Regional Operational Plan CF.2A.2016.08

Lower Cook Inlet Aerial and Ground Survey Salmon Escapement Monitoring Operational Plan, 2016–2018

by

Edward O. Otis

and

Glenn J. Hollowell

April 2016

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

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Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

REGIONAL OPERATIONAL PLAN CF.2A.2016.08

LOWER COOK INLET AERIAL AND GROUND SURVEY SALMON ESCAPEMENT MONITORING OPERATIONAL PLAN, 2016–2018

by

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April 2016

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Signature Page

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TABLE OF CONTENTS

Page

LIST OF TABLES iv
LIST OF FIGURES iv
LIST OF APPENDICES iv
PURPOSE 1
Background 1
OBJECTIVES 2
METHODS 2
Study Sites 2
Escapement Estimation 2
Aerial Survey 2
Ground Survey 3
Recording Survey Data in the Field 3
Post Processing of Aerial Survey Data 3
Post Processing of Ground Survey Data 4
Calculating Final Escapement Indices 4
Additional Guidelines and Procedures 5
Safety 5
Maintenance 5
Compliance with Alaska Department of Fish and Game Regulations 6
Violations 6
Emergencies 6
SCHEDULE AND DELIVERABLES 6
RESPONSIBILITIES 7
REFERENCES CITED 8
TABLES 9
FIGURES 19
APPENDIX A. AERIAL/GROUND SURVEY APPLICATION 27
APPENDIX B. POST PROCESSING OF AERIAL SURVEY DATA 33

LIST OF TABLES

Table **Page**

1. Sustainable escapement goals (SEG) for 12 chum, 18 pink, and 8 sockeye salmon stocks in Lower Cook Inlet, Alaska, year the goal was adopted, and the method(s) used to monitor stocks. 10
2. List of 221 salmon-producing streams in the Lower Cook Inlet Management Area. 11
3. Description of the rating scale used to characterize aerial survey conditions when monitoring salmon escapements to index streams in Lower Cook Inlet. 16
4. Example of raw data output from the handheld computer application used to collect information during ground and aerial surveys to monitor salmon escapement in Lower Cook Inlet, Alaska. 17
5. Example of final edited data file after running the raw handheld computer output file through the ArcGIS Spatial Join tool to assign survey observations to index streams/stream sections and to append associated information relevant to that stock. 17
6. Example of Excel spreadsheet used to document periodic aerial surveys and calculate a final escapement index using the area-under-the-curve (AUC) method. 18

LIST OF FIGURES

Figure **Page**

1. Lower Cook Inlet commercial salmon management area showing commercial fishing district and subdistrict boundaries. 20
2. Anadromous streams with escapement goals and their monitoring methods in Southern and Outer districts, Lower Cook Inlet. 21
3. Anadromous streams, monitoring methods, and commercial subdistrict boundaries in Eastern District, Lower Cook Inlet. 22
4. Anadromous streams and their monitoring methods in Kamishak District, Lower Cook Inlet. 23
5. Cessna 206 floatplane used to conduct aerial surveys of salmon escapement in LCI. 24
6. Cessna L19 Birddog floatplane used to conduct aerial surveys of salmon escapement in LCI. 24
7. Photo illustrating the Juniper Systems Archer ruggedized handheld computer running custom software (gpsDataLogger) designed to record aerial and ground survey salmon escapement counts. 25

LIST OF APPENDICES

Appendix **Page**

A1. Manual for gpsDataLogger application to record aerial/ground survey observations. 28

B1. Directions for using the Spatial Join tool in ArcGIS 10.x to assign raw survey counts to discrete sections of index streams in Lower Cook Inlet and append data associated with those streams (e.g., AWC stream code) to the survey's attribute table (Last updated by Ted Otis in April 2015). 34

B2. Directions for processing the .dbf output file from ArcGIS in Excel to create pivot tables summarizing escapement counts by stream, stratified by species and stream section. 37

PURPOSE

To facilitate informed inseason management of commercial fisheries targeting Pacific salmon *Oncorhynchus spp.*, the Alaska Department of Fish and Game uses aerial and ground survey methods to monitor escapement on select index streams in Lower Cook Inlet. Surveyors make periodic counts of sockeye *O. nerka*, chum *O. keta*, and pink *O. gorbuscha* salmon throughout the duration of their respective runs. Fishery managers use these data daily to manipulate time and area fishery openings/closures in an effort to assure that the final escapement level for monitored stocks falls within their individual escapement goal ranges. At the end of the season, periodic aerial and ground survey counts are used to calculate a final escapement index for each stream based on the area-under-the-curve method (pink and chum salmon) or the peak survey count (sockeye salmon). This report provides operational guidelines for aerial and ground survey-based monitoring of salmon escapements in Lower Cook Inlet.

Key words: sockeye salmon, chum salmon, pink salmon, *Oncorhynchus spp.*, escapement, Lower Cook Inlet, aerial survey, ground survey, sustainable escapement goal, monitoring methods, area-under-the-curve, AUC

BACKGROUND

The Lower Cook Inlet management area (LCIMA) comprises waters of the Cook Inlet Area, south of the latitude of Anchor Point including the western shore of Cook Inlet south to Cape Douglas, and the eastern shore of Cook Inlet along the Kenai Peninsula to Cape Fairfield. This area is included in Area H and encompasses all coastal waters and inland drainages entering this area.

This salmon management area is divided into 5 districts that correspond to local geography and distribution of the 5 species of Pacific salmon. Commercial salmon fisheries occur in all but the Barren Islands District (Figure 1). The management objective for all districts is the achievement of spawning escapement goals for major stocks, while allowing for orderly harvest of fish surplus to spawning requirements.

The use of aerial surveys to monitor salmon escapement on small clear streams in Alaska began in the 1930's (Eicher 1953) and continues today (Jones et al. 2007). This technique is fast and efficient, allowing an observer to estimate escapements for many stocks during a single flight, facilitating timely inseason management of commercial fisheries (Cousens et al. 1982). Similarly, foot-based/ground surveys are a very economical and long-used method for estimating spawner abundance in small clear streams (Crawford et al. 2007). Having staff on the ground also provides the opportunity to pursue secondary objectives, such as collecting tissue and biological samples, verifying species identification tentatively determined from the air, and assessing changes in spawning habitat that may affect stream productivity. However, both aerial and ground survey methods are susceptible to observer variability and bias (Jones et al. 1998). Consequently, they produce relative abundance indices rather than absolute abundance estimates, particularly when stream-specific streamlife and observer bias correction factors are not known (Bue et al. 1998).

Ground surveys are conducted primarily in Southern and Outer district streams near Homer, and aerial surveys are flown in all four districts supporting commercial salmon fisheries. Thirty-eight salmon stocks in the LCIMA have sustainable escapement goals (SEGs), 20 of which are monitored by aerial survey, 14 by ground survey, and the remainder by either remote video or

weir (Table 1, Figure 2; Otis et al. 2013). All 34 of the streams monitored by aerial or ground survey have escapement goals that were derived by data collected using those methods.

OBJECTIVES

1. Using periodic aerial and/or ground survey methods, estimate the relative abundance of spawners by species for 34 stocks of Pacific salmon in the LCIMA.

Additional tasks to be accomplished:

a. During normally scheduled aerial survey flights to southern Kamishak District, land at Mikfik and Chenik lakes to swap hard drives on their respective remote video systems to facilitate timely inseason escapement review for these stocks.
b. Opportunistically document coho and Chinook salmon in surveyed streams.
c. Opportunistically collect tissue and otolith samples for genetic and thermal mark analysis, respectively.

METHODS

STUDY SITES

There are 34 stocks of Pacific salmon with escapement goals in the LCIMA that are monitored by aerial and/or ground survey (Table 1, Figure 2-4). An additional 55 stocks without escapement goals are also monitored irregularly by aerial survey to identify commercially exploitable populations in years with strong runs. These index stocks are a subset of 221 important salmon producing streams in the LCIMA (Table 2). Ground survey is used to monitor most of the important stocks in Southern and Outer districts near Homer (Figure 2), while aerial survey is used for remote streams in Outer, Eastern, and Kamishak districts (Figures 3-4).

ESCAPEMENT ESTIMATION

Aerial Survey

The Division of Commercial Fisheries flies aerial surveys in LCI using chartered fixed-wing aircraft; either an L19 Cessna Birddog on floats, or a Cessna 206 on floats (Figures 5 and 6). The L19 is the preferred survey aircraft due to the ease of seeing out both sides of the aircraft, as well as its lower speed and better maneuverability, but the 206 is used when greater payload is needed to transport equipment or personnel to remote sites along the survey path (e.g., ground survey crew). Both aircraft are piloted by Jose DeCreeft, owner and operator of Northwind Aviation, who has been a commercial low-level survey pilot for the LCIMA since 1981. Generally one but sometimes two Alaska Department of Fish and Game observers accompany the pilot on survey flights to record relative abundance indices of salmon by species onto a handheld computer. Aerial surveys are generally flown at an altitude of 60-120 m and speeds between 100-130 km/hr, depending on weather, the terrain, and the survey aircraft. Surveys generally begin at saltwater and are flown upstream until either a barrier to fish migration is reached or no more fish are observed. Survey counts are stratified by stream section: bay, intertidal, lagoon, stream, lake. The bay count is not considered escapement. It is an indicator of fish staging to enter the river, but which are still vulnerable to commercial harvest.

In the L19, the observer sits directly behind the pilot providing viewing access out both sides of the aircraft through canted windows. In the 206, the observer sits next to the pilot and the pilot

orients the plane so the stream is on the observer side of the aircraft. When bends in the river or large aggregations of fish are encountered, the pilot often dips one wing while making a constant rate turn to provide the observer with a lengthy, unobstructed view of fish holding beneath the plane. The observer counts by 1's, 10's, 100's, and/or 1,000's depending on density of fish observed. Each individual data entry event includes species observed, number counted, the date and time, as well as the location the fish was seen (e.g., latitude, longitude). Along with fish counts, each record also includes survey conditions for the sky and water on a scale of 1-5 with one being Excellent and 5 Unsatisfactory (Table 3).

Ground Survey

Foot-based/ground surveys are typically conducted by a Fish and Wildlife Technician (FWT) III crew leader and a FWT II assistant. Each one carries a handheld computer running a custom salmon survey application similar to the one used by aerial surveyors. The ground survey team boats or flies out to that day's target index stream(s) and begins surveying from saltwater upstream until they "run out of fish" to count. Ground surveyors walk in or directly beside the stream so they have a clear view of all areas holding fish and generally count fish as they walk past them or the fish "spook" back downstream. Whenever possible, both ground surveyors count fish independently and average their results to determine the days' index for that stream. However, as the season progresses and more fish of different species are present, one surveyor may count pink salmon and the other chum salmon. The crew typically counts live fish while hiking upstream and carcasses on their way back downstream. Surveyors will split up to walk separate channels in braided sections of the river, but they generally stick together for safety and so they both encounter the same fish and conditions while conducting dual independent counts. Upon return to the Homer office, the ground survey crew synthesizes their respective survey files into a single file containing the final escapement indices by species and location for the stream(s) surveyed that day.

Recording Survey Data in the Field

Aerial and ground survey data are recorded in the field using a handheld computer (Juniper Systems Archer) running a customized salmon survey application (Figure 7). This application was written by Glenn Hollowell in a subset of the Java programming language optimized for handheld computers by Totalcross, Incorporated (formerly Superwaba). The Archer is equipped with an internal GPS so the precise location (latitude, longitude) of each observation can be logged, along with the date and time. Detailed instructions for running gpsDataLogger on the Juniper Systems Archer handheld computer can be found in Appendix A.

Post Processing of Aerial Survey Data

Upon returning from an aerial survey, surveyors download their data onto the local area network (LAN) at the Homer Office. These raw data files contain a considerable amount of information (Table 4) and require processing using ArcGIS tools to assign counts to specific sections of the index streams surveyed and to add additional information associated with that stock (e.g., AWC stream code). A series of file folders (e.g., 1_Raw, 2_Edited, 3_Final, 4_GIS) have been created on the O:drive (O:\DCF\Salmon\Escapement*current year* (YYYY)\Aerial\) to store copies of the survey files as they are processed from raw data files (Table 4) to final/edited data files containing geo-referenced survey counts by species, stream, and stream section (Table 5). Detailed instructions for importing survey results into ArcGIS in order to perform a spatial join to assign counts to pre-defined sections of each index stream can be found in Appendix B1.

Appendix B2 details how to process the output file from ArcGIS in Excel to create pivot tables to summarize escapement counts by stream, stratified by species and stream section. Once these data have been stratified, survey results for each stream can be entered into the appropriate AUC table on Excel spreadsheets archived on the Homer LAN (e.g., Table 6). Finally, the tracklog documenting the flight path the surveyors used to fly each stream is archived on the Homer LAN at: O:\DCF\Salmon\Escapement\2016\Aerial\4_GIS\7_Tracklogs.

Post Processing of Ground Survey Data

Upon returning from a ground survey, surveyors download their data onto the local area network (LAN) at the Homer Office. These raw data files contain fish counts by species, stream, stream section (intertidal or stream), and live/dead status, along with the date/time and latitude/longitude for each observation. A series of file folders (e.g., 1_RAW, 2_Edited, 3_Final, 4_GIS) have been created on the O:drive (O:\DCF\Salmon\Escapement\2016\Ground\) to store copies of the ground survey files as they are processed from individual raw data files (one for each surveyor) to final/edited data files containing the combined survey counts from each surveyor. Once these data have been finalized, survey results for each stream can be entered into the appropriate AUC table on Excel spreadsheets (e.g., 2014_In-Season_Ground_Pink_AUC.xls) archived on the Homer LAN in a folder named: O:\DCF\Salmon\Escapement\2016\Inseason_AUC\Ground\ (e.g., Table 6). Finally, the tracklog documenting the path the surveyors used to walk the stream is archived on the Homer LAN at: O:\DCF\Salmon\Escapement\2016\Ground\4_GIS\Tracklogs.

Calculating Final Escapement Indices

The peak survey count is used to represent the final escapement index for sockeye salmon. For pink and chum salmon, we used the trapezoidal approximation to estimate the area-under-the-curve (AUC):

$$(1)\ AUC = \sum_{i=2}^{n}(t_i - t_{i-1})\frac{(x_i + x_{i-1})}{2}$$

where t_i is the survey date and x_i is the number of salmon counted on the *i*th survey (English et al. 1992, Bue et al. 1998, Hilborn et al. 1999). When the number of fish counted on the first or last survey is not zero, we used methods described by Bue et al. (1998) to estimate the area-under-the-curve prior to the first survey (AUC_{first}) when the first survey count was not zero:

$$(2)\ AUC_{first} = \frac{x_1 s}{2}$$

where *s* is stream life. Since we do not have the means to estimate stream life annually for individual index streams, we have historically used 17.5 d as the long-term average stream life for pink salmon in Lower Cook Inlet (Davis and Valentine 1970, Otis and Dickson 2003). When the last survey count was not zero, we estimated the area-under-the-curve after the last survey (AUC_{last}) as:

$$(3)\ AUC_{last} = \frac{x_n s}{2}$$

After adding these first and last modifications (2) and (3), we have

(4) $AUC_{total} = AUC_{first} + AUC + AUC_{last}$

We estimated total-season escapement (*E*) by

(5) $\hat{E} = \frac{AUC_{total}}{sv}$

where *v* is an estimate of observer efficiency (Bue et al. 1998). Unlike Bue et al. (1998), we do not have the means to empirically estimate observer efficiency, so we set *v* at 1.

The above AUC calculations are currently done in an Excel-based spreadsheet that is updated throughout the spawning run so it can be used for inseason management (Table 6).

ADDITIONAL GUIDELINES AND PROCEDURES

Safety

Employees conducting aerial and ground surveys shall adhere to standard operating procedures (SOP) listed in relevant chapters/sections of Alaska Department of Fish and Game's SOP manual, including but not limited to Chapter 3, Section 700 (General Safety Policies/Procedures), to be found online at: http://intra.dfg.alaska.local/QRHome/Admin/QRAsops.html. Aerial and ground survey crews shall maintain current First Aid/CPR certifications. New ground survey crew members shall participate in a bear/firearms safety class prior to going afield or carrying a firearm. Experienced ground survey crew members shall attend periodic bear/firearms safety refresher training. New ground survey crew members shall be trained in safe boat operation by the Project Leader or ground survey crew leader prior to being allowed to take command of motorized watercraft. Aerial and ground survey crews are encouraged to take Underwater Egress Training when available to become knowledgeable and proficient in escaping aircraft that have crash landed in water. Aerial and ground survey crews shall always carry emergency communications equipment capable of functioning effectively from the remote locations they're working (e.g., cell phone, VHF radio, satellite phone, or an emergency satellite beacon/texting device such as DeLorme inReach).

Maintenance

The ground survey crew uses a variety of equipment and operates various watercraft (e.g., 22' Boston Whalers powered by twin outboard motors; 10' inflatable raft powered by oars and/or 4 HP outboard motor) to access index streams and conduct surveys. Hence, they are responsible for all in-season and post-season maintenance required to keep state equipment in good, serviceable condition. This includes but is not limited to all highway vehicles, boats, trailers, outboard motors, radios, satellite phones/messaging devices, handheld computers, waders, boots, shotguns, and other miscellaneous equipment.

Compliance with Alaska Department of Fish and Game Regulations

All employees are responsible for complying with local subsistence, sport fishing, and hunting regulations. Copies of State and Federal regulations will be available in the Homer office and should be carried while conducting field work where the public is likely to be encountered. Violations will be recorded on employee evaluations and may be cause for immediate dismissal.

Violations

If a fishing violation is observed, all information pertaining to the violation should be recorded immediately and retained by the employee. The project leader must be notified. If you have a camera, record as much as possible.

The use of the five Ws can aid in obtaining sufficient information pertaining to a violation.

1. What is the violation?
2. When did the violation take place?
3. Where did the violation occur?
4. Who is in violation and who are the witnesses?
5. Why was the violation committed?

If the violator refuses to cooperate with an employee without enforcement authority, no action should be taken, other than to relay all information and evidence collected to the Project Leader, who will contact the appropriate law enforcement authorities.

Emergencies

In the event of a medical emergency, administer first aid to stabilize the situation. If an injury is life threatening, immediately call for emergency response using a device appropriate for the remote survey location (e.g., satellite phone, inReach satellite messenger, VHF radio). If using a cell or satellite phone, call 911 or notify the US Coast Guard at 800-478-5555. The US Coast Guard can also be reached on SSB radio frequency 4.125 MHz or on VHF channel 16.

When contacting the U.S. Coast Guard, have the following information ready to pass along:

- Specific location of the emergency (latitude, longitude, if available),
- Name and phone number of supervisor,
- General nature of medical emergency,
- Number of patients,
- Specific information regarding the patient (name, age, primary complaint, and vital signs),
- Your assessment and treatment,
- Wind and weather conditions, and
- Other information pertinent to a possible medical evacuation.

SCHEDULE AND DELIVERABLES

1. Begin flying aerial surveys targeting early run sockeye salmon stocks.
   Target date: On or around May 20.

2. Begin walking stream surveys on Southern and Outer District index rivers supporting chum and pink salmon.
   Target date: On or around July 7.
3. Periodically estimate the relative abundance of salmon by species throughout their respective spawning runs for 34 salmon stocks in Lower Cook Inlet.
   Target date(s): May 20- September 15.
4. Use periodic survey counts to adjust time and area fishery openings/closures to assure the final escapement index falls within the escapement goal range for stocks targeted by commercial fisheries.
   Target date: May 20-September 15.
5. Using the current year's periodic survey counts and the area-under-the-curve method, calculate a final escapement index for all streams monitored by aerial/ground survey.
   Target date(s): October 1- November 15.
6. Publish aerial/ground survey results and final escapement indices in the LCI Annual Management Report (AMR) and the statewide escapement goal report
   Target date(s): January 1-March 31.

RESPONSIBILITIES

The Project Biologists, Ted Otis and Glenn Hollowell, will be responsible for project supervision as follows: the Area Management Biologist (AMB), Glenn Hollowell, will be responsible for flying aerial surveys, training the Asst. AMB to fly surveys, supervising the ground survey team, training the ground survey team, and providing raw data files downloaded from the aerial survey computer(s) to Ted Otis, the Area Research Biologist (ARB). The ground survey crew, Sigfus Sigurdsson (FWT III Crew Leader) and Patrick Houlihan (FWT II Assistant) are responsible for coordinating with the AMB to prioritize their ground survey schedule, coordinating with the air charter service for transportation, planning and conducting stream surveys in a safe and efficient manner, and downloading survey results from their handheld computers onto the Homer server. The ARB, Ted Otis, will be responsible for assisting with aerial and ground surveys when necessary, compiling, processing, and managing escapement data received from the AMB and ground survey crew in a timely manner so it can be used for inseason management, calculating final escapement indices for all streams surveyed by aerial/ground survey, and assuring that survey results are published in the LCI AMR and the statewide escapement goal report.

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TABLES

Table 1.–Sustainable escapement goals (SEG) for 12 chum, 18 pink, and 8 sockeye salmon stocks in Lower Cook Inlet, Alaska, year the goal was adopted, and the method(s) used to monitor stocks.

Species/Stock	Goal Type	Year Adopted	Escapement Goal Range			Monitoring Method			
			Lower	Mid	Upper	Aerial	Ground	Video	Weir
Chum Salmon (12)									
Port Graham River[1]	SEG	2001	1,450	3,125	4,800		x		
Dogfish Lagoon Creeks[1]	SEG	2001	3,350	6,250	9,150	x	x		
Rocky River[1]	SEG	2001	1,200	3,300	5,400	x			
Port Dick Creek[1]	SEG	2001	1,900	3,175	4,450	x	x		
Island Creek[1]	SEG	2001	6,400	11,000	15,600		x		
Big Kamishak River[1]	SEG	2001	9,350	16,675	24,000	x			
Little Kamishak River[1]	SEG	2001	6,550	15,175	23,800	x			
McNeil River[2]	SEG	2007	24,000	36,000	48,000	x			
Bruin River[1]	SEG	2001	6,000	8,125	10,250	x			
Ursus Lagoon Creeks[1]	SEG	2001	6,050	7,950	9,850	x			
Cottonwood Creek[1]	SEG	2001	5,750	8,875	12,000	x			
Iniskin River[1]	SEG	2001	7,850	10,775	13,700	x			
Pink Salmon (18)									
Humpy Creek[1]	SEG	2001	21,650	53,600	85,550		x		
China Poot Creek[1]	SEG	2001	2,900	5,550	8,200		x		
Tutka Creek[1]	SEG	2001	6,500	11,750	17,000		x		
Barabara Creek[1]	SEG	2001	1,900	5,425	8,950		x		
Seldovia River[1]	SEG	2001	19,050	29,000	38,950		x		
Port Graham River[1]	SEG	2001	7,700	13,775	19,850		x		
Dogfish Lagoon Creeks[4]	SEG	2013	1,200	4,800	8,400	x	x		
Port Chatham Creeks[1]	SEG	2001	7,800	14,400	21,000		x		
Windy Bay Right Creek[1]	SEG	2001	3,350	7,150	10,950	x			
Windy Bay Left Creek[1]	SEG	2001	3,650	16,800	29,950	x			
Rocky River[1]	SEG	2001	9,350	31,800	54,250	x			
Port Dick Creek[1]	SEG	2001	18,550	38,425	58,300	x	x		
Island Creek[1]	SEG	2001	7,200	17,750	28,300	x	x		
South Nuka Island Creek[1]	SEG	2001	2,700	8,475	14,250	x			
Desire Lake[1]	SEG	2001	1,900	11,050	20,200	x			
Bruin River[1]	SEG	2001	18,650	87,200	155,750	x			
Sunday Creek[1]	SEG	2001	4,850	16,850	28,850	x			
Brown's Peak Creek[1]	SEG	2001	2,450	10,625	18,800	x			
Sockeye Salmon (8)									
English Bay Lakes[1]	SEG	2001	6,000	9,750	13,500				x
Delight Lake[3]	SEG	2010	7,550	12,600	17,650	x			
Desire Lake[1]	SEG	2001	8,800	12,000	15,200	x			
Bear Lake[1]	SEG	2001	700	4,500	8,300				x
Aialik Lake[1]	SEG	2001	3,700	5,850	8,000	x			
Mikfik Lake[4]	SEG	2013	3,400	8,200	13,000			x	
Chenik Lake[3]	SEG	2010	3,500	8,750	14,000			x	
Amakdedori Creek[1]	SEG	2001	1,250	1,925	2,600	x			

Source: [1]Otis 2001; [2]Otis et al. 2007; [3]Otis et al. 2010; [4]Otis et al. 2013

Table 2.–List of 221 salmon-producing streams in the Lower Cook Inlet Management Area.

Name (or general location)	District	LATITUDE	LONGITUDE
1.) Bear Point Creek	Eastern District	59° 52.53' N.	149° 35.12' W.
2.) Bulldog Creek	Eastern District	59° 54.06' N.	149° 34.03' W.
3.) Callisto Head Creek	Eastern District	59° 55.9' N.	149° 29.02' W.
4.) Caines Head Creek	Eastern District	59° 58.49' N.	149° 25.89' W.
5.) Resurrection River #1	Eastern District	60° 07.43' N.	149° 24.34' W.
6.) Resurrection River #2	Eastern District	60° 07.55' N.	149° 23.72' W.
7.) Resurrection River #3	Eastern District	60° 07.65' N.	149° 22.99' W.
8.) Resurrection River #4	Eastern District	60° 07.35' N.	149° 22.37' W.
9.) Tonsina Creek	Eastern District	60° 02.76' N.	149° 26.70' W.
10.) Godwin Glacier Ck.	Eastern District	60° 05.82' N.	149° 21.86' W.
11.) Fourth of July Creek	Eastern District	60° 04.76' N.	149° 20.74' W.
12.) Likes Creek	Eastern District	60° 00.83' N.	149° 17.25' W.
13.) Humpy Cove	Eastern District	59° 57.72' N.	149° 17.17' W.
14.) Yalik Creek	Outer District	59° 25.47' N.	150° 43.86' W.
15.) South Petrov River	Outer District	59° 21.19' N.	150° 50.82' W.
16.) Tonsina Bay- East Creek	Outer District	59° 18.68' N.	150° 56.39' W.
17.) Tonsina Bay- West Creek	Outer District	59° 18.58' N.	150° 57.30' W.
18.) Nuka Passage Creek	Outer District	59° 16.61' N.	150° 53.79' W.
19.) South Nuka Creek	Outer District	59° 18.19' N.	150° 42.62' W.
20.) Berger Bay-South Creek	Outer District	59° 19.92' N.	150° 44.20' W.
21.) Berger Bay-North Creek	Outer District	59° 20.66' N.	150° 43.93' W.
22.) Mikes Bay- South Creek	Outer District	59° 21.38' N.	150° 42.76' W.
23.) Mikes Bay- North Creek	Outer District	59° 21.54' N.	150° 42.39' W.
24.) No Name Bay- South Creek	Outer District	59° 22.39' N.	150° 41.77' W.
25.) No Name Bay- North Creek	Outer District	59° 22.49' N.	150° 41.56' W.
26.) Home Cove- East Creek	Outer District	59° 23.69' N.	150° 41.11' W.
27.) Home Cove- West Creek	Outer District	59° 23.98' N.	150° 41.86' W.
28.) Yalik Peninsula Creek	Outer District	59° 25.39' N.	150° 39.27' W.
29.) Nuka Island- Northwest Creek #1	Outer District	59° 23.53' N.	150° 37.73' W.
30.) Nuka Island- Northwest Creek #2	Outer District	59° 23.47' N.	150° 37.89' W.
31.) Ariadne Creek	Outer District	59° 28.41' N.	150° 30.32' W.
32.) Babcock Creek	Outer District	59° 31.67' N.	150° 28.63' W.
33.) Quartz Creek	Outer District	59° 31.26' N.	150° 31.20' W.
34.) Palisade Creek South	Outer District	59° 32.84' N.	150° 32.44' W.
35.) Palisade Creek North	Outer District	59° 33.81' N.	150° 31.34' W.
36.) Pilot Harbor Creek	Outer District	59° 34.83' N.	150° 29.39' W.
37.) Split Glacier Creek East	Outer District	59° 36.00' N.	150° 30.60' W.
38.) Split Glacier Creek West	Outer District	59° 36.38' N.	150° 31.17' W.
39.) Storm Mountain Creek East	Outer District	59° 35.88' N.	150° 33.08' W.
40.) Storm Mountain Creek West	Outer District	59° 35.78' N.	150° 33.67' W.
41.) Nuka River	Outer District	59° 33.39' N.	150° 38.48' W.
42.) Nuka Delta	Outer District	59° 33.01' N.	150° 39.30' W.
43.) Ferrum Creek	Outer District	59° 32.82' N.	150° 39.65' W.
44.) Shelter Cove Creek	Outer District	59° 31.34' N.	150° 38.46' W.
45.) Yalik Bay Head End Creek	Outer District	59° 28.26' N.	150° 39.64' W.
46.) Yalik Bay South Shore Creek	Outer District	59° 27.67' N.	150° 38.63' W.
47.) Yalik Point Creek	Outer District	59° 26.92' N.	150° 35.48' W.
48.) Delight Lake Creek	Outer District	59° 32.03' N.	150° 20.45' W.
49.) Desire Lake Creek	Outer District	59° 34.88' N.	150° 17.38' W.
50.) James Lagoon Entrance Creek	Outer District	59° 33.58' N.	150° 24.82' W.
51.) James Lagoon Creek #1	Outer District	59° 34.83' N.	150° 25.47' W.
52.) James Lagoon Creek #2	Outer District	59° 34.98' N.	150° 25.35' W.

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Table 2. Page 2 of 4.

Name (or general location)	District	LATITUDE	LONGITUDE
53.) James Lagoon Creek #3	Outer District	59° 35.02' N.	150° 25.09' W.
54.) James Lagoon Creek #4	Outer District	59° 35.04' N.	150° 24.76' W.
55.) James Lagoon Creek #5	Outer District	59° 35.15' N.	150° 24.68' W.
56.) James Lagoon Creek #6	Outer District	59° 35.08' N.	150° 24.31' W.
57.) James Lagoon Creek #7	Outer District	59° 34.91' N.	150° 24.42' W.
58.) Dinglestadt Glacier Creek	Outer District	59° 37.49' N.	150° 19.49' W.
59.) East Arm Creek	Outer District	59° 38.01' N.	150° 15.96' W.
60.) Sandy Bay- East Creek	Outer District	59° 39.70' N.	149° 60.00' W.
61.) Sandy Bay- Head End	Outer District	59° 39.86' N.	150° 00.53' W.
62.) Cup Cove Creek	Outer District	59° 40.02' N.	149° 56.94' W.
63.) Harris Bay Creek	Outer District	59° 42.50' N.	149° 55.39' W.
64.) Northwestern Lagoon #1	Outer District	59° 43.08' N.	149° 55.71' W.
65.) Northwestern Lagoon #2	Outer District	59° 43.23' N.	149° 57.17' W.
66.) Northwestern Lagoon #3	Outer District	59° 42.94' N.	149° 57.79' W.
67.) Boulder Creek	Outer District	59° 46.23' N.	149° 56.09' W.
68.) Northwestern Fjord Creek #3	Outer District	59° 46.27' N.	149° 54.94' W.
69.) Northwestern Fjord Creek #2	Outer District	59° 46.17' N.	149° 54.49' W.
70.) Paguna Arm- Right Side Creek	Outer District	59° 40.77' N.	150° 06.36' W.
71.) Northwestern Lagoon #4	Outer District	59° 45.41' N.	149° 53.55' W.
72.) Paguna Arm- Head End Creek #3	Outer District	59° 41.69' N.	150° 07.94' W.
73.) Paguna Arm- Head End Creek #2	Outer District	59° 41.64' N.	150° 08.21' W.
74.) Crescent Beach Pond	Outer District	59° 44.33' N.	149° 50.80' W.
75.) Paguna Arm- Head End Creek #1	Outer District	59° 41.51' N.	150° 08.40' W.
76.) Taroka Bay- Head End Creek #2	Outer District	59° 37.70' N.	150° 08.23' W.
77.) Taroka Bay- Head End Creek #1	Outer District	59° 37.22' N.	150° 09.83' W.
78.) Taroka Bay- South Side Creek	Outer District	59° 36.69' N.	150° 09.21' W.
79.) Cloudy Creek	Outer District	59° 35.31' N.	150° 06.83' W.
80.) Thunder Bay #3	Outer District	59° 34.77' N.	150° 10.52' W.
81.) Thunder Bay #2	Outer District	59° 35.07' N.	150° 10.95' W.
82.) Thunder Bay #1	Outer District	59° 34.39' N.	150° 12.77' W.
83.) Aialik Bay Creek #10	Eastern District	59° 51.22' N.	149° 39.51' W.
84.) Aialik Bay Creek #9	Eastern District	59° 53.34' N.	149° 39.29' W.
85.) Aialik Bay Creek #8	Eastern District	59° 53.96' N.	149° 38.42' W.
86.) Aialik Bay Creek #7	Eastern District	59° 54.79' N.	149° 39.26' W.
87.) Aialik Bay Creek #6	Eastern District	59° 55.54' N.	149° 39.92' W.
88.) Aialik Bay Creek #5	Eastern District	59° 56.14' N.	149° 40.27' W.
89.) Aialik Bay Creek #4	Eastern District	59° 56.86' N.	149° 41.03' W.
90.) Aialik Bay Creek #3	Eastern District	59° 56.93' N.	149° 41.07' W.
91.) Aialik Bay Creek #2	Eastern District	59° 56.97' N.	149° 41.17' W.
92.) Aialik Bay Creek #1	Eastern District	59° 57.26' N.	149° 43.03' W.
93.) Aialik Lagoon Entrance	Eastern District	59° 52.71' N.	149° 44.46' W.
94.) Aialik Lake Creek	Eastern District	59° 53.85' N.	149° 44.21' W
95.) Holgate South Creek	Eastern District	59° 50.05' N.	149° 46.23' W.
96.) Holgate North Creek	Eastern District	59° 50.29' N.	149° 46.49' W.
97.) Quicksand Creek	Eastern District	59° 47.13' N.	149° 47.39' W.
98.) Cape Fairfield Creek	Eastern District	59° 56.39' N.	148° 52.84' W.
99.) Whidbey Creek	Eastern District	59° 58.58' N.	148° 56.88' W.
100.) Horsehead Lagoon Entrance	Eastern District	59° 58.01' N.	149° 01.90' W
101.) Horsehead Creek	Eastern District	59° 58.96' N.	149° 01.51' W.
102.) Day Harbor Creek #1	Eastern District	60° 01.93' N.	149° 09.64' W.
103.) Day Harbor Creek #2	Eastern District	60° 02.74' N.	149° 07.51' W.
104.) Day Harbor Creek #3	Eastern District	60° 03.25' N.	149° 03.92' W.

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Table 2.–Page 2 of 4.

Name (or general location)	District	LATITUDE	LONGITUDE
105.) Day Harbor Creek #4	Eastern District	60° 02.59' N.	149° 02.01' W.
106.) unnamed creek 2 mi south of Point Naskowhak	Southern District	59° 26.27' N.	151° 48.00' W.
107.) Seldovia River, main channel	Southern District	59° 23.41' N.	151° 41.11' W
108.) Seldovia River, side stem	Southern District	59° 23.88' N.	151° 40.84' W
109.) Seldovia Slough	Southern District	59° 26.06' N.	151° 42.78' W.
110.) Fish Creek	Southern District	59° 26.36' N.	151° 42.36' W.
111.) Barabara Creek	Southern District	59° 29.00' N.	151° 39.18' W.
112.) Beluga Sough	Southern District	59° 38.09' N.	151° 32.05' W.
113.) Fritz Creek	Southern District	59° 40.92' N.	151° 22.32' W.
114.) Humpy Creek	Southern District	59° 39.59' N.	151° 08.81' W.
115.) Mallard Bay Creek	Southern District	59° 40.90' N.	151° 07.04' W.
116.) Aurora Lagoon Creek	Southern District	59° 41.63' N.	151° 05.98' W.
117.) Martin River	Southern District	59° 45.76' N.	151° 00.31' W.
118.) Battle Creek	Southern District	59° 45.81' N.	150° 58.84' W.
119.) Wosnesenski River	Southern District	59° 32.49' N.	151° 22.43' W.
120.) Stonehocker Creek	Southern District	59° 33.23' N.	151° 19.01' W.
121.) Silver Creek	Southern District	59° 33.09' N.	151° 18.21' W.
122.) China Poot Creek	Southern District	59° 32.83' N.	151° 14.41' W
123.) Halibut Cove Creek	Southern District	59° 35.40' N.	151° 13.89' W.
124.) HCL Ranger Station Estuary Creek	Southern District	59° 33.69' N.	151° 11.87' W.
125.) Jakolof Creek	Southern District	59° 27.01' N.	151° 29.11' W.
126.) Tutka Lagoon Creek	Southern District	59° 26.29' N.	151° 25.04' W.
127.) Tutka Lagoon mouth	Southern District	59° 26.34' N.	151° 24.42' W
128.) Tutka Head End Creek	Southern District	59° 26.61' N.	151° 16.80' W
129.) Sadie Cove Head End Right Creek	Southern District	59° 27.55' N.	151° 21.04' W.
130.) Sadie Cove Head End Left Creek	Southern District	59° 27.59' N.	151° 20.71' W.
131.) Tulcan Creek	Southern District	59° 20.46' N.	151° 48.88' W.
132.) Port Graham River	Southern District	59° 19.17' N.	151° 46.47' W.
133.) Port Graham Head End Creek #2	Southern District	59° 19.42' N.	151° 45.58' W.
134.) Port Graham Head End Creek #1	Southern District	59° 20.10' N.	151° 46.37' W.
135.) Mud Lagoon Creek	Southern District	59° 22.36' N.	151° 51.13' W.
136.) Johnson Lagoon entrance	Southern District	59° 22.41' N.	151° 51.89' W
137.) Pogibshi Creek	Southern District	59° 22.63' N.	151° 53.23' W
138.) Magnet Rock Creek #2	Southern District	59° 16.88' N.	151° 58.61' W.
139.) Magnet Rock Creek #1	Southern District	59° 17.71' N.	151° 58.97' W.
140.) English Bay River	Southern District	59° 20.90' N.	151° 55.09' W.
141.) Dogfish Bay Head End Creek	Outer District	59° 14.28' N.	151° 48.81' W
142.) Dogfish Bay Left Side Creek	Outer District	59° 14.74' N.	151° 51.58' W.
143.) Perl Island Creek	Outer District	59° 07.35' N.	151° 42.83' W.
144.) Chugach Passage Creek	Outer District	59° 09.84' N.	151° 41.86' W
145.) Port Chatham Right Arm Creek #2	Outer District	59° 12.18' N.	151° 42.15' W.
146.) Port Chatham Right Arm Creek #1	Outer District	59° 12.24' N.	151° 42.13' W.
147.) Port Chatham Left Arm Creek #2	Outer District	59° 13.25' N.	151° 42.10' W.
148.) Port Chatham Left Arm Creek #1	Outer District	59° 13.37' N.	151° 42.08' W
149.) Chrome Bay Creek	Outer District	59° 12.87' N.	151° 48.69' W.
150.) Elizabeth Island Creek	Outer District	59° 09.19' N.	151° 48.16' W.
151.) Chugach Bay Right Arm Creek	Outer District	59° 12.43' N.	151° 33.86' W.
152.) Chugach Bay Left Arm Creek	Outer District	59° 11.06' N.	151° 37.91' W.
153.) One-Haul Bay (Touglaalek Bay) Stream #3	Outer District	59° 13.21' N.	151° 12.17' W.
154.) One-Haul Bay (Touglaalek Bay) Stream #2	Outer District	59° 13.34' N.	151° 12.99' W.
155.) One-Haul Bay (Touglaalek Bay) Stream #1	Outer District	59° 13.37' N.	151° 13.78' W.
156.) Bootlegger Cove (Qikutulig Bay)	Outer District	59° 14.65' N.	151° 18.03' W.

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Table 2.–Page 3 of 4.

Name (or general location)	District	LATITUDE	LONGITUDE
157.) Rocky Bay #5	Outer District	59° 16.04' N.	151° 23.50' W.
158.) Outer Rocky Bay Creek	Outer District	59° 14.36' N.	151° 22.02' W
159.) Rocky Bay #4	Outer District	59° 16.21' N.	151° 23.62' W.
160.) Rocky Bay #3	Outer District	59° 16.22' N.	151° 23.80' W.
161.) Rocky Bay #2	Outer District	59° 16.82' N.	151° 24.36' W.
162.) Rocky Bay #1	Outer District	59° 16.95' N.	151° 24.37' W.
163.) Picnic Harbor Mouth stream	Outer District	59° 15.52' N.	151° 24.85' W.
164.) Picnic Harbor Head End stream	Outer District	59° 16.35' N.	151° 26.48' W.
165.) Scurvy Creek	Outer District	59° 14.85' N.	151° 27.05' W.
166.) Windy Bay #10	Outer District	59° 13.95' N.	151° 29.70' W.
167.) Windy Bay #9	Outer District	59° 13.79' N.	151° 31.15' W.
168.) Windy Bay #8	Outer District	59° 14.06' N.	151° 33.69' W.
169.) Windy Bay #7	Outer District	59° 13.83' N.	151° 34.54' W.
170.) Windy Bay #6	Outer District	59° 13.57' N.	151° 34.71' W
171.) Windy Bay #5	Outer District	59° 13.57' N.	151° 34.38' W
172.) Windy Bay #4	Outer District	59° 13.47' N.	151° 33.70' W
173.) Windy Bay #3	Outer District	59° 13.44' N.	151° 33.66' W.
174.) Windy Bay #2	Outer District	59° 13.50' N.	151° 33.16' W.
175.) Windy Bay #1	Outer District	59° 13.50' N.	151° 33.07' W.
176.) Tacoma Cove Creek	Outer District	59° 15.35' N.	150° 58.46' W.
177.) Sunday Harbor Creek	Outer District	59° 16.66' N.	150° 58.05' W.
178.) Island Creek	Outer District	59° 17.58' N.	151° 08.74' W.
179.) Middle Creek Right	Outer District	59° 18.47' N.	151° 12.31' W.
180.) Middle Creek Left	Outer District	59° 18.57' N.	151° 12.78' W.
181.) Slide Creek	Outer District	59° 18.77' N.	151° 18.23' W.
182.) Port Dick Head End Creek	Outer District	59° 18.56' N.	151° 18.99' W.
183.) Taylor Bay- Right Creek	Outer District	59° 18.69' N.	151° 01.20' W.
184.) Taylor Bay- Middle Creek	Outer District	59° 19.39' N.	151° 01.30' W.
185.) Taylor Bay- Left Creek	Outer District	59° 19.16' N.	151° 02.43' W.
186.) Little Kamishak River	Kamishak District	59° 01.46' N.	154° 10.50' W
187.) Big Kamishak River	Kamishak District	59° 01.50' N.	154° 09.47' W.
188.) Akumwarvik no name creek #1	Kamishak District	59° 04.46' N.	154° 00.94' W.
189.) Akumwarvik no name creek #2	Kamishak District	59° 03.59' N.	153° 52.90' W.
190.) Douglas River	Kamishak District	59° 03.61' N.	153° 45.79' W.
191.) Paint River	Kamishak District	59° 09.50' N.	154° 14.54' W
192.) McNeil River	Kamishak District	59° 07.20' N.	154° 15.69' W.
193.) Mikfik Creek	Kamishak District	59° 06.63' N.	154° 15.25' W.
194.) Chenik River	Kamishak District	59° 13.00' N.	154° 08.64' W.
195.) Amakdedori Creek	Kamishak District	59° 16.65' N.	154° 07.90' W.
196.) Bruin Bay River	Kamishak District	59° 22.52' N.	154° 07.88' W.
197.) Fortification Bluff- west end creek	Kamishak District	59° 25.22' N.	153° 50.95' W.
198.) Fortification Bluff- east end creek	Kamishak District	59° 25.78' N.	153° 46.41' W.
199.) Sunday Creek	Kamishak District	59° 26.78' N.	153° 44.53' W.
200.) Ursus Cove- outer creek	Kamishak District	59° 31.47' N.	153° 46.88' W.
201.) Ursus Cove- inner creek	Kamishak District	59° 31.44' N.	153° 47.34' W.
202.) Ursus Lagoon Creek	Kamishak District	59° 32.51' N.	153° 52.09' W.
203.) Ursus Lagoon Right Hand Creek	Kamishak District	59° 33.01' N.	153° 49.36' W.
204.) Brown's Peak Creek	Kamishak District	59° 32.91' N.	153° 43.86' W.
205.) Ursus Head Creek	Kamishak District	59° 33.12' N.	153° 37.85' W.
206.) Cottonwood Bay- left creek	Kamishak District	59° 37.31' N.	153° 40.78' W.
207.) Cottonwood Creek	Kamishak District	59° 38.06' N.	153° 42.74' W.
208.) Black Reef Creek	Kamishak District	59° 38.16' N.	153° 31.85' W.

-continued-

Table 2.–Page 4 of 4.

Name (or general location)	District	LATITUDE	LONGITUDE
209.) Iniskin Left Creek #1	Kamishak District	59° 44.07' N.	153° 26.96' W.
210.) Iniskin Left Creek #2	Kamishak District	59° 44.24' N.	153° 27.17' W.
211.) Sugarloaf Creek	Kamishak District	59° 46.34' N.	153° 27.33' W.
212.) Iniskin River	Kamishak District	59° 47.18' N.	153° 27.08' W.
213.) Portage Creek	Kamishak District	59° 44.04' N.	153° 20.96' W.
214.) Right Arm Creek	Kamishak District	59° 43.68' N.	153° 20.63' W.
215.) Bowser Creek	Kamishak District	59° 40.02' N.	153° 19.27' W.
216.) Brown Creek	Kamishak District	59° 41.02' N.	153° 8.04' W.
217.) Douglas River	Kamishak District	58° 59.87' N.	153° 35.53' W.
218.) Douglas Beach River	Kamishak District	58° 59.80' N.	153° 35.23' W
219.) Spotted Glacier	Kamishak District	58° 59.72' N.	153° 28.7' W.
220.) No name- north of Sukhoi Bay	Kamishak District	58° 55.7' N.	153° 22.38' W.
221.) Sukhoi Bay	Kamishak District	58° 53.26' N.	153° 19.59' W.

Table 3.–Description of the rating scale used to characterize aerial survey conditions when monitoring salmon escapements to index streams in Lower Cook Inlet.

Rating	Descriptor	General Conditions	Water Conditions
1	Excellent	calm, excellent lighting, no shadows	no turbidity; very easy to see fish
2	Good	light wind, uneven lighting,	low or no turbidity; easy to see fish
3	Fair	moderate wind and/or surface glare, shadows	moderate turbulence or turbidity; still relatively easy to see fish
4	Poor	high winds and/or surface glare, poor light	moderate-high turbulence or turbidity; difficult to see fish
5	Unsatisfactory	wind, glare, and/or lighting unsatisfactory	turbulence or turbidity too high to see fish reliably

Table 4.–Example of raw data output from the handheld computer application used to collect information during ground and aerial surveys to monitor salmon escapement in Lower Cook Inlet, Alaska.

Time_stamp	Species	Count	Location	Samplername	Latitude	NS	Longitude	EW	Sky	Water	Overall	Live	SurveyType	RowId
20140708050936	Chum	10	McNeil-below falls	Glenn Hollowell	59.121	N	-154.252	W	3	3	3	Live	dual	2
20140708050948	Chum	10	McNeil-below falls	Glenn Hollowell	59.121	N	-154.246	W	3	3	3	Live	dual	3
20140708050953	Chum	10	McNeil-below falls	Glenn Hollowell	59.122	N	-154.247	W	3	3	3	Live	dual	4
20140708050953	Chum	10	McNeil-below falls	Glenn Hollowell	59.122	N	-154.247	W	3	3	3	Live	dual	5
20140708050954	Chum	10	McNeil-below falls	Glenn Hollowell	59.122	N	-154.247	W	3	3	3	Live	dual	6
20140708050954	Chum	10	McNeil-below falls	Glenn Hollowell	59.122	N	-154.247	W	3	3	3	Live	dual	7
20140708051040	Chum	10	McNeil-below falls	Glenn Hollowell	59.119	N	-154.250	W	3	3	3	Live	dual	8
20140708051059	Chum	100	McNeil-below falls	Glenn Hollowell	59.121	N	-154.260	W	3	3	3	Live	dual	9
20140708051115	Chum	10	McNeil-below falls	Glenn Hollowell	59.121	N	-154.269	W	3	3	3	Live	dual	10
20140708051116	Chum	100	McNeil-below falls	Glenn Hollowell	59.120	N	-154.271	W	3	3	3	Live	dual	11
20140708051117	Chum	100	McNeil-below falls	Glenn Hollowell	59.120	N	-154.271	W	3	3	3	Live	dual	12
20140708051122	Chum	100	McNeil-below falls	Glenn Hollowell	59.119	N	-154.274	W	3	3	3	Live	dual	13

Table 5.–Example of final edited data file after running the raw handheld computer output file through the ArcGIS Spatial Join tool to assign survey observations to index streams/stream sections and to append associated information relevant to that stock.

Time_stamp	DATE	Species	Live	Count	Samplernam	Overall	District	Stream	ABR_CF_NAM	STOCK	Section	StreamSect	Sect_Code	Latitude	NS	Longitude	EW	Sky	Water	SurveyType	RowId_	CF_S_Code	AWSC_Code	Dist_SubD	Dist_CF_Cd	Index_Area
20140708050936	7/8/2014	Chum	Live	10	Glenn Hollowell	3	Kamishak	McNeil_Mikfik	McnlMikf	McNeil_Mikfik	Lagoon	McNeil Mikfik Lagoon	3	59.1206	N	-154.252	W	3	3	dual	2	4003	243-20-10035	249-50	249-50-4003	McNeil_Mikfik
20140708050948	7/8/2014	Chum	Live	10	Glenn Hollowell	3	Kamishak	McNeil_Mikfik	McnlMikf	McNeil_Mikfik	Lagoon	McNeil Mikfik Lagoon	3	59.1205	N	-154.246	W	3	3	dual	3	4003	243-20-10035	249-50	249-50-4003	McNeil_Mikfik
20140708050953	7/8/2014	Chum	Live	10	Glenn Hollowell	3	Kamishak	McNeil_Mikfik	McnlMikf	McNeil_Mikfik	Lagoon	McNeil Mikfik Lagoon	3	59.1217	N	-154.247	W	3	3	dual	4	4003	243-20-10035	249-50	249-50-4003	McNeil_Mikfik
20140708050953	7/8/2014	Chum	Live	10	Glenn Hollowell	3	Kamishak	McNeil_Mikfik	McnlMikf	McNeil_Mikfik	Lagoon	McNeil Mikfik Lagoon	3	59.1217	N	-154.247	W	3	3	dual	5	4003	243-20-10035	249-50	249-50-4003	McNeil_Mikfik
20140708050954	7/8/2014	Chum	Live	10	Glenn Hollowell	3	Kamishak	McNeil_Mikfik	McnlMikf	McNeil_Mikfik	Lagoon	McNeil Mikfik Lagoon	3	59.1219	N	-154.247	W	3	3	dual	6	4003	243-20-10035	249-50	249-50-4003	McNeil_Mikfik
20140708050954	7/8/2014	Chum	Live	10	Glenn Hollowell	3	Kamishak	McNeil_Mikfik	McnlMikf	McNeil_Mikfik	Lagoon	McNeil Mikfik Lagoon	3	59.1219	N	-154.247	W	3	3	dual	7	4003	243-20-10035	249-50	249-50-4003	McNeil_Mikfik
20140708051040	7/8/2014	Chum	Live	10	Glenn Hollowell	3	Kamishak	McNeil_Mikfik	McnlMikf	McNeil_Mikfik	Lagoon	McNeil Mikfik Lagoon	3	59.1186	N	-154.250	W	3	3	dual	8	4003	243-20-10035	249-50	249-50-4003	McNeil_Mikfik
20140708051059	7/8/2014	Chum	Live	100	Glenn Hollowell	3	Kamishak	McNeil_Mikfik	McnlMikf	McNeil_Mikfik	Lagoon	McNeil Mikfik Lagoon	3	59.1212	N	-154.260	W	3	3	dual	9	4003	243-20-10035	249-50	249-50-4003	McNeil_Mikfik
20140708051115	7/8/2014	Chum	Live	10	Glenn Hollowell	3	Kamishak	McNeil River	MCNL	McNeil	Intertidal	McNeil River Intertidal	2	59.1207	N	-154.269	W	3	3	dual	10	4380	243-20-10035	249-50	249-50-4380	McNeil_Mikfik
20140708051116	7/8/2014	Chum	Live	100	Glenn Hollowell	3	Kamishak	McNeil River	MCNL	McNeil	Intertidal	McNeil River Intertidal	2	59.1204	N	-154.271	W	3	3	dual	11	4380	243-20-10035	249-50	249-50-4380	McNeil_Mikfik
20140708051117	7/8/2014	Chum	Live	100	Glenn Hollowell	3	Kamishak	McNeil River	MCNL	McNeil	Intertidal	McNeil River Intertidal	2	59.1203	N	-154.271	W	3	3	dual	12	4380	243-20-10035	249-50	249-50-4380	McNeil_Mikfik
20140708051122	7/8/2014	Chum	Live	100	Glenn Hollowell	3	Kamishak	McNeil River	MCNL	McNeil	Intertidal	McNeil River Intertidal	2	59.1194	N	-154.274	W	3	3	dual	13	4380	243-20-10035	249-50	249-50-4380	McNeil_Mikfik

Table 6.–Example of Excel spreadsheet used to document periodic aerial surveys and calculate a final escapement index using the area-under-the-curve (AUC) method.

1	YEAR:	2014	STREAM:	McNeil River		SPECIES:	Chum Salmon		Surv. Meth:	Aerial					Final Esc. Index:	10,544
	CF Code:	4380	AWC Code:	243-20-10035		Stat Area:	249-50		District:	Kamishak					Abbr. Name:	MCNL (Below, Within, or Above)
	SEG (Lo):	24,000	SEG (Mid):	36,000	SEG (Hi):	48,000		Met EG?	NO	Above EG?	NO				EG Status:	BELOW (AUC or Peak Count)
	Avg. SL:	17.5	*Obs Eff:*	1.00	*Total Fish Days:*	184,527	*AUC:*	10,544	*Peak Count:*	7,280	*Avg. Rating:*	1.8			*Index Used:*	AUC

Survey	Survey Date	ti	t_{i-1}	(t_i-t_{i-1})	c_i	c_{i-1}	(c_i+c_{i-1})	fish-days A^b	fish-days Accum. A^b	Escap. Index	Accum. Escap.	Accum. % Escap.	Survey Rating	Bay Count	Escap + Bay	Surveyor(s)	Comments
t_{start}	*eg. 20110701*	6/5/14															Start Date (0 fish)
1	20140605	6/5/14	6/5/14	0	0	0	0	0	0	0	0	0%	1		0	Hollowell	
2	20140611	6/11/14	6/5/14	6	0	0	0	0	0	0	0	0%	1		0	Hollowell	
3	20140618	6/18/14	6/11/14	7	0	0	0	0	0	0	0	0%	2		0	Hollowell	
4	20140624	6/24/14	6/18/14	6	4,513	0	4,513	13,539	13,539	774	774	7%	1	110	4,623	Hollowell	4,300 above falls
5	20140629	6/29/14	6/24/14	5	5,670	4,513	10,183	25,458	38,997	1,455	2,228	21%	2	0	5,670	Hollowell	5,630 above falls
6	20140708	7/8/14	6/29/14	9	2,530	5,670	8,200	36,900	75,897	2,109	4,337	41%	3	0	2,530	Hollowell	2,360 above falls
7	20140714	7/14/14	7/8/14	6	2,122	2,530	4,652	13,956	89,853	797	5,134	49%	1	10	2,132	Hollowell	~600 above falls
8	20140723	7/23/14	7/14/14	9	7,280	2,122	9,402	42,309	132,162	2,418	7,552	72%	3	10	7,290	Hollowell	360 above falls
9	20140728	7/28/14	7/23/14	5	2,410	7,280	9,690	24,225	156,387	1,384	8,936	85%	2		2,410	Hollowell	215 above falls
~~10~~	~~20140820~~	~~8/20/14~~	~~7/28/14~~	~~23~~	~~21~~	~~2,410~~	~~2,431~~	~~27,957~~	~~184,343~~	~~1,598~~	~~10,534~~	~~100%~~	~~2~~		~~21~~	~~Hollowell~~	~~0 above falls No Survey?~~
t_{end}		9/6/14		18				184	184,527	11	10,544	100%					End Date (0 fish)

10	surveys	Survey Season (d):	76	Counts	Accum. Fish Days:	184,527	Cum. Esc.	10,544	
		Avg:	8.5	2,455					
		Min:	0.0	0			Median Escapement:	4,337	
		Max:	23.0	7,280	Avg. Survey Rating:	1.8	50% Escapement:	5,272	
Bay Count (last survey):	0	Harvest on/after last survey:			Escap. Added to last survey:	0	Approx. Peak of Run:	mid July	
Data Source:	O:\DCF\SALMON\ESCAPEMENT\2014\AERIAL\3_FINAL\								

Directions: User inputs values into the white cells with red borders and the contents of the remaining cells are autocalculated.

Notes: Peak count was 7,280 chums on July 23 with most fish observed below the falls. The peak "above-falls" count was 5,670 chums on June 29. This represents the 2nd highest above-the-falls index since 1988. We tend to get better above-falls escapement in years with strong early runs, presumably because the fish are able to migrate through the falls before too many bears have aggregated there to feed. We enjoyed fairly good survey conditions this year. The last survey of the year, flown on 20 August, was not used to since it occurred after August 8, the end of the chum run and a period when growning pink salmon numbers in McNeil River make it difficult distinquish between the two species.

FIGURES

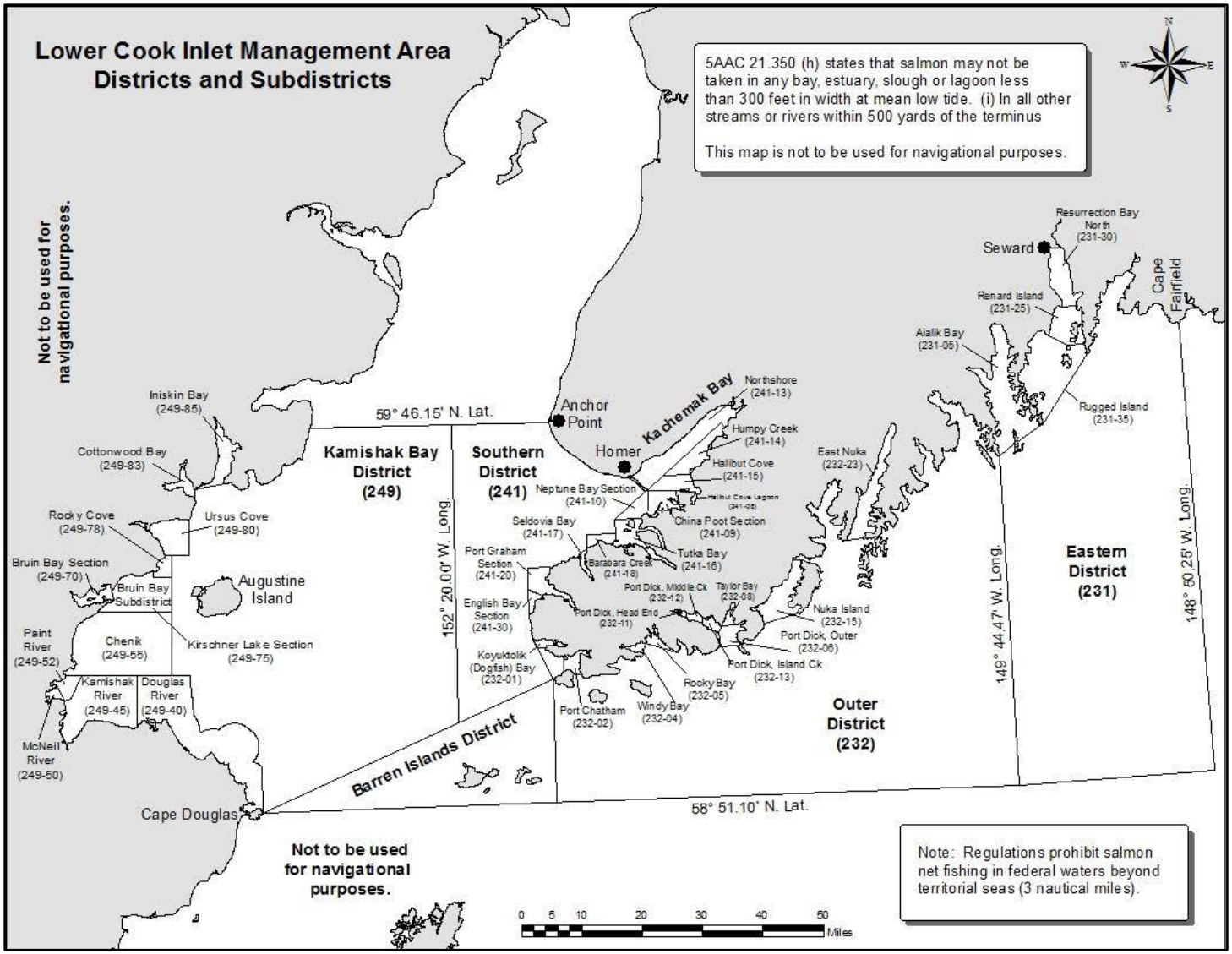


Figure 1.–Lower Cook Inlet commercial salmon management area showing commercial fishing district and subdistrict boundaries.

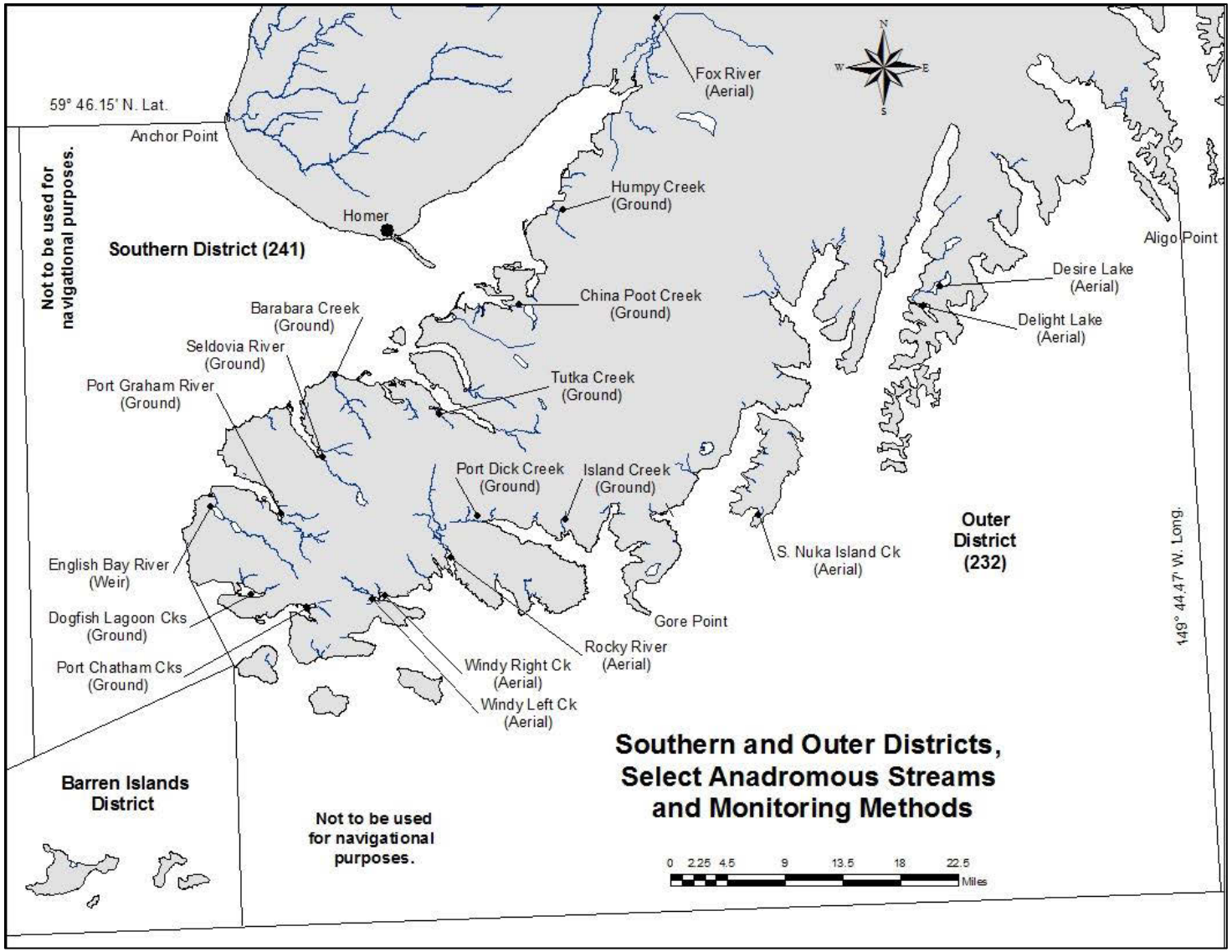


Figure 2.–Anadromous streams with escapement goals and their monitoring methods in Southern and Outer districts, Lower Cook Inlet.

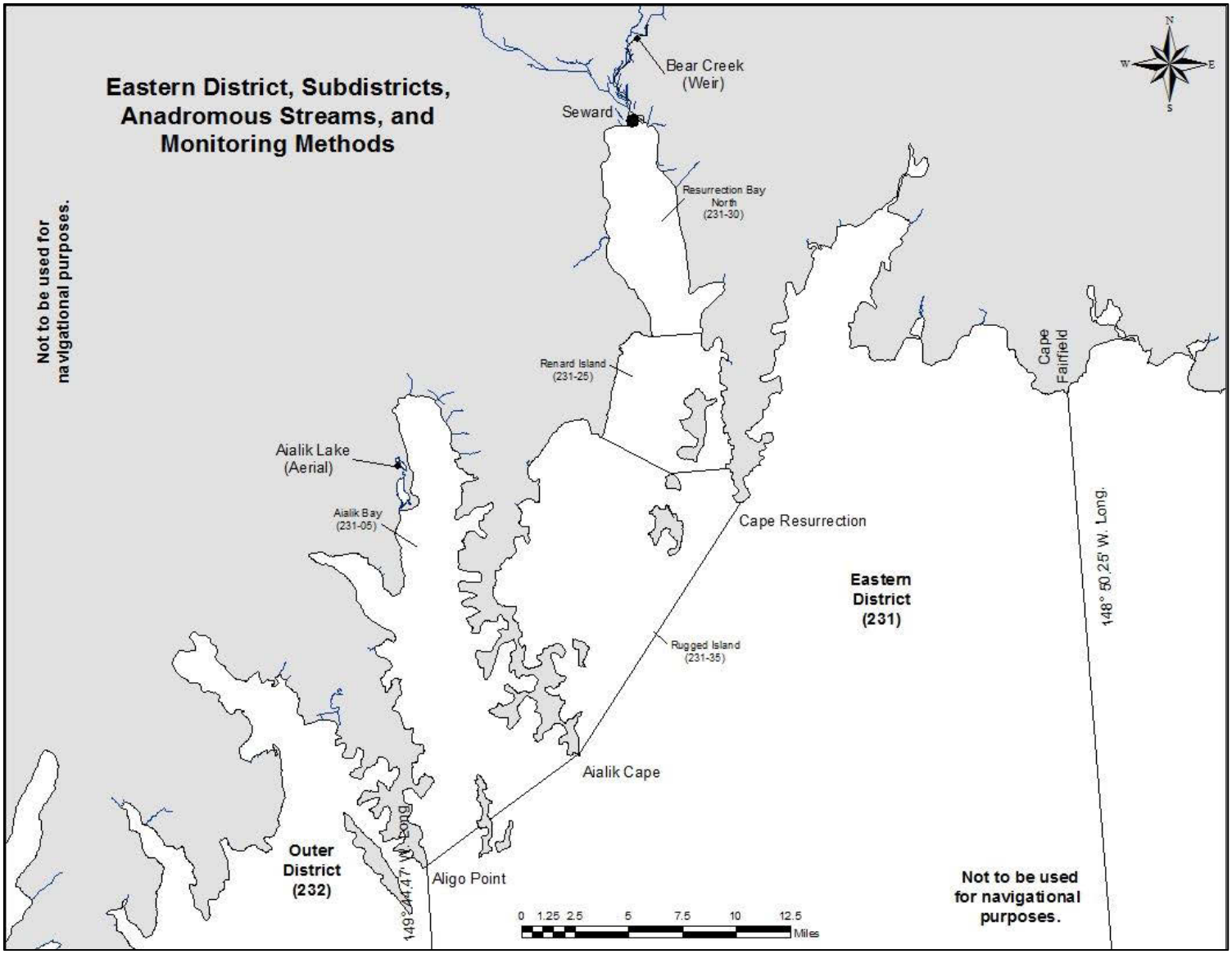


Figure 3.–Anadromous streams, monitoring methods, and commercial subdistrict boundaries in Eastern District, Lower Cook Inlet.

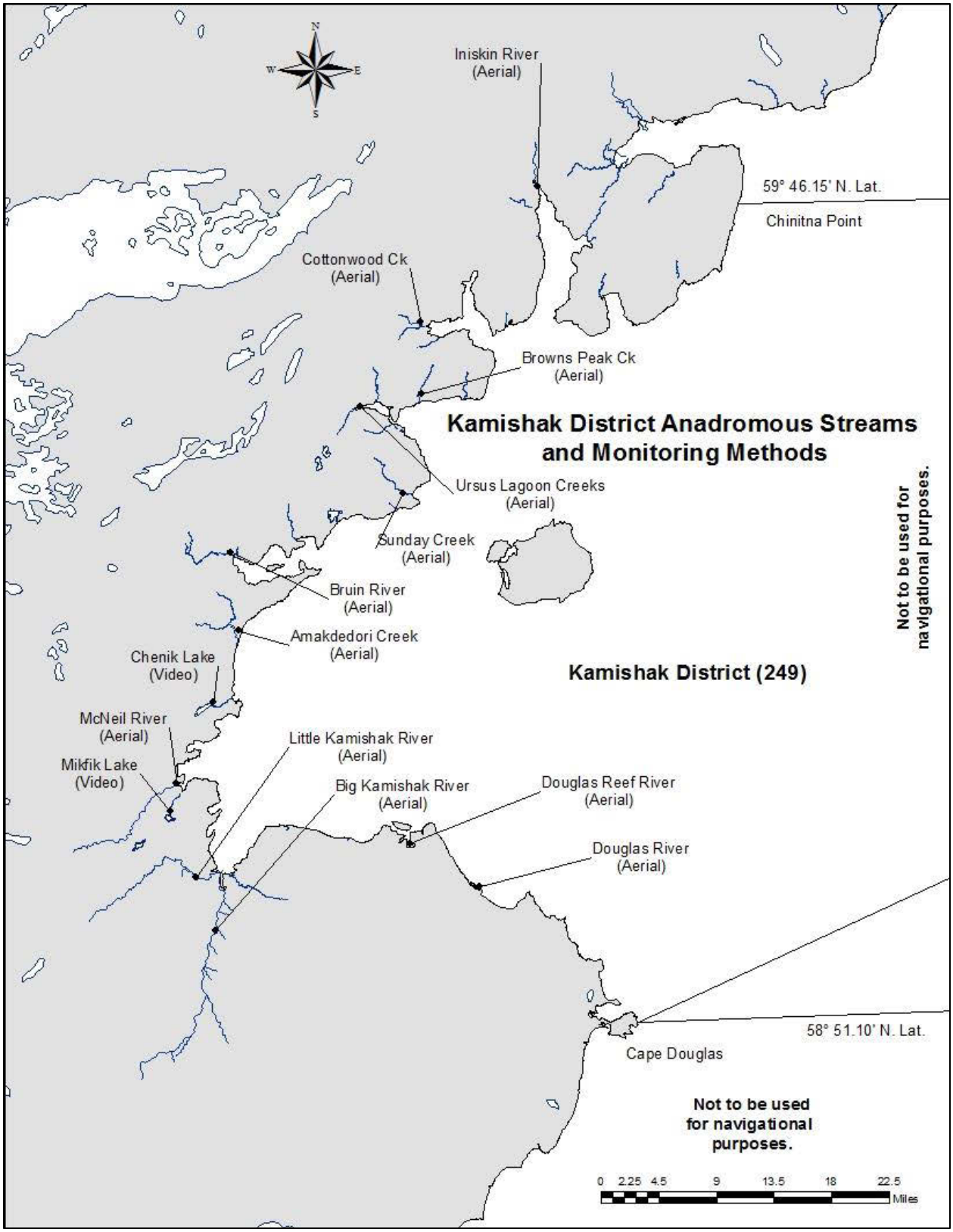


Figure 4.–Anadromous streams and their monitoring methods in Kamishak District, Lower Cook Inlet.

Figure 5.–Cessna 206 floatplane used to conduct aerial surveys of salmon escapement in LCI.

Figure 6.–Cessna L19 Birddog floatplane used to conduct aerial surveys of salmon escapement in LCI.

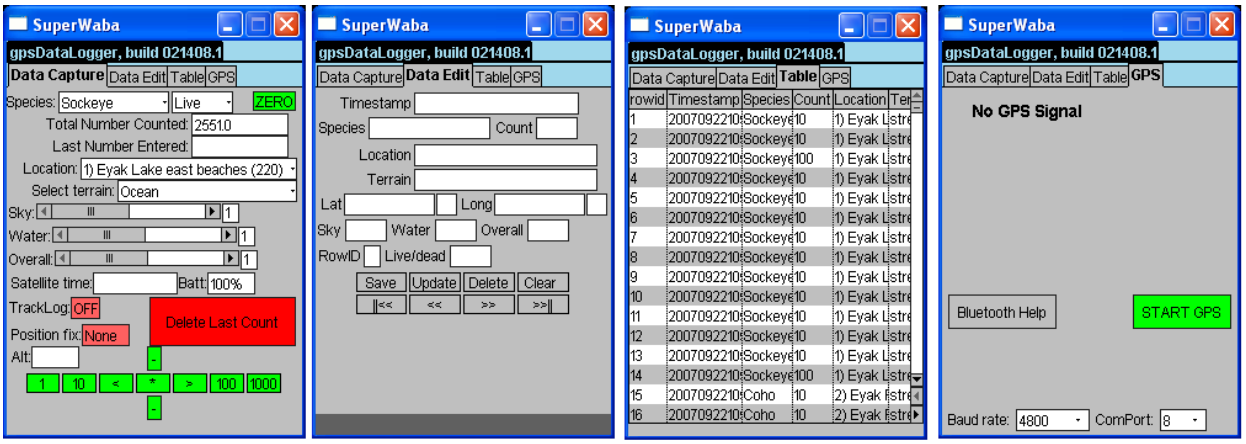
Figure 7.–Photo illustrating the Juniper Systems Archer ruggedized handheld computer running custom software (gpsDataLogger) designed to record aerial and ground survey salmon escapement counts.

APPENDIX A. AERIAL/GROUND SURVEY APPLICATION

Appendix A1.–Manual for gpsDataLogger application to record aerial/ground survey observations.

This application was written to collect georeferenced field data with minimal visual contact with the device. Counts are made by pressing hardware buttons on the device. Fields such as species and location can also be changed through the use of hardware buttons. Use of the stylus and touchscreen is minimal to allow the user to focus on the subject being documented.

There are four main screens in the application. These are shown below.



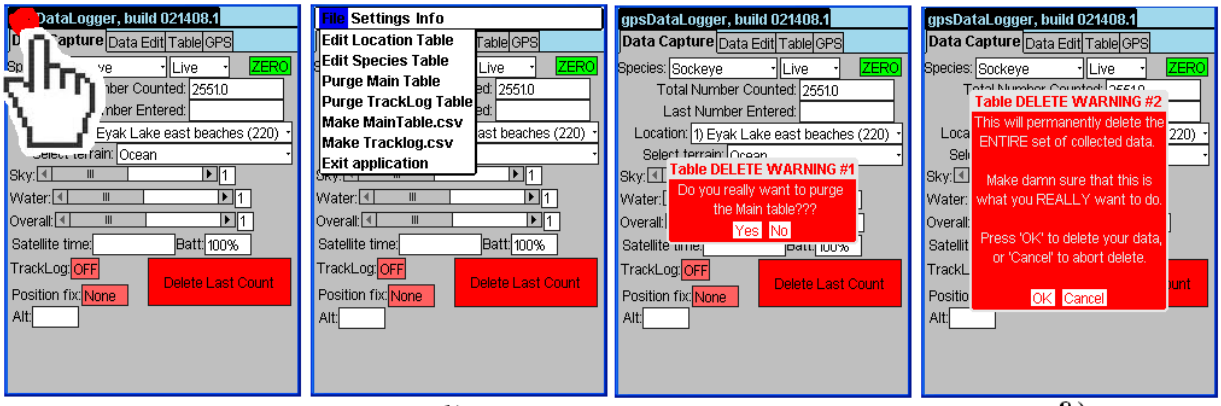
1. Data entry. 2. Data edit 3. Data review 4. GPS signal

Most surveys will only require that the user access screen #1 for data entry. Data review and editing in the field is not advised, given that this is time consuming and may lead to accidental deletion of target data. Time in the field is limited, very expensive and best spent collecting data.

Instructions:

1.) Power the device on and allow the GPS device to lock onto satellites. Open the application gpsDataLogger. It should be listed on the Start menu in Windows CE devices. Opening the application before satellite lock will result in a program error in some devices (Juniper Archers).

2.) Delete previously collected data from the internal database on the device. This is done by opening the dropdown menus in the program. Do this with the stylus by touching the left side of "gpsDataLogger" in the title bar. See #5 below.



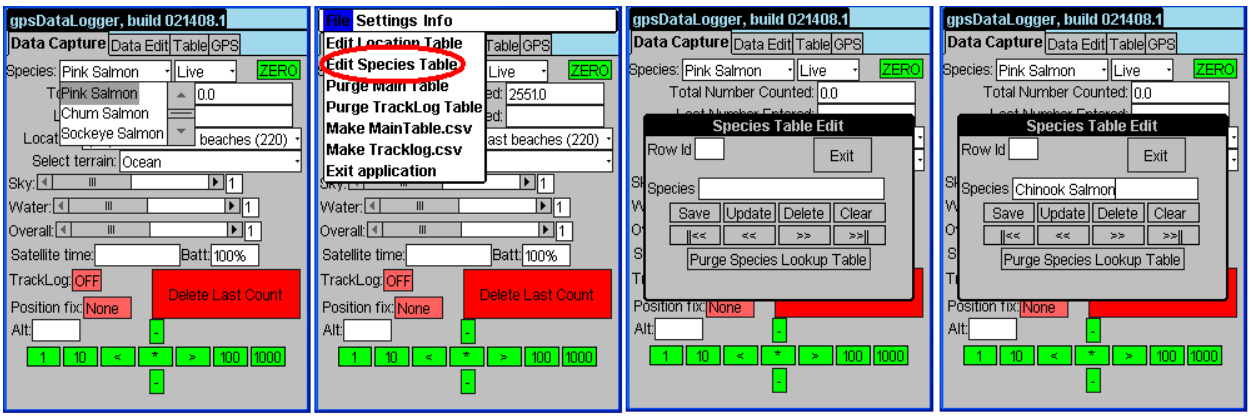
5.) 6.) 7.) 8.)

3.) Select “Purge Main Table”, then click the “Yes” and “OK” button indicating that irreversible data deletion is intended.

4.) Repeat for the Tracklog Table.

5.) Confirm that the species dropdown, location dropdown and sampler dropdown boxes are configured properly. These should not require adjusting as their contents are held in memory when the device is off.

6.) If a dropdown needs to be edited, select the appropriate dropdown from the menu bar to access the relevant lookup table. Below shows additions to the “Species” table.



9.) 10.) 11.) 12.)

7.) To enter the species name in the Species Table Edit window (Illustration #11) touch the white window next to Species and a keypad will pop out. When finished entering the species name, press the [SAVE] button in the window to create a new record in the lookup table, then press [EXIT] to get back in the application. Other buttons in this window and their functions are,

a. [UPDATE]- This will modify the database record shown in the window,

b. [DELETE]- this will delete the database record shown in the window,

c. [CLEAR]- this will clear the window, but not change the database,

d. [||<<]- pressing this will show the top record in the database,

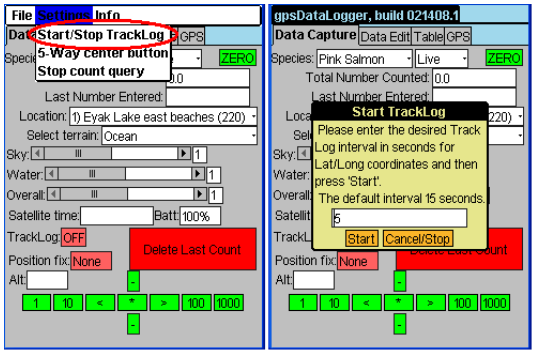
e. [<<]- this will show the previous record in the database,

f. [>>]- this will show the next record in the database, and

g. [>>||]- this will show the last record in the database table.

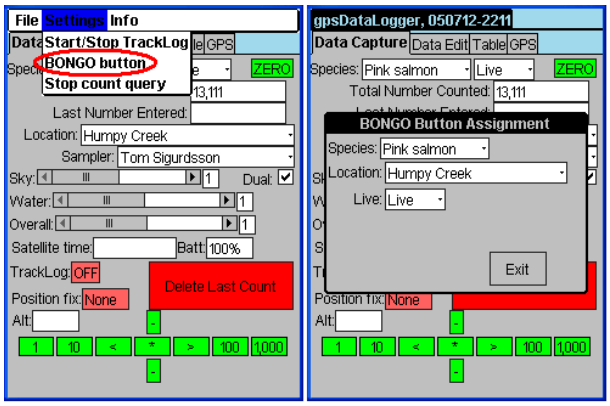
8.) To collect data, press the one of the hardware keys with the 1, 10, 100, 1000, 10000 labels. This will create a record in the database for the species shown in the species window, the location, etc. In addition, there are sky, water and overall slider bars that are used to note observation conditions. A perfect day with no clouds and clear water is a 5.

9.) To create a Tracklog, open the “Settings” dropdown menu, (see #13 below.) select “Start/Stop Tracklog” from the menu. Press “Start” in the pop-up window in addition, the number of seconds between recorded points can be adjusted. The default is 5 seconds.



13.) 14.)

10.) Periodically, unexpected animals show up in our surveys. While we may not target these specifically, it is often useful to document their presence. Examples might be Chinook salmon, humpback whales or grizzly bears. In order to quickly document these events, a button has been assigned that the user can define to such a species. Pressing this button will change the species field to the preselected species for one count. The field will then revert to the previously counted species. This is referred to as the "Bongo" button. See illustration 15 and 16.



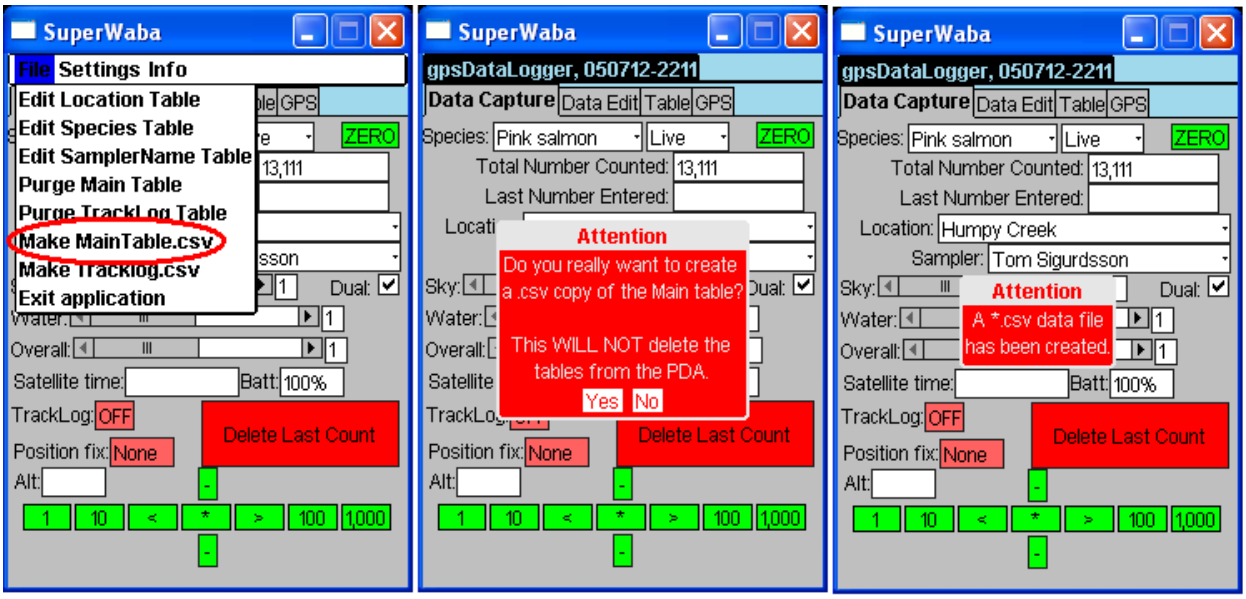
15.) 16.)

If not specifically assigned to another species, the "Bongo" button toggles between the Live and Carcass field.

Data offload

To transfer data to a desktop computer follow the following steps.

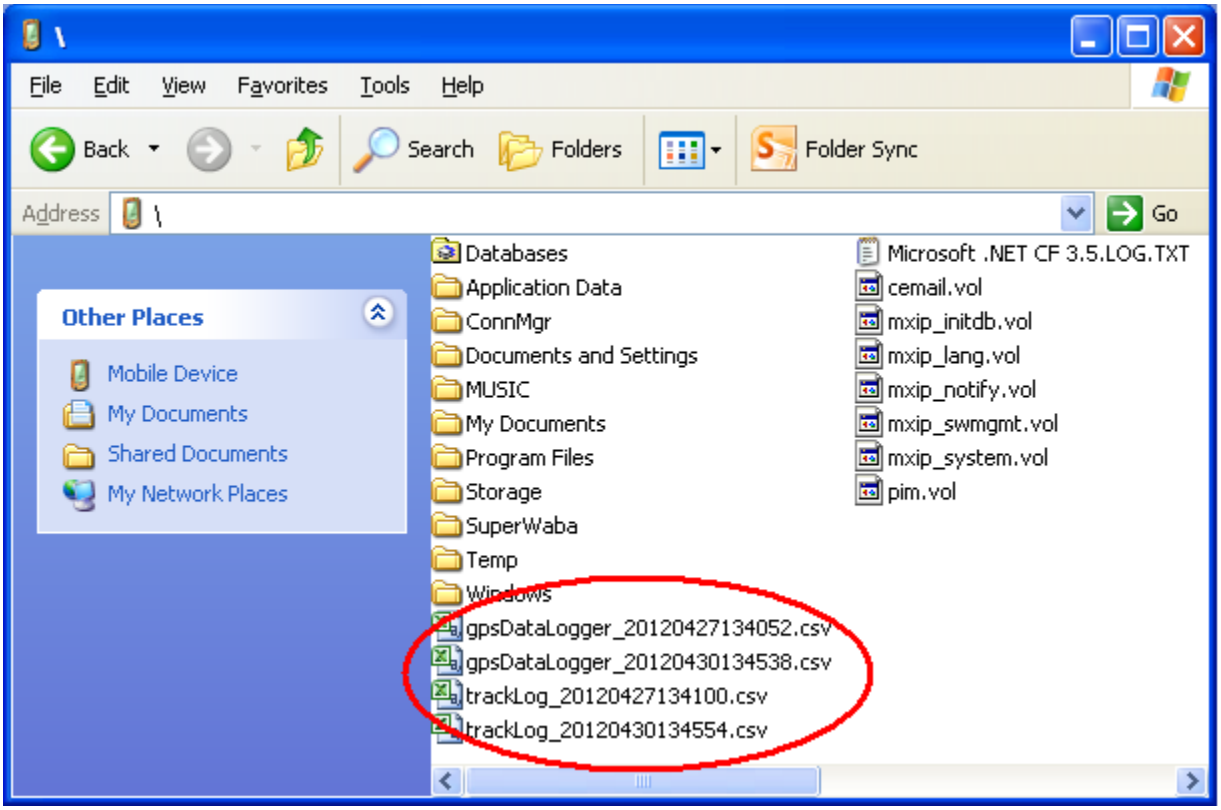
1) Convert the data from the internal database to comma separated variable (csv) format in the device. Do this by selecting "Make MainTable.csv" from the dropdown menu (see below).



15.) 16.) 17.)

2) Then pressing the "Yes" button in the pop-up window. A CSV file will automatically be parsed from the internal database. This may take 30 to 40 seconds depending on the size of the table.

3) Connect the Windows CE device to a desktop computer using Microsoft ActiveSync software. This will allow you to access the files within the device directly. See below.



Circled in red are the offloaded main files as well as the tracklog files from two surveys. The name consists of “gpsDataLogger” or “trackLog” with a timestamp (YYYYMMDDHHMMSS) suffix. These files can be transferred to the desktop and opened in Excel.

Other items:

To rotate the display, close gpsDataLogger and then open the program “RotateScreen” in the Start menu. Select 180 degrees. Close the RotateScreen application by pressing the button in the upper right of the window. Reopen gpsDataLogger.

Known Problems:

Currently application crashes when running on Juniper Archer handhelds when it is opened before the GPS has a full satellite lock. This can be avoided by looking in the window in the back of the unit at the red light that shows on the left side. A steady light indicates that a lock has NOT occurred. A slow flashing light indicates that the device has locked on to satellites and is ready for use.

APPENDIX B. POST PROCESSING OF AERIAL SURVEY DATA

Appendix B1.–Directions for using the Spatial Join tool in ArcGIS 10.x to assign raw survey counts to discrete sections of index streams in Lower Cook Inlet and append data associated with those streams (e.g., AWC stream code) to the survey's attribute table (Last updated by Ted Otis in April 2015).

1. For these spatial join directions to work correctly, you must use ArcGIS 10.x.
2. Open Explorer and navigate to: O:\DCF\SALMON\ESCAPEMENT\2016\AERIAL\1_RAW then locate the folder containing the most recent survey data (counts and trackline) that you want to process (the folder name will include the date and district flown, e.g., 2016 June 15 Kamishak).
3. Open ArcGIS 10.x and open then open the following project: O:\DCF\SALMON\ESCAPEMENT\ARC_MAP_FILES\ARC_MAP_PROJECTS_mxds\2016_LCI_SALMON_GIS_10.2.mxd
4. Open Arc Catalog
5. In Arc Catalog, navigate to O:\DCF\SALMON\ESCAPEMENT\2016\AERIAL\1_RAW, and right click the fish count file (e.g., gpsDataLogger_20160727143029.csv)
6. Select: Create Feature Class/From XY, then hit Enter.
7. In the dialogue box, leave the first 3 drop downs the same (X=Longitude, Y=Latitude, Z=None), then hit the Select Coordinate System of Input Coordinates button and do the following
8. Hit the Select button to select a pre-defined coordinate system , then select Geographic Coordinate System, then Select World, and then WGS 1984.prj and then hit Add followed by OK.
9. Next, hit the browse folder to the right of the box asking you to "Specify output shapefile or feature class: and navigate to O:\DCF\SALMON\ESCAPEMENT\2016\AERIAL\4_GIS\5_UNJOINED and use the following naming convention to name the file you're creating: DIST_YYYYMMDD_Surveyor.shp (e.g., KAMI_20160728_Hollowell.shp). Hit OK.
10. Pull the .shp file you just created into the ArcGIS project file you have open, inserting it at the top of the list of layers on the left side of the screen (Note: A message may appear warning you that the Geographic Coordinate System of the file you are importing differs from that of the project you have open. This is not a problem, so just hit CLOSE).
11. Now open ArcToolbox (located in the Geoprocessing drop down menu) and do the following:
12. Open Analysis Tool, then Overlay, then Spatial Join.
13. When the Spatial Join tool box opens, do the following:
14. Hit the Browse button to the right of the Target Features and Navigate to the .shp file we just created (probably at the top of the drop down list).
15. Hit the Browse button to the right of the Join Features and select LCI_POLYGONS.shp located here: O:\DCF\SALMON\ESCAPEMENT\ARC_MAP_FILES\AERIAL_BUFFERS\Aerial_Buffers_SALMON

Note: If the buffer file is already in the project TOC then you'll just need to hit the drop down button and select it from the list rather than navigate to it using the browser button.

16. Hit the Browse button to the right of the Output Feature Class, navigate to here: O:\DCF\SALMON\ESCAPEMENT\2016\AERIAL\4_GIS\6_JOINED\ and use the following naming convention to save this joined file: DIST_YYYYMMDD_Surveyor_JOINED.shp (e.g., KAMI_20160727_Hollowell_JOINED.shp).
17. The rest of the selections are optional and should be kept as the following:
    a. Join Operation = JOIN_ONE_TO_ONE
    b. Check in the box next to Keep All Target Features (Optional)
    c. Match Option = INTERSECT
    d. Search Radius is left Blank
18. Now hit the OK button. This creates the JOINED file and automatically adds it your project at the top of the list of LAYERS.
19. Uncheck the unjoined .shp file that you first brought into the project so only the JOINED features show on the map (this will come in handy later if you need move points around to get them inside the stream buffers). At this point I also usually remove the unjoined file from the project as you won't need it anymore.
20. Open the new JOINED file's attribute table (right click on the JOINED file you just created in the LAYERS list and select "Open Attribute Table" then SORT ASCENDING on the Join_Count field to locate all the points that fell outside the defined stream polygons. If there is no data associated with the records with "0" in the Join_Count field, just delete those records. However, if there is data in those records, we need to move those points inside the stream buffers they're supposed to reside within… here's how
21. Highlight one of the records with "0" in the Join_Count field (by clicking on the gray box to the left of the FID field), and then right click on the JOINED .shp file you just created and select "Zoom to Selected Features". Pan/Zoom around till you can verify that this errant point is indeed just outside the buffer polygon for the stream that the record indicates it should be associated with. We just need to move this point inside the polygon by doing the following:
22. Go to the Editor Drop Down menu and select Start Editing. From the list of .shp files in your project that you can edit, select the .shp file you recently created for this survey and hit OK. You will likely get a warning message saying one or more layers have spatial references that don't match the dataframe. This not a problem, so just hit Continue.
23. A Create Features box appears and the selected point that you want to move has an X over it. Move your arrow cursor over the selected point (a cross will appear next to the arrow) and move the point inside the polygon by left clicking and dragging the point. Now we need to recalculate the Lat/Long of the point to its new location by doing the following:

24. Go back to the attribute table, make sure that the only record selected is the one you just moved, then right click the Latitude fieldname and select Calculate Geometry. This brings up a dialogue box that wants you to confirm the coordinate system in use (WGS 1984) and the Units (Decimal Degrees). Be sure the check box next to Calculate Selected Records Only is checked (Note: also make sure the only record selected is the one you just moved). Hit OK.
25. Repeat the step above for Longitude.
26. Add the following to the Comment field for the record you just edited "Moved errant point inside polygon".
27. Repeat the steps 22-27 above for any other records that had "0" in the Join_Count field.
28. When all the records with a 0 in the Join_Count field have been edited, Sort Ascending on the Location field and go to each of the records with 0 in the Join_Count field that you just edited and Copy/Paste the appropriate values from the record above down into blank fields for Sect_Code, Stream, CF_S_Code, Dist_SubD, Dist_CF_Cd, Index_Area, AMA, District, StreamSect, ABR_CF_NAM, and STOCK. This is easier than doing another spatial join if there are only a few records to edit.
29. When all the records have been edited correctly, go to the Editor drop down menu, select SAVE Edits, then STOP Editing.
30. Close ArcGIS, Arc Catalog and Arc Toolbox.
31. Now go back to Explorer and navigate to the folder containing the JOINED .shp file's attribute table you just finished editing (e.g., KAMI_20160725_Hollowell_JOINED.dbf), right click on it and then select Open With Excel (If available, UNCHECK the box that asks if you should always use Excel to open .csv files).
32. Go to the last column in the spreadsheet "Sect_Code" right click column and **cut**. Go to "Stream" column in spreadsheet right click column and select **insert cut cells**.
33. IMMEDIATELY hit SAVE AS and save this .dbf file into the 2_EDITED folder (immediately below the 1_RAW folder in the AERIAL folder) using the following naming convention: DIST_YYYYMMDD_Surveyor_JOINED.xlsx (e.g., KAMI_20160728_Hollowell_JOINED.xlsx).
34. This will be the source file used by the PIVOT table template that summarizes survey counts by species, stream, and stream section. To implement that phase of the data summary, open the file named Survey_Summary_Template.xlsx located here: O:\DCF\SALMON\ESCAPEMENT\2016\AERIAL and follow the directions on the first tab of that file (called Notes).

Appendix B2.–Directions for processing the .dbf output file from ArcGIS in Excel to create pivot tables summarizing escapement counts by stream, stratified by species and stream section.

The following steps are documented on the "Notes" page of the Excel aerial survey template file used to process the .dbf output file from ArcGIS.

#	Subject	Description
1	**Joined File**	Open the edited (i.e., JOINED) Excel file containing the aerial survey data you want to summarize by stream, species, stream section. It should look something like this: DIST_YYYYMMDD_SURVEYOR_JOINED.xlsx and be located here: O:\DCF\SALMON\ESCAPEMENT\2016\AERIAL\2_EDITED
2	**Template**	Now open the Excel file named "Survey_Summary_Template.xls" located here: O:\DCF\SALMON\ESCAPEMENT\AUC Templates
3	**Pivot File**	IMMEDIATELY save the template file in the appropriate escapement year's folder under O:\DCF\SALMON\ESCAPEMENT\YYYY\AERIAL\3_FINAL using the same filename as the survey file, but replace JOINED with PIVOT, for example KAMI_20160611_Hollowell_JOINED.xlsx becomes KAMI_20160611_Hollowell_PIVOT.xlsx. (MAKE SURE YOU SAVE IT IN THE 3_FINAL FOLDER)
4	**Copy**	Go back to the JOINED survey file and click the box to the left of Column A and above Row 1. This should highlight the entire spreadsheet. Click COPY.
5	**Paste**	Now go to the PIVOT file you just created (i.e., this file) and go to the tab labeled RAW_Data. Highlight Cell A1 and then click PASTE SPECIAL/VALUES ONLY. If you mistakenly hit PASTE ALL, hit the UNDO button and make sure you paste the VALUES only so you don't overwrite the formatting.
6		Open the tab labeled "Reformatted_DATA" in this file. The data you just dropped into the RAW page should now be visible here, but in a slightly different order and format (NOTE: There will be MANY rows below those containing survey data that have zeros, #VALUE!, and #NA error values. IGNORE THESE. THEY ARE NOT IMPORTANT.)
7	**Streams Pivot**	First, we want to create a pivot table listing all the streams that were surveyed on this date and the overall survey rating associated with that stream
8	**Streams Pivot**	Highlight all the cells containing data in Columns A:K in the Tab named "Reformatted_DATA"
9	**Streams Pivot**	Click on the drop down tool list named INSERT and select PIVOT TABLE; it should already show the cells you've highlighted in the Table/Range box

#	Subject	Description
10	**Streams Pivot**	Select the option indicating you want to insert the pivot table in an existing worksheet and then navigate to the tab named ESCAP_Pivots and select cell A5; This inserts a pivot table starting in cell A5;
11	**Streams Pivot**	Now select STOCK and OVERALL from the field list; STOCK should become the ROW LABEL and OVERALL should go in the bottom right Value box. Default is SUM values, but we want Average OVERALL so click on SUM of OVERALL and then select Value Field Settings from the drop down list and select AVERAGE; the Pivot table should now contain a list of all streams surveyed and the average overall survey rating for that stream.
12	**Filter**	Now we need to sort these data by species, Live/Dead, and Stream Section by using the FILTER tool.
13	**Filter Spp**	Note that each of the Field Names in Row 1 has a small arrow to the right designating a drop down menu. Go to the Species Field, click the drop down arrow and select Pink Salmon (If there were no pinks, select ONE of the other species, but this example will continue assuming there were pink salmon)
14	**Filter Live**	Now go to the LIVE field and make sure only LIVE fish are selected (no DEAD, zero, or blank cells).
15	**Filter Escap**	Go to the SECTION field and Select Sections Intertidal, Lagoon, Lake, and Stream (if they exist). MAKE SURE YOU UNSELECT BAY, #NA, AND ANY OTHER IRRELEVANT SECTIONS
16		Once these filters have been activated, the table should only contain LIVE fish of the species you selected (e.g., Pink Salmon) that were documented in sections of the stream considered escapement.
17	**Copy Spp**	Copy ALL the rows and columns containing the filtered data (NOT including Row 1 with the filenames), navigate to Cell A2 in the appropriate tab for that species (e.g., Pink Salmon) and hit PASTE SPECIAL/VALUES ONLY
18	**Copy Spp**	Go back to the SPECIES field in the Reformatted_Data tab, Unselect the species you just filtered and select ONE of the other species present on that survey (e.g., Chum Salmon). Leave the LIVE and SECTION filters in place.
19	**Copy Spp**	Copy ALL the rows and columns containing the filtered data (NOT including Row 1 with the filenames), navigate to Cell A2 in the appropriate tab for that species (e.g., Chum Salmon) and hit PASTE SPECIAL/VALUES ONLY
20	**Copy Spp**	Repeat Steps 13 and 14 for all the different species observed during that survey (remember to paste the VALUES ONLY)

#	Subject	Description
21	**Unfilter**	After copy/pasting all the LIVE, ESCAPEMENT COUNTS for each SPECIES seen in that survey, deactivate all the filters you activated in the Reformatted_Data tab so all the data are visible.
22	**Filter BAY**	Now go to the SECTION field and select BAY, making sure all the other sections are not checked. Make sure ALL the species observed on that flight are checked.
23	**Copy Bay**	Copy ALL the rows and columns containing the BAY filtered data (NOT including Row 1 with the filenames), navigate to Cell A2 in the BAY_Cnts tab and hit PASTE SPECIAL/VALUES ONLY in Cell A2
24		You're now ready to create pivot tables to summarize the number of fish counted by stream, species, and stream section (escapement vs. bay counts).
25	**Pivot Spp**	Next we'll build the pivot tables for each of the species observed
26	**Pivot Spp**	Go to the first species tab containing data (e.g., often the king and coho tabs will have no data), and do the following:
27	**Pivot Spp**	Highlight Cells A1:K1 (the field names up through the Comments field) and then hold down the SHIFT key while hitting the END button and then the PAGE DOWN button. This should highlight all the survey data.
28	**Pivot Spp**	With the data highlighted, hit INSERT/PIVOT TABLE. A box appears. The range you just highlighted should appear in the top box, the bottom box asks you where you want the pivot table to be placed.
29	**Pivot Spp**	Select the Existing worksheet button and then click the file icon next to the box to so you can navigate to the ESCAP_PIVOTS page. Highlight the appropriate cell in Row 5 given the species you are summarizing (e.g., Cell A5 for King Salmon, D5 for Pink Salmon, etc.) Hit ENTER or OK to save these setting and exit the PIVOT Table menu.
30	**Pivot Spp**	Navigate to the ESCAP_PIVOTS tab and select the following from the Pivot Table Field List. First Check the box next to Stock. This should add STOCK to the Row Labels box (bottom left); Next check the COUNT field, this should add SUM of COUNT in the VALUES field (bottom right). If something other than SUM appears next to COUNT, hit the drop down arrow next to COUNT and then select Value Field Settings and select SUM
31	**Pivot Spp**	As you Select the above options, the pivot table is automatically built, listing each STOCK surveyed that day with a COUNT (for that species) of fish observed above the BAY (i.e., in the sections considered Escapement)

#	Subject	Description
32	**Pivot Spp**	Repeat Steps 26-31 for each species observed during that survey, creating a pivot table for each that summarizes the number of fish observed of that species on that survey date (above the BAY)
33	**Pivot Bay**	Next you'll do the same for all species counted in the BAY section of each stream. Go to the BAY_Cnts tab and highlight all the rows (columns A-K) containing data.
34	**Pivot Bay**	Repeat steps 27-31 for these BAY fish, inserting the pivot table into Cell A5 of the tab labeled BAY_Pivots; Since we've included all species in the data table, you'll need to select STOCK and then SPECIES for the Row Labels, and then SUM OF COUNTS for the Values.
35	**Save**	That completes the steps to sort the survey counts by stock, species, and stream reach. SAVE THIS FILE so you don't lose your work!! The last thing to do now is enter these data into the In-Season AUC spreadsheet so they're available to the management staff. Leave this file open, and open the YYYY_In-season_Aerial_SPECIES.xlsx file for each of the species observed during the survey you just summarized.
36	**Update In-Season AUC Tables**	Now go to the NOTES page in each of those files and follow the directions. All you need to do is enter date, Escap. Count, Surveyor, Overall Conditions, and Comments for each Stream that was surveyed. Note: Unless the surveyor entered a 0 count for species NOT observed on a given stream that STOCK will not appear in the ESCAP Pivot table, but we still want to enter our "0" count for that stream survey. You can use the STREAM pivot table to see which streams were surveyed and compare that list to the ESCAP Pivot tables, (Note: only stocks with escapement goals are included in the In-Season_Aerial_AUC spreadsheets for each species.