone numerous regulatory changes over the past 2 decades, reflecting efforts by the state and federal governments and the court system to develop a legal definition of subsistence use (Brannian and Fox 1996). In 1996, most of Cook Inlet was closed to subsistence harvest of salmon. In lieu of subsistence fisheries, 4 personal use fisheries were opened to all Alaska residents: Fish Creek dip net, Kasilof River set gillnet, Kasilof River dip net, and Kenai River dip net. All of these fisheries target sockeye salmon (*Oncorhynchus nerka*), although Chinook salmon (*O. tshawytscha*), coho salmon (*O. kisutch*), pink salmon (*O. gorbuscha*), chum salmon (*O. keta*), and flounder (Pleuronectidae) are harvested incidentally.

All Upper Cook Inlet personal use (UCIPU) salmon fisheries are managed under the provisions of the *Upper Cook Inlet Personal Use Salmon Fishery Management Plan* (Alaska Administrative Code 5 AAC 77.540). Specific regulations for these fisheries are outlined in Alaska administrative codes 5 AAC 77.015, 5 AAC 77.525, and 5 AAC 77.540. The fisheries are open to Alaska residents only. The total annual limit for all UCIPU fisheries combined is 25 salmon for the head of the household and 10 salmon for each additional household member. Unless closed to harvest by EO, there is an annual limit of 1 Chinook salmon from the Kenai River dip net fishery. No Chinook salmon can be retained from the Kasilof River dip net fishery, but there is no annual limit for Chinook salmon caught in the Kasilof River set gillnet fishery. Fish Creek opens by EO and targets sockeye salmon.

All participants in UCIPU fisheries are required to get a free permit or be a member of a household with a permit. UCIPU permits are household permits that allow all members of the household to fish under the same permit in any of the 4 personal use fisheries. Permits, filled out in their entirety with participation dates, locations, and harvests, must be returned to the Alaska Department of Fish and Game (ADF&G) following each fishing season (Appendix A1). This report presents harvest, effort, and other summary information from UCIPU salmon permits issued during the 2013–2015 seasons for the Kasilof River dip net, Kasilof River set gillnet, Kenai River dip net, and Fish Creek dip net fisheries.

KASILOF RIVER

Two personal use fisheries occur in or near the mouth of the Kasilof River, which drains Tustumena Lake south of the Kenai River: a set gillnet fishery and a dip net fishery (Figure 1,

Panels A and B). ADF&G Division of Commercial Fisheries (CF) is responsible for inseason management of the set gillnet fishery and also operates a sonar site on the Kasilof River. From 1996 through 2001, the set gillnet fishery was opened and closed by emergency order (EO) based on a target harvest range. In 2002, the Alaska Board of Fisheries (BOF) changed the management plan so that the set gillnet fishery opens and closes by regulation, requiring inseason management only if the projected biological escapement goal (BEG) will not be met based on the inseason sonar count. Inseason management of the dip net fishery is the responsibility of the ADF&G Division of Sport Fish (SF). The dip net fishery also opens and closes by regulation, and inseason management is only required if the BEG will not be met based on the projected inseason sonar count.

Dipnetting is allowed in the area from regulatory markers located on the Cook Inlet beaches outside of the terminus of the river and within the first river mile from the terminus (Figure 1, Panel B). The dip net season is open 24 hours per day and begins on 25 June and ends on 7 August. A legal dip net for all UCIPU dip net fisheries is a bag-shaped net supported on all sides by a rigid frame. The net opening may not exceed 5 feet across, and the depth of the net must be at least one-half the net opening. The mesh used to construct the net may not exceed 4.5 inches stretched. Dip nets must be operated by hand.

The legal fishing area for the Kasilof River set gillnet fishery is from ADF&G regulatory markers located at the Kasilof River mouth to ADF&G commercial fishing regulatory markers located approximately 1 mile from the mouth in either direction (Figure 1, Panel A). Additionally, fishing is prohibited more than 1 mile from the mean high tide mark and within any flowing waters of the Kasilof River at any tide stage. Only 1 set gillnet can be operated per permit. The set gillnet must be attended by a person named on the permit at all times when the gillnet is being fished. No set gillnet can be operated within 100 feet of another set gillnet. The gillnet cannot exceed 10 fathoms in length, have larger than a 6-inch stretched mesh size, or be more than 45 meshes deep. By regulation, the fishery is open from 15 June through 24 June, between 0600 and 2300 hours.

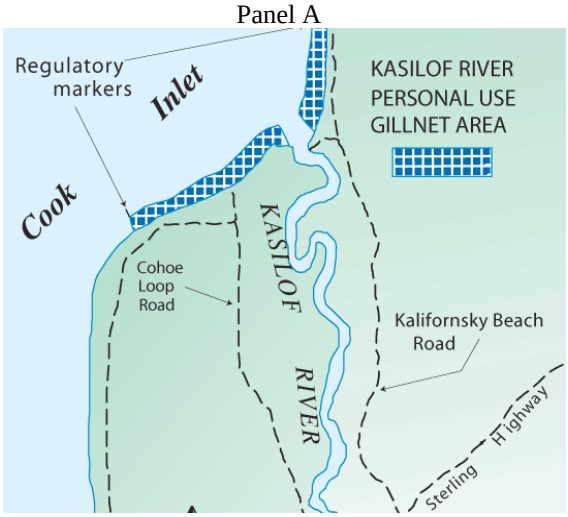
KENAI RIVER

The Kenai River drains Kenai Lake in the Kenai Mountains, through the Kenai National Wildlife Refuge and Skilak Lake, to its outlet into Cook Inlet. The river is 82 miles long, and the popular Kenai River dipnet fishery occurs near its mouth. Inseason management of the Kenai River dip net fishery is the responsibility of SF. The fishery opens and closes by regulation, and inseason management by SF is only required if the projected inriver escapement goal for sockeye salmon will not be met.

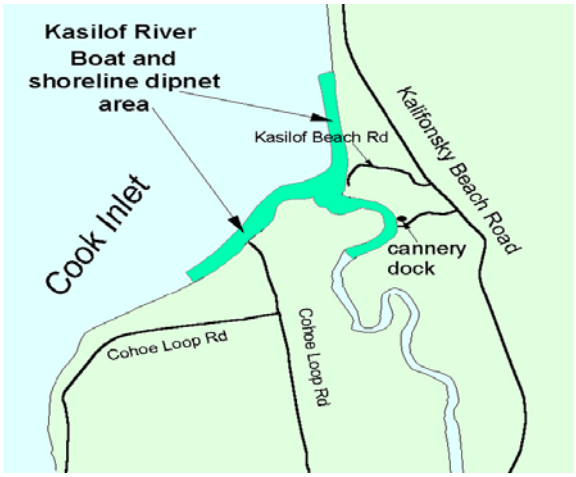
Dip nets can only be used from shore in the area from ADF&G regulatory markers located on the Cook Inlet beaches outside of the terminus of the Kenai River upstream to the Warren Ames Bridge (Figure 1, Panel C). The north shoreline is closed to dipnetting from shore between an ADF&G marker located on the river below Main Street in the city of Kenai upstream to ADF&G markers located near the Kenai City Dock. This regulation is implemented to minimize erosion of the bluffs below the city of Kenai.

Dipnetting from a boat is only allowed from ADF&G markers located near the Kenai City Dock upstream to the Warren Ames Bridge. Salmon may not be taken from a boat powered by a 2-stroke motor other than one that is manufactured as a direct fuel injection motor. The fishery is open from 10 July through 31 July between 0600 and 2300 hours.

Panel A



Panel B



Panel C

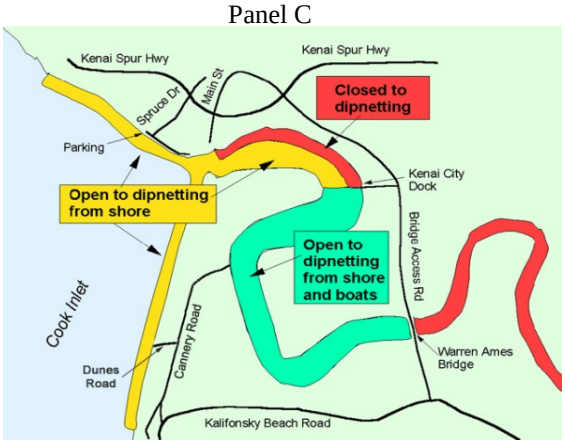


Figure 1.–Maps of Upper Cook Inlet personal use salmon fisheries: A) Kasilof River set gillnet fishery, B) Kasilof River dip net fishery, and C) Kenai River dip net fishery.

FISH CREEK

Fish Creek drains Big Lake, which is located approximately 60 highway miles north of Anchorage, and empties into Knik Arm. SF is responsible for inseason management of the Fish Creek dip net fishery as well as the operation of a weir in Fish Creek. Prior to 2002, the fishery opened and closed by regulation; however, frequent inseason management actions were required due to poor inriver runs. In 2002, BOF changed the management plan so that the fishery opened only by EO when ADF&G projected escapement of sockeye salmon into Fish Creek exceeding 70,000 fish.

Prior to 2002, dipnetting was allowed in the area from ADF&G regulatory markers located on both sides of the terminus of Fish Creek upstream to ADF&G regulatory markers located approximately one-quarter mile upstream of the Knik–Goose Bay Road. Regulations for the years 1996-2001 allowed personal use dipnetting from 10 July through 31 July, between 1100 and 2300 hours.

In 2002, regulations were modified so that the fishery opened only by EO, but the area and location of the fishery remained the same. In 2013, Fish Creek did not open. In 2014, Fish Creek was opened from 1100 to 2300 hours from 25 July to 31 July and in 2015, it was open the same hours from 24 July to 31 July.

OBJECTIVES

From 2013 through 2015, the objectives of the study were as follows:

1) Estimate participation (household days fished) in each of the 4 personal use fisheries. All estimates of participation will be within 5% of true value 95% of the time.
2) Estimate sockeye salmon harvest in each of the 4 personal use fisheries. Estimates of sockeye salmon harvest from the Kasilof dipnet, Kenai dipnet, and the Kasilof gillnet fisheries will be within 5% of true values 95% of the time. Estimates from the Fish Creek dipnet fishery will be within 20% of true values 95% of the time.
3) Estimate Chinook salmon harvest in the Kenai dipnet and the Kasilof gillnet fisheries. Estimates of Chinook salmon harvest will be within 10% of true values 95% of the time.
4) Estimate coho salmon harvest in the Kasilof and Kenai dipnet fisheries. Estimates of coho salmon harvest will be within 15% of true values 95% of the time.
5) Estimate pink salmon harvest in the Kasilof and Kenai dipnet fisheries. Estimates of pink salmon harvest will be within 15% of true values 95% of the time.

Additionally, demographic patterns in effort and harvest in the UCIPU fisheries were addressed posthoc throughout the report.

METHODS

STUDY DESIGN

All participants in the 2013–2015 UCIPU salmon fisheries were required to get a permit or be a member of a household with a permit. Permits were free to residents with a valid Alaska sport

fishing license and were issued by more than 60 vendors and ADF&G offices located in Anchorage, Fairbanks, the Kenai Peninsula, and the Matanuska–Susitna Valley.

Each permit was divided into numbered halves (Appendix A1). Permits were sequentially numbered, and vendors were given known sequences. The top half was a vendor copy, which was retained by the vendor and contained the permit holder's contact information, sport fishing license number, and their signature. Vendor copies were returned to the Anchorage ADF&G office periodically throughout the summer using courtesy reply envelopes provided by SF. Data from the returned vendor copies were entered into an electronic database periodically throughout the summer.

The bottom half of each permit was a harvest card that was given to the applicant. Participants were required to have this permit in their possession when personal use fishing. Immediately upon harvesting a fish, participants were required to record harvest information including fishery, dates fished, and number of salmon harvested by species. A check box was provided for households that did not fish. All permits, even those issued to households that did not fish, were required to be returned to ADF&G by 15 August of each year.

Households that did not return their permits received up to 2 reminder letters featuring a copy of the original permit with the original permit number. These letters stated that ADF&G had not received their completed permits and reminded participants to send their harvest information immediately. The second reminder letter was mailed after allowing an approximate 4-week response period from the previous mailing. Data from returned permits were entered into an electronic database as they were received. In some cases returned permits reported that the household had harvested in excess of their seasonal limit, fished out of season, were not Alaska residents, or had committed some other regulatory violation. This information was entered into the database as it was recorded on the permit.

All households that returned their permits before the second reminder letter were considered "compliant" households. Permits that were returned after the second reminder letter was mailed or were not returned at all were considered "noncompliant" households. Participation and harvest by all noncompliant households was estimated by calculating the mean participation (household-days fished) and harvest by species for noncompliant permits that were returned. These were then expanded to include nonrespondents. Total estimates of participation and harvest by species for each fishery were obtained by summing the estimates for the noncompliant households with the information obtained from compliant households.

Occasionally, vendors failed to return vendor copies from some of the permits they had issued. This resulted in some households returning permits that lacked a vendor copy. The total number of permits issued was estimated by assuming that the response rate (prior to mailing the first reminder letter) among known permits was the same as the response rate among permits lacking a vendor copy ("orphan permits"). This response rate was applied to the orphan permits to estimate the total number of permits issued without a vendor copy.

In 2015, SF began a pilot program to issue UCIPU permits online through ADF&G's online store (https://www.adfg.alaska.gov/Store/) and to allow participants to report their harvests electronically (https://www.adfg.alaska.gov/sf/PU/). The options to acquire permits and report online were advertised via media releases, Sportsman Show venues, license vendors, and discussions with staff. During this first pilot year, the overwhelming majority of permits issued and returned were physical permits so electronic permits were treated the same as physical

permits for all data analyses. In future years, as the transition to online permitting continues, questions of how estimates differ between physical and electronic permitting will be addressed.

DATA ANALYSIS

Because some vendors did not return all of their permits, the total number of permits issued was estimated as follows:

$$\hat{N} = \left(o\ \hat{p}^{-1}\right) + M\ , \tag{1}$$

where

$\hat{N}$ = the estimated total number of permits issued,

M = the total number of permits with vendor cards,

o = the number of permits issued and returned by permit holders before the first reminder letter, but with no vendor card ("orphan permits"),

$\hat{P}$ = the response rate, before the first reminder letter, among permits with vendor cards,

where

$$\hat{p} = \frac{m}{M}, \tag{2}$$

and where

m = the number of permits with vendor cards returned before the first reminder letter was mailed.

Variance of $\hat{N}$ was calculated as follows:

$$\mathrm{var}\left(\hat{N}\right) = \left[\frac{o^2 \mathrm{var}(\hat{p})}{\hat{p}^4}\right], \tag{3}$$

where

$$\mathrm{var}(\hat{p}) = \left[\frac{\hat{p}(1-\hat{p})}{M-1}\right]. \tag{4}$$

The estimated number of issued permits ($\hat{N}$) was divided in 4 groups:

$$\hat{N} = N_{cf} + N_{cz} + \hat{N}_{df} + \hat{N}_{dz}\ , \tag{5}$$

where

N_{cf} = the number of compliant permits that reported fishing,

N_{cz} = the number of compliant permits that reported no fishing,

$\hat{N}_{df}$ = the estimated number of noncompliant permits that fished, and

$\hat{N}_{dz}$ = the estimated number of noncompliant permits that did not fish,

where

$$\hat{N}_{df} = \left[\hat{N} - \left(N_{cf} + N_{cz}\right)\right]\hat{w} \tag{6}$$

where

$$\hat{w} = \frac{n_{df}}{n_d}, \tag{7}$$

and where

n_{df} = the number of noncompliant households responding to the second reminder that reported fishing,

n_d = the number of noncompliant households responding to the second reminder.

and finally, where

$$\hat{N}_{dz} = \hat{N} - \left(N_{cf} + N_{cz} + \hat{N}_{df}\right). \tag{8}$$

Harvest for each species or participation for each fishery was estimated by the following procedure (with subscripts denoting parameter of estimation deleted for simplicity):

$$\hat{H} = H_{cf} + \hat{H}_{df} \tag{9}$$

where

$\hat{H}$ = estimated total harvest or participation,

H_{cf} = harvest or participation reported by compliant permits, and

$\hat{H}_{df}$ = estimated harvest by noncompliant households,

where

$$\hat{H}_{df} = \hat{N}_{df}\overline{h}_{df} \tag{10}$$

and where

$\overline{h}_{df}$ = the mean harvest or participation per household for noncompliant households that reported fishing,

or

$$\overline{h}_{df} = \frac{\left(\sum_{j=1}^{n_{df}} h_{dfj}\right)}{n_{df}}, \tag{11}$$

where

h_{dfj} = reported harvest by responding noncompliant household *j*, and

n_{df} = the number of noncompliant households responding to the second reminder.

Variance of $\hat{H}$ was calculated as follows (Goodman 1960):

$$\text{var}\left(\hat{H}\right) = \text{Var}\left(H_{cf}\right) + \text{var}\left(\hat{H}_{df}\right) = 0 + \text{var}\left(\hat{H}_{df}\right) \tag{12}$$

therefore

$$\text{var}\left(\hat{H}\right) = \text{var}\left(\hat{H}_{df}\right) \tag{13}$$

and from Equation 10

$$\text{var}(\widehat{H}_{df}) = \text{var}(\widehat{N}_{df}\bar{h}_{df}) = \widehat{N}_{df}^2\text{var}(\bar{h}_{df}) + \bar{h}_{df}^2\text{var}(\widehat{N}_{df}) - \text{var}(\bar{h}_{df})\text{var}(\widehat{N}_{df}), \quad (14)$$

where from Equation 6

$$\text{var}(\widehat{N}_{df}) = \text{var}(\widehat{N}\widehat{w}) = \widehat{N}^2\text{var}(\widehat{w}) + \widehat{w}^2\text{var}(\widehat{N}) - \text{var}(\widehat{w})\text{var}(\widehat{N}), \quad (15)$$

and from Equation 7

$$\text{var}(\widehat{w}) = \left[\frac{\widehat{w}(1-\widehat{w})}{n_d - 1}\right], \quad (16)$$

and from Equation 11

$$\text{var}(\bar{h}_{df}) = \left(1 - \frac{n_{df}}{\widehat{N}_{df}}\right)\frac{s_{df}^2}{n_{df}}, \quad (17)$$

for which s_{df}^2 is the sample variance for the mean reported harvest by responding noncompliant households:

$$s_{df}^2 = \frac{\sum_{j=1}^{n_{df}} \left(h_{dfj} - \bar{h}_{df}\right)^2}{n_{df} - 1}. \quad (18)$$

Standard errors were calculated from the square root of the variance estimates. Households that failed to indicate which fishery they participated in were estimated as "unknown fishery" by the procedure outlined above.

RESULTS

PERMITS ISSUED AND RETURNED

The numbers of permits issued for UCIPU fisheries between 2013 and 2015 were the highest since the fisheries began (Appendix B1). The peak was in 2014 with an estimated 35,989 (SE 2) issued permits (Table 1). However, in 2015, the number of issued permits decreased to 34,920 (SE 1), which was the lowest number issued during this reporting period. The return rates for permits during this time averaged 78%. On average, 58% of households returned their permits voluntarily, 13% were returned after the first reminder letter, and 7% were returned after the second reminder. On average, 22% of households that were issued UCIPU permits during this study period did not fish (Table 2), which is an increase over the last reporting period (2010–2012) when on average only 13% of households with permits did not participate in the fisheries (Dunker 2013).

Table 1.–Number of Upper Cook Inlet personal use salmon fishery permits issued by year, and number of permits returned by mailing and year, 2013–2015.

			Permits returned [b]									
	Permits issued [a]		Voluntary [c]		Mailing 1		Mailing 2		Total		Permits not returned	
Year	Number	SE	Number	%	Number	%	Number	%	Number	%	Number	%
2013	35,211	2	17,865	51%	5,840	17%	3,050	9%	27,180	77%	8,031	23%
2014	35,989	2	21,574	61%	3,777	11%	2,518	7%	27,866	79%	7,627	21%
2015	34,920	1	21,158	61%	4,149	12%	1,811	5%	27,118	78%	7,802	22%
Average	35,373		20,199	58%	4,589	13%	2,460	7%	27,388	78%	7,820	22%

[a] "Permits issued" is an estimate that accounts for "orphan permits."

[b] "Permits returned" and "Permits not returned" are based on permits actually received and are not estimates.

[c] "Voluntary" households are those that voluntarily returned their completed permits without being mailed a reminder letter.

Table 2.–Estimated number of Upper Cook Inlet personal use salmon fishery permits that reported not fishing by year for 2013–2015.

	Permits issued		Did not fish		Did fish	
Year	Number	SE	Number	%	Number	%
2013	35,211	2	7,905	23%	27,306	78%
2014	35,989	2	7,394	21%	28,595	80%
2015	34,920	1	7,871	23%	27,049	78%
Average	35,373		7,723	22%	27,650	78%

ESTIMATED HARVEST AND EFFORT

From an estimated 141,214 angler-days fished (Table 3), there were an estimated 1,551,057 salmon and 17,070 flounder harvested in UCIPU fisheries between 2013 and 2015 (Tables 4 and 5). All 5 species of salmon were harvested but sockeye salmon composed the major portion (Figure 2). Over 2013–2015, effort for all fisheries averaged 47,071 household-days and ranged from an average of 1,403 days fished for the Kasilof River gillnet fishery to an average of 33,687 days fished for the Kenai River dip net fishery (Table 3). Overall fishing effort was greatest in 2014 (50,819 household-days fished, SE 94), and lowest in 2013 (43,698 household-days fished, SE 73) (Table 3). The Kenai River dip net fishery was the most popular UCIPU fishery, and most of the salmon harvest and effort occurred there (Tables 3 and 4). Since 2005, it has been legal to harvest flounder in UCIPU fisheries with the exception of Fish Creek. The greatest harvest of flounder occurred in the Kenai River dip net fishery (Table 5).

Kasilof River Set Gillnet Fishery

Participation in the Kasilof River set gillnet fishery for the years 2013–2015 averaged 1,403 household-days per year and ranged from 1,082 (SE 13) household-days in 2013, when the fishery was only open 5 days from 15 to 19 June, to 1,741 (SE 22) household-days in 2015, when the fishery was open for the entire 10 days (Table 3). Annual sockeye salmon harvest in the Kasilof set gillnet fishery averaged 21,524 fish and ranged from 14,439 (SE 197) fish in 2013 to 27,567 (SE 339) fish in 2015 (Table 4). For Chinook salmon, annual harvest averaged 52 fish but ranged from 46 (SE 2) fish in 2013 to 61 (SE 3) fish in 2015 (Table 4). Excluding Fish Creek EO dipnetting, the Kasilof River set gillnet fishery has the shortest UCIPU fishing season, and for each year of this study period, over 50% of the sockeye salmon harvest from this fishery was taken by 19 June (Figure 3 and Appendix C1).

Kasilof River Dip Net Fishery

Between 2013 and 2015, participation in the Kasilof River dip net fishery averaged 9,713 household-days per year and followed a similar annual trend in effort to the Kasilof River set gillnet fishery with greatest number of household-days in 2015 (10,346 [SE 52]) and least number in 2013 (8,556 [SE 36]) (Table 3). Annual sockeye salmon harvest averaged 87,680 fish with the greatest harvest occurring in 2015 (89,000 sockeye salmon, SE 556) (Table 4). As with the set gillnet fishery, the lowest sockeye salmon harvest in the Kasilof River dip net fishery occurred in 2013, when 85,528 (SE 473) fish were harvested. Harvests of other salmon species totaled 4,024 fish.

The harvest timing of the Kasilof River dip net fishery was similar between years. Over half of the sockeye salmon harvest was taken by 16 July during all 3 years of this study period (Figure 4 and Appendix C2). The percent of the overall sockeye salmon harvest for both Kasilof River personal use fisheries (set gillnet and dip net combined) averaged 16% of the total (sport, commercial, educational, subsistence, and personal use) Kasilof River harvest (Table 6), which was down from an average of 22% during the previous reporting period (2010–2012) (Dunker 2013).

Table 3.–Effort (household-days) in the Upper Cook Inlet personal use (UCIPU) salmon fisheries, 2013–2015.

			Days fished		
Fishery	Year	Days open	Estimate	SE	RP [a]
Kasilof River gillnet					
	2013	5	1,082	13	2%
	2014	10	1,386	17	2%
	2015	10	1,741	22	2%
	Mean		1,403		
Kasilof River dip net					
	2013 [b]	44	8,556	36	1%
	2014 [c]	44	10,236	51	1%
	2015 [d]	44	10,346	52	1%
	Mean		9,713		
Kenai River dip net					
	2013 [e]	22	33,193	63	0%
	2014	22	36,380	81	0%
	2015 [f]	22	31,487	75	0%
	Mean		33,687		
Fish Creek dip net					
	2013	0	-	-	-
	2014 [g]	7	1,792	22	2%
	2015 [h]	8	2,303	22	2%
	Mean		1,792		
Unknown fishery					
	2013		867	15	3%
	2014		1,022	14	3%
	2015		820	14	3%
	Mean		903		
UCIPU total					
	2013		43,698	73	0%
	2014		50,819	94	0%
	2015		46,697	91	0%
	Mean		47,071		

[a] Relative precision (RP) = ((SE×1.96)/estimate).

[b] EO 2-RS-1-38-13 extended the fishing area for the Kasilof River dipnet fishery from July 13 to August 7, 2013.

[c] EO 2-RS-1-36-14 extended the fishing area for the Kasilof River dipnet fishery from July 4 to August 7, 2014.

[d] EO 2-RS-1-40-15 extended the fishing area for the Kasilof River dipnet fishery from July 1 to August 7, 2015.

[e] EO 2-RS-1-42-13 increased the hours of the Kenai River dipnet fishery to 24 hours from July 22 to July 31, 2013.

[f] EO 2-RS-1-51-15 increased the hours of the Kenai River dipnet fishery to 24 hours from July 28 to July 31, 2015.

[g] EO 2-RS-2-41-14 opened the Fish Creek dipnet fishery from 6:00 am July 25 to 11:00 pm July 31, 2014.

[h] EO 2-RS-2-45-15 opened the Fish Creek dipnet fishery from 6:00 am July 24 to 11:00 pm July 31, 2015.

Table 4.–Harvest of salmon in the Upper Cook Inlet personal use (UCIPU) fisheries, 2013–2015.

		Sockeye			Chinook			Coho			Pink			Chum			Total		
Fishery	Year	Est.	SE	RP	Est.	SE	RP	Est.	SE	RP	Est.	SE	RP	Est.	SE	RP	Est.	SE	RP
Kasilof River gillnet																			
	2013	14,439	187	3%	46	2	9%	129	32	49%	3	0	0%	5	1	39%	14,621	187	3%
	2014	22,567	302	3%	50	2	8%	30	10	65%	105	44	82%	18	0	0%	22,770	306	3%
	2015	27,567	339	2%	61	3	10%	191	41	42%	20	5	49%	2	1	98%	27,841	341	2%
	Mean	21,524			52			117			43			8			21,744		
Kasilof River dip net																			
	2013	85,528	473	1%	18	1	1%	1,666	84	10%	683	19	5%	339	15	9%	88,233	481	1%
	2014	88,513	547	1%	0	0	0%	2,606	106	8%	2,769	66	5%	342	15	9%	94,230	561	1%
	2015	89,000	566	1%	0	0	0%	2,723	95	7%	1,607	74	9%	597	31	10%	93,927	579	1%
	Mean	87,680			6			2,332			1,686			426			92,130		
Kenai River dip net																			
	2013 [a]	347,222	822	0%	11	1	18%	3,169	74	5%	3,625	49	3%	701	29	8%	354,727	827	0%
	2014 [b]	379,823	1,023	1%	0	0	0%	4,710	157	7%	19,140	184	2%	1,194	51	8%	404,866	1,053	1%
	2015 [c, d]	377,532	1,088	1%	66	2	0%	4,150	130	6%	4,147	99	5%	957	45	9%	386,853	1,101	1%
	Mean	368,192			26			4,010			8,971			951			382,149		
Fish Creek dip net																			
	2013	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
	2014	5,829	113	4%	0	0	0%	1,895	48	5%	4,218	74	3%	227	8	7%	12,170	144	2%
	2015	19,260	280	3%	0	0	0%	3,321	87	5%	1,329	48	7%	329	27	16%	24,239	298	2%
	Mean	5,829			0			1,895			4,218			227			12,170		
Unknown fishery																			
	2013	7,126	154	4%	9	2	44%	155	17	21%	113	8	14%	8	2	49%	7,411	154	4%
	2014	9,315	131	3%	0	0	0%	129	18	27%	563	22	8%	78	15	38%	10,085	135	3%
	2015	8,626	183	4%	0	0	0%	263	19	14%	153	12	15%	41	3	14%	9,084	184	4%
	Mean	8,356			3			182			276			42			8,860		
UCIPU total																			
	2013	454,314	958	0%	83	3	7%	5,119	122	5%	4,423	53	2%	1,052	35	7%	464,993	968	0%
	2014	506,047	1,164	0%	50	2	8%	9,370	199	4%	26,795	217	2%	1,859	56	6%	544,121	1,202	0%
	2015	521,985	1,256	0%	127	4	6%	10,648	191	4%	7,257	137	4%	1,927	62	6%	541,943	1,279	0%
	Mean	494,115			87			8,379			12,825			1,613			517,019		

Note: Relative precision (RP) = ((SE×1.96)/estimate).

[a] EO 2-KS-1-34-13 prohibited the retention of Chinook salmon in the Kenai River dipnet fishery from July 10 to July 31, 2013.

[b] EO 2-KS-1-27-14 prohibited the retention of Chinook salmon in the Kenai River dipnet fishery from July 10 to July 31, 2014.

[c] EO 2-KS-1-36-15 prohibited the retention of Chinook salmon in the Kenai River dipnet fishery from July 10 to July 31, 2015.

[d] EO 2-KS-1-47-15 restored the retention of Chinook salmon in the Kenai River dipnet fishery from July 25 to July 31, 2015.

Table 5.–Effort (household-days) and flounder harvests, standard errors, and relative precision in Upper Cook Inlet personal use (UCIPU) fisheries, 2013–2015.

Fishery	Year	Days open	Days fished			Flounder		
			Est.	SE	RP [a]	Est.	SE	RP [a]
Kasilof gillnet								
	2013	5	1,082	13	2%	44	3	13%
	2014	10	1,386	17	2%	65	4	12%
	2015	10	1,741	22	2%	79	6	15%
Kasilof dip net								
	2013 [b]	44	8,556	36	1%	865	14	3%
	2014 [c]	44	10,236	51	1%	959	18	4%
	2015 [d]	44	10,346	52	1%	941	20	4%
Kenai River dip net								
	2013 [e]	22	33,193	63	0%	4,802	52	2%
	2014	22	36,380	81	0%	4,580	54	2%
	2015 [f]	22	31,487	75	0%	4,380	53	2%
Fish Creek Dip Net								
	2013	0	–	–	–	–	–	–
	2014 [g]	7	1,792	22	2%	30	12	78%
	2015 [h]	8	2,303	22	2%	0	0	0%
Unknown Fishery								
	2013		867	15	3%	87	2	5%
	2014		1,022	14	3%	146	10	13%
	2015		820	14	3%	88	1	2%
UCIPU total								
	2013		43,698	73	0%	5,801	54	2%
	2014		50,819	94	0%	5,781	60	2%
	2015		46,697	91	0%	5,488	58	2%

[a] Relative precision (RP) = ((SE×1.96)/estimate).

[b] EO 2-RS-1-38-13 extended the fishing area for the Kasilof River dipnet fishery from July 13 to August 7, 2013.

[c] EO 2-RS-1-36-14 extended the fishing area for the Kasilof River dipnet fishery from July 4 to August 7, 2014.

[d] EO 2-RS-1-40-15 extended the fishing area for the Kasilof River dipnet fishery from July 1 to August 7, 2015.

[e] EO 2-RS-1-42-13 increased the hours of the Kenai River dipnet fishery to 24 hours from July 22 to July 31, 2013.

[f] EO 2-RS-1-51-15 increased the hours of the Kenai River dipnet fishery to 24 hours from July 28 to July 31, 2015.

[g] EO 2-RS-2-41-14 opened the Fish Creek dipnet fishery from 6:00 am July 25 to 11:00 pm July 31, 2014.

[h] EO 2-RS-2-45-15 opened the Fish Creek dipnet fishery from 6:00 am July 24 to 11:00 pm July 31, 2015.

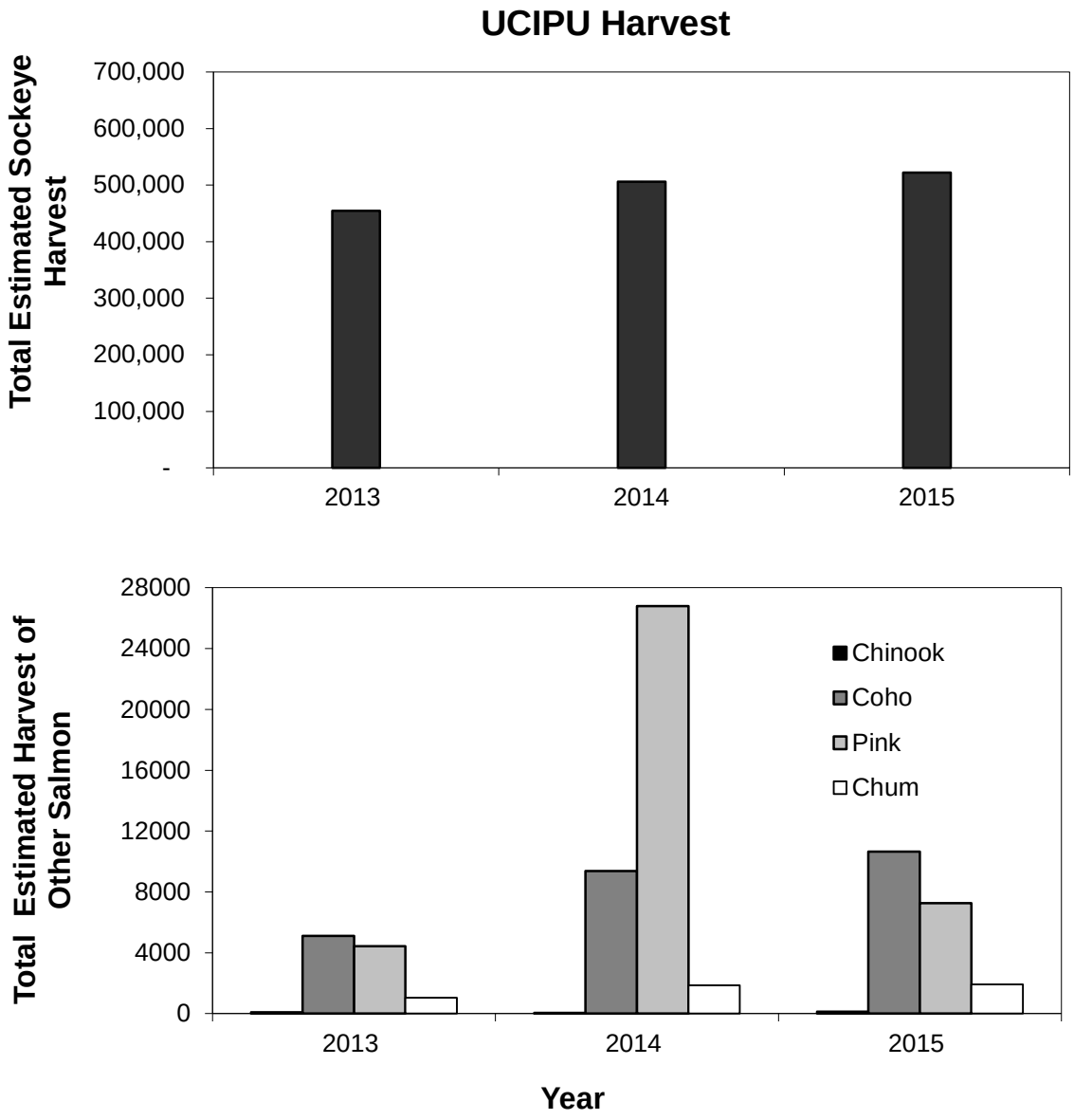


Figure 2.–Total estimated salmon harvest for all Upper Cook Inlet personal use fisheries combined. Top figure shows harvest of sockeye salmon, and the bottom figure shows harvest for all other salmon species.

Note: Y-axes scales differ between graphs. For top graph, all standard errors are less than ±1,300; for bottom graph, all standard errors are less than ±220.

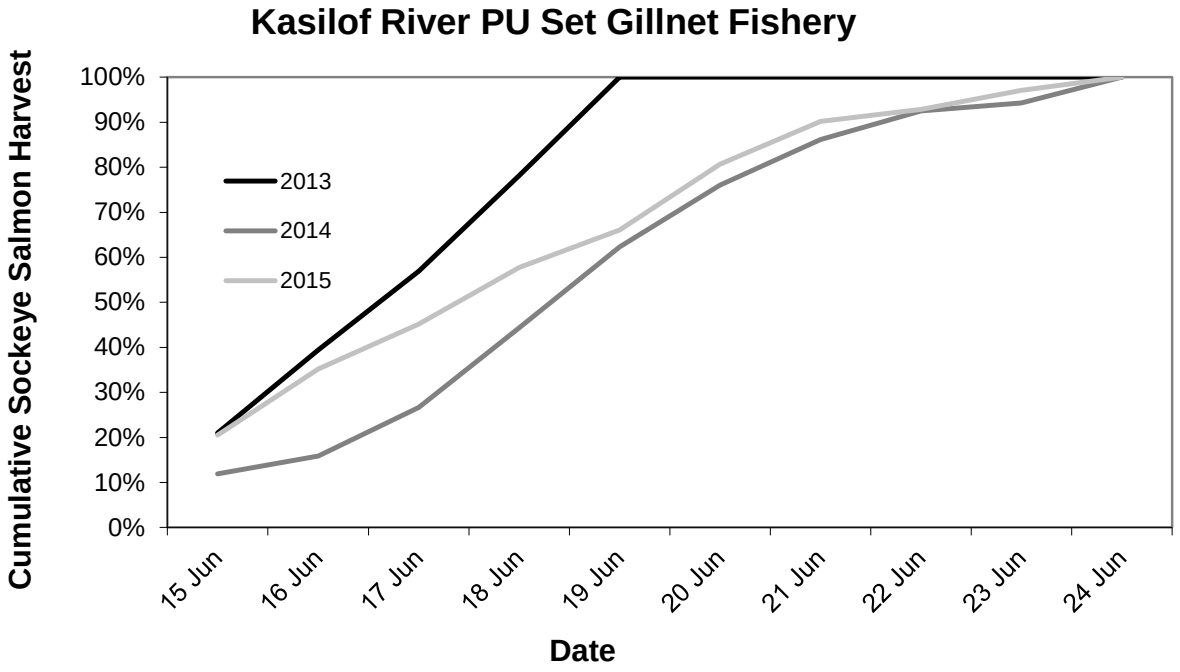


Figure 3.–Cumulative harvest timing for sockeye salmon during the Kasilof River personal use set gillnet fishery, 2013–2015.

Note: Total harvest by day of sockeye salmon is listed in Appendix C1. Data are presented for "known" permits during legal harvest dates only.

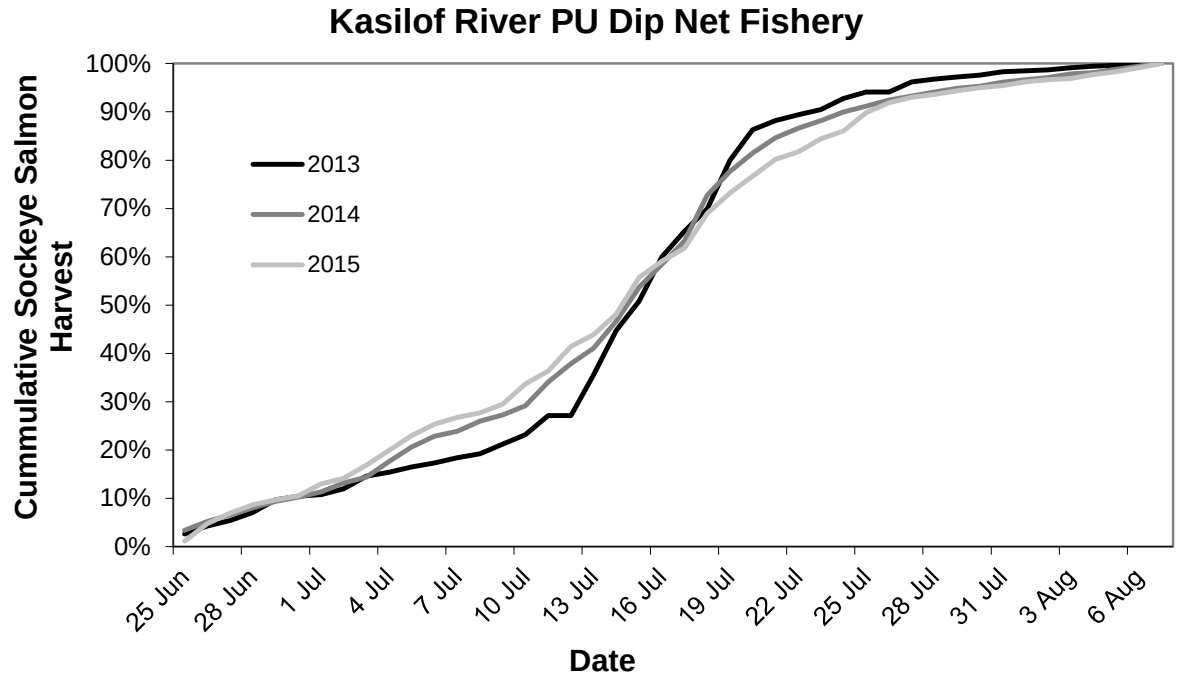


Figure 4.–Cumulative harvest timing for sockeye salmon during the Kasilof River personal use dip net fishery, 2013–2015.

Note: Total harvest by day of sockeye salmon is listed in Appendix C2. Data are presented for "known" permits during legal harvest dates only.

Table 6.–Percent of the total sockeye salmon harvest by Upper Cook Inlet personal use fisheries, 2013–2015.

Fishery	Year	Total run [a]	Total harvest	Personal use harvest	%	Commercial harvest [a]	%	Sport harvest [b,c]	%	Educational harvest [b,c]	%	Federal subsistence harvest [b,c]	%
Kasilof River													
	2013	1,111,179	628,402	99,967	16%	515,878	82%	12,257	2.0%	300	0.048%	0	0.00%
	2014	1,104,536	697,788	111,080	16%	566,871	81%	19,819	2.8%	18	0.003%	0	0.00%
	2015	1,145,826	679,886	116,567	17%	547,511	81%	15,553	2.3%	32	0.005%	223	0.03%
	Mean	1,120,514	668,692	109,205	16%	543,420	81%	15,876	2.4%	117	0.017%	74	0.01%
Kenai River													
	2013	3,463,880	2,504,149	347,222	14%	1,716,292	69%	436,988	17.5%	3,080	0.123%	567	0.02%
	2014	3,278,731	2,139,057	379,823	18%	1,393,588	65%	360,831	16.9%	4,195	0.196%	620	0.03%
	2015	3,887,601	2,458,419	377,532	15%	1,697,123	69%	376,422	15.3%	6,563	0.267%	779	0.03%
	Mean	3,543,404	2,367,208	368,192	16%	1,602,334	68%	391,414	16.5%	4,613	0.195%	655	0.03%
Fish Creek													
	2013	31,663	9,760	0	0%	7,011	72%	2,749	28.2%				
	2014	64,729	23,142	5,829	25%	15,061	65%	2,252	9.7%				
	2015	141,871	41,322	19,260	47%	19,879	48%	2,183	5.3%				
	Mean	79,421	24,741	8,363	36%	13,984	62%	2,395	14.4%				

Note: "Total run" includes total harvest and escapement. "Total harvest" is the sum of the sport, commercial, educational, Federal subsistence, and personal use harvests presented in this table. "%" refers to the percent of the total harvest.

[a] Pat Shields, Fish and Game Coordinator, and Mark Willette, Fishery Biologist, Soldotna, AK, personal communication.

[b] Begich et al. 2017.

[c] Sandee Simons, Fish and Wildlife Technician, and Jason Pawluk, Fishery Biologist, Soldotna, AK, personal communication.

Kenai River Dip Net Fishery

Participation in the Kenai River dip net fishery averaged 33,687 household-days per year and ranged from 31,487 (SE 75) days in 2015 to 36,380 (SE 81) days in 2014 (Table 3). Annual sockeye salmon harvest averaged 368,192 fish with a range of 347,222 (SE 822) fish in 2013 to 377,532 (SE 1,088) fish in 2015 (Table 4). These harvests were substantially lower than during the previous reporting period (2010–2012) despite greater participation and effort during 2013–2015 (Dunker 2013). Harvests of other species were comparatively small. For example, pink salmon had the second highest harvest, with an average of 8,971 fish.

The harvest timing of the Kenai River dip net fishery was relatively consistent between 2013 and 2015 (Figure 5 and Appendix C3). In all years, 50% of the harvest was achieved on or before 21 July, which is just past the median date of this fishery. In 2013 and 2014, over half of all sockeye salmon were harvested by 18 July and 19 July, respectively. In 2015, 50% of the harvest level was achieved on 21 July. The percent of the total Kenai River sockeye salmon harvest taken by the dip net fishery averaged 16% and ranged from 14% (2013) to 18% (2014) (Table 6), which are slight increases from the previous reporting period (2010–2012) (Dunker 2013). The commercial sockeye salmon fishery composed the largest portion of the overall sockeye salmon harvest in the Kenai River and averaged 68% during the years 2013–2015.

Fish Creek Dip Net Fishery

The Fish Creek dip net fishery was not opened in 2013. There were 1,792 (SE 22) household-days of effort in the Fish Creek dip net fishery in 2014 and 2,303 (SE 22) days in 2015, although the fishery was only open 1 day longer in 2015 (Table 3). There were an estimated 5,829 (SE 113) sockeye salmon harvested in 2014, but in 2015, the sockeye salmon harvest rose to 19,260 (SE 280) fish (Table 4), with over 50% taken by 28 July in 2014 and by 29 July in 2015 (Figure 6 and Appendix C4). Harvests of other salmon species were smaller with the exception of pink salmon, which had a mean harvest of 4,218 for the 2 years this fishery was open (Table 4). During these years, the Fish Creek dip net fishery composed an average of 36% of the overall sockeye salmon harvest for Fish Creek (Table 6), a notable increase over the previous reporting period when it only composed an average of 13% (2010–2012) (Dunker 2013).

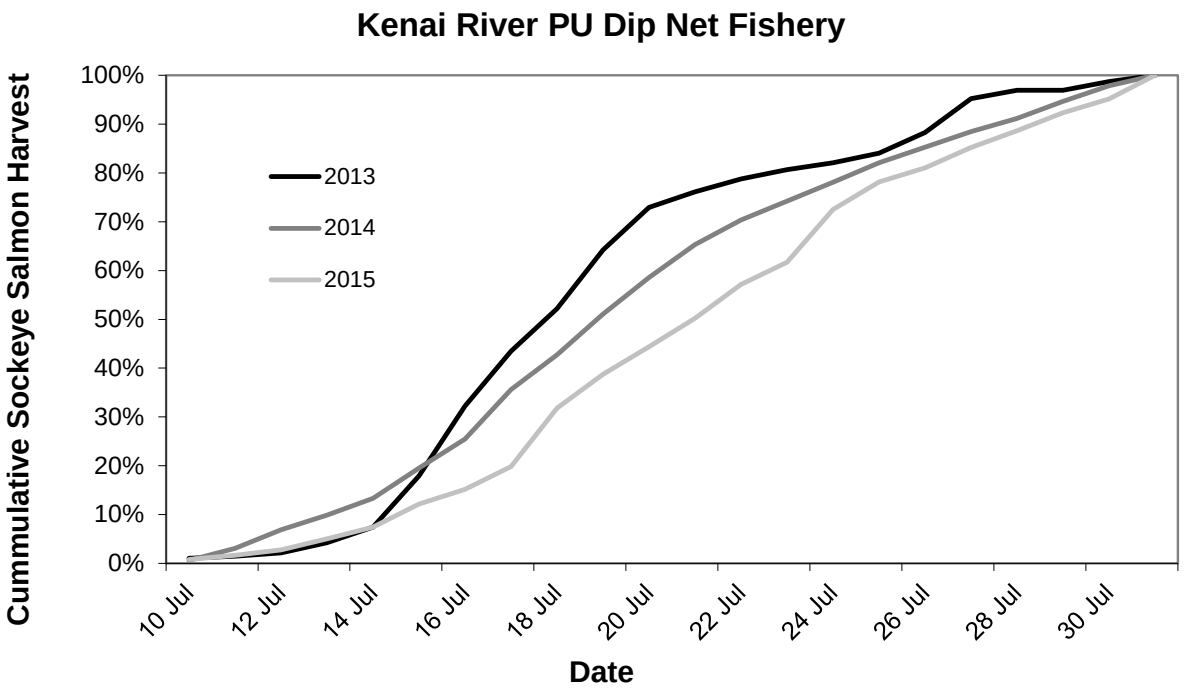


Figure 5.–Cumulative harvest timing for sockeye salmon during the Kenai River personal use dip net fishery, 2013–2015.

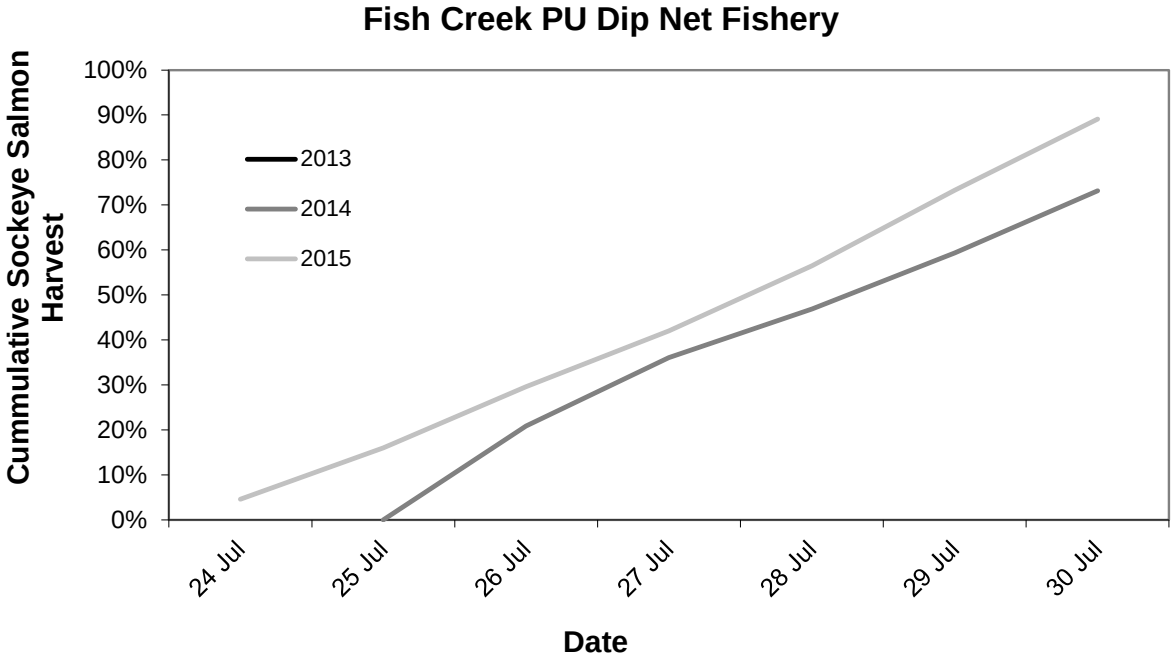


Figure 6.–Cumulative harvest timing for sockeye salmon during the Fish Creek personal use dip net fishery, 2013–2015.

CHARACTERISTICS OF PERMIT HOLDERS

Residency of Permit Holders

Over 95% of all UCIPU participants resided in Southcentral Alaska (Region 2) during each year of the study (Table 7). Less than 4% lived in Interior Alaska (Region 3) and less than 0.3% resided in Southeast Alaska (Region 1). Of the participants from Southcentral Alaska, most were from Anchorage (at least 59%), followed by the Kenai Peninsula (at least 20%), and the Matanuska–Susitna (Mat-Su) Valley (at least 18%). The percentage of households from Anchorage decreased by about 2% from 2013 to 2015, a similar trend to the previous reporting period (2010–2012) (Dunker 2013).

Anchorage residents composed the majority of the Kenai River and Kasilof River personal use dip net fishery participants (Table 8 and Figure 7) and also composed the majority of permit-holding households that did not participate in any UCIPU fisheries. Among participating Anchorage households, the average harvest was 19.0 (SE 0.08) salmon (Figure 8). Residents of the Kenai Peninsula harvested a greater proportion of salmon in the Kasilof River personal use set gillnet fishery each year with the exception of 2015 when Anchorage residents harvested a slightly larger percentage (Figure 7). Kenai Peninsula residents participating in UCIPU fisheries harvested an average of 19.5 (SE 0.13) salmon per household (Figure 8). Mat-Su residents had the highest average harvest overall of 20.6 (SE 0.16) salmon per household (Figure 8). Residents from the Mat-Su harvested the greatest portion of salmon in the Fish Creek dip net fishery (Figure 7). Conversely, less than 1% of Kenai Peninsula residents participated in the Fish Creek dip net fishery during the years it was open. The mean harvest decreases for all residency areas when permit holders that did not fish are included. In these cases, mean harvest was 15.7 (SE 0.08) salmon per household for Anchorage, 15.4 (SE 0.12) for Kenai Peninsula, and 16.7 (SE 0.15) for Mat-Su residents. In general, patterns in the residency of participants in UCIPU fisheries were relatively consistent throughout this study and did not differ much from patterns observed during previous years (Dunker and Lafferty 2007; Dunker 2010; Dunker 2013).

Table 7.–Residence areas for Upper Cook Inlet personal use salmon fishery permit holders by year, 2013–2015.

			Year		
Breakdown	Area of residence	SWHS area [a]	2013	2104	2015
By region [b]					
	Region 1	A–H	0.2%	0.2%	0.2%
	Region 2	J–N,P–T	95.4%	95.2%	95.7%
	Region 3	I, U–Z	3.6%	3.5%	3.5%
	Out of state or unknown residence		0.7%	1.0%	0.6%
	Total		100%	100%	100%
Region 2					
	Anchorage area	L	61.0%	59.7%	59.2%
	Kenai Peninsula area	P	20.5%	20.8%	21.1%
	Matanuska-Susitna Valley area	K	18.3%	19.2%	19.5%
	Other	J,M,N,Q–T	0.3%	0.2%	0.2%
	Total		100%	100%	100%

Note: Data exclude permits lacking a vendor copy ("orphan permits").

[a] Statistical areas are those used in the Statewide Harvest Survey (SWHS) (Jennings et al. 2011).

[b] Region 1 is Southeastern Alaska, Region 2 is Southcentral Alaska, and Region 3 is Interior Alaska.

Table 8.–Effort and harvest by residence of participants in the Upper Cook Inlet personal use fisheries, 2013–2015.

			2013		2014		2015	
Breakdown	Area of residence	Fishery	Days fished	Total salmon	Days fished	Total salmon	Days fished	Total salmon
By region								
	Region 1	Kenai dip net	59	616	82	901	57	715
		Kasilof dip net	16	150	9	62	16	188
		Kasilof gillnet	3	39	3	45	6	45
		Fish Creek	0	0	0	0	1	4
		Unknown fishery	0	0	1	16	1	0
	Region 2	Kenai dip net	25,100	273,355	28,537	319,248	24,775	305,249
		Kasilof dip net	6,429	66,534	7,991	73,781	7,868	72,017
		Kasilof gillnet	869	11,757	1,139	9,718	1,386	22,517
		Fish Creek	0	0	1,401	9,718	1,675	17,733
		Unknown fishery	619	5,526	794	8,309	628	7,066
	Region 3	Kenai dip net	1,030	12,519	1,154	13,545	1,019	13,479
		Kasilof dip net	258	2,843	271	2,316	304	2,678
		Kasilof gillnet	30	353	40	547	41	716
		Fish Creek	0	0	6	30	13	145
		Unknown fishery	21	165	36	368	19	231
	Unknown	Kenai dip net	191	1,879	330	3,391	157	1,940
		Kasilof dip net	44	509	76	670	60	441
		Kasilof gillnet	5	37	4	62	4	35
		Fish Creek	0	0	38	215	9	65
		Unknown fishery	6	59	10	75	3	14
Region 2								
	Anchorage	Kenai dip net	15,434	163,917	17,252	192,685	14,740	183,966
		Kasilof dip net	3,850	40,014	4,825	44,432	4,988	46,185
		Kasilof gillnet	320	4,361	425	6,965	559	9,577
		Fish Creek	0	0	369	2,206	457	4,244
		Unknown fishery	394	3,285	495	4,690	371	4,172
	Kenai Pen.	Kenai dip net	5,342	57,136	6,673	70,463	6,096	67,917
		Kasilof dip net	1,153	9,932	1,388	10,693	1,331	10,575
		Kasilof gillnet	390	5,105	523	8,054	578	8,711
		Fish Creek	0	0	5	14	3	22
		Unknown fishery	111	1,053	172	2,134	141	1,597
	Mat-Su Valley	Kenai dip net	4,264	51,468	4,569	55,482	3,912	52,965
		Kasilof dip net	1,400	16,419	1,767	18,574	1,540	15,126
		Kasilof gillnet	158	2,256	191	3,652	249	4,229
		Fish Creek	0	0	1,026	7,496	1,213	13,450
		Unknown fishery	111	1,181	126	1,485	115	1,295
	Other	Kenai dip net	60	834	43	618	27	401
		Kasilof dip net	26	169	11	82	9	131
		Kasilof gillnet	1	35	0	0	0	0
		Fish Creek	0	0	1	2	2	17
		Unknown fishery	1	9	1	0	1	2

Note: Data exclude permits lacking a vendor copy ("orphan permits").

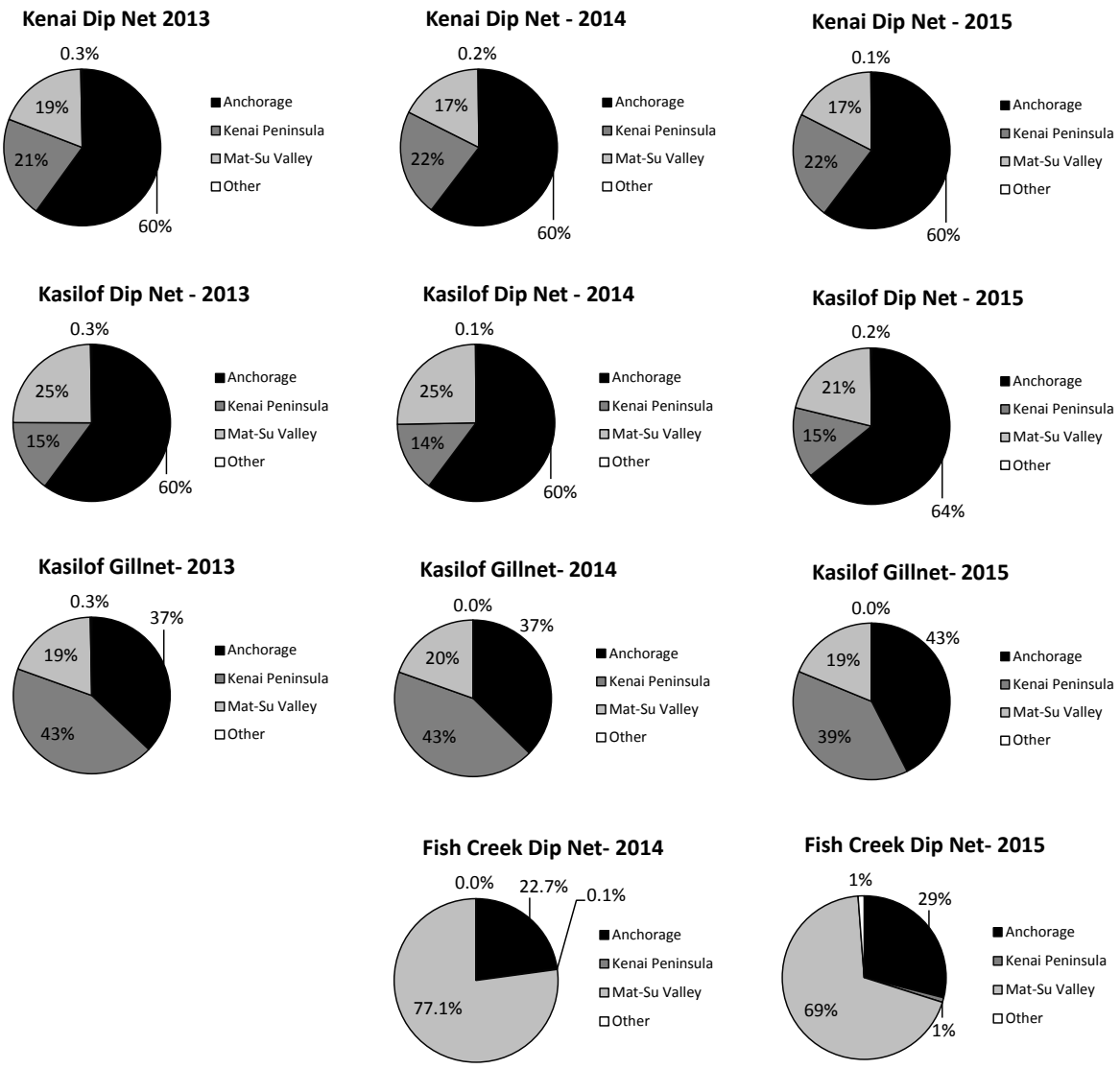


Figure 7.–Proportion of salmon harvested in the Upper Cook Inlet personal use fisheries by residence of permit holders.

Note: Data exclude permits lacking a vendor copy ("orphan permits").

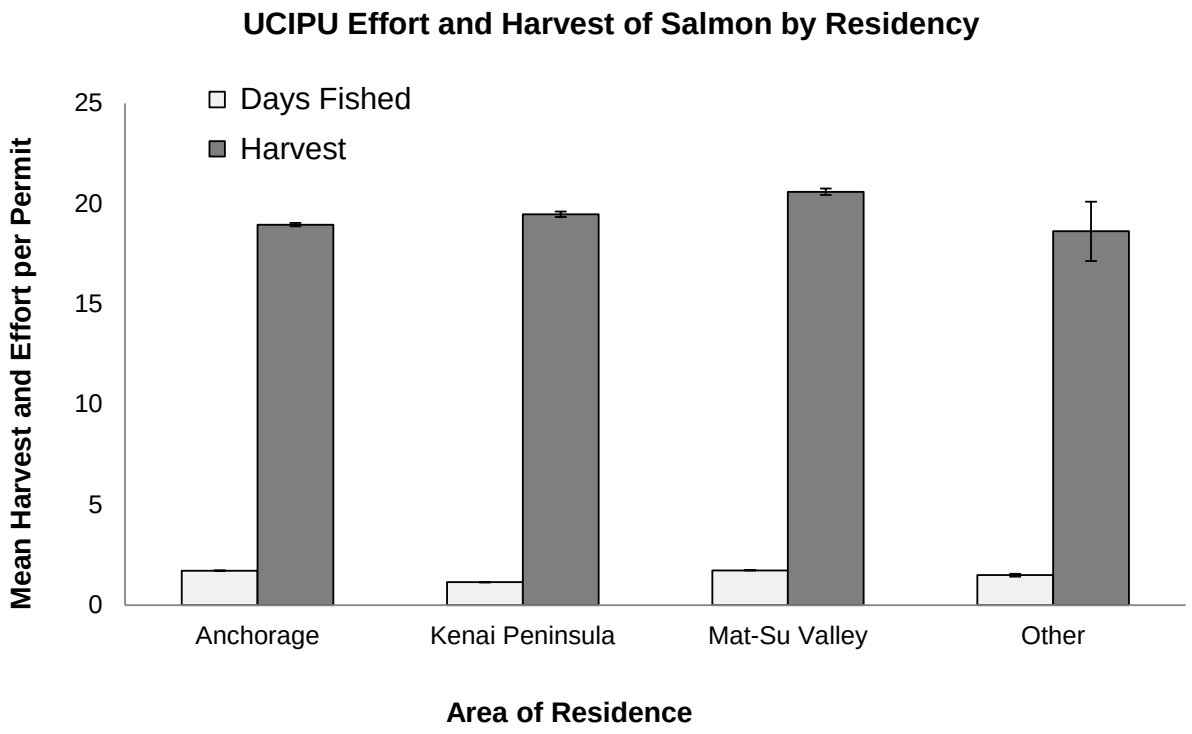


Figure 8.–Mean harvest and days fished per permit by residence of participants in the Upper Cook Inlet personal use fisheries.

Note: Standard error bars are shown.

Household and Fishery Variation in Harvest

The overall mean harvest per permit from households that fished was 19.4 (SE 0.06) and for all permits, including those that did not fish, it was 15.9 (SE 0.06). The average household harvested between 40% and 48% of their annual limits (Table 9), which is lower than in previous years (Dunker 2013). The percentage of households that fished and harvested over 80% of their annual limits was 12% in 2013, 13.4% in 2014, and 15.2% in 2015 (Figure 9). From Figure 9, it appears most households harvested less than 40% of their available limits and between 2013 and 2015, approximately 30% of permit holders did not harvest any of their bag limits. Participation in the UCIPU fisheries varies greatly, and like previous years, the Kasilof River gillnet fishery was the least utilized of all UCIPU fisheries (Table 3). However, participants fishing the Kasilof River set gillnet fishery tended to be the most successful, harvesting between 63.5% (SE 0.017) and 73.2% (SE 0.012) of their annual bag limits from 2013 to 2015 (Figure 10). Participants fishing the dip net fisheries, in contrast, generally harvested less than half of what they were allowed during all years (Figure 10).

Of all the salmon harvested in the UCIPU fisheries, over 73% came from the Kenai River dip net fishery each year, whereas less than 20% were typically harvested from the Kasilof River fisheries (Figure 11). Less than 6% of all salmon harvested were taken in the Fish Creek dip net fishery during the years it was open (Figure 11). Similarly, over 69% of households participated in the Kenai River dip net fishery each year, whereas less than 21% and less than 6% participated in the Kasilof River fisheries or the Fish Creek dip net fishery, respectively (Figure 12).

Table 9.–Summary of Upper Cook Inlet personal use permit holders by year, number of fisheries fished, number of days fished, and household size, 2013–2015.

Parameter	Parameter value	Percent of all permits	Total salmon harvested	Percent of total harvest	Average % of bag limit filled	SE (% of bag limit filled)
Year						
	2013	32.4	376,570	29.6	40.4	0.2
	2014	35.0	452,323	35.5	45.0	0.2
	2015	32.6	445,278	34.9	47.3	0.2
	Total	100.0	1,274,171	100.0		
Number of fisheries fished [a]						
	0	18.1	0	0.0	0.0	0.0
	1	75.5	1,143,475	89.7	43.5	0.1
	2	6.2	126,070	9.8	53.6	0.8
	3	0.2	4,600	0.4	58.5	2.4
	4	<0.1	26	<0.1	74.0	0.0
	Total	100.0	1,274,171	99.9		
Number of days fished						
	0	18.1	0	0.0	0.0	0.0
	1	44.0	502,492	39.4	34.4	0.2
	2	22.8	404,878	31.8	50.5	0.2
	3	9.3	205,798	16.2	60.0	0.3
	4	3.7	98,073	7.7	68.0	0.5
	5	1.9	55,335	4.3	70.5	0.7
	6	0.1	4,897	0.4	80.2	2.2
	7+	0.1	2,698	0.2	86.1	2.5
	Total	100.0	1,274,171	100.0		
Number of household members						
	1	15.3	126,444	9.9	50.5	0.4
	2	32.6	361,908	28.4	48.4	0.2
	3	16.8	208,306	16.3	42.2	0.3
	4	17.5	250,817	19.7	39.7	0.3
	5	9.3	149,989	11.8	37.7	0.4
	6	4.2	77,197	6.1	37.6	0.6
	7+	4.3	99,510	7.8	38.0	0.6
	Total	100	1,274,171	100.0		

Note: Data presented for "reported harvests" only (unexpanded). Harvests presented in Table 3 are estimates that include harvests by nonrespondents.

[a] For all years combined.

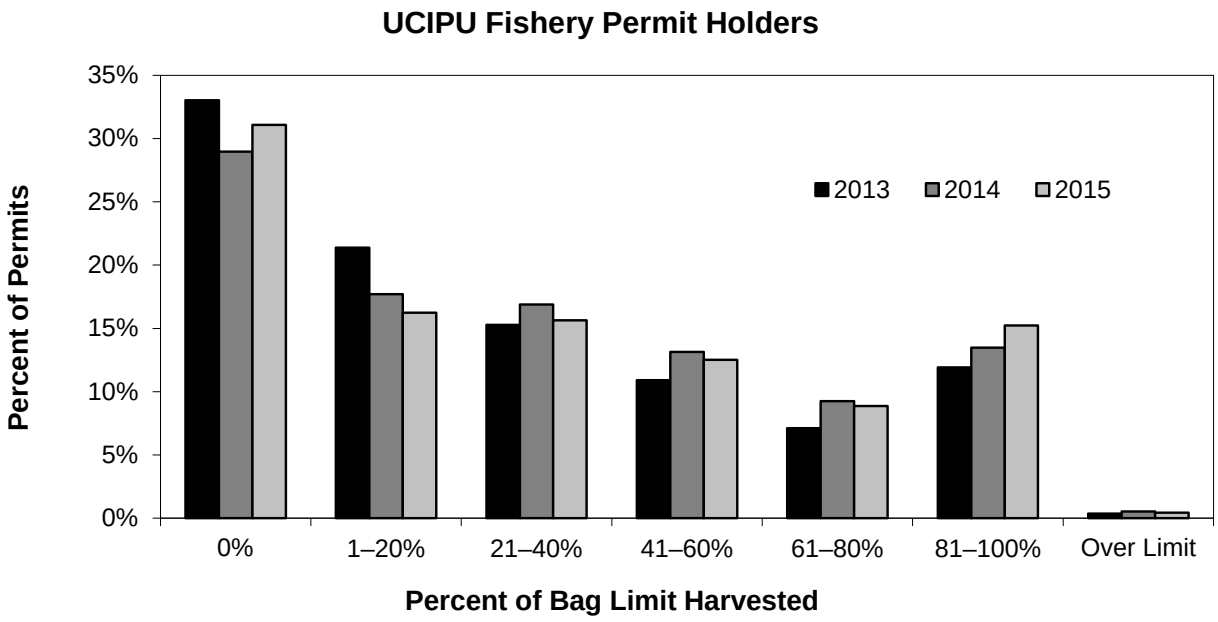


Figure 9.–Percent of bag limits harvested by Upper Cook Inlet personal use salmon fishery permit holders, 2013–2015.

Note: The category 0% includes participants that did not fish as well as participants that fished and did not catch anything.

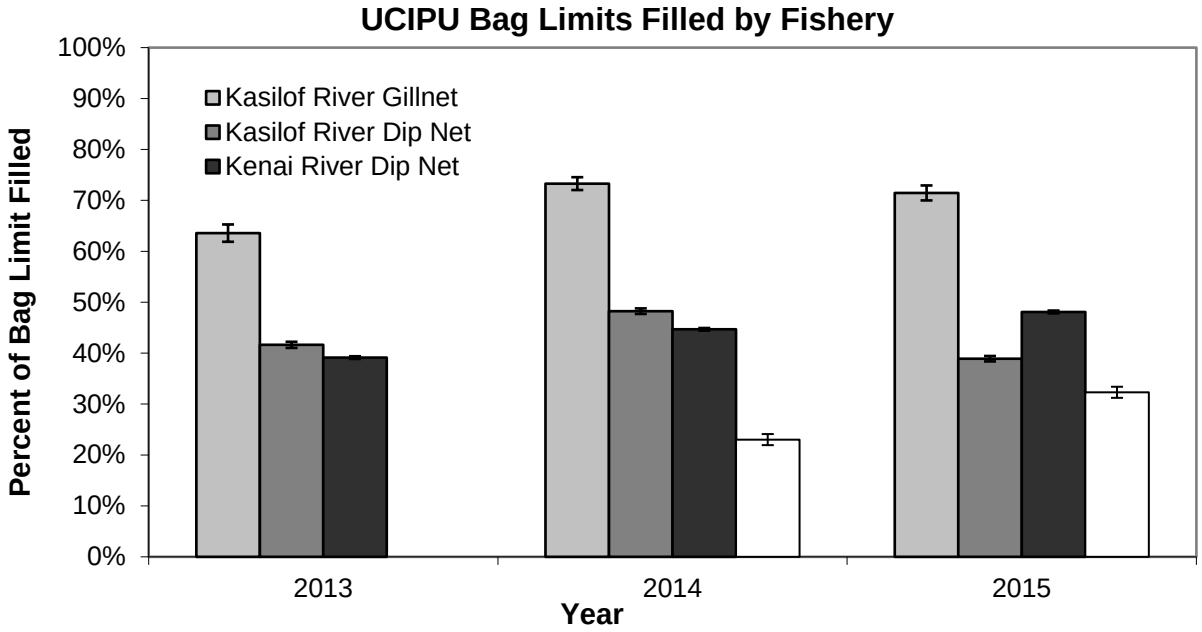


Figure 10.–Average percent of bag limit filled by fishery, 2013–2015.

Note: Data are presented for permit holders that only participated in 1 fishery and that fishery was known (91% of permit holders who fished).

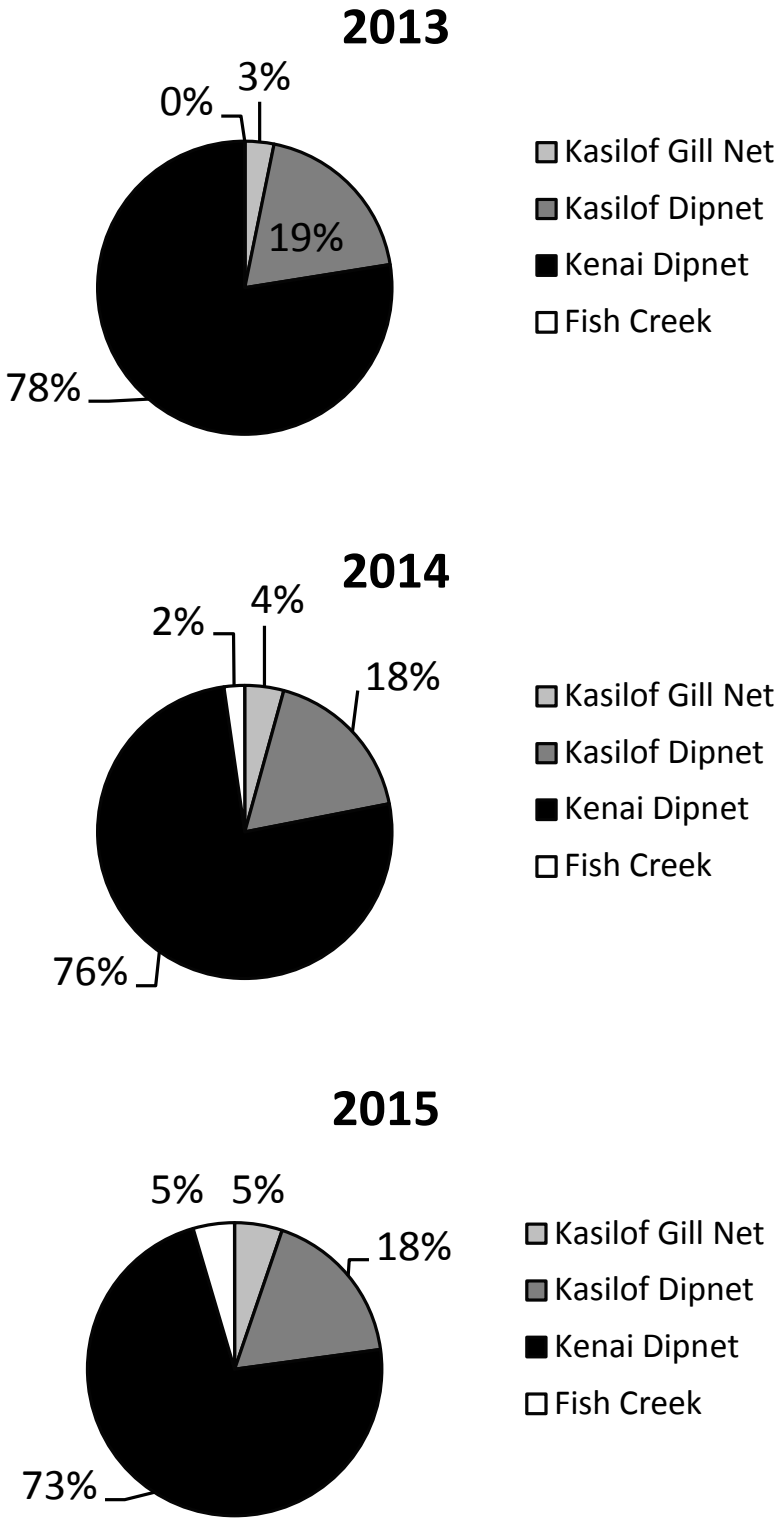


Figure 11.–Percent of salmon harvest by fishery, 2013–2015.

Note: Data presented exclude salmon reported from permits with "unknown" fisheries (<3%).

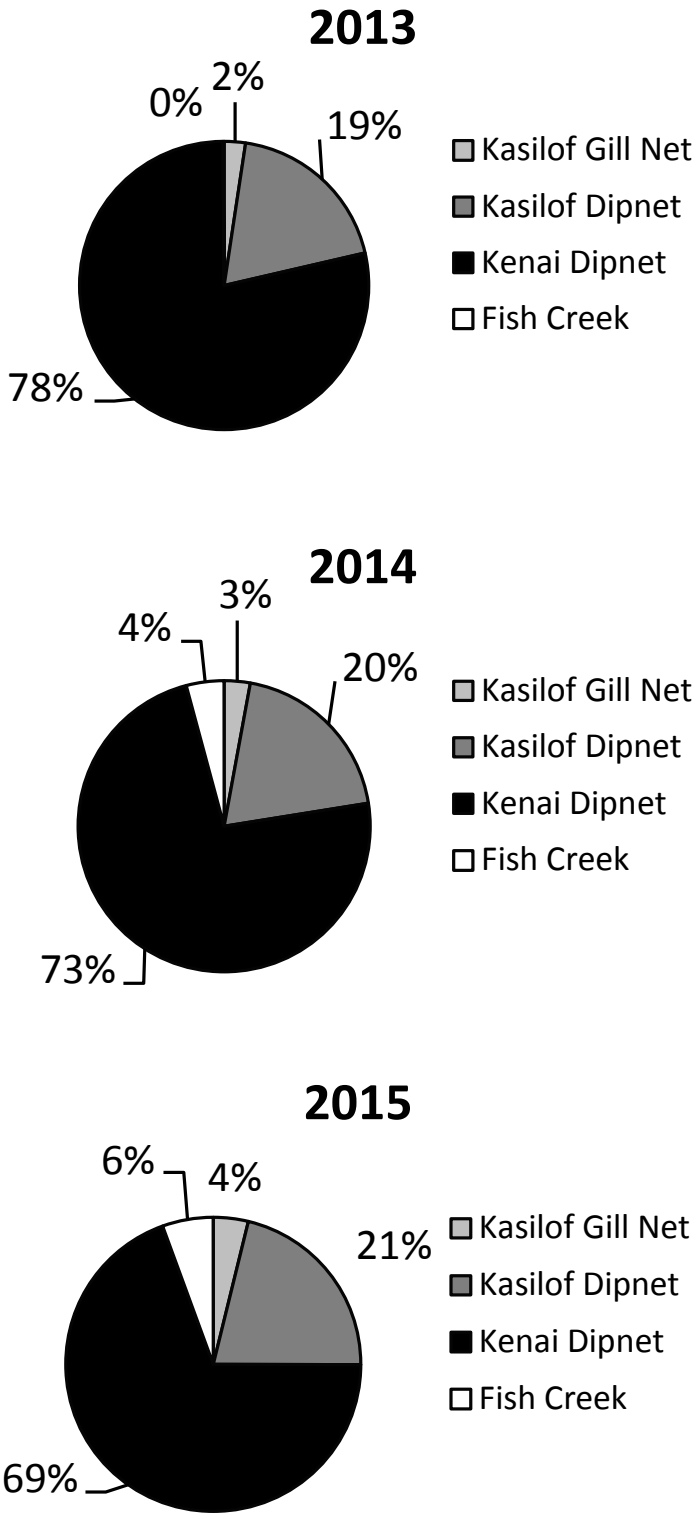


Figure 12.–Percent of permits participating in each fishery, 2013–2015.

Note: Data presented are only for permits that fished and the fishery location was known (82% of all permits).

Household Size

From 2013 to 2015, permits were most commonly issued to 2-person households (Table 9). Although some very large households obtained permits, households of 5 people or less composed about 92% of the total permits issued (Table 9). For all permits issued, the average percentage of the annual limit harvested varied by about 12% for households of different sizes, with single-person households tending to have the greatest "success" fulfilling bag limits and households of 6 tending to have the least success (Table 9 and Figure 13). Overall patterns in the percentage of permits and the percentage of salmon harvested according to household size were remarkably similar between fisheries (Figure 13). Although permits are issued per household, harvest patterns per person were evaluated by dividing the harvest on each permit by the number of household members (Figure 14). Mean harvest of salmon per person differed very little between years, and the mean harvest per person over all years (2013–2015) was approximately 6.2 (SE 0.02) salmon; if permits that did not fish are excluded, mean harvest per person was 7.5 (SE 0.02) salmon. Mean harvest of salmon per person was also determined by fishery and year for households that only fished in 1 fishery. The mean harvests per person in the Kenai River dip net fishery ranged between 6 and 8 fish, and harvests per person were greatest in the Kasilof gillnet fishery where harvests ranged from 11 to 13 salmon per person (Figure 14).

Number of Days Fished, Fisheries Visited, and Harvest Rates

Thirty-eight percent of households with personal use permits fished multiple days per season and 44% of households with personal use permits fished only 1 day (Table 9). Households that fished only 1 day harvested an average of 34.4% (SE 0.2%) of their annual limits, but households that fished for at least 5 days harvested over 70.5% (SE 0.7%) of their annual limits. When analyzed separately by fishery for households that participated in only 1 fishery, participants in UCIPU fisheries generally increased their harvest with added days of fishing effort. For all fisheries, households (fishing only 1 fishery) achieved over 60% of their annual limits if they participated for at least 4 days (Figure 15). However, if participants of any of the fisheries fished for longer than 4 days, there appeared to be little difference in their average harvests from those that fished for 4 days (Figure 15). Overall, patterns in the percentage of permits and the percentage of salmon harvested over multiple days were similar between all UCIPU fisheries (Figure 15).

Only about 6.5% of households participated in more than 1 fishery during this study (Table 9). Of those households that participated in 2 fisheries, 89% fished the Kenai River along with another fishery (most often Kasilof River dip net). Of those that participated in 3 fisheries, combinations involving the Kenai River accounted for 97.5%. During this study period, fishing in multiple fisheries increased the average percentage of the annual limit filled from 43.5% (SE 0.1%) for 1 fishery to 74% for the 1 household that participated in all 4 fisheries (Table 9), although this is confounded by the fact that households that fished in multiple fisheries also participated for multiple days.

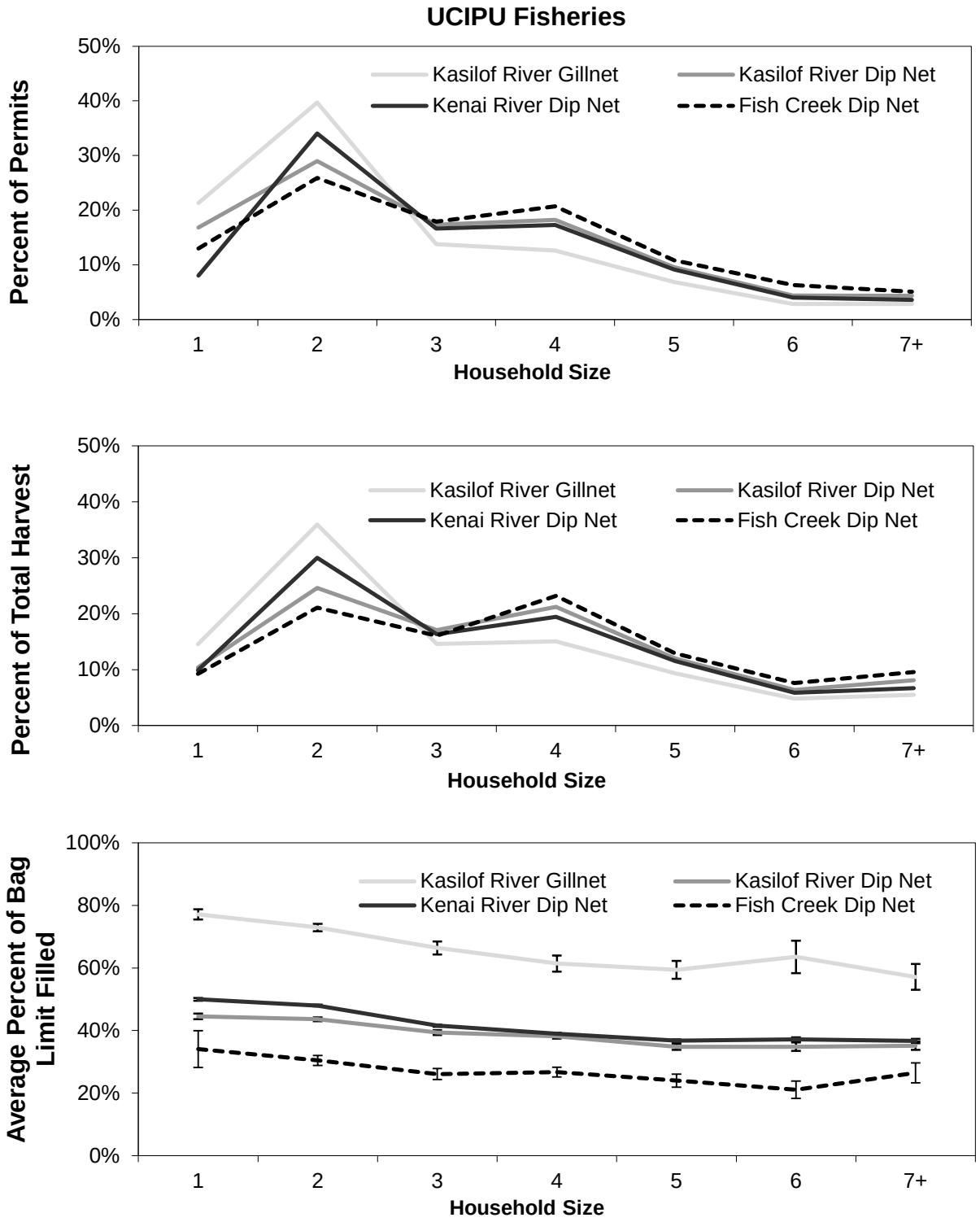


Figure 13.–Percent of permits (top), percent of total harvest (middle), and average percent of bag limit filled (bottom) by personal use salmon fishery and household size, 2013–2015.

Note: Data are presented for participants that only fished in one of the following fisheries: Kenai dip net, Kasilof dip net, and Kasilof gillnet (about 91% of permit holders who fished). These figures exclude data for participants who fished in multiple fisheries, did not fish at all, or did not accurately report their fishing location.

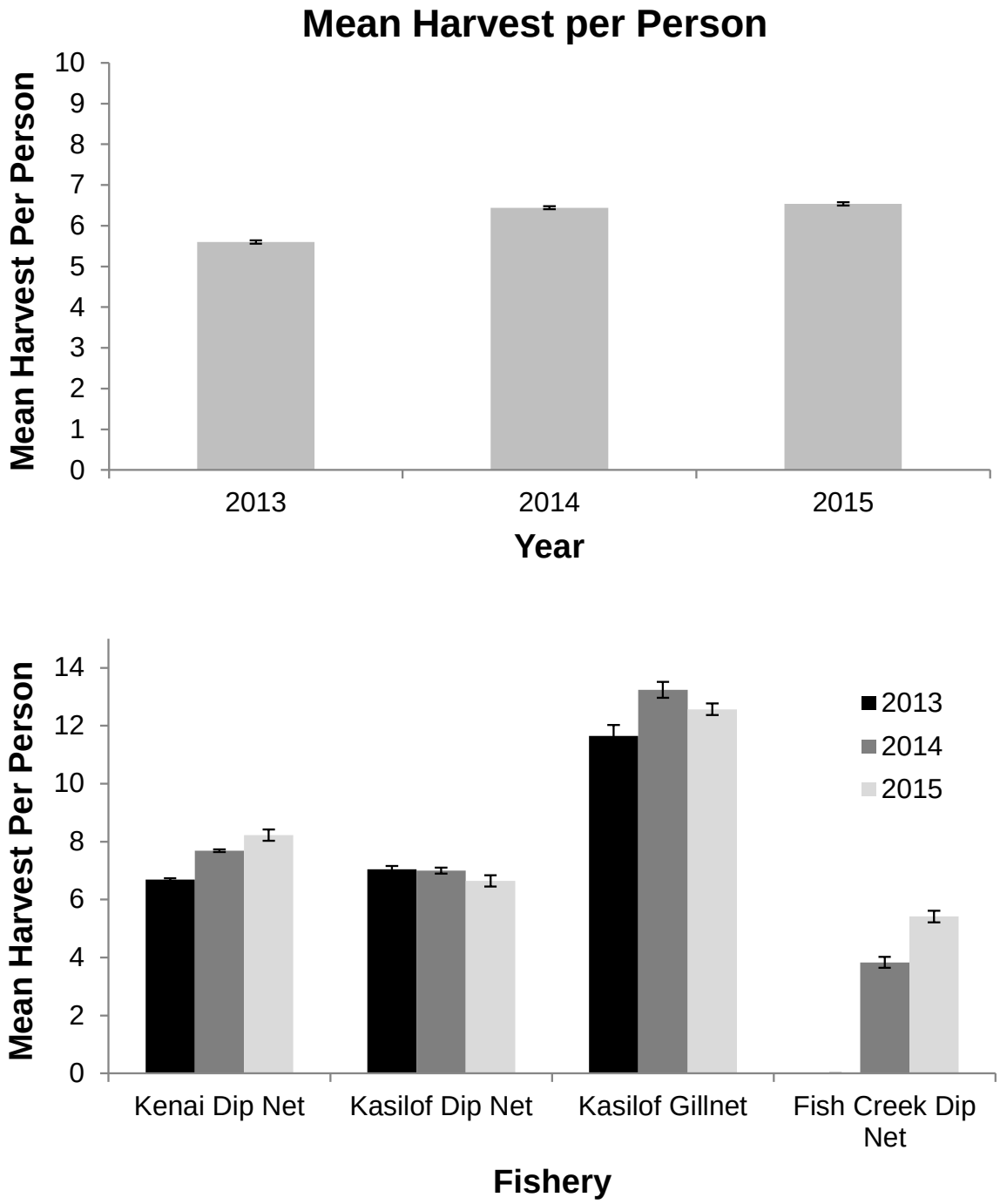


Figure 14.–Mean harvest per person in Upper Cook Inlet personal use fisheries by year (top) and by fishery and year (bottom).

Note: Data presented in the top graph are for the entire data set, including permits that did not fish. Data presented in the bottom graph are for permit holders that only participated in one fishery and the fishery was known (91% of permit holders who fished).

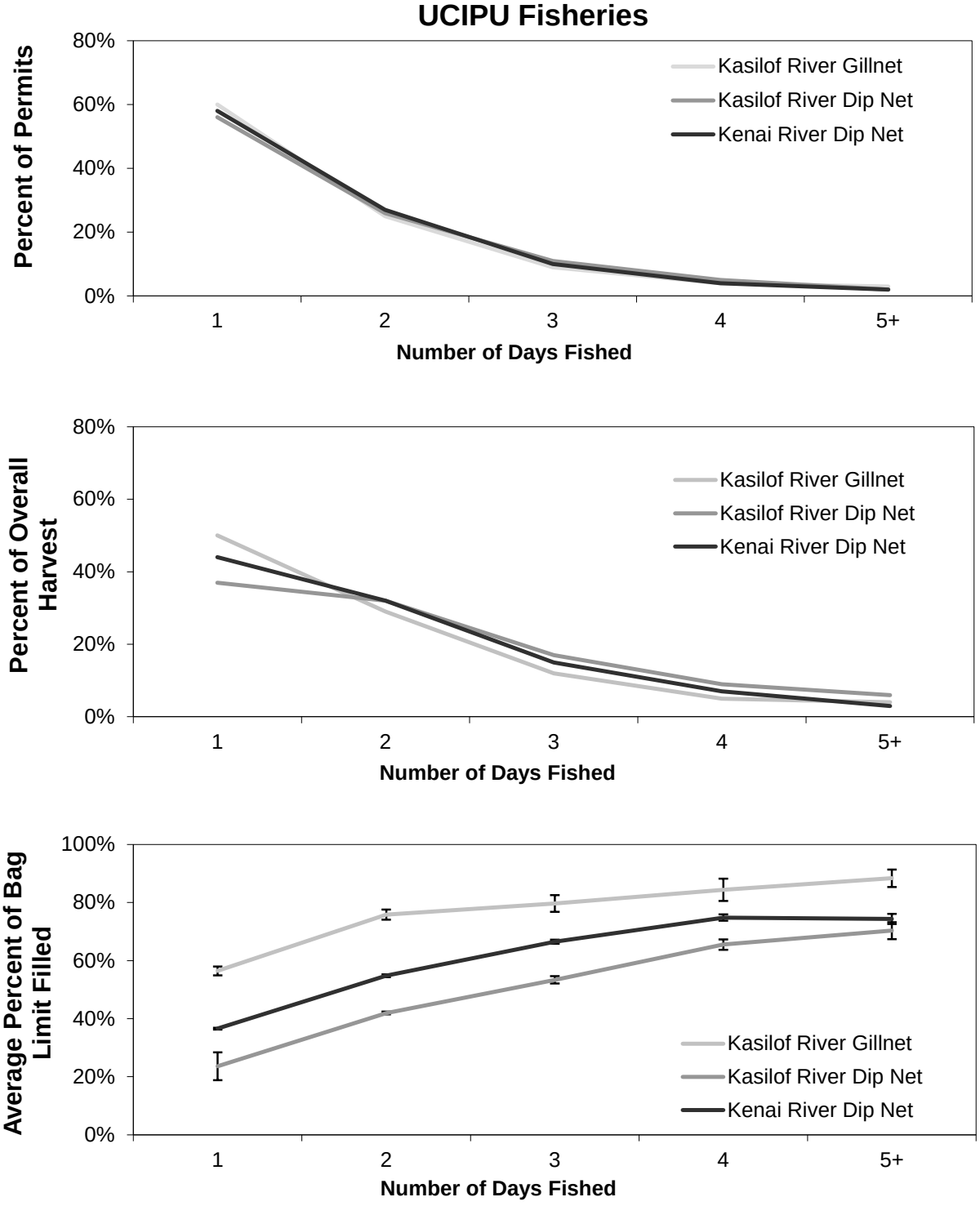


Figure 15.–Percent of permits, percent of total harvest, and average percent of bag limit filled by personal use salmon fishery and number of days fished, 2013–2015.

Note: Data presented are for participants that only fished in one of the following fisheries: Kenai dip net, Kasilof dip net, and Kasilof gillnet (about 91% of permit holders who fished). These figures exclude data for participants who fished in multiple fisheries, did not fish at all, or did not accurately report their fishing location.

DISCUSSION

Overall, more UCIPU permits were issued during this study period (2013–2015) than previous reporting periods, but the number of issued permits decreased in 2015 for the first time since 2011 (Appendix B1). On average, 35,373 permits were issued each year from 2013 through 2015 (Table 1). In contrast, the average number of permits issued from the start of these fisheries in 1996 through the present is 23,862 (calculated from Reimer and Sigurdsson 2004; Dunker and Lafferty 2007; Dunker 2010; Dunker 2013). Return rates continued to decrease slightly. Compared with the previous reporting period (2010–2012), return rates for UCIPU permits decreased during this study period from 80% (Dunker 2013) to 78%, which is perhaps a function of the growing popularity of these fisheries coupled with a lack of familiarity with the reporting requirements by new participants or, conversely, the increase in the percent of permit holders that did not fish and may have forgotten to return their harvest cards.

With the growing popularity of UCIPU fisheries since 1996, effort and harvest estimates have also increased, but the rate of increase is beginning to slow down. Average annual effort from 2013 through 2015 (47,071 household-days; Table 3) was only about 4,200 more household-days than the average effort from 2010 through 2012 (42,807 household-days; Dunker 2013) but about 20,800 more household-days above the historical average effort between 1996 and 2012 (calculated from Reimer and Sigurdsson 2004; Dunker and Lafferty 2007; Dunker 2010; Dunker 2013). Mirroring this trend, the average salmon harvest was about 88,500 fish less during the years 2013–2015 (average harvest 517,019 fish; Table 3) than the previous reporting period (average harvest 605,516 fish; Dunker 2013), but about 186,600 fish more than the historical average between 1996 and 2012 (calculated from Reimer and Sigurdsson 2004; Dunker and Lafferty 2007; Dunker 2010; Dunker 2013). Overall, mean effort and harvest have certainly increased since the fisheries first opened. However, household effort per permit has remained relatively constant over the years (Appendix D1), and harvest per permit of each species has been quite variable (Appendices D2–D6). The reason total effort increased whereas harvest decreased in this study period may be because the number of permits issued is beginning to stabilize and because of lower total sockeye salmon runs between 2013 and 2015 (Table 6) compared with previous years (i.e., in 2011 and 2012; Dunker 2013) rather than because of substantial differences in effort by individual households (Appendices B1 and D1). The average percentage of permit holders who were issued permits but did not fish (22%; Table 2) was 9 percentage points higher than the previous reporting period (2010–2012) (Dunker 2013) but similar to the historical average percentage between 1996 and 2012 (calculated from Reimer and Sigurdsson 2004; Dunker and Lafferty 2007; Dunker 2010; Dunker 2013).

Although total fishing effort in the Kenai River dip net fishery remained high from 2013 through 2015, harvest of sockeye salmon decreased from previously observed levels (Appendices D1 and D2). During this reporting period (2013–2015), the greatest sockeye salmon harvest occurred in the 2014 Kenai River dip net fishery (Appendix D2) which coincided with the overall peak in effort in the UCIPU fishery since 1996 (Appendix D1). Coho salmon harvests remained high during this reporting period, particularly for the Kasilof dip net fishery, which experienced the largest coho salmon harvests since that fishery began (Appendix D3). Chinook salmon harvests were relatively nonexistent during this study (Appendix D4), but this is explained by the closures to Chinook salmon harvests due to low returns. Total chum salmon harvest in the Kenai River dip net fishery peaked in 2014 (Appendix D5), and harvests in all chum salmon fisheries followed trends similar to coho salmon fisheries (Appendix D3), but pink salmon harvests were

substantially higher in 2014 in the dip net fisheries (especially the Kenai dip net fishery) than both before and after (Appendix D6).

The Kenai River dip net fishery has grown since 1996. Effort in this fishery, as a function of household days fished, was at an all-time high in 2014 (Appendix D1), although salmon harvests, particularly for sockeye salmon as mentioned, were higher during the previous reporting period (2010–2012) (Dunker 2013). During this study period (2013–2015), the total sockeye salmon harvest in the Kenai dip net fishery was greatest in 2014 (Table 4), but mean harvest per person in this fishery was greatest in 2015 (Figure 14, lower panel). However, mean harvest per person during all years of this study period (5.6–6.5 fish per person; Figure 14, upper panel) was less than during the previous study period (2010–2012) (mean 7.4; Dunker 2013). This may reflect a continued growing interest in the Kenai dip net fishery but lower availability of fish due to smaller sockeye salmon runs (Table 6 vs. Dunker [2013: Table 5]). That said, inriver sockeye salmon runs during 2013–2015 were only lower than the previous reporting period in 2013 and 2014 (Appendix E1) so perhaps other factors such increased competition with other dipnetters contributed to lower reported harvest per permit in those years. Regardless of the factors contributing to lower harvests, the percentage of annual bag limit filled by households fishing in the Kenai River was approximately 5–10 percentage points less than for 2010–2012 (Figure 10; Dunker 2013).

Harvest of sockeye salmon and overall effort in the Kasilof River personal use fisheries were slightly higher, but not substantially so from previous years (Appendices D1 and D2). The success of Kasilof River dipnetters, as determined by the average percent of annual bag limit filled (39–48%; Figure 10) and the sockeye harvest per permit (9.9–10.8; Appendix D2), did not differ much from previous years (Dunker and Lafferty 2007; Dunker 2010; Dunker 2013). Although participants in the Kasilof River set gillnet fishery harvested a greater percentage of their annual limit than participants in the dip net fisheries, it remains the least popular Kenai Peninsula UCIPU fishery in terms of number of participants (Figure 12; Reimer and Sigurdsson 2004; Dunker and Lafferty 2007; Dunker 2010; Dunker 2013).

The Fish Creek dip net fishery was opened for 7 days in 2014 and for 8 days in 2015. As expected and consistent with the previous reporting period (2010 and 2011), participants were overwhelmingly from the Matanuska–Susitna Valley (Figure 7; Dunker 2013), and harvest levels were not as high as in the Kenai Peninsula UCIPU fisheries (Figures 10 and 11).

Most permit holders did not fill their annual limit although differences in the percentage of the annual limit filled varied with respect to the number of fisheries fished and the amount of effort spent fishing (Table 9 and Figure 9). However, following the decreased harvest trend this reporting period, the percentage of permits that harvested most of their limits (81–100%) was substantially less (12–15%, Figure 9) than in the previous reporting period (22–27%, Dunker 2013). Residency trends for these fisheries observed during this study have not changed substantially from earlier years. When comparing 1996 to the present, more Anchorage and Matanuska–Susitna Valley (Mat–Su) residents are now participating in these fisheries, and the percentage of Kenai area residents has decreased slightly, but these shifts in residency patterns have occurred slowly over the years (Appendix F1). Regardless, from 2013 through 2015, most permits were issued to residents of Anchorage followed by residents of the Kenai Peninsula and the Mat–Su, and relatively few permits were issued to Alaskans who did not reside in Southcentral Alaska (Table 7 and Figure 7). Participants residing in the Mat–Su harvested more salmon per permit on average than residents from Anchorage and the Kenai Peninsula (Figure 8).

Although this could be attributed to expending more effort fishing when traveling farther distances (e.g., to the Kenai UCIPU fisheries), this is unlikely because residents from the Mat–Su and Anchorage did not spend significantly more time fishing than residents from the Kenai Peninsula (Figure 8) and because the Fish Creek dip net fishery, when open, has highest harvests from local Mat–Su residents (Appendix F2). However, Anchorage residents, because of their high participation, continue to consistently harvest more total salmon than Kenai Peninsula or Mat–Su residents (Appendix F2).

Beginning in 2015, ADF&G piloted a program to begin transitioning the UCIPU permit program to an electronic online format. It is anticipated that eventually the majority of permits will be obtained and reported online. In this first year, only 11% (3,808) of permits were acquired through ADF&G's online store, but 28.3% (7,693) of permit holders reported their harvest electronically. In coming years, fewer "paper" permits will be available, and license vendors will be instructed to direct their customers to ADF&G's online store when they run out of paper permits to distribute. Consequently, use of electronic permitting is anticipated to grow. There are many benefits to this program, including simpler and more timely reporting (e.g., e-mail reminders will precede physical reminder mailings), fewer lost or prematurely returned permits because users will have electronic permit copies, and tighter controls for enforcement because losses of permits through the mail system will no longer be an issue, and the automated system could eventually preclude nonrespondents from being eligible for permits. In the 2015, the focus was in getting the electronic permitting program running. No specific analyses of the electronic permit data were run contrasting harvest and effort patterns to those of physical permit holders. In the next reporting period (2016–2018), when electronic permitting is available each year, questions such as these will be addressed.

The public continues to feel that regulatory violations in the UCIPU fisheries are common (Barrett 2001a-b in Reimer and Sigurdsson 2004; Dunker and Lafferty 2007; Dunker 2010; Dunker 2013). Regulatory violations may result from a lack of understanding of personal use fishing regulations by some participants, but these types of violations are not widespread. Regulatory violations have only occasionally been recorded on permits (Reimer and Sigurdsson 2004; Dunker and Lafferty 2007; Dunker 2010; Dunker 2013), some of which occurred during the 2013–2015 study period. For example, 18 Chinook salmon were recorded on permits from the Kasilof River dip net fishery where regulations do not allow retention of Chinook salmon, and 11 Chinook salmon were harvested from the Kenai River in 2013, when their retention was prohibited by emergency order (Table 4). Also, a small number (less than 0.5%) of households reported harvests in excess of their annual harvest limit (Figure 9). In addition, a few participants each year (less than 0.3%) gave out-of-state addresses on the vendor copy of their permit (Table 7). What it is not possible to assess from returned permits, and what could be a more significant problem, is if large numbers of fishermen were not obtaining permits, were not recording harvested fish on their permits, or failing to return obtained permits.

Accurate and comprehensive reporting is essential to generate accurate estimates of effort and harvest. Alaska Wildlife Troopers and staff from the Alaska Department of Fish and Game, Division of Sport Fish enforce regulatory violations and check the accuracy of harvest reported on permits in the field. Local Alaska Wildlife Troopers indicate that they rarely encounter personal use fishermen who do not have a permit; of course, this is something that requires continued and diligent attention from law enforcement. The return rate for permits was lower during this study period than in previous years (Dunker and Lafferty 2007; Dunker 2010; Dunker

2013). However, the current return rate is sufficient to generate accurate and precise harvest and effort estimates. The return rate will continue to be monitored. If it continues to decrease, ADF&G will begin enforcement efforts against permit holders who fail to return their permits. In cooperation with ADF&G, Alaska Wildlife Troopers could begin issuing citations to those permit holders that received permits but failed to return their permits for at least 2 consecutive years. If this were to happen, the goal of this enforcement action would be to make the public more aware of the regulations and the importance of following them, and ultimately to increase compliance with the UCIPU fishery regulations. Finally, as this permit program continues to transition to the automated permit acquisition and reporting format, it will be much easier to track and correspond with permit holders and preclude nonrespondents from obtaining permits and participating in these fisheries.

ACKNOWLEDGEMENTS

Thanks to all individuals involved with the success of this project. Kirk Brogdon was a principal investigator on this project. Pat Hansen served as project biometrician. In addition, Michaela Young, Andrea Hamby, Diane Novinska, Raili Kedzior, Jackie Shelley, Kathryn Froning, and Mikkel Fotmar were charged with entering the data from approximately 35,000 permits per year. There were over 60 vendors who were responsible for the distribution of Upper Cook Inlet personal use permits. Their help was invaluable, and they deserve many thanks.

REFERENCES CITED

Barrett, J. 2001a. Dipnetting spawns fishing frenzy, personal-use fishery brings no shortage of concerns., Peninsula Clarion. July 13, 2001. Kenai.

Barrett, J. 2001b. Scofflaws reportedly abundant in fishery. Peninsula Clarion. July 13, 2001. Kenai.

Begich, R. N., J. A. Pawluk, J. L. Cope, and S. K. Simons. 2017. 2014–2015 Annual Management Report and 2016 sport fisheries overview for Northern Kenai Peninsula: fisheries under consideration by the Alaska Board of Fisheries, 2017. Alaska Department of Fish and Game, Fishery Management Report No. 17-06, Anchorage. http://www.adfg.alaska.gov/FedAidPDFs/FMR17-06.pdf

Brannian, L., and J. Fox. 1996. Upper Cook Inlet Subsistence and Personal Use Fisheries, Report to the Alaska Board of Fisheries, 1996. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A96-03, Anchorage. http://www.adfg.alaska.gov/FedAidPDFs/RIR.2A.1996.03.pdf

Dunker, K. J. 2010. Upper Cook Inlet personal use salmon fisheries, 2007-2009. Alaska Department of Fish and Game, Fishery Data Series No. 10-89, Anchorage. http://www.adfg.alaska.gov/FedAidpdfs/FDS10-89.pdf

Dunker, K. J. 2013. Upper Cook Inlet personal use salmon fisheries, 2010–2012. Alaska Department of Fish and Game, Fishery Data Series No. 13-59, Anchorage. http://www.adfg.alaska.gov/FedAidpdfs/FDS13-59

Dunker, K. J., and R. Lafferty. 2007. Upper Cook Inlet personal use salmon fisheries, 2004-2006. Alaska Department of Fish and Game, Fishery Data Series No. 07-88, Anchorage. http://www.adfg.alaska.gov/FedAidpdfs/fds07-88.pdf

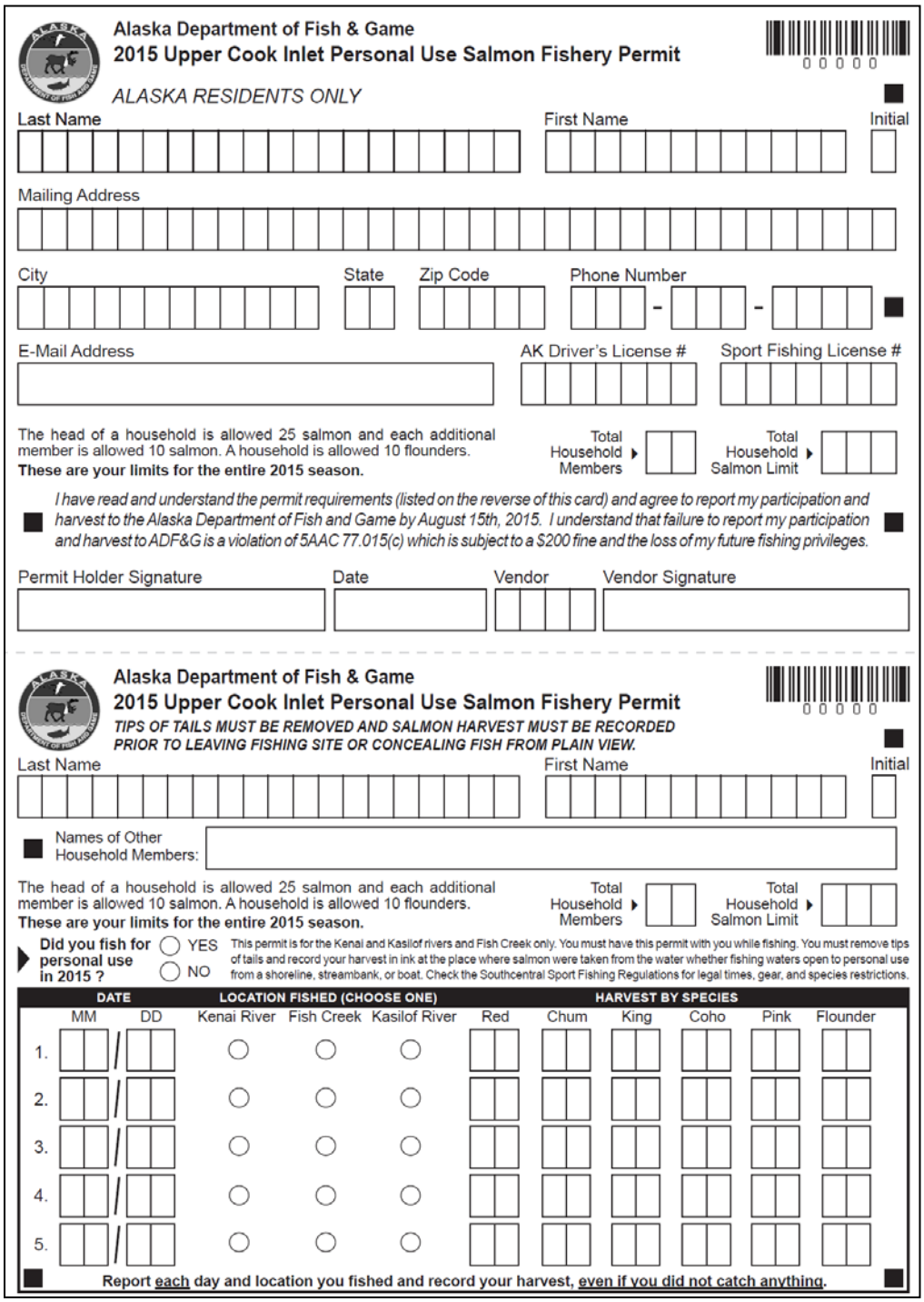
Goodman, L. A. 1960. On the exact variance of products. Journal of the American Statistical Association 55:708-713.

Jennings, G. B., K. Sundet, and A. E. Bingham. 2011. Estimates of participation, catch, and harvest in Alaska sport fisheries during 2010. Alaska Department of Fish and Game, Fishery Data Series No. 11-60, Anchorage. http://www.adfg.alaska.gov/FedAidpdfs/FDS11-60

Reimer, A. M., and D. Sigurdsson. 2004. Upper Cook Inlet personal use salmon fisheries, 1996-2003. Alaska Department of Fish and Game, Fishery Data Series No. 04-31, Anchorage. http://www.adfg.alaska.gov/FedAidPDFs/fds04-31.pdf

APPENDIX A: EXAMPLE OF AN UPPER COOK INLET PERSONAL USE PERMIT

Appendix A1.–Example of an Upper Cook Inlet personal use permit.



Alaska Department of Fish & Game
2015 Upper Cook Inlet Personal Use Salmon Fishery Permit

00000

ALASKA RESIDENTS ONLY

Last Name | First Name | Initial

Mailing Address

City | State | Zip Code | Phone Number

E-Mail Address | AK Driver's License # | Sport Fishing License #

The head of a household is allowed 25 salmon and each additional member is allowed 10 salmon. A household is allowed 10 flounders.
These are your limits for the entire 2015 season.

Total Household Members ▸ | Total Household Salmon Limit ▸

I have read and understand the permit requirements (listed on the reverse of this card) and agree to report my participation and harvest to the Alaska Department of Fish and Game by August 15th, 2015. I understand that failure to report my participation and harvest to ADF&G is a violation of 5AAC 77.015(c) which is subject to a $200 fine and the loss of my future fishing privileges.

Permit Holder Signature | Date | Vendor | Vendor Signature

Alaska Department of Fish & Game
2015 Upper Cook Inlet Personal Use Salmon Fishery Permit

00000

TIPS OF TAILS MUST BE REMOVED AND SALMON HARVEST MUST BE RECORDED PRIOR TO LEAVING FISHING SITE OR CONCEALING FISH FROM PLAIN VIEW.

Last Name | First Name | Initial

Names of Other Household Members:

The head of a household is allowed 25 salmon and each additional member is allowed 10 salmon. A household is allowed 10 flounders.
These are your limits for the entire 2015 season.

Total Household Members ▸ | Total Household Salmon Limit ▸

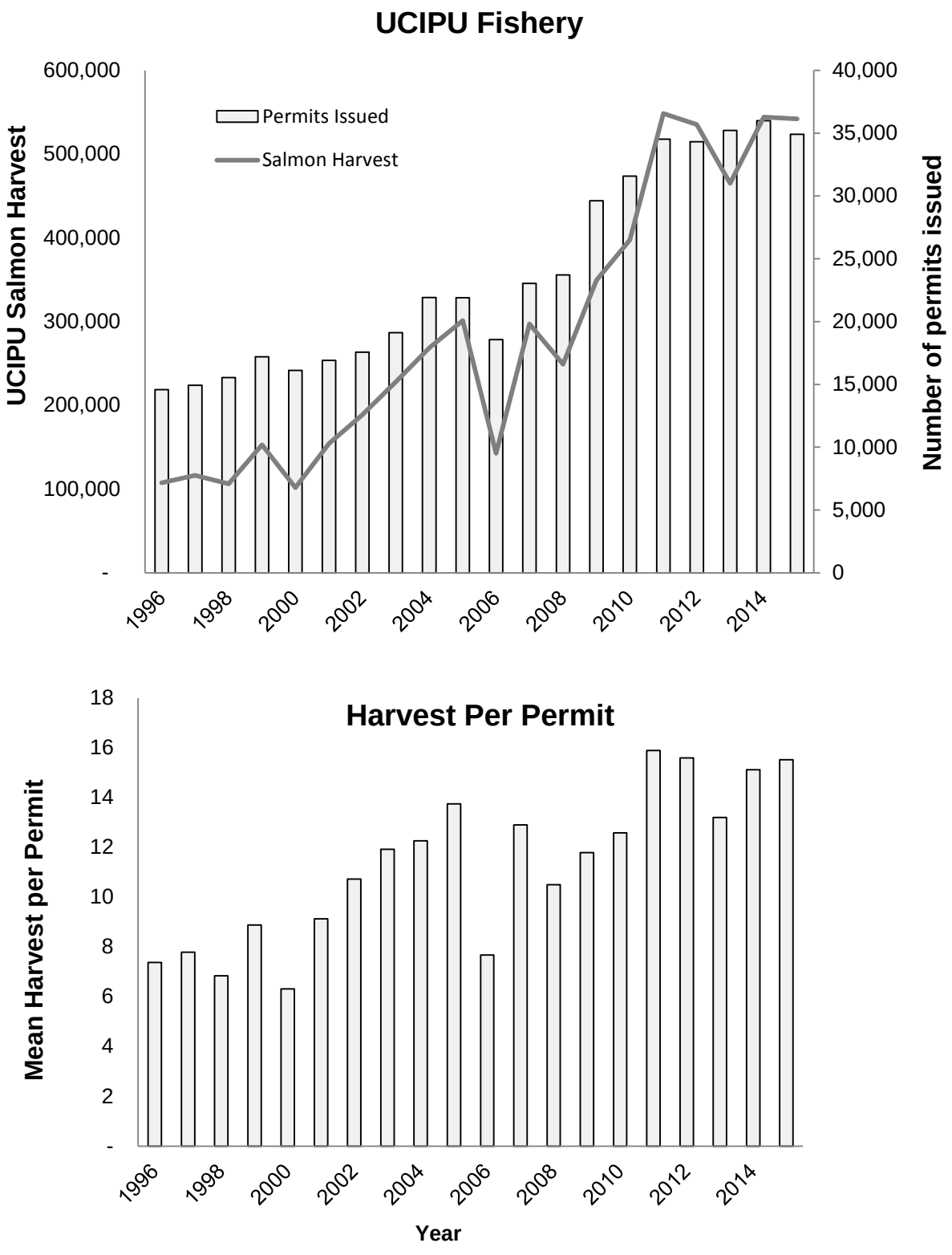
Did you fish for personal use in 2015 ? ◯ YES ◯ NO

This permit is for the Kenai and Kasilof rivers and Fish Creek only. You must have this permit with you while fishing. You must remove tips of tails and record your harvest in ink at the place where salmon were taken from the water whether fishing waters open to personal use from a shoreline, streambank, or boat. Check the Southcentral Sport Fishing Regulations for legal times, gear, and species restrictions.

DATE		LOCATION FISHED (CHOOSE ONE)			HARVEST BY SPECIES					
MM	DD	Kenai River	Fish Creek	Kasilof River	Red	Chum	King	Coho	Pink	Flounder
1.	/	◯	◯	◯						
2.	/	◯	◯	◯						
3.	/	◯	◯	◯						
4.	/	◯	◯	◯						
5.	/	◯	◯	◯						

Report <u>each</u> day and location you fished and record your harvest, <u>even if you did not catch anything</u>.

APPENDIX B: HISTORICAL TRENDS IN UCIPU SALMON HARVEST, PARTICIPATION, AND HARVEST PER PERMIT, 1996–2015



Appendix B1.–Historical trends in UCIPU salmon harvest and participation (top) and harvest per permit (bottom), 1996–2015.

Note: Estimates presented for all permit holders (both compliant and noncompliant) who fished.

APPENDIX C: SOCKEYE SALMON HARVEST BY DATE DURING THE UPPER COOK INLET PERSONAL USE FISHERIES, 2013–2015

Appendix C1.–Sockeye salmon harvest by date during the Kasilof River set gillnet fishery, 2013–2015.

	2013			2014			2015		
Date	Total	Mean [a]	SE	Total	Mean [a]	SE	Total	Mean [a]	SE
15 Jun	2,436	12.8	0.9	1,383	1,383	0.9	4,743	19.6	0.9
16 Jun	2,133	12.1	0.9	1,668	1,668	0.7	3,409	17.7	0.9
17 Jun	2,027	12.6	0.8	2,067	2,067	0.9	2,304	13.7	0.8
18 Jun	2,458	14.6	0.9	3,399	3,399	0.9	2,916	15.0	0.9
19 Jun	2,530	16.1	1.1	3,445	3,445	1.0	1,929	12.9	0.8
20 Jun				2,636	2,636	1.3	3,387	18.9	1.0
21 Jun				1,946	1,946	1.0	2,190	16.3	1.1
22 Jun				1,213	1,213	1.7	624	11.3	1.6
23 Jun				344	344	1.3	986	13.9	1.2
24 Jun				1,098	1,098	1.6	666	13.1	1.8

Note: Data are presented for "known" permits during legal harvest dates only.

[a] Average harvest per permit.

Appendix C2.–Sockeye salmon harvest by date during the Kasilof River dip net fishery, 2013–2015.

	2013			2014			2015		
Date	Total	Mean [a]	SE	Total	Mean [a]	SE	Total	Mean [a]	SE
25 Jun	1,780	16.2	1.5	2,428	12.20	0.9	807	6.16	0.5
26 Jun	1,095	12.7	1.0	1,296	11.27	1.1	2,592	12.64	0.7
27 Jun	742	10.9	1.4	973	6.49	0.5	1,505	7.31	0.4
28 Jun	1,098	11.1	1.1	1,029	5.75	0.4	1,197	7.98	0.6
29 Jun	1,741	9.9	0.7	949	6.78	0.6	742	8.73	0.8
30 Jun	527	6.0	0.7	658	7.00	0.7	590	6.48	0.7
1 Jul	201	4.9	1.0	738	6.90	0.6	1,721	12.03	1.0
2 Jul	835	9.7	0.9	1,314	9.45	0.7	808	6.79	0.7
3 Jul	1,734	13.3	1.0	878	6.97	0.7	1,931	6.64	0.4
4 Jul	546	5.6	0.7	2,329	7.51	0.4	2,161	6.63	0.4
5 Jul	732	5.2	0.5	2,111	8.12	0.5	2,178	10.68	0.7
6 Jul	552	4.6	0.6	1,618	10.05	0.6	1,655	11.99	1.2
7 Jul	690	7.1	0.9	692	8.24	0.7	976	7.81	0.7
8 Jul	567	6.8	0.8	1,528	10.19	0.7	670	7.05	0.7
9 Jul	1,313	15.3	1.3	873	6.98	0.7	1,265	8.11	0.6
10 Jul	1,310	11.2	0.9	1,379	8.51	0.7	2,962	10.39	0.6
11 Jul	644	7.3	0.8	3,502	11.26	0.5	1,902	6.32	0.4
12 Jul	2,021	8.4	0.5	2,725	6.58	0.4	3,575	11.76	0.5
13 Jul	5,606	11.9	0.5	2,243	7.17	0.4	1,684	8.46	0.5
14 Jul	6,138	15.7	0.6	3,987	9.63	0.5	3,033	10.60	0.6
15 Jul	4,036	15.1	0.9	5,005	11.43	0.5	5,318	12.66	0.6
16 Jul	6,104	18.4	0.7	3,381	8.19	0.4	2,409	8.79	0.5
17 Jul	3,532	12.8	0.8	3,402	9.42	0.5	1,878	5.25	0.3
18 Jul	3,115	11.1	0.6	6,750	13.39	0.5	5,039	8.43	0.4
19 Jul	6,706	15.0	0.6	3,532	7.14	0.3	3,029	7.71	0.4
20 Jul	4,214	7.7	0.4	2,697	8.45	0.5	2,402	8.73	0.5
21 Jul	1,271	5.4	0.5	2,272	11.30	0.7	2,487	11.79	0.6
22 Jul	780	5.3	0.5	1,378	10.13	0.8	1,086	7.99	1.0
23 Jul	731	4.8	0.5	1,146	8.82	0.7	1,915	10.76	0.8
24 Jul	693	5.8	0.7	1,300	9.77	0.8	1,104	6.57	0.7
25 Jul	835	6.9	0.6	826	6.03	0.5	2,723	9.69	0.6
26 Jul	909	6.1	0.5	901	4.84	0.5	1,443	8.54	0.7
27 Jul	1,393	6.1	0.5	631	4.74	0.6	769	9.05	0.9
28 Jul	394	4.5	0.7	572	7.53	0.9	439	7.08	1.0
29 Jul	298	5.5	0.8	543	8.23	0.9	502	7.49	1.0
30 Jul	259	6.5	1.5	334	6.30	0.8	486	6.23	0.9
31 Jul	447	8.4	1.2	552	10.62	1.4	304	4.47	0.7
1 Aug	116	4.3	0.9	378	8.22	1.3	512	4.83	0.6
2 Aug	163	4.9	0.8	335	3.32	0.4	328	4.21	0.6
3 Aug	275	4.4	0.7	547	7.29	0.8	187	5.05	0.8
4 Aug	223	4.2	0.6	185	4.20	0.9	597	9.63	0.9
5 Aug	134	4.1	0.7	460	8.21	1.3	392	9.12	1.5
6 Aug	153	4.4	1.0	486	9.00	1.4	576	10.29	1.1
7 Aug	73	3.2	0.9	380	10.27	1.4	619	8.14	1.0

Note: Data are presented for "known" permits during legal harvest dates only.

[a] Average harvest per permit.

Appendix C3.–Sockeye salmon harvest by date during the Kenai River dip net fishery, 2013–2015.

	2013			2014			2015		
Date	Total	Mean	SE	Total	Mean	SE	Total	Mean	SE
10 Jul	2,887	11.4	0.6	1,846	5.70	0.4	2,543	6.99	0.4
11 Jul	1,120	5.5	0.4	7,745	10.47	0.4	2,504	5.21	0.3
12 Jul	1,966	4.5	0.3	11,659	9.14	0.2	3,536	8.02	0.4
13 Jul	5,831	6.1	0.2	9,519	8.31	0.2	6,903	11.72	0.4
14 Jul	8,704	9.9	0.3	10,525	7.56	0.2	7,529	10.16	0.3
15 Jul	29,204	19.8	0.4	19,312	9.43	0.2	14,556	10.28	0.3
16 Jul	39,682	20.7	0.3	18,548	8.18	0.2	9,445	7.47	0.2
17 Jul	31,107	15.0	0.3	31,467	12.47	0.2	14,411	8.80	0.2
18 Jul	24,071	12.1	0.2	22,089	9.05	0.2	37,133	14.60	0.2
19 Jul	33,354	13.0	0.2	25,838	10.63	0.2	21,504	11.93	0.2
20 Jul	24,201	8.3	0.2	23,339	12.54	0.2	17,502	10.76	0.3
21 Jul	8,787	5.8	0.2	21,065	13.84	0.3	17,927	11.45	0.2
22 Jul	7,343	6.0	0.2	15,528	11.79	0.3	21,593	13.49	0.3
23 Jul	5,267	5.2	0.2	12,135	10.13	0.3	14,083	11.70	0.3
24 Jul	3,896	4.6	0.2	12,003	11.54	0.3	33,503	18.36	0.3
25 Jul	5,436	6.5	0.3	12,294	11.06	0.3	17,405	11.63	0.3
26 Jul	11,864	11.5	0.3	9,961	8.21	0.2	8,892	10.67	0.3
27 Jul	11,750	9.5	0.3	9,945	10.94	0.3	12,936	15.40	0.4
28 Jul	7,338	9.1	0.3	8,334	13.36	0.5	10,817	13.99	0.4
29 Jul	4,895	8.9	0.4	10,906	15.99	0.5	11,345	15.13	0.5
30 Jul	4,881	9.0	0.4	9,871	14.93	0.5	8,708	11.46	0.4
31 Jul	3,547	9.5	0.5	6,650	12.34	0.5	15,016	16.80	0.4

Note: Data are presented for "known" permits during legal harvest dates only.

[a] Average harvest per permit.

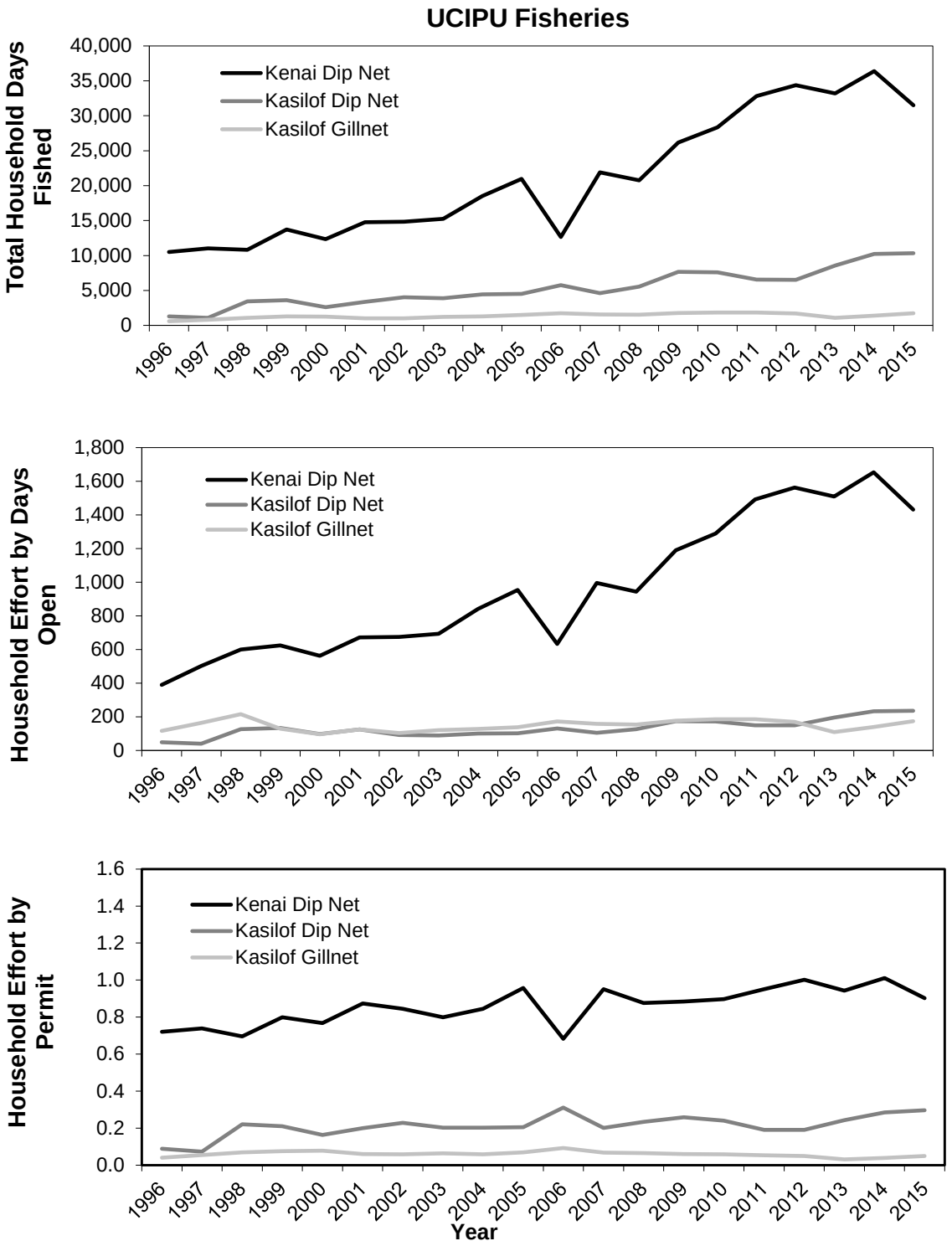
Appendix C4.–Sockeye salmon harvest by date during the Fish Creek dip net fishery, 2013–2015.

	2013			2014			2015		
Date	Total	Mean [a]	SE	Total	Mean [a]	SE	Total	Mean [a]	SE
24 Jul	–	–	–	–	–	–	672	3.95	0.51
25 Jul	–	–	–	918	3.43	0.28	1,679	8.93	0.95
26 Jul	–	–	–	671	3.12	0.31	2,005	10.78	0.84
27 Jul	–	–	–	477	2.66	0.33	1,829	11.15	0.86
28 Jul	–	–	–	549	4.13	0.41	2,130	10.44	0.86
29 Jul	–	–	–	608	3.27	0.31	2,464	10.27	0.73
30 Jul	–	–	–	523	2.97	0.35	2,326	7.68	0.51
31 Jul	–	–	–	659	3.99	0.46	1,608	6.43	0.47

Note: Data are presented for "known" permits during legal harvest dates only.

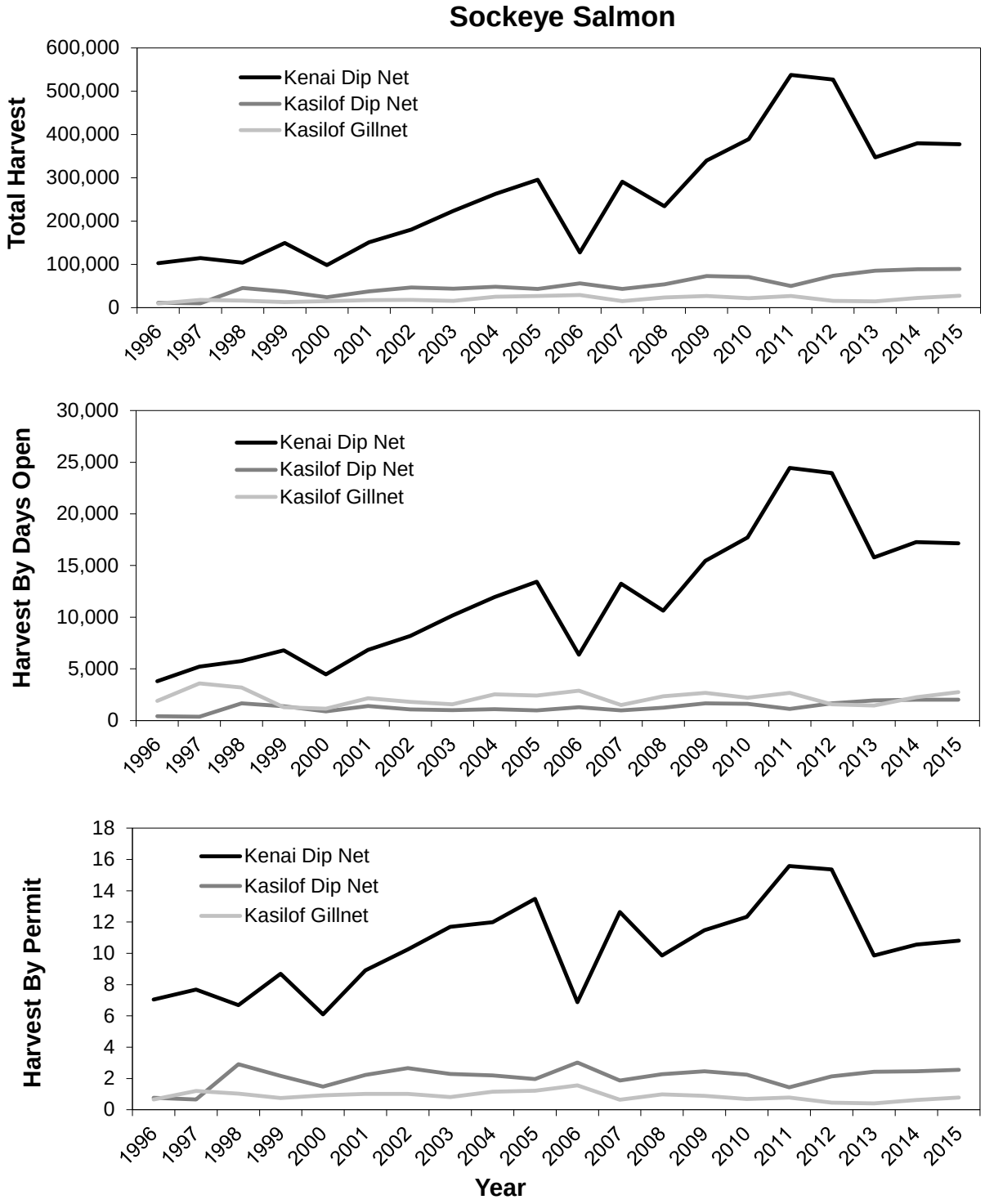
[a] Average harvest per permit.

APPENDIX D: EFFORT AND HARVEST TRENDS DURING THE UPPER COOK INLET PERSONAL USE FISHERIES, 1996–2015



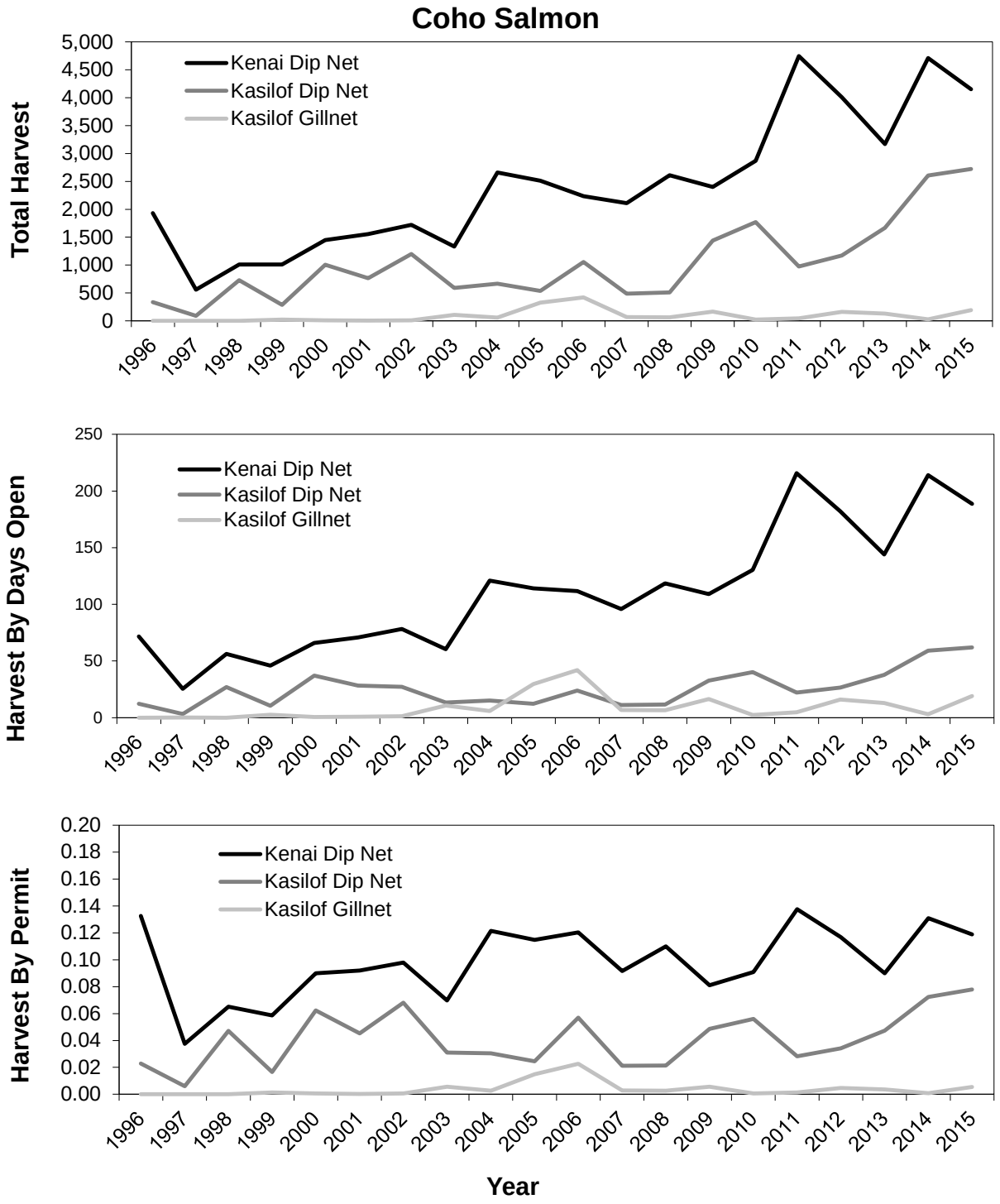
Appendix D1.–Total household-days fished (top), household effort by days open (middle), and household effort by permit (bottom) during the Upper Cook Inlet personal use salmon fisheries, 1996–2015.

Note: For top graph, all standard errors are less than ±81. Middle graph data were calculated as the overall number of household-days fished divided by the number of days the fishery was open each year. Bottom graph data were calculated as the overall number of household-days fished divided by the number of permits.



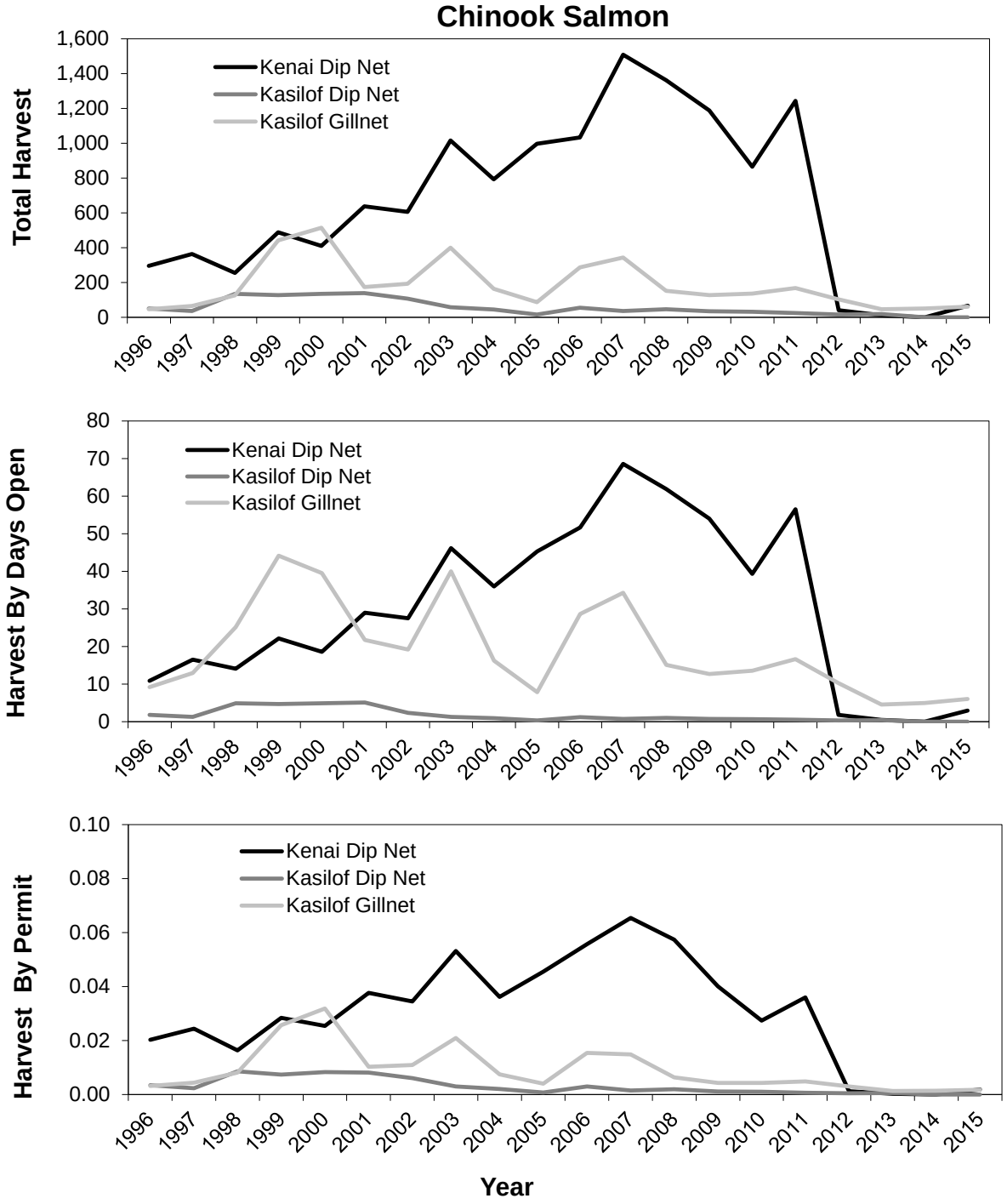
Appendix D2.–Total sockeye salmon harvest (top), sockeye salmon harvest by days open (middle), and sockeye salmon harvest by permit (bottom) during the Upper Cook Inlet personal use salmon fisheries, 1996–2015.

Note: For top graph, all standard errors are less than ±1,088. Middle graph data were calculated as the overall sockeye salmon harvest divided by the number of days the fishery was open each year. Bottom graph data were calculated as the overall sockeye salmon harvest divided by the number of permits issued each year.



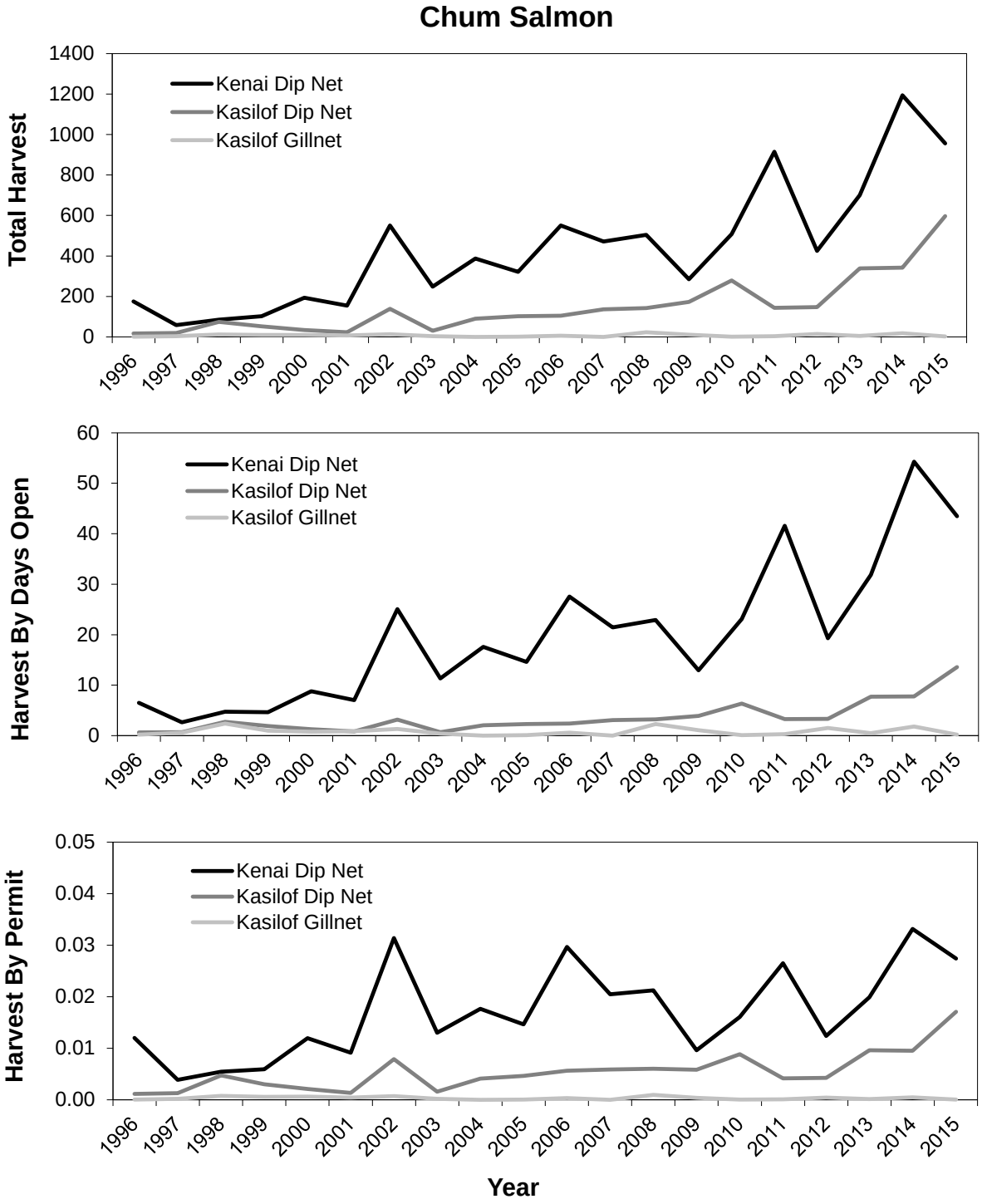
Appendix D3.–Total coho salmon harvest (top), coho salmon harvest by days open (middle), and coho salmon harvest by permit (bottom) during the Upper Cook Inlet personal use salmon fisheries, 1996–2015.

Note: For top graph, all standard errors are less than ±157. Middle graph data were calculated as the overall coho salmon harvest divided by the number of days the fishery was open each year. Bottom graph data were calculated as the overall coho salmon harvest divided by the number of permits issued each year.



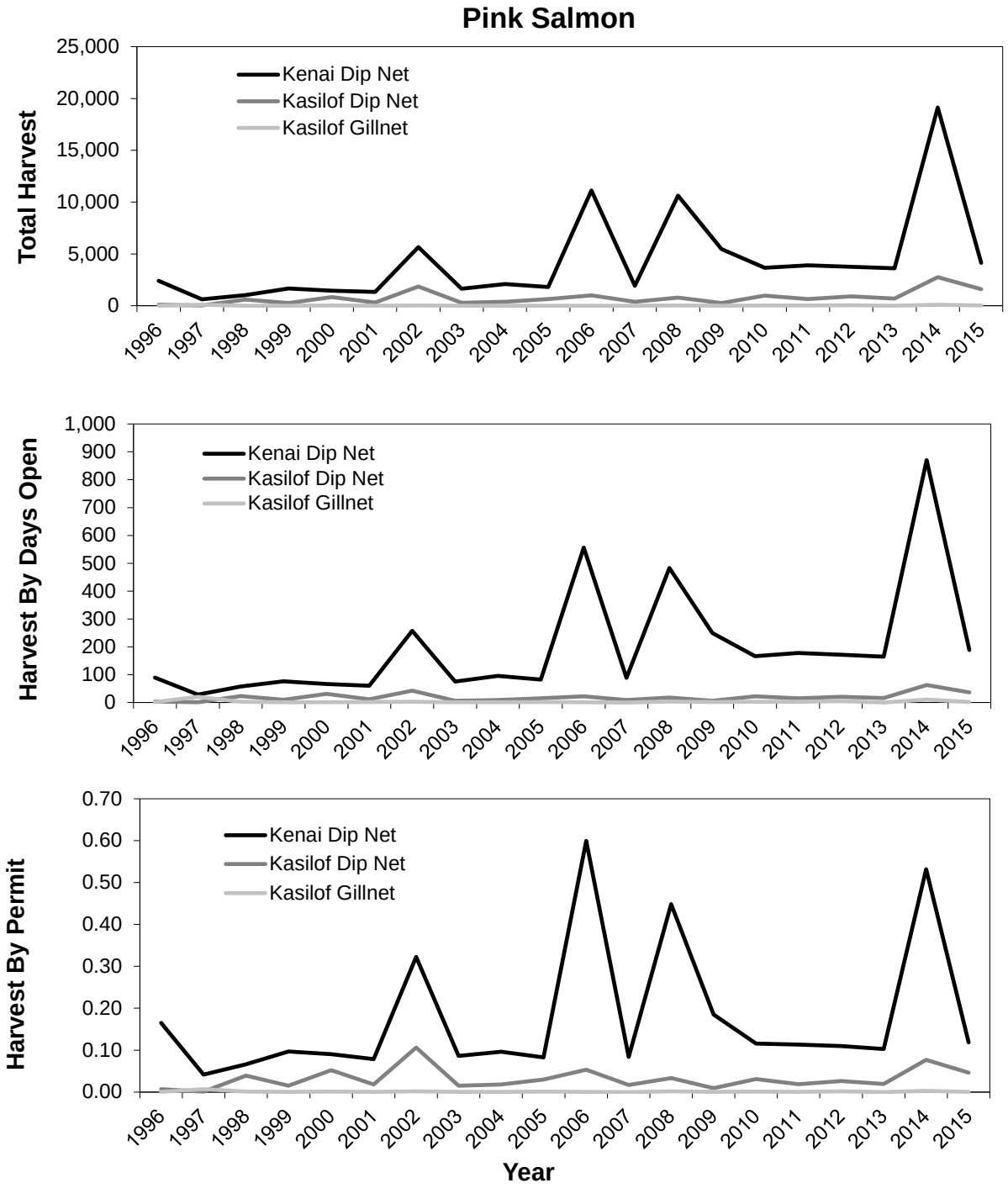
Appendix D4.–Total Chinook salmon harvest (top), Chinook salmon harvest by days open (middle), and Chinook salmon harvest by permit (bottom) during the Upper Cook Inlet personal use salmon fisheries, 1996–2015.

Note: For top graph, all standard errors are less than ±3. Middle graph data were calculated as the overall Chinook salmon harvest divided by the number of days the fishery was open each year. Bottom graph data were calculated as the overall Chinook salmon harvest divided by the number of permits issued each year.



Appendix D5.–Total chum salmon harvest (top), chum salmon harvest by days open (middle), and chum salmon harvest by permit (bottom) during the Upper Cook Inlet personal use salmon fisheries, 1996–2015.

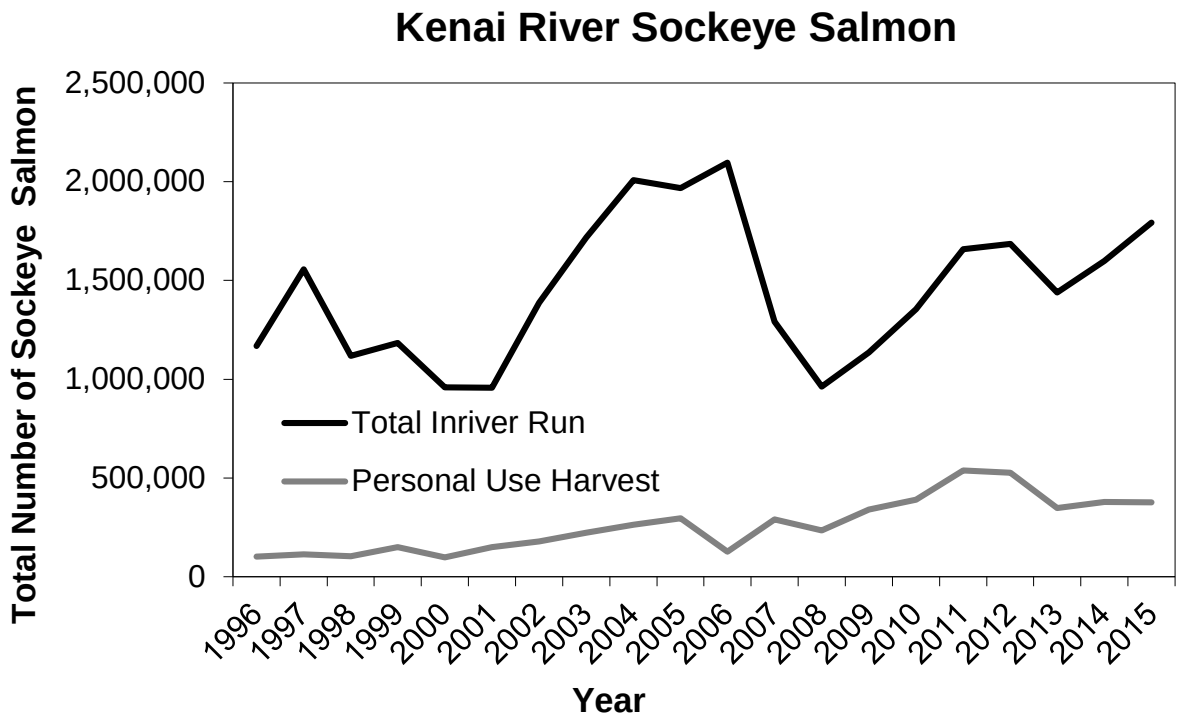
Note: For top graph, all standard errors are less than ±51. Middle graph data were calculated as the overall chum salmon harvest divided by the number of days the fishery was open each year. Bottom graph data were calculated as the overall chum salmon harvest divided by the number of permits issued each year.



Appendix D6.–Total pink salmon harvest (top), pink salmon harvest by days open (middle), and pink salmon harvest by permit (bottom) during the Upper Cook Inlet personal use salmon fisheries, 1996–2015.

Note: For top graph, all standard errors are less than ±184. Middle graph data were calculated as the overall pink salmon harvest divided by the number of days the fishery was open each year. Bottom graph data were calculated as the overall pink salmon harvest divided by the number of permits issued each year.

APPENDIX E: TRENDS IN SOCKEYE SALMON HARVESTS RELATIVE TO TOTAL INRIVER SOCKEYE SALMON RUNS, KENAI RIVER, 1996–2015



Appendix E1.–Trends in sockeye salmon harvests relative to total inriver sockeye salmon runs, Kenai River, 1996–2015.

APPENDIX F: HISTORICAL RESIDENCY TRENDS FOR PARTICIPANTS IN THE UPPER COOK INLET PERSONAL USE SALMON FISHERIES

Appendix F1.–Historical residence areas for Upper Cook Inlet personal use salmon fishery participants.

	Area of residence by region [a]				Total over Regions 1–3	Area of residence within Region 2				
Year	Region 1	Region 2	Region 3	Out of state or unknown		Anchorage area	Kenai Peninsula area	Mat–Su Valley area	Other	Total over Region 2
1996	0.2%	98.5%	1.3%	0.0%	100%	52.0%	30.4%	14.8%	1.3%	99%
1997	0.2%	98.6%	1.3%	0.0%	100%	53.9%	31.3%	12.4%	1.0%	99%
1998	0.3%	98.1%	1.3%	0.3%	100%	54.2%	32.3%	10.5%	1.1%	98%
1999	0.1%	98.3%	1.5%	0.1%	100%	55.4%	32.1%	9.5%	1.3%	98%
2000	0.2%	98.5%	1.3%	0.1%	100%	57.0%	29.2%	11.3%	1.0%	99%
2001	0.2%	98.1%	1.6%	0.1%	100%	58.6%	29.7%	8.6%	1.2%	98%
2002	0.1%	97.7%	2.0%	0.1%	100%	58.2%	29.1%	9.2%	1.2%	98%
2003	0.2%	97.4%	2.3%	0.1%	100%	59.4%	26.4%	10.1%	1.6%	98%
2004	0.1%	97.1%	2.5%	0.3%	100%	61.1%	25.0%	12.1%	1.8%	100%
2005	0.2%	97.0%	2.7%	0.2%	100%	61.0%	24.5%	12.9%	1.6%	100%
2006	0.2%	96.7%	2.9%	0.2%	100%	59.8%	26.1%	12.6%	1.5%	100%
2007	0.2%	97.1%	2.4%	0.3%	100%	59.7%	25.7%	14.4%	0.2%	100%
2008	0.2%	97.1%	2.5%	0.3%	100%	58.8%	26.2%	14.9%	0.1%	100%
2009	2.0%	96.7%	2.8%	0.2%	100%	57.5%	24.0%	18.3%	0.2%	100%
2010	0.2%	95.2%	3.4%	1.2%	100%	60.8%	21.6%	17.4%	0.3%	100%
2011	0.3%	96.3%	3.0%	0.3%	100%	57.7%	22.4%	19.7%	0.2%	100%
2012	0.2%	95.5%	3.1%	1.0%	100%	58.5%	21.8%	19.5%	0.3%	100%
2013	0.2%	95.4%	3.6%	0.7%	100%	61.0%	20.5%	18.3%	0.3%	100%
2014	0.2%	95.2%	3.5%	1.0%	100%	59.7%	20.8%	19.2%	0.2%	100%
2015	0.2%	95.7%	3.5%	0.6%	100%	59.2%	21.1%	19.5%	0.2%	100%

Note: Data exclude permits missing vendor copy ("orphan permits").

[a] Region 1 is Southeastern Alaska, Region 2 is Southcentral Alaska, and Region 3 is Interior Alaska.

Appendix F2.–Historical salmon harvest by Region 2 residence area.

Residence	Year	Kenai dip net	Kasilof dip net	Kasilof gillnet	Fish Creek	Unknown fishery
Anchorage						
	2007	154,369	24,158	5,181	–	3,091
	2008	120,544	28,372	7,653	–	3,842
	2009	170,925	37,378	9,087	2,571	3,883
	2010	188,210	36,486	6,907	7,375	4,293
	2011	259,529	24,512	9,382	1,433	5,962
	2012	259,151	35,956	5,039	–	5,812
	2013	163,917	40,014	4,361	–	3,285
	2014	192,685	44,432	6,965	2,206	4,690
	2015	183,966	46,185	9,577	4,244	4,172
Kenai Peninsula						
	2007	66,593	7,615	5,025	–	1,691
	2008	58,593	10,075	8,837	–	1,290
	2009	78,193	12,085	8,859	82	1,644
	2010	74,439	10,257	7,761	0	1,293
	2011	93,902	6,362	8,917	105	1,373
	2012	85,390	9,018	4,895	–	2,134
	2013	57,136	9,932	5,105	–	1,053
	2014	70,463	10,693	8,054	14	2,134
	2015	67,917	10,575	8,711	22	1,597
Mat-Su Valley						
	2007	40,883	6,722	3,054	–	994
	2008	36,066	9,461	4,907	–	1,122
	2009	51,349	13,731	5,082	6,116	1,437
	2010	58,504	11,663	3,797	16,590	1,109
	2011	86,093	8,798	4,620	3,592	1,439
	2012	78,101	13,825	2,741	–	2,031
	2013	51,468	16,419	2,256	–	1,181
	2014	55,482	18,574	3,652	7,496	1,485
	2015	52,965	15,126	4,229	13,450	1,295
Other						
	2007	276	87	35	–	0
	2008	424	108	55	–	28
	2009	503	152	135	0	0
	2010	699	67	31	32	0
	2011	772	37	67	0	114
	2012	936	173	61	–	0
	2013	834	169	35	–	9
	2014	618	82	0	2	0
	2015	401	131	0	17	2

Note: Data exclude permits missing vendor copy ("orphan permits"). An endash means there are no data because the fishery was not opened.