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Migratory Timing and Abundance Estimates of Sockeye Salmon into Upper Cook Inlet, Alaska, 2008

by

Pat Shields

and

Mark Willette

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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)

Measures (fisheries)

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

Mathematics, statistics

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

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by
Pat Shields and Mark Willette
Alaska Department of Fish and Game, Division of Commercial Fisheries, Soldotna

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

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Pat Shields and Mark Willette
Alaska Department of Fish and Game, Division of Commercial Fisheries,
43961 Kalifornsky Beach Road, Suite B, Soldotna, AK 99669-8367, USA

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ABSTRACT

In 2008, an Offshore Test Fishery (OTF) was conducted during the Upper Cook Inlet (UCI) commercial salmon fishing season. The primary objective of the test fishery was to estimate the abundance and timing of the sockeye salmon Oncorhynchus nerka run, as measured along a transect near the southern boundary of the UCI management area. The test fishery was conducted from 1 July through 31 July and captured 2,447 sockeye salmon, representing 1,594 catch per unit of effort (CPUE) index points. The midpoint of the 2008 run occurred on 11 July, which was 4 days early relative to the historical mean date of 15 July. This represents the fourth earliest run timing since the test fishery began in 1979. A non-linear mathematical model estimated the 2008 OTF project spanned approximately 78% of the sockeye salmon run. Two formal estimates of the size and timing of the 2008 sockeye salmon run were made during the commercial fishing season (on 21 July and 24 July), with the first best-fit estimator from each analysis forecasting a total run to UCI of 5.17 and 3.57 million sockeye salmon, respectively. These estimates deviated from the actual total run of 4.11 million by +26% and -13%, respectively. The final passage rate was estimated at approximately 2,439 sockeye salmon per CPUE point.

Key words: Salmon, *Oncorhynchus*, Upper Cook Inlet, Alaska, test fishery, migratory behavior

INTRODUCTION

In 1979 the Alaska Department of Fish and Game (ADF&G) began an Offshore Test Fish (OTF) project near the southern boundary of the Upper Cook Inlet (UCI) salmon management area (Figure 1). The objectives of the project have been to estimate the total run and run timing of sockeye salmon *Oncorhynchus nerka* returning to UCI during the commercial salmon fishing season. These data have become extremely important to ADF&G staff, as they are used to help adjust commercial fishing times and areas fished to most efficiently harvest sockeye salmon that are surplus to spawning needs or to restrict fisheries that might potentially overharvest specific stocks. In recent years, the Alaska Board of Fisheries (BOF) has assembled various management plans that require inseason estimates of the size of the annual sockeye salmon run in order to implement specific provisions of those plans. The OTF project has increasingly become one of the most important tools fishery managers utilize to make inseason fishery management decisions to comply with BOF management directives.

Test fishing results have been reported annually since 1979 (Waltemyer 1983-1986; Hilsinger and Waltemyer 1987; Hilsinger 1988; Tarbox and Waltemyer 1989; Tarbox 1990-1999; Tarbox and King 1992; Shields 2000-2003; and Shields and Willette 2004-2008). This report presents the results of the 2008 test fishing project.

OBJECTIVES

The primary objective of the project is to:

1. Make an inseason estimate of the 2008 Upper Cook Inlet sockeye salmon *Oncorhynchus nerka* total run (including run timing).

METHODS

TEST FISHING

Sockeye salmon returning to UCI were sampled by fishing 6 geographically fixed stations between Anchor Point and the Red River Delta (Figure 1). This same configuration of stations has been fished since 1992 (Tarbox 1994) and was established based on analyses that showed it provided the most reliable estimates of inseason run size and timing. Stations were numbered consecutively from east to west, with station locations (latitude and longitude) determined with global positioning system technology. A chartered test fishing vessel, *FV Americanus*, sampled all 6 stations (numbered 4, 5, 6, 6.5, 7 and 8) daily, traveling east to west on odd-numbered days and west to east on even-numbered days. Sampling started on 1 July and continued through 31 July. The vessel fished 366 m (1,200 ft or 200 fathoms) of multi-filament drift gillnet with a mesh size of 13 cm (5 1/8 in). The net was 45 meshes deep and constructed of double knot Super Crystal[1] shade number 1, with a filament size of number 53/S6F.

The following physical and chemical readings were taken at the start of each set: air temperature, water temperature (at 1 m below the surface), wind velocity and direction, tide stage, water depth, and water clarity. Air and water temperatures were measured using a YSI salinity/temperature meter. Wind speed was measured in knots and direction was recorded as 0 (no wind), 1 (north), 2 (northeast), 3 (east), 4 (southeast), 5 (south), 6 (southwest), 7 (west), or 8 (northwest) using a Kestrel 4000 pocket weather tracker. Tide stage was classified as 1 (high slack), 2 (low slack), 3 (flooding), or 4 (ebbing) by observing the movement of the vessel while drifting with the gill net. Water depth was measured in fathoms (fm) using a Simrad echo sounder, and water clarity was measured in meters (m) using a 17.5 cm secchi disk.

All salmon captured in the drift gillnet were identified by species and enumerated. Sockeye salmon (n<50 at each station) were measured for fork length (mid eye to fork of tail) to the nearest mm and also had an axillary process removed for genetic analysis (as described by Habicht et al. 2007).

The number of fish captured at each station (s) on each day (i) was expressed as a catch per unit of effort (CPUE) statistic, or index point, and standardized to the number of fish caught in 100 fathoms of gear in one hour of fishing time.

$$CPUE_{s,i} = \frac{100\,fm \;\; x \;\; 60\min \;\; x \;\; number\ of\ fish}{fm\ of\ gear \;\; x \;\; MFT} \tag{1}$$

where mean fishing time (MFT) was calculated as:

$$MFT = (C - B) + \frac{(\mathrm{B} - \mathrm{A}) + (\mathrm{D} - \mathrm{C})}{2} \tag{2}$$

where:
- A = time net deployment started,
- B = time net fully deployed,
- C = time net retrieval started, and
- D = time net fully retrieved.

Once deployed at a station, the drift gillnet was fished 30 minutes before retrieval started. However, the net was capable of capturing fish prior to being fully deployed, as it was during the time it was being retrieved. *MFT* was therefore adjusted by summing the total time it took to set and retrieve the net, then dividing this time in half, and adding it to the time when the entire net was deployed and fished.

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[1] Product names used in this report are included for scientific completeness, but do not constitute a product endorsement.

Daily $CPUE_i$ data were summed for all m stations (typically 6) as follows:

$$CPUE_i = \sum_{s=1}^{m} CPUE_{s,i} \tag{3}$$

Cumulative $CPUE_i$ ($CCPUE_d$) was given by:

$$CCPUE_d = \sum_{i=1}^{d} CPUE_i \tag{4}$$

where: d = day for which estimate is being made.

DESCRIBING THE SALMON MIGRATION AND PROJECTING TOTAL RUN

The sockeye salmon run was described for each of the previous years based on the respective test fishing data as per Mundy (1979):

$$Y_{yr,d} = 1 \Big/ \left(1 + e^{-(\mathrm{a} + \mathrm{bd})}\right) \tag{5}$$

where: $Y_{yr,d}$ = modeled cumulative proportion of $CCPUE_{yr,f}$ (f = final day of season) for year yr as of day d,

a and b = model parameters.

Variables without the subscript *yr* indicating year refer to the current year's estimate. To determine which of the previous run timing models most closely fit the current year's data, and to estimate total run for the entire season (TR_f), a projection of the current year's $CCPUE_d$ at the end of the season ($CCPUE_f$) was estimated as per Waltemyer (1983a):

$$CCPUE_f = \frac{\sum_{i=0}^{d} CCPUE_d^{\,2}}{\sum_{i=0}^{d} Y_{yr,d} \cdot CCPUE_d} \tag{6}$$

This model assumes that the average day of return and its variance for previous year *yr* is the same as for the current year (Mundy 1979). To test this assumption, in season Y_d was estimated as:

$$Y_d = \frac{CCPUE_d}{CCPUE_f} \tag{7}$$

and mean squared error (*MSE*) between *Yd* and *Yyr,d* was estimated as:

$$MSE = \frac{\sum_{i=0}^{d} \left(Y_{yr,d} - Y_d\right)^2}{d + 1} \tag{8}$$

Years were ranked from lowest *MSE* (best model) to highest (worst), and the best fit years were used to estimate $CCPUE_f$ for the current year. Catchability, or the fraction of the available population taken by a defined unit of fishing effort, was estimated as:

$$q_d = \frac{CCPUE_d}{r_d} \tag{9}$$

where: q_d = estimated cumulative catchability as of day d,

$r\text{–}_d$ = cumulative total run as of day d.

The cumulative total run on day d was estimated from the sum of all commercial, recreational, and personal use harvests to date, the estimated total escapement to date, and an estimate of the number of sockeye salmon residual (i.e. residing) in the district at that time. Commercial harvest data was estimated inseason from catch reports called or faxed into the ADF&G office. All commercially harvested salmon in UCI, whether sold or kept for personal use, are required to be reported to the Soldotna ADF&G office by fishermen or the processors they sell their fish to within 12 hours of the close of a fishing period. For a complete list of reporting requirements, please see 16.05.690(a) and 5 AAC 39.130. Recreational harvests were estimated inseason and provided by Division of Sport Fish staff. Personal use harvests were also estimated inseason from daily reports from the various fisheries in combination with an assessment of previous years' personal use catches from runs of similar abundance. Total escapement to date included estimated escapements into all monitored systems (Crescent, Susitna, Kenai and Kasilof Rivers, and Fish Creek) and unmonitored systems, which are assumed to be 15% of the escapement into monitored systems (Tobias and Willette 2003). The number of fish residual in the district was estimated by assuming exploitation rates of 70% in set net fisheries, 40% in district wide drift net fisheries, and 25% in reduced district drift net fisheries (Mundy et al. 1993). For example, if the drift gillnet fleet harvested 500 thousand sockeye salmon on an inlet-wide fishing period, the number of sockeye salmon originally in the district would have been estimated at 1,250 thousand (500/0.40 = 1,250) and the number remaining, or the residual, would have been estimated at 750 thousand (1,250–500 = 750).

Passage rate, the expansion factor used to convert CPUE into estimated numbers of salmon passing the test fishing transect line into UCI, was calculated as:

$$PR_d = 1/q_d \tag{10}$$

Total run at the end of the season (TR_f) was then estimated from:

$$TR = PR \cdot CCPUE_f \tag{11}$$

To calculate the midpoint of the run, which is the day on which approximately 50% of the total run had passed the OTF transect, the following formula was used:

$$M = a/b \tag{12}$$

where: M = mean date of run,

a and b = model parameters.

Because the test fishery did not encompass the entire sockeye salmon run, the total $CCPUE_f$ for the test fishery was estimated after the season using the following 2 methods:

$$CCPUE_f^h = CCPUE_f \cdot \frac{H_t}{H_L} \tag{13}$$

where: $CCPUE_f^h$ = total estimated $CCPUE_f$ for the season, based on harvest,

H_t = total commercial harvest for the season,

$H\neg_L$ = total commercial harvest through final day of test fishery (f+2), and

L = number of days (lag time) it took salmon to travel from test fishery to commercial harvest areas (2 days).

$$CCPUE_t^r = CCPUE_f \cdot \frac{E_t + H_t}{\sum_{S=1}^{6} E_L + H_L} \tag{14}$$

where: $CCPUE_t^r$ = total estimated $CCPUE_f$ for the season, based upon total run,

E_t = total escapement for the season

H_t = total commercial harvest for the season

$E\neg_L$ = total Upper Cook Inlet escapement through final day of test fishery

$H\neg_L$ = total Upper Cook Inlet commercial harvest through final day of test fishery

L = number of days (lag time) it took salmon to travel from test fishery to spawning streams or to be available for commercial harvest.

The total run adjustment to $CCPUE_f$ (Equation 14) has replaced adjustments based on harvest alone (Equation 9) primarily due to modifications to commercial fishing management plans made by the BOF. Management plans now provide much less fishing time in August than in the past; therefore, adjustments based on harvest alone would not have accurately reflected the additional fish that entered the district after the test fishery ceased. The total run to date on the last day of the test fishery was computed by summing all commercial harvest data and estimates of escapement from the 4 sockeye salmon sonar enumeration sites, one weir site, and an estimate of escapement to all unmonitored systems through day *d*. An estimate of sockeye salmon escapement to all non-monitored systems in UCI is considered to be 15% of the monitored runs. Lag times are the approximate time needed for fish to migrate from the test fish transect to a destination. As suggested by Mundy et al. (1993), lag times must be accounted for when estimating the total run passing the test fish transect on day d. A lag time of up to 2 days was assumed for fish harvested in the commercial fishery. The following lag times were assumed for fish entering the escapement: Crescent River, 1 day; Kasilof and Kenai Rivers, 2 days; and Yentna River and Fish Creek, 7 days (15% of these totals are allocated to unmonitored systems) (Mundy et al. 1993). The number of sockeye salmon harvested in sport and personal use fisheries after test fishing ceased, that are not already accounted for in escapement monitoring, are assumed to be insignificant and therefore are not utilized in the $CCPUE_f$ post test fishery adjustment.

Adjusted estimates of $CCPUE_f$ ($CCPUE_t^h$ and $CCPUE_t^r$) were used for postseason estimates of TR_f.

RESULTS AND DISCUSSION

In 2008, the test boat was unable to fish 1 station on 16 July, 2 stations on 20 July, 1 station on 21 July, all 6 stations on 24 July, 2 stations on 26 July, and 1 station on 31 July (all due to rough seas). Catch data for missed stations were interpolated by averaging catches from the day before and the day after for each station that was not fished, other than for 31 July, where no interpolation was made as this was the last day fished. After applying the adjustments for the missed stations, a total of 2,447 sockeye salmon were estimated to have been captured during the 2008 test fishery, as well as 306 pink salmon *O. gorbuscha,* 405 chum salmon *O. keta*, 1,024 coho salmon *O. kisutch*, and 3 Chinook salmon *O. tshawytscha* (Tables 1–2, Appendices A1–A12). Sockeye salmon daily catches ranged from 3 on 19 July to 496 fish on 2 July (Tables 1–2). The unadjusted total sockeye salmon $CCPUE_f$ for the 2008 project was 1,594 with daily CPUE values ranging from 3 to 233. The $CCPUE_f$ of 1,594 represented the sixth lowest unadjusted $CCPUE_f$ since 1992, which is when the number of stations sampled by the test fish boat was standardized to the current 6 still being fished (Tarbox 1994). The relationship between the 1992–2008 annual test fish unadjusted $CCPUE_f$ and the total annual run of sockeye salmon to UCI (Figure 2) is significantly (α=0.05) correlated (P=0.039 and R^2=0.25); however 75% of the variation remains unexplained, indicating that the $CCPUE_f$ statistic by itself would not be a reliable predictor of the total annual sockeye salmon run.

The distribution of sockeye salmon catches along the test fish transect was similar to the distribution of CPUE values (Tables 2 and 3), which would be expected when fishing occurs at fixed intervals at each station.

Tarbox and Waltemyer (1989) provided detail into some of the assumptions used in the curve fitting procedures to estimate the $CCPUE_f$ statistic during the season. One of the major assumptions is that 24 June represents the first day of the sockeye salmon run to UCI. Variability in actual runs can therefore result in an average or early run being misclassified as late, especially during the first couple weeks of the test fish program. For this reason, 20 July was chosen as the earliest date that inseason formal estimates of each year's total run size and run timing should be made. By this date there are enough data points in the current year's run timing curve to provide a more accurate estimate of what the $CCPUE_f$ will be at the end of the season. In addition, Tarbox and King (1992) and later OTF annual reports all demonstrated that the initial first choice (best fit) estimate of the $CCPUE_f$ statistic and total run made around mid July was often not the best fit estimate later in July. Therefore, the method now used when making formal inseason estimates of the total run includes an examination of the top 5 or 6 best fits. Careful consideration is given to those years whose fits reveal the least day to day change in predicting what the $CCPUE_f$ will be. These years are identified as being potentially better fits, especially if the mean squared error (Equation 8), also referred to as the mean sum of squares, statistic is also improving. Sockeye salmon run timing from other areas of the state are also considered to see if a consistent pattern exists.

The first formal estimate of the 2008 UCI sockeye salmon run was made on 22 July, using commercial, sport and personal use harvests, escapement, and test fishery data through 21 July (Table 4). The 2008 test fish *CCPUE* curve was mathematically compared (mean sum of squares statistic) to runs from 1979 through 2007, with fits of the data ranked from best to worst. Based on an estimate of the run to date of 3.27 million sockeye salmon through 21 July (this estimate included the number of fish residual in the district), a passage rate of 2,472 was calculated. The

2008 test fish *CCPUE* curve most closely tracked the 1989 run and estimated a $CCPUE_f$ of 2,091 points, which when multiplied by the passage rate of 2,472 made for a total run estimate of 5.17 million fish. As cautioned earlier, the first best fit (lowest mean sum of squares) from approximately 20 July often turns out not to be the best fit by year's end, so the top 5 fits were considered, which included runs from 1979, 2006, 1984, and 2005 (in order of best fit). Using these data, a total run estimate of 3.67 to 10.84 million sockeye salmon was made. Unfortunately, the best fits included runs from 5 days early to 9 days late, which raised concerns about which run-timing pattern the current year's run would follow.

The second formal estimate of the total run of sockeye salmon to UCI in 2008 was made following the 24 July inlet wide commercial fishing period (Table 4). The run to date was now estimated at 3.39 million sockeye salmon, with the test fish *CCPUE* at 1,416. The passage rate was therefore estimated to be 2,396 fish per CPUE point. The 2008 *CCPUE* curve now most closely tracked the 1979 run, which was the second best fit on the 22 July assessment, and projected a $CCPUE_f$ of 1,492 and a total run of 3.57 million fish. The top 5 best fits included 1988, as it moved up from the 8th best fit from the 21 July data, while the 1995 fit dropped out of the top 5. The estimated total sockeye salmon run using the top 5 fits projected a total run ranging from 3.57 to 9.09 million fish.

The actual total run of sockeye salmon to UCI in 2008 was estimated at approximately 4.11 million fish, which included commercial, sport, and personal use harvests, as well as escapement to all systems. Therefore, the first best fit total-run estimate from the 2 formal inseason projections of the 2008 run were approximately 26% higher and 13% lower, respectively, than the actual run size.

In addition to making inseason estimates of the total size of the annual sockeye salmon run, UCI commercial fishery management plans compel the Department to also make an inseason estimate of the number of sockeye salmon in each year's run that are of Kenai River origin. Various management actions in both sport and commercial fisheries are tied to the total abundance of Kenai River sockeye salmon, which is characterized by 3 different size ranges: less than 2 million fish, between 2 and 4 million fish, and greater than 4 million fish (Shields 2007). As just explained, the *CCPUE* curves from the top 5 best fits of previous year's test fish data were used to project the $CCPUE_f$ for 2008, which was then used to estimate the total UCI sockeye salmon run. The Kenai River component of the run is determined in part from a weighted age-composition allocation method to estimate the stock composition of the commercial harvest (Tobias and Tarbox 1999). This method (Bernard 1983) allocates the commercial harvest to various stocks by analyzing the age-composition of the escapement that occurs in the major river systems of UCI and compares it to the age-composition of sockeye salmon harvested commercially. Three important assumptions of the weighted age-composition method are that (a) the age-composition of fish escaping the various river systems are representative of the age-composition in the commercial harvest, (b) the commercial harvest in specific areas is composed of nearby stocks, and (c) equal exploitation rates apply to all available stocks. The Kenai River sockeye salmon run to date is estimated by summing: (1) the commercial harvest of Kenai River stocks, (2) the estimated sockeye salmon passage in the Kenai River, and (3) an estimate of sport and personal use harvest below the mile-19 sonar site. Finally, a projection can be made of the remainder of the run that will be Kenai River origin by subtracting the run to date from the total run estimate and then applying an estimate of the proportion of the run remaining that will be Kenai River sockeye salmon, which is made by assessing previous years' data for runs of similar timing.

Using the 24 July total UCI run estimate, the total Kenai River sockeye salmon run was projected to range between 1.81 and 5.67 million fish (Table 5). Assuming that 1.58 million Kenai River sockeye salmon were accounted for in the run to date, this meant that 0.23 to 4.09 million fish remained in the run, which was somewhat problematic. The preseason forecast for Kenai River sockeye salmon had projected a total run of 3.06 million fish, which required commercial fisheries management to follow the guidelines for a run of 2 to 4 million fish. However, the first best fit estimator from the 24 July assessment was projecting a Kenai River run of less than 2 million fish, while 3 of the next 4 best fits all estimated the run would be between 2 and 4 million, and one estimate was predicting a final run greater than 4 million. Thus, these data alerted staff that a precautionary approach to management of the commercial fisheries was in order. A few days later, the second formal inseason assessment of the Kenai River sockeye salmon run was made. Using data through 27 July, the total Kenai River run was now projected to range between 1.79 and 2.67 million fish (Table 5). Approximately 1.62 million sockeye salmon had already been accounted for in the run to date, which left 0.17 to 1.04 million fish of Kenai River origin remaining in the 2008 run (assuming 70% of the run remaining would be Kenai River stock). With the first best fit of the data again suggesting the total run would be less than 2 million fish, and considering that 2 of the next 4 estimates projected the run to be very close to 2 million fish, this inseason projection indicated to staff that following the guidelines for the lowest tiered run was prudent.

The postseason estimate of the 2008 Kenai River sockeye salmon run totaled 2.2 million fish, with personal use harvest in the Kenai River dip net fishery being nearly 100,000 fish more than inseason estimates. Nevertheless, the test fish first best fit estimators from both formal inseason projections were very important in alerting staff to the fact that the 2008 run was likely much smaller than the preseason forecast had indicated.

Table 6 and Figure 3 show the OTF absolute percent error (APE) in projecting the total sockeye salmon run using the *CCPUE* first best fit estimate on or soon after 20 July. As can be seen in Figure 3, the APE in the 20 July estimate has been >30% only on runs that were 2 or more days early. For runs that were 1-day early, on time, or late, the OTF error in predicting the annual total run ranged from -27.5% to +15.8%, with a mean of 9.3%. Conversely, for runs that entered the district 2 or more days earlier than average, the OTF curve-fitting estimator did not perform nearly as well, with a range in error of +8.8% to +75.4%, or a mean of +34.5%. For all runs, regardless of run-timing, the APE using the first best fit run estimator on or soon after 20 July was 17.0%. In 2008, the total sockeye salmon run projection using data through 21 July estimated a total run that was 26% greater than the actual run. Again, the 2008 run was 4 days early.

The last day of test fishing typically occurs on 30 July each year, which means the “tail end” of the sockeye salmon run is not assessed by the project. In 2008, the test fish project ended on 31 July, but sockeye salmon escapement monitoring lasted until August 10 in the Yentna and Kasilof Rivers and until August 17 in the Kenai River, while commercial fishing continued into September. Therefore, in order to estimate the proportion of the run that occurred after the test fishery ceased, 2 methods were used to adjust the $CCPUE_f$ statistic to reflect what it would have been had the project continued through the end of the sockeye salmon run.

The first method accounted for the number of fish harvested commercially after the test fishery ended (Equation 13), while the second method enumerated both escapement and commercial catch (total run) after the test fishery terminated (Equation 14). The sport and personal use harvest of sockeye salmon that occurred after the test fishery concluded was assumed to be minimal and therefore was not considered. Table 7 shows the differences in the annual $CCPUE_f$ statistic after postseason adjustments were made using either the harvest or total run method. Although the differences were often relatively minor, they did affect calculations of the a & b coefficients in the equations used to describe historical run timing curves, which in turn had an effect on estimates of subsequent $CCPUE_f$ values. Beginning in 2002, the total run method was used to make postseason adjustments to all previous years' $CCPUE_f$ statistics (Shields 2003). For the 2008 season, the test fish $CCPUE_f$ of 1,594 was adjusted to 1,679 based on the number of sockeye salmon that were commercially harvested and escaped after the test fishery ceased. Therefore, this method estimated that approximately 5% of the sockeye salmon run occurred after the test fishery ceased. Historical *a* and *b* coefficients calculated using total run-adjusted $CCPUE_f$ values are now being used for all inseason run projections. Using the total run-adjusted values, the relationship between sockeye salmon total run and test fishery CPUE (P=0.029) improves only slightly from the unadjusted values (P=0.039).

A non-linear mathematical model (Mundy 1979) was fit to the *CCPUE* proportions of the 2008 sockeye salmon run to UCI. Using the total run-adjusted $CCPUE_f$, this analysis suggested that 16.4% of the run had passed the transect prior to the start of test fishing on 1 July, and that the run was 95.1% complete at project termination on 31 July (Figure 4 and Appendix A13). Therefore, the mathematical model indicated that the 2008 test fishery covered approximately 78.7% of the run. The test fish passage rate for the season can be calculated by dividing the total number of sockeye salmon that were available to capture by the test fishery $CCPUE_f$. In 2008, the estimated final passage rate was 2,439.

The midpoint of the 2008 UCI sockeye salmon run, or the day on which approximately 50% of the total run had entered UCI at the test fish transect, occurred on day 18.4, or 11 July, which was 4 days early relative to the historic average mean date of 15 July (Table 8). This marked the first early run in UCI after 4 consecutive years where the sockeye salmon run timing was late.

Surface water temperatures measured along the test fish transect ranged from 7.6°C to 11.5°C and averaged 9.3°C for the year (Appendices A14 and A15). These water temperature data were very similar to the 2007 average of 9.4°C, but represented the coldest average since 1988. Water temperatures are believed to play a significant role in the timing of salmon runs (Burgner 1980), so these data have been closely monitored. In general, warmer water temperatures are thought to result in early runs, while cooler temperatures produce late runs. For example, in Bristol Bay, Burgner (1980) reported that the arrival dates of sockeye salmon were early during years when water temperatures were warmer than average. In a later Bristol Bay study, Ruggerone (1997) found that the change in temperature from winter to spring was a better predictor of run timing than temperature alone. However, water temperature data alone may or may not be an accurate predictive tool for gauging the run timing of UCI salmon stocks. The 2005 UCI sockeye salmon run was the second latest run ever observed, yet surface water temperatures along the test fish transect were the warmest ever measured, and as just mentioned, the 2008 run was 4 days early, yet surface water temperatures were much cooler than average. It appears that factors other than just water temperature likely play a role in determining salmon run timing in UCI. Pearcy (1992) summarized some of the factors that affect the coastal migration of returning adult salmon. He reviewed the orientation mechanisms used by salmon in coastal waters and concluded that prior to entering estuaries adult salmon probably rely on cues that are different from those used in the open ocean phases of their migration. Salinity, temperature, currents, and bathymetry were all thought to play a role in migration. Another dynamic to consider that could affect run timing is the age composition of the run, which relates to fish size; larger fish swim faster than smaller fish (Flynn and Hilborn 2004). Finally, it should be noted that when classifying sockeye salmon run timing in UCI, the size of the Kenai River run should be considered. Kenai River sockeye salmon return to UCI later than any other numerically significant stock, and because the Kenai River run is the largest in UCI, runs classified as late in general tend to be large Kenai River runs. For example, from 1979–2008, the average Kenai River annual run for years where the UCI return was classified as early, was 2.3 million fish, yet for UCI runs classified as on time or late, the Kenai River run averaged 3.8 million fish. Thus, a combination of these factors (water temperature, salinity, currents, bathymetry, fish size, and stock composition of the run) likely affects fish migration and run timing.

In an attempt to better understand and predict sockeye salmon migrations into UCI, ADF&G conducted a companion study on board the test fish vessel from 2002–2005. Using side-scan sonar, fish distribution in the water column was measured in relation to various oceanographic data, such as water temperature, salinity, tide stage, and water clarity. These data have not been published yet, but one of the objectives of the study was to determine whether or not the OTF inseason run forecasting model could be improved using this additional information.

In 2008, air temperatures along the test fish transect ranged from 9°C to 13°C and averaged 10.5°C, or the coldest average air temperature since the test fishery began in 1979 (Appendices A14 and A15). Wind velocities averaged 6.3 knots for the month, which represents the second calmest conditions observed since 1992. Wind direction was variable, but in general winds originated out of the south, which is the dominate wind orientation in UCI during July. Salinity and secchi disk readings were similar to the averages from all previous years (Appendices A15 and A16).

Appendix A15 provides a summary of the physical data that has been collected at each of the 6 test fish stations for the past 10 years. Station 4, which is on the east side of Cook Inlet (Figure 1), was the shallowest station, averaging 23.7 fathoms (144 feet) in depth. It should be noted, though, that changes in depth are a result of different stages of tide as well as minor differences in set location from day to day. Station 4 also had the clearest water, with a 1999–2008 secchi disk average depth of 8.2 m. In general, water clarity along the test fish transect decreases from east to west (secchi disk average depth decreases from 8.2 m at station 4 to 2.9 m at station 8) as a result of numerous glacial watersheds draining into the west side of Cook Inlet.

From 2002–2007, scale samples were collected from all sockeye salmon that were measured to estimate mean length (ASL samples). The average age structure and size of fish from samples collected at the 6 test fish stations were very similar to samples obtained from the drift gillnet commercial harvest (see previous test fish reports for these data). Scale samples from the test fishery were also collected with the intent of assessing whether or not Kenai River sockeye salmon, which are the dominant stock in Cook Inlet runs, might be identified using "size at age" criteria as they entered the district at the test fish transect. This analysis would compare the average size of each age-class of sockeye salmon collected at various escapement monitoring sites throughout UCI to the average size of the same age-classes collected at the 6 stations along the test fish transect. The results of this "mixture-model" analysis, when and if completed, will be summarized in future test fish annual reports. In 2008, scale samples were not collected from fish captured in the test fishery, as these fish are now being analyzed using a new genetic stock identification (GSI) technique (Habicht et al. 2007).

ADF&G has been developing and refining the technique of GSI since the early 1990s. Beginning in 2006, fish captured in the test fishery that were utilized for ASL data were also sampled for GSI analysis. Nearly 3,500 of the samples that were collected in 2006 and 2007 were successfully genotyped (Table 9). Samples were pooled into discrete time periods to meet sample size goals, resulting in 4 time periods in 2006 and 5 periods in 2007. The data from these 2 years revealed somewhat similar findings, i.e., as you progressed into the month of July the proportion of Kasilof River sockeye salmon stocks decreased while Kenai River stocks increased. By the 29th of July, Kenai River sockeye salmon comprised approximately 70% of the sockeye salmon population passing the test fishery transect. GSI samples collected during the 2008 test fishery had not been analyzed at the time this report was prepared.

The efficacy of using GSI analyses in combination with the test fishery for inseason management of the UCI commercial fishery remains unclear. While it could be very useful to know when specific stocks are entering the Central District, the variability of their migration routes both inter- and intra-annually through the district makes adjustments of commercial fishing periods for the purpose of increasing or decreasing exploitation on specific stocks very subjective. That said, GSI data will no doubt serve as the foundation for future research projects aimed at attempting to more clearly understand stock specific run timing and migration through UCI.

The UCI test fishery continues to provide fishery managers with very important data about the strength and timing of each year's sockeye salmon run. Since commercial, sport, and personal use fishery management plans depend on inseason sockeye salmon run estimates, the UCI test fishery project remains one of the most essential tools available for management of these fisheries.

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TABLES AND FIGURES

Table 1.–Summary of sockeye salmon fishing effort, daily and cumulative catch, and daily and cumulative CPUE, Upper Cook Inlet offshore test fish project, 2008.

Date	Number of Stations	Mean Fishing Time (min)	CATCH		CPUE		Mean Length (mm)
			Daily	Cum	Daily	Cum	
7/01	6	230.5	114	114	81	81	556
7/02	6	259.5	496	610	233	314	548
7/03	6	236.0	100	710	67	381	552
7/04	6	254.0	160	870	97	479	549
7/05	6	228.5	7	877	6	485	560
7/06	6	224.5	4	881	3	488	560
7/07	6	218.0	41	922	33	520	553
7/08	6	237.0	118	1,040	83	603	556
7/09	6	226.5	69	1,109	52	656	572
7/10	6	227.0	98	1,207	76	732	568
7/11	6	237.0	120	1,327	82	814	571
7/12	6	239.5	140	1,467	93	907	573
7/13	6	246.5	122	1,589	84	991	572
7/14	6	230.5	85	1,674	61	1,052	557
7/15	6	249.0	130	1,804	84	1,136	566
7/16	5a	189.0	50	1,854	39	1,175	571
7/17	6	237.5	92	1,946	68	1,242	568
7/18	6	220.0	9	1,955	7	1,250	570
7/19	6	216.0	3	1,958	3	1,252	564
7/20	4a	166.5	56	2,014	38	1,290	568
7/21	5a	191.0	48	2,062	34	1,324	567
7/22	6	253.0	113	2,175	78	1,402	568
7/23	6	213.5	5	2,180	4	1,406	543
7/24	0a	0.0	15	2,195	10	1,416	562
7/25	6	222.5	21	2,216	17	1,433	569
7/26	4a	153.0	18	2,234	14	1,447	562
7/27	6	222.0	13	2,247	10	1,457	553
7/28	6	246.0	79	2,326	48	1,505	577
7/29	6	221.0	26	2,352	21	1,525	567
7/30	6	240.0	68	2,420	43	1,568	570
7/31	5[a]	162.5	27	2,447	26	1,594	568

[a] Not all stations fished due to weather; the data for missing stations were interpolated.

Table 2.–Estimated sockeye salmon catch by date and station, Upper Cook Inlet offshore test fish project, 2008.

Date	Station Number 4	5	6	6.5	7	8	Total
7/01	6	8	20	3	77	0	114
7/02	3	429	63	1	0	0	496
7/03	1	14	7	0	74	4	100
7/04	43	3	107	0	6	1	160
7/05	0	0	4	3	0	0	7
7/06	1	3	0	0	0	0	4
7/07	2	33	4	1	0	1	41
7/08	37	6	6	4	65	0	118
7/09	13	28	28	0	0	0	69
7/10	30	15	34	16	3	0	98
7/11	13	70	29	8	0	0	120
7/12	14	13	94	8	3	8	140
7/13	11	60	5	6	33	7	122
7/14	1	8	34	38	1	3	85
7/15	0	8	30	11	81	0	130
7/16[a]	1	6	15	15	10	**3**	50
7/17	3	7	29	40	8	5	92
7/18	2	0	3	0	2	2	9
7/19	0	2	0	1	0	0	3
7/20[a]	8	**8**	**0**	15	25	0	56
7/21[a]	4	13	0	1	**28**	2	48
7/22	4	4	18	38	30	19	113
7/23	0	3	0	1	1	0	5
7/24[a]	**1**	**5**	**4**	**1**	**3**	**1**	15
7/25	1	6	7	1	4	2	21
7/26[a]	1	4	8	**1**	**2**	2	18
7/27	1	10	1	0	0	1	13
7/28	2	3	3	35	29	7	79
7/29	2	0	14	9	0	1	26
7/30	1	0	8	4	52	3	68
7/31	**0**	0	10	9	8	0	27
Total	206	769	585	270	545	72	2,447
%	8%	31%	24%	11%	22%	3%	100%

[a] Not all stations fished due to weather; the data for missing stations (in bold) was interpolated.

Table 3.–Estimated sockeye salmon CPUE by date and station, Upper Cook Inlet offshore test fish project, 2008.

	Station Number						
Date	4	5	6	6.5	7	8	Total
7/01	5	6	15	3	52	0	81
7/02	2	188	42	1	0	0	233
7/03	1	11	6	0	47	3	67
7/04	32	2	58	0	5	1	97
7/05	0	0	3	2	0	0	6
7/06	1	2	0	0	0	0	3
7/07	2	26	3	1	0	1	33
7/08	27	5	5	3	44	0	83
7/09	10	21	22	0	0	0	52
7/10	23	12	26	12	2	0	76
7/11	10	46	20	6	0	0	82
7/12	11	10	56	6	2	6	93
7/13	8	38	4	5	24	6	84
7/14	1	6	24	26	1	3	61
7/15	0	6	19	7	51	0	84
7/16[a]	1	5	12	12	8	**2**	39
7/17	2	5	21	29	6	4	68
7/18	2	0	2	0	2	2	7
7/19	0	2	0	1	0	0	3
7/20[a]	6	**6**	**0**	11	16	0	38
7/21[a]	3	9	0	1	**19**	2	34
7/22	3	3	12	24	22	14	78
7/23	0	2	0	1	1	0	4
7/24[a]	**0**	**4**	**3**	**1**	**2**	**1**	10
7/25	1	5	6	1	3	2	17
7/26[a]	1	3	6	**0**	**2**	2	14
7/27	1	8	1	0	0	1	10
7/28	2	2	2	21	20	1	48
7/29	2	1	10	7	0	1	21
7/30	1	0	6	3	31	2	43
7/31	**0**	0	13	6	6	0	26
TOTAL	157	435	397	190	364	52	1,594
%	9.8%	27.3%	24.9%	11.9%	22.8%	3.2%	100%

[a] Not all stations fished due to weather; the data for missing stations (in bold) was interpolated.

Table 4.–Total run estimates for sockeye salmon to Upper Cook Inlet, Alaska, made during the 2008 season.

Based on data through 7/21/2008						
Escapement						800,216
Cumulative Catch (Commercial, Sport, & PU)						2,229,152
Residual in District						243,679
Total Run Through 7/21/2008 =						3,273,047
2008 Cumulative OTF CPUE through 7/21 =						1,324
Passage Rate (Total Run/Cumulative CPUE) through 7/21 =						2,472
Run Estimates Based on Model Results (Fit of Current Year to Past Years)						
	Mean Sum	Estimated Total CPUE				Estimated
Year	of Squares	Current	Previous Day	Difference	Timing	Total Run
1989	0.001183	2,091	2,110	-19	on time	5,168,015
1979	0.001198	1,486	1,489	-3	5 day early	3,674,005
2006	0.001544	4,384	4,552	-168	9 day late	10,837,320
1984	0.001622	1,678	1,694	-15	3 day early	4,148,822
2005	0.001678	3,444	3,549	-105	7 day late	8,514,154
1994	0.002637	3,279	3,395	-116	5 day late	8,104,717
1985	0.002682	2,127	2,170	-43	on time	5,256,655
1988	0.002690	2,056	2,095	-39	1 day early	5,082,637
1997	0.002708	2,629	2,702	-72	3 day late	6,499,302
1998	0.002816	2,590	2,661	-71	3 day late	6,401,812
1982	0.003210	2,270	2,324	-55	1 day late	5,609,956
1986	0.003900	2,230	2,286	-57	on time	5,511,305
2001	0.004053	1,771	1,799	-28	2 day early	4,376,999
1993	0.004150	2,101	2,150	-50	on time	5,192,906
2002	0.004518	1,787	1,818	-31	2 day early	4,417,067
1987	0.005606	3,118	3,264	-146	4 day late	7,707,170
2007	0.005700	3,093	3,237	-145	4 day late	7,644,410
1981	0.005795	1,330	1,320	10	8 day early	3,287,631
1983	0.005928	2,285	2,356	-72	1 day late	5,647,553
2004	0.006929	2,685	2,799	-114	2 day late	6,638,121
1980	0.007026	1,363	1,353	10	8 day early	3,369,152
1991	0.007080	2,630	2,739	-109	2 day late	6,500,019
2003	0.007123	2,063	2,122	-58	1 day early	5,100,583
1996	0.007179	1,950	1,999	-49	1 day early	4,819,731
1995	0.008106	2,210	2,285	-75	on time	5,462,856
1999	0.009129	2,855	3,004	-149	3 day late	7,056,456
2000	0.009544	1,784	1,824	-40	2 day early	4,409,059
1990	0.010068	3,307	3,530	-223	4 day late	8,175,437
1992	0.010926	2,777	2,929	-152	2 day late	6,863,529

-continued-

Table 4.–Page 2 of 2.

Based on data through 7/24/2008						
Escapement						932,908
Cumulative Catch (Commercial, Sport, & PU)						2,366,293
Residual in District						93,460
Total Run Through 7/24/2008 =						3,392,661
2008 Cumulative OTF CPUE through 7/24 =						1,416
Passage Rate (Total Run/Cumulative CPUE) through 7/24 =						2,396
Run Estimates Based on Model Results (Fit of Current Year to Past Years)						
	Mean Sum	Estimated Total CPUE				Estimated
Year	of Squares	Current	Previous Day	Difference	Timing	Total Run
1979	0.001026	1,492	1,491	1	Early 5 days	3,574,107
1989	0.001560	2,025	2,044	-18	On Time	4,851,364
1984	0.001718	1,644	1,652	-8	Early 4 days	3,937,094
2006	0.004112	3,794	3,934	-140	Late 9 days	9,087,969
1988	0.004133	1,939	1,967	-27	Early 2 days	4,645,558
2005	0.004134	3,066	3,155	-88	Late 7 days	7,344,678
1985	0.004316	1,996	2,027	-30	On Time	4,781,660
2001	0.004596	1,700	1,715	-15	Early 2 days	4,071,735
2002	0.005156	1,710	1,727	-17	Early 1 days	4,095,927
1997	0.005345	2,394	2,449	-55	Late 1 day	5,734,639
1982	0.005417	2,101	2,140	-39	Late 2 days	5,032,977
1998	0.005462	2,360	2,414	-53	Late 3 days	5,653,797
1994	0.005923	2,890	2,980	-90	Late 4 days	6,923,556
1993	0.006143	1,957	1,989	-32	Early 1 day	4,687,117
1981	0.006197	1,376	1,367	9	Early 9 days	3,296,010
1986	0.006253	2,060	2,098	-38	Late 1 day	4,933,404
1980	0.007053	1,408	1,399	9	Early 9 days	3,372,301
1996	0.008905	1,820	1,847	-27	Early 2 days	4,358,742
1983	0.009111	2,077	2,122	-45	On Time	4,975,106
2003	0.009512	1,904	1,938	-34	Early 2 days	4,560,572
2000	0.010135	1,688	1,707	-19	Early 2 days	4,044,428
1987	0.010989	2,671	2,768	-97	Late 2 days	6,397,256
2007	0.011092	2,651	2,747	-95	Late 4 days	6,350,548
1995	0.011479	2,003	2,047	-43	On Time	4,798,547
2004	0.011935	2,350	2,421	-72	Late 2 days	5,628,526
1991	0.011964	2,309	2,377	-68	Late 2 days	5,530,941
1999	0.015799	2,429	2,517	-88	Late 3 days	5,817,660
1992	0.018080	2,355	2,441	-85	Late 2 days	5,642,059
1990	0.019025	2,686	2,811	-125	Late 3 days	6,433,498

Table 5.–Projected total Kenai River sockeye salmon run (millions) in 2008 estimated from total offshore test fish CPUE and age composition stock allocation data through July 24 and July 27, 2008.

Data through 24 July

		Est. Total OTF CPUE										
Year	MSS	Current	Prev. Day	Timing	Passage Rate	Estimated UCI Total run	Estimated UCI Run to Date[a]	Estimated UCI Run Remaining	Estimated Kenai Run to Date	Prop. Kenai	Estimated Kenai Run Remaining	Estimated Total Kenai Return
1979	0.00103	1,492	1,491	Early 5 days	2,395	3.57	3.25	0.32	1.58	70%	0.227	1.807
1989	0.00156	2,025	2,044	On Time	2,395	4.85	3.25	1.60	1.58	70%	1.122	2.702
1984	0.00172	1,644	1,652	Early 4 days	2,395	3.94	3.25	0.69	1.58	70%	0.482	2.062
2006	0.00411	3,794	3,934	Late 9 days	2,395	9.09	3.25	5.84	1.58	70%	4.087	5.667
1988	0.00413	1,939	1,967	Early 2 days	2,395	4.65	3.25	1.40	1.58	70%	0.977	2.557

Data through 27 July

		Est. Total OTF CPUE										
Year	MSS	Current	Prev. Day	Timing	Passage Rate	Estimated UCI Total run	Estimated UCI Run to Date[a]	Estimated UCI Run Remaining	Estimated Kenai Run to Date	Prop. Kenai	Estimated Kenai Run Remaining	Estimated Total Kenai Return
1979	0.00095	1,494	1,493	Early 5 days	2,534	3.78	3.55	0.24	1.62	70%	0.165	1.788
1984	0.00180	1,629	1,636	Early 4 days	2,534	4.13	3.55	0.58	1.62	70%	0.405	2.028
1989	0.00199	1,988	2,007	On Time	2,534	5.04	3.55	1.49	1.62	70%	1.043	2.666
2001	0.00478	1,674	1,686	Early 2 days	2,534	4.24	3.55	0.69	1.62	70%	0.485	2.108
1988	0.00494	1,891	1,914	Early 2 days	2,534	4.79	3.55	1.24	1.62	70%	0.870	2.493

Note: MSS is the mean sum of squares

[a] Does not include residual fish still resident in the Central District.

Table 6.–Absolute Percentage Error (APE) using the first best fit estimate of test fish data on or after July 20 to project the total annual UCI sockeye salmon run.

Year	Actual Run (millions)	July 20 Estimate [a]	APE	Run Timing
1988	8.52	11.30	32.6%	1 day early
1990	5.00	4.90	1.9%	4 day late
1991	3.66	3.90	6.5%	2 day late
1992	10.90	11.40	4.5%	2 day late
1993	6.48	6.40	1.2%	on time
1994	5.51	5.30	3.8%	5 day late
1995	4.51	4.50	0.2%	on time
1996	5.63	8.50	51.0%	1 day early
1997	6.41	6.00	6.4%	3 day late
1998	3.00	3.40	13.3%	3 day late
1999	4.57	5.20	13.7%	3 day late
2000	2.94	3.20	8.8%	2 day early
2001	3.53	6.20	75.4%	2 day early
2002	4.84	5.50	13.6%	2 day early
2003	6.29	6.79	8.0%	1 day early
2004	7.92	8.94	12.8%	2 day late
2005	7.92	9.17	15.8%	7 day late
2006	4.96	3.60	27.5%	9 day late
2007	5.44	4.65	14.6%	4 day late
2008	4.11	5.17	25.8%	4 day early

[a] Estimate made after a regular fishing period on or soon after July 20.

Table 7.–A comparison of methods used to make postseason adjustments to the offshore test fish final CPUE.

Year	Final OTF CPUE	Postseason OTF CPUE Adjustment Harvest-adjusted	Postseason OTF CPUE Adjustment Total Run-adjusted	Harvest Adjusted *a*	Harvest Adjusted *b*	Total Run Adjusted *a*	Total Run Adjusted *b*
1979	602	651	664	-3.2451	0.1876	-3.3380	0.2004
1980	740	770	777	-2.2537	0.1640	-2.2403	0.1612
1981	364	383	387	-2.5459	0.1856	-2.5243	0.1819
1982	651	775	786	-3.6839	0.1522	-3.7156	0.1633
1983	2,464	2,472	2,474	-4.2719	0.1883	-4.2732	0.1884
1984	1,331	1,334	1,341	-3.4257	0.1855	-3.4018	0.1834
1985	1,422	1,575	1,563	-3.4581	0.1523	-3.5633	0.1626
1986	1,653	1,731	1,714	-3.7671	0.1633	-3.8642	0.1719
1987	1,404	1,422	1,428	-4.3442	0.1689	-4.6385	0.1785
1988	1,131	1,145	1,169	-3.3682	0.1639	-3.5655	0.1662
1989	619	682	692	-2.7114	0.1258	-2.7031	0.1238
1990	1,358	1,404	1,426	-5.7913	0.2259	-5.7085	0.2211
1991	1,574	1,759	1,740	-4.5806	0.1885	-4.6331	0.1919
1992	2,021	2,186	2,195	-5.4366	0.2235	-5.4043	0.2217
1993	1,815	1,882	1,913	-4.0776	0.1906	-3.9018	0.1797
1994	1,012	1,145	1,199	-4.0770	0.1553	-3.9757	0.1453
1995	1,712	1,828	1,850	-4.7036	0.2131	-4.6219	0.2078
1996	1,723	1,765	1,796	-4.6328	0.2266	-4.4605	0.2144
1997	1,656	1,705	1,826	-3.8265	0.1621	-3.7000	0.1496
1998	1,158	1,355	1,313	-3.6700	0.1473	-3.7142	0.1515
1999	2,226	2,475	2,419	-5.3100	0.2175	-5.1500	0.2081
2000	1,520	1,532	1,565	-5.1094	0.2614	-4.9141	0.2480
2001	1,586	1,594	1,630	-3.9323	0.2002	-3.9823	0.2041
2002	1,736	1,749	1,825	-4.3694	0.2292	-4.0642	0.2068
2003	1,787	1,824	1,848	-4.5091	0.2117	-4.4402	0.2068
2004	2,028	2,220	2,345	-4.6374	0.1903	-4.6374	0.1903
2005	2,643	3,032	3,191	-3.7460	0.1354	-3.7152	0.1302
2006	1,507	1,756	1,969	-4.2031	0.1438	-4.0762	0.1308
2007	2,584	2,774	2,924	-4.9217	0.1962	-4.6427	0.1793
2008	1,594	1,612	1,675	-2.9601	0.1665	-2.8021	0.1521

Table 8.–Mean date of the sockeye salmon run across the Anchor Point transect, Upper Cook Inlet offshore test fish project, 1979–2008.

	Mean Date[a]	
Year	Coded	Calendar
1979	16.7	7/10
1980	13.9	7/07
1981	13.9	7/07
1982	22.8	7/16
1983	22.7	7/16
1984	18.5	7/12
1985	21.9	7/15
1986	22.5	7/15
1987	26.0	7/19
1988	21.5	7/14
1989	21.8	7/15
1990	25.8	7/19
1991	24.1	7/17
1992	24.4	7/17
1993	21.7	7/15
1994	27.4	7/20
1995	22.2	7/15
1996	20.8	7/14
1997	24.7	7/18
1998	24.5	7/18
1999	24.7	7/18
2000	19.8	7/13
2001	19.5	7/13
2002	19.7	7/13
2003	21.5	7/14
2004	24.4	7/17
2005	28.5	7/22
2006	31.2	7/24
2007	25.9	7/19
2008	18.4	7/11
Average	22.4	7/15

[a] Day (1) = June 24.

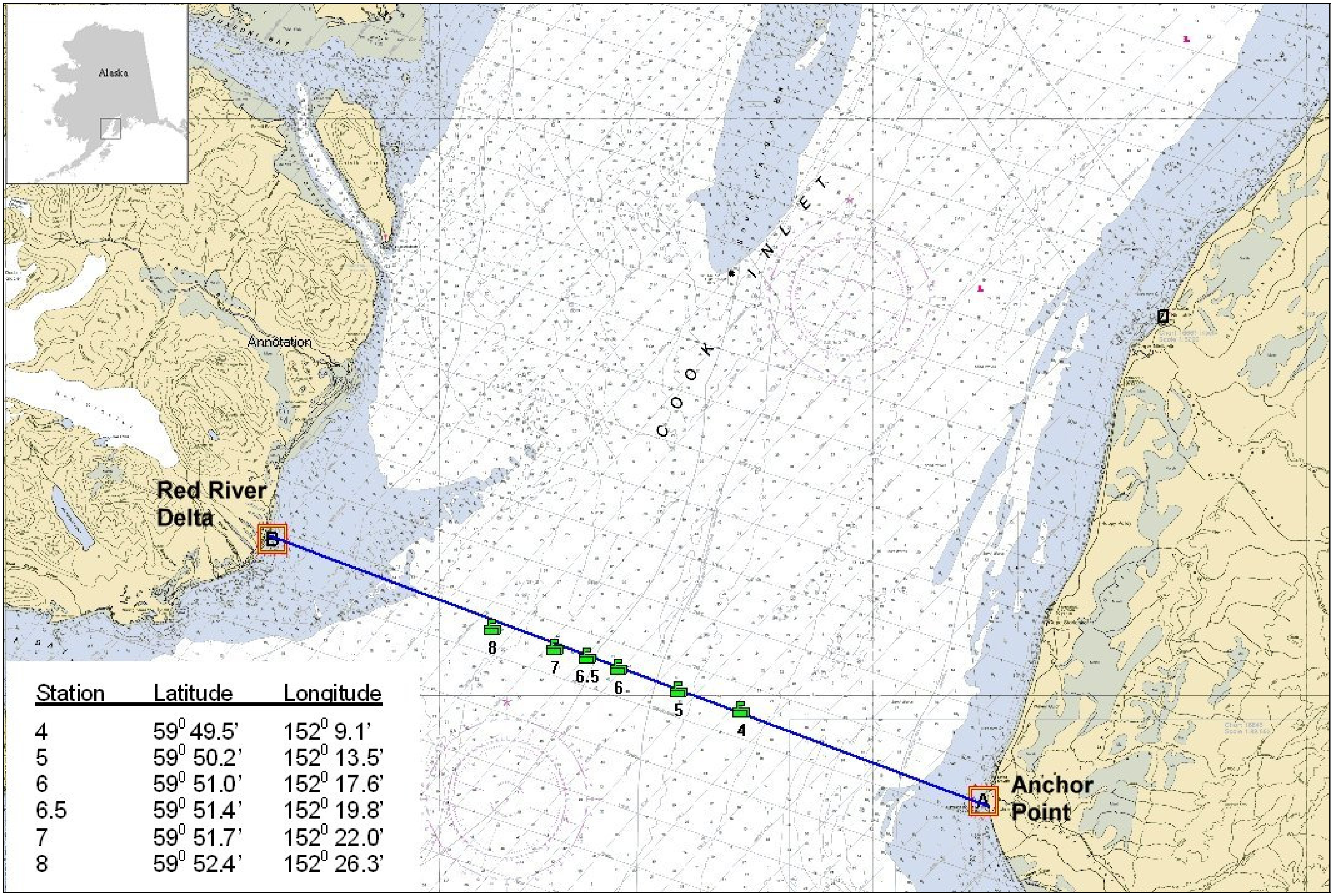
Table 9.–Stock composition estimate and the number of fish successfully screened for mixtures of fish captured in the Cook Inlet offshore test fishery in 2006 and 2007.

Date(s)	N	West	Yentna	Susitna	Knik	Northeast	Kenai	Kasilof
				2006				
7/1-9	325	0.11	0.06	0.00	0.01	0.00	0.30	0.51
		(0.08 - 0.15)	0.04 - 0.10)	(0.00 - 0.01)	(0.00 - 0.02)	(0.00 - 0.00)	(0.24 - 0.36)	(0.45 - 0.58)
7/10-16	266	0.08	0.13	0.07	0.05	0.00	0.34	0.33
		(0.05 - 0.12)	(0.07 - 0.19)	(0.04 - 0.11)	(0.02 - 0.08)	(0.00 - 0.00)	(0.27 - 0040)	(0.26 - 0.39)
7/17-23	401	0.10	0.09	0.02	0.02	0.00	0.61	0.16
		(0.07 - 0.13)	(0.06 - 0.13)	(0.01 - 0.03)	(0.01 - 0.03)	(0.00 - 0.00)	(0.56 - 0.67)	(0.12 - 0.21)
7/24-8/1	393	0.05	0.07	0.03	0.02	0.00	0.70	0.12
		(0.03 - 0.07)	(0.03 - 0.12)	(0.00 - 0.07)	(0.01 - 0.04)	(0.00 - 0.01)	(0.65 - 0.75)	(0.08 - 0.16)

Date(s)	N	West	Yentna	Susitna	Knik	Northeast	Kenai	Kasilof
				2007				
7/1-9	374	0.17	0.12	0.01	0.06	0.00	0.41	0.24
		(0.12 - 0.22)	(0.07 - 0.16)	(0.00 - 0.02)	(0.04 - 0.09)	(0.00 - 0.01)	(0.35 - 0.47)	(0.18 - 0.29)
7/10-13	444	0.07	0.15	0.02	0.04	0.00	0.54	0.18
		(0.05 - 0.10)	(0.11 - 0.19)	(0.00 - 0.04)	(0.02 - 0.07)	(0.00 - 0.00)	(0.48 - 0.60)	(0.13 - 0.23)
7/14-18	404	0.07	0.13	0.04	0.03	0.00	0.62	0.12
		(0.04 - 0.10)	(0.08 - 0.18)	(0.01 - 0.09)	(0.01 - 0.04)	(0.00 - 0.00)	(0.57 - 0.67)	(0.08 - 0.16)
7/19-23	429	0.08	0.08	0.05	0.03	0.00	0.68	0.09
		(0.06 - 0.11)	(0.05 - 0.12)	(0.02 - 0.08)	(0.01 - 0.04)	(0.00 - 0.00)	(0.63 - 0.73)	(0.06 - 0.13)
7/24-8/2	439	0.07	0.07	0.05	0.01	0.00	0.71	0.09
		(0.05 - 0.10)	(0.04 - 0.10)	(0.03 - 0.07)	(0.00 - 0.02)	(0.00 - 0.00)	(0.66 - 0.76)	(0.06 - 0.13)

Source: Reproduced from Habicht et al. 2007.

Note: Credibility intervals (90%) are included in parentheses. Proportions are estimated from BAYES using a SPAM prior.



Station	Latitude	Longitude
4	59^0 49.5’	152^0 9.1’
5	59^0 50.2’	152^0 13.5’
6	59^0 51.0’	152^0 17.6’
6.5	59^0 51.4’	152^0 19.8’
7	59^0 51.7’	152^0 22.0’
8	59^0 52.4’	152^0 26.3’

Figure 1.–Location of offshore test fish transect and fishing stations in Cook Inlet, Alaska, 2008.

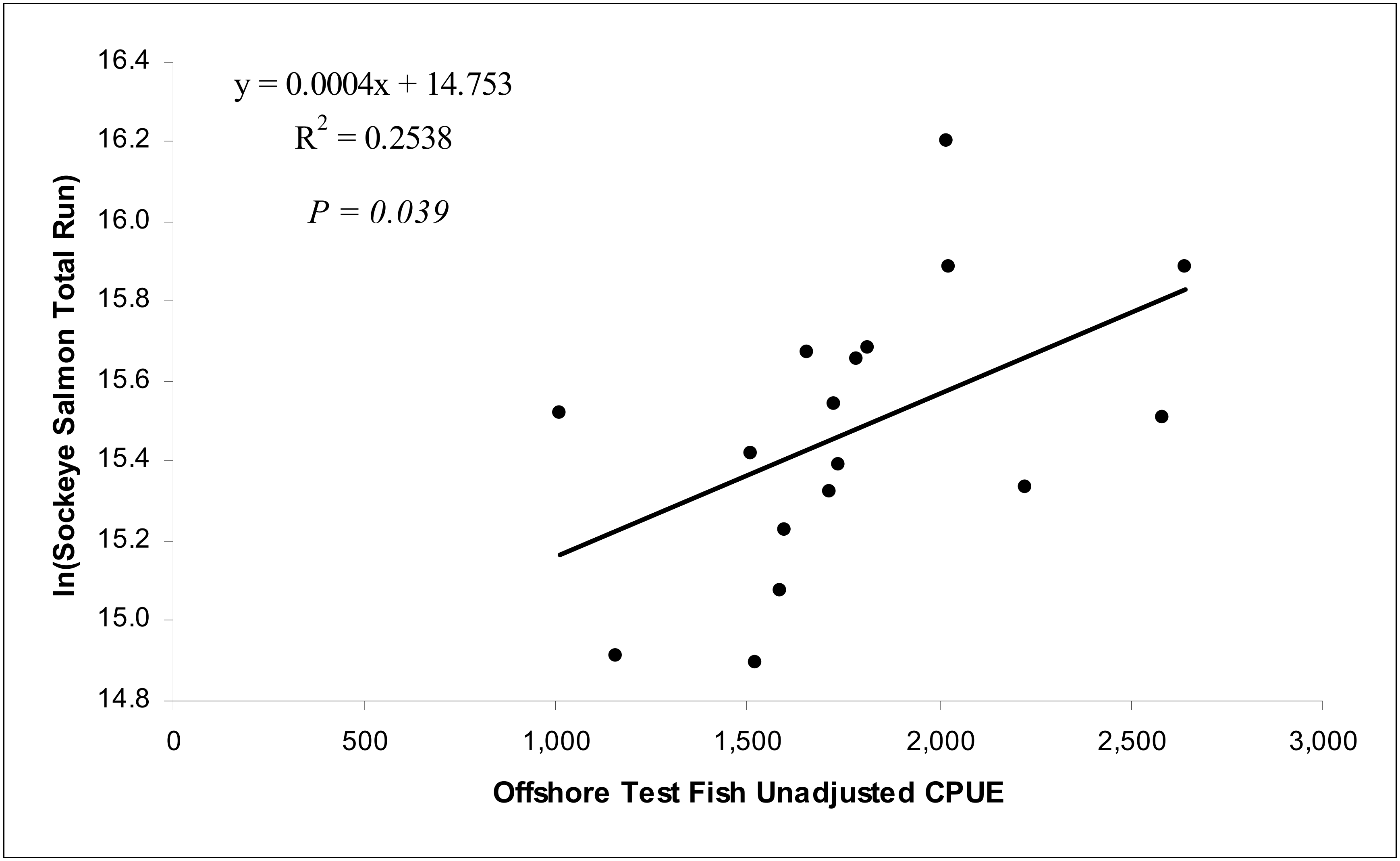


Figure 2.–Linear regression of the relationship between logged offshore test fish unadjusted cumulative CPUE and Upper Cook Inlet sockeye salmon total annual run, 1992–2008.

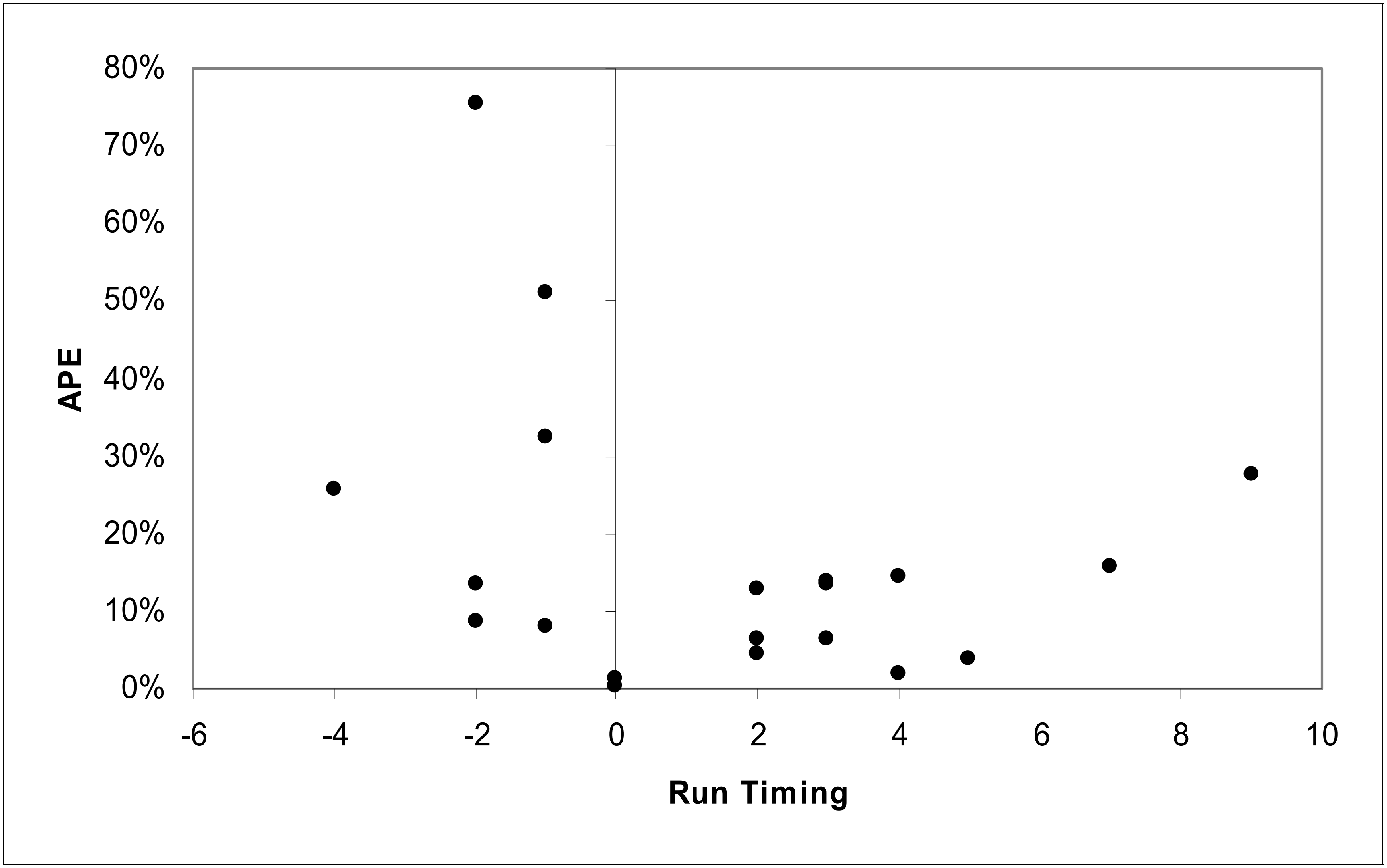


Figure 3.–Actual Percentage Error (APE) in forecasting the total sockeye salmon run to Upper Cook Inlet using the 20 July best fit estimate.

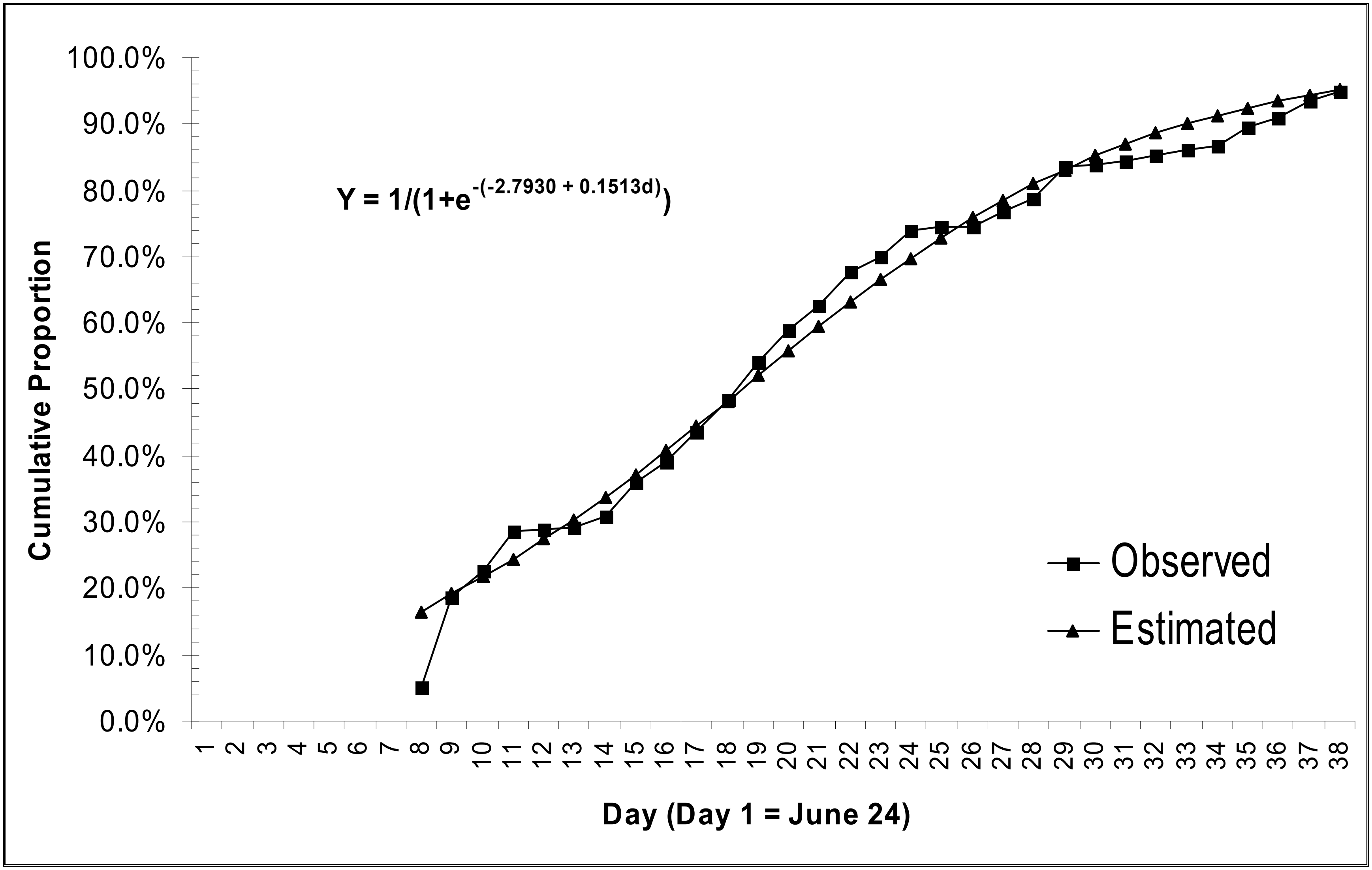


Figure 4.–Cumulative proportions estimated for the sockeye salmon run to Upper Cook Inlet, Alaska, 2008.

APPENDIX A

Appendix A1.–Summary of pink salmon fishing effort, daily and cumulative catch, and daily and cumulative CPUE, Upper Cook Inlet offshore test fish project, 2008.

Date	Number of Stations	Mean Fishing Time (min)	CATCH		CPUE	
			Daily	Cum	Daily	Cum
7/01	6	230.5	0	0	0	0
7/02	6	259.5	0	0	0	0
7/03	6	236.0	0	0	0	0
7/04	6	254.0	0	0	0	0
7/05	6	228.5	0	0	0	0
7/06	6	224.5	0	0	0	0
7/07	6	218.0	3	3	2	2
7/08	6	237.0	4	7	3	5
7/09	6	226.5	2	9	2	7
7/10	6	227.0	3	12	2	9
7/11	6	237.0	7	19	5	15
7/12	6	239.5	10	29	8	23
7/13	6	246.5	18	47	12	35
7/14	6	230.5	10	57	7	42
7/15	6	249.0	23	80	16	58
7/16	5[a]	189.0	15	95	11	70
7/17	6	237.5	23	118	20	90
7/18	6	220.0	3	121	2	92
7/19	6	216.0	1	122	1	93
7/20	4[a]	166.5	14	136	10	103
7/21	5[a]	191.0	12	148	8	111
7/22	6	253.0	19	167	13	124
7/23	6	213.5	2	169	2	126
7/24	0[a]	0.0	4	173	3	129
7/25	6	222.5	5	178	4	133
7/26	4[a]	153.0	13	191	9	143
7/27	6	222.0	2	193	2	144
7/28	6	246.0	38	231	25	169
7/29	6	221.0	9	240	7	176
7/30	6	240.0	41	281	26	203
7/31	5[a]	162.5	25	306	24	226

[a] Not all stations fished due to weather; the data for missing stations was interpolated.

Appendix A2.–Estimated pink salmon catch by date and station, Upper Cook Inlet offshore test fish project, 2008.

Date	Station Number 4	5	6	6.5	7	8	Total
7/01	0	0	0	0	0	0	0
7/02	0	0	0	0	0	0	0
7/03	0	0	0	0	0	0	0
7/04	0	0	0	0	0	0	0
7/05	0	0	0	0	0	0	0
7/06	0	0	0	0	0	0	0
7/07	0	0	2	0	1	0	3
7/08	3	0	0	1	0	0	4
7/09	0	2	0	0	0	0	2
7/10	1	0	1	1	0	0	3
7/11	3	2	0	1	0	1	7
7/12	3	3	0	1	2	1	10
7/13	2	9	1	0	6	0	18
7/14	0	5	4	1	0	0	10
7/15	0	8	4	2	9	0	23
7/16[a]	4	2	4	3	1	**1**	15
7/17	1	0	4	7	10	1	23
7/18	2	0	1	0	0	0	3
7/19	0	0	0	0	1	0	1
7/20[a]	1	**3**	**1**	3	3	3	14
7/21[a]	1	6	1	0	**4**	0	12
7/22	0	3	4	5	4	3	19
7/23	0	1	0	1	0	0	2
7/24[a]	**2**	**1**	**0**	**1**	**0**	**0**	4
7/25	3	1	0	1	0	0	5
7/26[a]	1	3	5	**1**	**1**	2	13
7/27	0	0	0	0	1	1	2
7/28	1	1	6	18	12	0	38
7/29	1	1	5	2	0	0	9
7/30	1	1	1	6	30	2	41
7/31[a]	**0**	0	9	7	9	0	25
Total	30	52	53	62	94	15	306
%	10%	17%	17%	20%	31%	5%	100%

[a] Not all stations fished due to weather; the data for missing stations (in bold) was interpolated.

Appendix A3.–Estimated pink salmon CPUE by date and station, Upper Cook Inlet offshore test fish project, 2008.

	Station Number						
Date	4	5	6	6.5	7	8	Total
7/01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/03	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/04	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/05	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/06	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/07	0.0	0.0	1.6	0.0	0.9	0.0	2.5
7/08	2.1	0.0	0.0	0.8	0.0	0.0	3.0
7/09	0.0	1.5	0.0	0.0	0.0	0.0	1.5
7/10	0.8	0.0	0.8	0.8	0.0	0.0	2.3
7/11	2.4	1.3	0.0	0.8	0.0	0.9	5.3
7/12	2.4	2.4	0.0	0.8	1.6	0.8	8.0
7/13	1.4	5.7	0.8	0.0	4.3	0.0	12.2
7/14	0.0	3.9	2.9	0.7	0.0	0.0	7.5
7/15	0.0	6.5	2.5	1.4	5.7	0.0	16.0
7/16[a]	3.2	1.6	3.1	2.4	0.8	**0.4**	11.5
7/17	0.8	0.0	3.0	5.0	10.7	0.8	20.4
7/18	1.6	0.0	0.8	0.0	0.0	0.0	2.4
7/19	0.0	0.0	0.0	0.0	0.8	0.0	0.8
7/20[a]	0.8	**2.2**	**0.4**	2.1	1.9	2.4	9.8
7/21[a]	0.8	4.3	0.8	0.0	**2.4**	0.0	8.3
7/22	0.0	2.2	2.6	3.2	2.9	2.2	13.1
7/23	0.0	0.8	0.0	0.8	0.0	0.0	1.7
7/24[a]	**1.3**	**0.8**	**0.0**	**0.8**	**0.0**	**0.0**	2.9
7/25	2.6	0.8	0.0	0.8	0.0	0.0	4.2
7/26[a]	0.8	2.4	4.0	**0.4**	**0.4**	1.5	9.5
7/27	0.0	0.0	0.0	0.0	0.9	0.8	1.6
7/28	0.8	0.8	4.6	10.6	8.3	0.0	25.2
7/29	0.8	0.9	3.6	1.6	0.0	0.0	6.9
7/30	0.8	0.9	0.7	4.5	17.8	1.6	26.4
7/31[a]	**0.0**	0.0	11.7	4.9	7.1	0.0	23.8
Total	23	39	44	42	67	11	226
Percent	10%	17%	19%	19%	29%	5%	100%

[a] Not all stations fished due to weather; the data for missing stations (in bold) was interpolated.

Appendix A4.–Summary of chum salmon fishing effort, daily and cumulative catch, and daily and cumulative CPUE, Upper Cook Inlet offshore test fish project, 2008.

Date	Number of Stations	Mean Fishing Time (min)	CATCH		CPUE	
			Daily	Cum	Daily	Cum
7/01	6	230.5	2	2	1.47	1
7/02	6	259.5	1	3	0.67	2
7/03	6	236.0	4	7	3	5
7/04	6	254.0	4	11	2.16	7
7/05	6	228.5	0	11	0	7
7/06	6	224.5	0	11	0	7
7/07	6	218.0	2	13	1.6	9
7/08	6	237.0	13	26	9.31	18
7/09	6	226.5	1	27	0.76	19
7/10	6	227.0	5	32	3.99	23
7/11	6	237.0	12	44	8.28	31
7/12	6	239.5	13	57	8.35	40
7/13	6	246.5	23	80	14.97	55
7/14	6	230.5	5	85	3.65	58
7/15	6	249.0	33	118	21.32	80
7/16	5[a]	189.0	3	121	2.37	82
7/17	6	237.5	19	140	13.85	96
7/18	6	220.0	1	141	0.81	97
7/19	6	216.0	0	141	0	97
7/20	4[a]	166.5	13	154	8.32	105
7/21	5[a]	191.0	13	167	9.05	114
7/22	6	253.0	46	213	31.62	146
7/23	6	213.5	2	215	1.69	147
7/24	0[a]	0.0	5	220	3.28	151
7/25	6	222.5	6	226	4.84	155
7/26	4[a]	153.0	19	245	14.64	170
7/27	6	222.0	12	257	9.27	179
7/28	6	246.0	78	335	47.96	227
7/29	6	221.0	6	341	4.78	232
7/30	6	240.0	54	395	33.45	265
7/31	5[a]	162.5	10	405	7.29	273

[a] Not all stations fished due to weather; the data for missing stations was interpolated.

Appendix A5.–Estimated chum salmon catch by date and station, Upper Cook Inlet offshore test fish project, 2008.

	Station Number						
Date	4	5	6	6.5	7	8	Total
7/01	0	1	0	0	1	0	2
7/02	0	0	1	0	0	0	1
7/03	0	0	3	0	1	0	4
7/04	0	0	4	0	0	0	4
7/05	0	0	0	0	0	0	0
7/06	0	0	0	0	0	0	0
7/07	0	0	2	0	0	0	2
7/08	3	0	3	1	6	0	13
7/09	1	0	0	0	0	0	1
7/10	0	3	1	1	0	0	5
7/11	0	2	9	1	0	0	12
7/12	0	0	10	1	1	1	13
7/13	1	19	0	1	1	1	23
7/14	0	0	1	3	0	1	5
7/15	0	1	7	7	18	0	33
7/16[a]	0	3	0	0	0	**0**	3
7/17	0	1	4	5	9	0	19
7/18	0	0	0	0	1	0	1
7/19	0	0	0	0	0	0	0
7/20[a]	1	**3**	**0**	1	8	0	13
7/21[a]	0	5	0	0	**8**	0	13
7/22	0	12	15	8	8	3	46
7/23	0	0	1	1	0	0	2
7/24[a]	**1**	**1**	**1**	**1**	**1**	**0**	5
7/25	1	2	1	0	2	0	6
7/26[a]	1	3	2	**1**	**1**	11	19
7/27	0	9	0	2	0	1	12
7/28	0	0	1	60	16	1	78
7/29	1	1	1	3	0	0	6
7/30	0	0	7	3	44	0	54
7/31[a]	**0**	0	0	7	2	1	10
Total	10	66	74	107	128	20	405
Percent	2%	16%	18%	26%	32%	5%	100%

[a] Not all stations fished due to weather; the data for missing stations (in bold) was interpolated.

Appendix A6.–Estimated chum salmon CPUE by date and station, Upper Cook Inlet offshore test fish project, 2008.

	Station Number						
Date	4	5	6	6.5	7	8	Total
7/01	0.0	0.8	0.0	0.0	0.7	0.0	1.5
7/02	0.0	0.0	0.7	0.0	0.0	0.0	0.7
7/03	0.0	0.0	2.4	0.0	0.6	0.0	3.0
7/04	0.0	0.0	2.2	0.0	0.0	0.0	2.2
7/05	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/06	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/07	0.0	0.0	1.6	0.0	0.0	0.0	1.6
7/08	2.1	0.0	2.3	0.8	4.0	0.0	9.3
7/09	0.8	0.0	0.0	0.0	0.0	0.0	0.8
7/10	0.0	2.5	0.8	0.8	0.0	0.0	4.0
7/11	0.0	1.3	6.2	0.8	0.0	0.0	8.3
7/12	0.0	0.0	6.0	0.8	0.8	0.8	8.4
7/13	0.7	12.0	0.0	0.8	0.7	0.8	15.0
7/14	0.0	0.0	0.7	2.1	0.0	0.9	3.7
7/15	0.0	0.8	4.4	4.8	11.3	0.0	21.3
7/16[a]	0.0	2.4	0.0	0.0	0.0	**0.0**	2.4
7/17	0.0	0.7	3.0	3.6	6.6	0.0	13.9
7/18	0.0	0.0	0.0	0.0	0.8	0.0	0.8
7/19	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/20[a]	0.8	**1.8**	**0.0**	0.7	5.1	0.0	8.3
7/21[a]	0.0	3.6	0.0	0.0	**5.5**	0.0	9.1
7/22	0.0	8.8	9.8	5.1	5.8	2.2	31.6
7/23	0.0	0.0	0.9	0.8	0.0	0.0	1.7
7/24[a]	**0.4**	**0.8**	**0.8**	**0.4**	**0.8**	**0.0**	3.3
7/25	0.9	1.6	0.8	0.0	1.6	0.0	4.8
7/26[a]	0.8	2.4	1.6	**0.8**	**0.8**	8.3	14.6
7/27	0.0	6.8	0.0	1.7	0.0	0.8	9.3
7/28	0.0	0.0	0.8	35.4	11.0	0.8	48.0
7/29	0.8	0.9	0.7	2.4	0.0	0.0	4.8
7/30	0.0	0.0	5.1	2.3	26.1	0.0	33.5
7/31[a]	**0.0**	0.0	0.0	4.9	1.6	0.8	7.3
Total	7	47	51	69	84	15	273
Percent	3%	17%	19%	25%	31%	6%	100%

[a] Not all stations fished due to weather; the data for missing stations (in bold) was interpolated.

Appendix A7.–Summary of coho salmon fishing effort, daily and cumulative catch, and daily and cumulative CPUE, Upper Cook Inlet offshore test fish project, 2008.

Date	Number of Stations	Mean Fishing Time (min)	CATCH		CPUE	
			Daily	Cum	Daily	Cum
7/01	6	230.5	5	5	4	4
7/02	6	259.5	2	7	1	5
7/03	6	236.0	1	8	1	5
7/04	6	254.0	4	12	3	8
7/05	6	228.5	0	12	0	8
7/06	6	224.5	6	18	5	13
7/07	6	218.0	6	24	5	18
7/08	6	237.0	27	51	19	37
7/09	6	226.5	8	59	6	43
7/10	6	227.0	31	90	24	68
7/11	6	237.0	47	137	33	100
7/12	6	239.5	45	182	31	132
7/13	6	246.5	66	248	47	178
7/14	6	230.5	28	276	20	198
7/15	6	249.0	75	351	48	246
7/16	5a	189.0	16	367	13	259
7/17	6	237.5	62	429	46	304
7/18	6	220.0	5	434	4	308
7/19	6	216.0	1	435	1	309
7/20	4a	166.5	68	503	47	356
7/21	5a	191.0	22	525	15	370
7/22	6	253.0	66	591	45	415
7/23	6	213.5	6	597	5	420
7/24	0a	0.0	18	615	14	434
7/25	6	222.5	29	644	23	458
7/26	4a	153.0	24	668	18	475
7/27	6	222.0	17	685	13	488
7/28	6	246.0	124	809	78	566
7/29	6	221.0	8	817	6	572
7/30	6	240.0	124	941	82	655
7/31	5[a]	162.5	83	1,024	64	718

[a] Not all stations fished due to weather; the data for missing stations was interpolated.

Appendix A8.–Estimated coho salmon catch by date and station, Upper Cook Inlet offshore test fish project, 2008.

	Station Number						
Date	4	5	6	6.5	7	8	Total
7/01	0	0	1	2	2	0	5
7/02	0	2	0	0	0	0	2
7/03	0	0	1	0	0	0	1
7/04	1	1	1	0	1	0	4
7/05	0	0	0	0	0	0	0
7/06	0	3	3	0	0	0	6
7/07	0	2	4	0	0	0	6
7/08	9	1	5	1	11	0	27
7/09	3	4	1	0	0	0	8
7/10	9	9	6	6	1	0	31
7/11	1	8	32	6	0	0	47
7/12	2	4	18	20	1	0	45
7/13	29	13	3	3	17	1	66
7/14	0	4	4	19	1	0	28
7/15	0	0	28	9	38	0	75
7/16[a]	2	4	3	2	3	**2**	16
7/17	0	12	1	21	24	4	62
7/18	0	0	4	1	0	0	5
7/19	0	0	0	1	0	0	1
7/20[a]	0	**2**	**0**	46	19	1	68
7/21[a]	2	3	0	0	**16**	1	22
7/22	0	5	29	12	12	8	66
7/23	0	0	1	3	2	0	6
7/24[a]	**0**	**4**	**1**	**2**	**5**	**6**	18
7/25	0	7	1	1	8	12	29
7/26[a]	0	0	2	**1**	**5**	16	24
7/27	0	11	2	0	1	3	17
7/28	0	0	6	85	26	7	124
7/29	0	0	3	5	0	0	8
7/30	0	1	32	27	64	0	124
7/31[a]	**0**	1	6	62	9	5	83
Total	58	101	198	335	266	66	1,024
Percent	6%	10%	19%	33%	26%	6%	100%

[a] Not all stations fished due to weather; the data for missing stations (in bold) was interpolated.

Appendix A9.–Estimated coho salmon CPUE by date and station, Upper Cook Inlet offshore test fish project, 2008.

	Station Number						
Date	4	5	6	6.5	7	8	Total
7/01	0.0	0.0	0.8	1.7	1.2	0.0	4
7/02	0.0	0.9	0.0	0.0	0.0	0.0	1
7/03	0.0	0.0	0.8	0.0	0.0	0.0	1
7/04	0.7	0.8	0.5	0.0	0.8	0.0	3
7/05	0.0	0.0	0.0	0.0	0.0	0.0	0
7/06	0.0	2.4	2.5	0.0	0.0	0.0	5
7/07	0.0	1.6	3.2	0.0	0.0	0.0	5
7/08	6.4	0.8	3.9	0.8	7.4	0.0	19
7/09	2.3	3.0	0.8	0.0	0.0	0.0	6
7/10	6.9	7.4	4.6	4.6	0.8	0.0	24
7/11	0.8	5.2	22.1	4.6	0.0	0.0	33
7/12	1.6	3.2	10.8	15.0	0.8	0.0	31
7/13	20.6	8.2	2.4	2.3	12.2	0.8	47
7/14	0.0	3.1	2.8	13.1	0.8	0.0	20
7/15	0.0	0.0	17.6	6.1	23.9	0.0	48
7/16[a]	1.6	3.2	2.3	1.6	2.4	**1.6**	13
7/17	0.0	8.9	0.7	15.1	17.5	3.2	46
7/18	0.0	0.0	3.3	0.8	0.0	0.0	4
7/19	0.0	0.0	0.0	0.8	0.0	0.0	1
7/20[a]	0.0	**1.1**	**0.0**	32.7	12.0	0.8	47
7/21[a]	1.6	2.2	0.0	0.0	**10.4**	0.8	15
7/22	0.0	3.7	18.9	7.6	8.8	5.9	45
7/23	0.0	0.0	0.9	2.5	1.6	0.0	5
7/24[a]	**0.0**	**2.8**	**0.8**	**1.7**	**4.0**	**4.8**	14
7/25	0.0	5.6	0.8	0.8	6.4	9.6	23
7/26[a]	0.0	0.0	1.6	**0.4**	**3.6**	12.0	18
7/27	0.0	8.4	1.6	0.0	0.9	2.3	13
7/28	0.0	0.0	4.6	50.2	17.9	5.3	78
7/29	0.0	0.0	2.2	4.0	0.0	0.0	6
7/30	0.0	0.9	23.1	20.3	38.0	0.0	82
7/31[a]	**0.0**	1.4	7.8	43.4	7.1	4.1	64
Total	43	75	141	230	179	51	718
Percent	6%	10%	20%	32%	25%	7%	100%

[a] Not all stations fished due to weather; the data for missing stations (in bold) was interpolated.

Appendix A10.–Summary of Chinook salmon fishing effort, daily and cumulative catch, and daily and cumulative CPUE, Upper Cook Inlet offshore test fish project, 2008.

Date	Number of Stations	Mean Fishing Time (min)	CATCH		CPUE	
			Daily	Cum	Daily	Cum
7/01	6	230.5	0	0	0	0
7/02	6	259.5	0	0	0	0
7/03	6	236.0	0	0	0	0
7/04	6	254.0	0	0	0	0
7/05	6	228.5	0	0	0	0
7/06	6	224.5	0	0	0	0
7/07	6	218.0	0	0	0	0
7/08	6	237.0	1	1	1	1
7/09	6	226.5	0	1	0	1
7/10	6	227.0	0	1	0	1
7/11	6	237.0	0	1	0	1
7/12	6	239.5	0	1	0	1
7/13	6	246.5	0	1	0	1
7/14	6	230.5	1	2	1	1
7/15	6	249.0	0	2	0	1
7/16	5[a]	189.0	0	2	0	1
7/17	6	237.5	0	2	0	1
7/18	6	220.0	0	2	0	1
7/19	6	216.0	0	2	0	1
7/20	4[a]	166.5	0	2	0	1
7/21	5[a]	191.0	0	2	0	1
7/22	6	253.0	1	3	1	2
7/23	6	213.5	0	3	0	2
7/24	0[a]	0.0	0	3	0	2
7/25	6	222.5	0	3	0	2
7/26	4[a]	153.0	0	3	0	2
7/27	6	222.0	0	3	0	2
7/28	6	246.0	0	3	0	2
7/29	6	221.0	0	3	0	2
7/30	6	240.0	0	3	0	2
7/31	5[a]	162.5	0	3	0	2

[a] Not all stations fished due to weather; the data for missing stations was interpolated.

Appendix A11.–Estimated Chinook salmon catch by date and station, Upper Cook Inlet offshore test fish project, 2008.

	Station Number						
Date	4	5	6	6.5	7	8	Total
7/01	0	0	0	0	0	0	0
7/02	0	0	0	0	0	0	0
7/03	0	0	0	0	0	0	0
7/04	0	0	0	0	0	0	0
7/05	0	0	0	0	0	0	0
7/06	0	0	0	0	0	0	0
7/07	0	0	0	0	0	0	0
7/08	0	0	1	0	0	0	1
7/09	0	0	0	0	0	0	0
7/10	0	0	0	0	0	0	0
7/11	0	0	0	0	0	0	0
7/12	0	0	0	0	0	0	0
7/13	0	0	0	0	0	0	0
7/14	0	0	0	1	0	0	1
7/15	0	0	0	0	0	0	0
7/16[a]	0	0	0	0	0	**0**	0
7/17	0	0	0	0	0	0	0
7/18	0	0	0	0	0	0	0
7/19	0	0	0	0	0	0	0
7/20[a]	0	**0**	**0**	0	0	0	0
7/21[a]	0	0	0	0	**0**	0	0
7/22	0	0	1	0	0	0	1
7/23	0	0	0	0	0	0	0
7/24[a]	**0**	**0**	**0**	**0**	**0**	**0**	0
7/25	0	0	0	0	0	0	0
7/26[a]	0	0	0	**0**	**0**	0	0
7/27	0	0	0	0	0	0	0
7/28	0	0	0	0	0	0	0
7/29	0	0	0	0	0	0	0
7/30	0	0	0	0	0	0	0
7/31[a]	**0**	0	0	0	0	0	0
Total	0	0	2	1	0	0	3
Percent	0%	0%	67%	33%	0%	0%	100%

[a] Not all stations fished due to weather; the data for missing stations (in bold) was interpolated.

Appendix A12.–Estimated Chinook salmon CPUE by date and station, Upper Cook Inlet offshore test fish project, 2008.

	Station Number						
Date	4	5	6	6.5	7	8	Total
7/01	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/02	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/03	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/04	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/05	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/06	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/07	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/08	0.0	0.0	0.8	0.0	0.0	0.0	0.8
7/09	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/10	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/11	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/12	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/13	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/14	0.0	0.0	0.0	0.7	0.0	0.0	0.7
7/15	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/16[a]	0.0	0.0	0.0	0.0	0.0	**0.0**	0.0
7/17	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/18	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/19	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/20[a]	0.0	**0.0**	**0.0**	0.0	0.0	0.0	0.0
7/21[a]	0.0	0.0	0.0	0.0	**0.0**	0.0	0.0
7/22	0.0	0.0	0.7	0.0	0.0	0.0	0.7
7/23	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/24[a]	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	0.0
7/25	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/26[a]	0.0	0.0	0.0	**0.0**	**0.0**	0.0	0.0
7/27	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/28	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/29	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/30	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7/31[a]	**0.0**	0.0	0.0	0.0	0.0	0.0	0.0
Total	0.0	0.0	1.4	0.7	0.0	0.0	2.1
Percent	0%	0%	67%	33%	0%	0%	100%

[a] Not all stations fished due to weather; the data for missing stations (in bold) was interpolated.

Appendix A13.–Entry pattern of sockeye salmon into Upper Cook Inlet, Alaska, 2008 estimated from daily CPUE measured at the latitude of Anchor Point.

Input y	Estimated y	Residual	Change in Input Y	Change in Estimated Y
0.0502	0.1641	-0.1139		
0.1871	0.1929	-0.0058	0.1389	0.0225
0.2272	0.2176	0.0096	0.0401	0.0247
0.2852	0.2444	0.0408	0.0580	0.0269
0.2886	0.2734	0.0152	0.0034	0.0290
0.2905	0.3045	-0.0139	0.0019	0.0311
0.3100	0.3374	-0.0275	0.0194	0.0330
0.3594	0.3720	-0.0127	0.0494	0.0346
0.3906	0.4080	-0.0174	0.0312	0.0360
0.4360	0.4450	-0.0090	0.0454	0.0370
0.4849	0.4826	0.0023	0.0489	0.0376
0.5402	0.5204	0.0198	0.0554	0.0378
0.5900	0.5580	0.0320	0.0497	0.0376
0.6264	0.5949	0.0315	0.0364	0.0369
0.6764	0.6308	0.0456	0.0500	0.0359
0.6997	0.6653	0.0344	0.0233	0.0345
0.7400	0.6981	0.0419	0.0403	0.0328
0.7444	0.7290	0.0154	0.0044	0.0309
0.7459	0.7578	-0.0120	0.0015	0.0288
0.7685	0.7845	-0.0160	0.0227	0.0267
0.7886	0.8090	-0.0204	0.0201	0.0245
0.8349	0.8313	0.0036	0.0462	0.0223
0.8373	0.8515	-0.0141	0.0025	0.0202
0.8436	0.8696	-0.0260	0.0062	0.0181
0.8536	0.8858	-0.0322	0.0100	0.0162
0.8618	0.9003	-0.0384	0.0082	0.0144
0.8678	0.9130	-0.0452	0.0060	0.0128
0.8963	0.9243	-0.0280	0.0285	0.0113
0.9085	0.9343	-0.0257	0.0123	0.0099
0.9341	0.9430	-0.0088	0.0256	0.0087
0.9494	0.9506	-0.0012	0.0153	0.0076

Appendix A14.–Chemical and physical observations made in Upper Cook Inlet, Alaska, during the 2008 offshore test fish project.

Date	Sta	Air Temp (c)	Water Temp (c)	Wind Vel. (knots)	Wind Dir	Tide Stage	Salinity (ppt)	Water Depth (f)	Secchi (m)
7/01	4	9	8.1	8	south	low	31.1	22.5	6.5
	5	9	8.1	7	south	flood	30.8	35.5	6.0
	6	10	8.4	6	south	flood	30.5	49.3	6.0
	6.5	9	8.9	4	south	flood	30.0	41.0	5.0
	7	10	8.8	8	south	flood	30.1	46.5	5.0
	8	10	8.4	5	south	flood	30.1	32.0	4.0
7/02	8	10	8.5	5	southwest	ebb	30.0	30.7	5.0
	7	9	8.7	7	southwest	ebb	29.8	43.3	5.0
	6.5	9	8.5	3	southwest	ebb	30.5	42.2	4.0
	6	10	9.1	4	south	ebb	29.2	45.1	4.5
	5	11	8.2	1	south	low	30.6	35.8	6.5
	4	9	8.3	6	south	flood	30.8	26.0	5.0
7/03	4	11	7.9	5	northwest	ebb	31.4	22.5	6.0
	5	10	8.3	6	south	ebb	30.9	32.0	4.5
	6	11	8.5	4	northwest	ebb	30.1	45.0	4.0
	6.5	10	8.7	8	west	ebb	30.0	39.7	3.0
	7	9	8.6	10	west	high	30.0	42.3	3.0
	8	11	8.9	17	west	flood	29.8	31.1	3.0
7/04	8	10	8.5	10	northeast	ebb	30.3	31.9	3.5
	7	10	8.5	8	northeast	ebb	30.3	46.2	4.0
	6.5	10	8.4	8	northeast	ebb	30.4	45.5	4.0
	6	10	8.5	5	northeast	ebb	30.3	43.5	4.0
	5	10	8.3	6	northeast	ebb	30.8	34.6	4.0
	4	11	8.4	8	northeast	flood	31.0	24.6	4.5
7/05	4	10	7.6	3	south	ebb	31.4	24.5	7.5
	5	9	8.0	6	southwest	ebb	31.2	34.8	6.0
	6	11	9.0	6	southwest	ebb	30.0	46.7	4.5
	6.5	10	9.0	3	south	ebb	30.0	41.7	3.0
	7	11	8.9	2	south	ebb	30.8	44.2	3.5
	8	13	9.0	0	0	flood	29.7	28.0	3.0
7/06	8	10	8.6	2	west	flood	30.3	32.7	3.0
	7	11	8.7	1	west	flood	30.3	46.7	4.0
	6.5	10	8.7	3	west	flood	30.2	43.9	4.0
	6	10	8.5	2	southeast	flood	30.5	48.5	5.0
	5	12	8.0	1	east	flood	30.1	34.9	7.5
	4	13	7.6	2	southwest	flood	31.3	22.5	7.0

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Date	Sta	Air Temp (c)	Water Temp (c)	Wind Vel. (knots)	Wind Dir	Tide Stage	Salinity (ppt)	Water Depth (f)	Secchi (m)
7/07	4	9	7.7	7	southwest	flood	30.1	25.8	6.5
	5	9	7.9	9	southwest	flood	30.9	36.2	6.0
	6	9	8.9	11	south	ebb	29.9	45.6	5.0
	6.5	10	9.3	10	southwest	ebb	29.7	42.5	4.5
	7	10	9.3	6	southwest	ebb	29.7	43.9	3.5
	8	10	9.3	4	southwest	ebb	29.6	32.1	3.0
7/08	8	9	9.2	8	southwest	flood	29.6	32.3	3.0
	7	9	8.8	11	southeast	flood	30.1	46.0	4.0
	6.5	9	8.8	10	southeast	flood	30.2	40.3	4.5
	6	9	8.1	11	southeast	high	30.7	49.6	5.0
	5	9	8.0	14	southeast	high	30.9	34.1	6.5
	4	9	7.9	15	southeast	ebb	30.1	23.0	7.0
7/09	4	9	7.9	10	southeast	flood	30.1	26.3	7.0
	5	9	8.2	11	southeast	high	30.7	36.8	6.0
	6	10	9.0	10	southeast	high	30.0	48.5	4.0
	6.5	11	9.3	2	southwest	high	29.7	43.1	4.0
	7	11	9.5	3	southwest	ebb	39.7	44.9	3.0
	8	12	9.6	2	southwest	ebb	29.6	28.6	4.0
7/10	8	11	9.3	1	southwest	low	29.6	30.5	3.0
	7	12	10.3	2	southwest	low	28.8	45.6	3.0
	6.5	11	9.5	2	southwest	low	29.3	43.5	4.0
	6	11	9.2	2	south	low	29.8	48.0	5.0
	5	11	8.2	2	southwest	low	30.7	36.8	7.0
	4	11	8.0	2	south	low	30.1	24.2	7.0
7/11	4	10	8.4	4	southwest	flood	30.7	25.2	7.0
	5	10	9.5	5	south	flood	29.6	36.4	5.0
	6	10	9.7	4	south	flood	29.3	48.1	4.0
	6.5	10	9.9	5	south	flood	29.4	43.1	4.5
	7	10	9.7	6	southwest	flood	29.5	44.9	4.0
	8	10	9.7	6	southwest	flood	29.4	28.1	3.5
7/12	8	10	9.5	7	south	ebb	29.4	29.5	4.0
	7	10	10.1	8	south	ebb	28.5	44.3	3.5
	6.5	10	10.4	6	south	ebb	27.9	42.7	3.5
	6	11	10.3	4	south	flood	28.2	46.7	4.0
	5	11	10.0	2	south	ebb	29.2	36.8	4.5
	4	11	8.2	2	south	ebb	31.2	25.2	11.5

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Date	Sta	Air Temp (c)	Water Temp (c)	Wind Vel. (knots)	Wind Dir	Tide Stage	Salinity (ppt)	Water Depth (f)	Secchi (m)
7/13	4	11	9.0	3	northeast	ebb	30.1	23.8	7.0
	5	11	9.8	4	north	ebb	29.4	36.5	5.0
	6	11	10.6	2	north	ebb	27.9	47.5	4.5
	6.5	11	10.6	2	northwest	ebb	27.9	43.2	3.5
	7	13	10.6	1	northwest	ebb	27.5	46.2	4.5
	8	11	11.1	3	west	ebb	27.4	28.2	3.0
7/14	8	11	10.0	6	southwest	flood	28.8	25.5	4.0
	7	11	10.4	5	southwest	ebb	27.9	43.5	5.5
	6.5	11	10.1	3	south	ebb	27.6	42.6	4.5
	6	11	10.8	3	south	ebb	26.9	46.7	4.0
	5	13	9.4	2	south	ebb	28.9	37.2	5.5
	4	13	8.5	1	south	flood	31.0	25.0	9.0
7/15	4	11	8.5	2	southwest	flood	31.0	24.2	8.0
	5	11	9.7	4	southwest	flood	29.5	36.3	5.0
	6	11	10.6	4	southwest	flood	27.7	45.3	5.0
	6.5	11	11.3	5	southwest	flood	26.3	41.9	4.0
	7	12	11.3	7	southwest	flood	26.4	46.4	4.5
	8	11	10.2	4	southwest	flood	28.2	27.9	4.0
7/16	8	-	-	-	-	-	-	-	-
	7	11	10.2	5	east	ebb	28.1	46.5	4.0
	6.5	11	10.3	10	southeast	ebb	28.0	38.6	4.0
	6	11	10.0	5	southeast	ebb	28.4	47.6	5.0
	5	10	9.7	11	southeast	ebb	29.4	33.3	6.0
	4	10	8.6	7	southeast	high	30.9	23.1	7.0
7/17	4	9	8.5	9	southwest	ebb	31.1	24.2	6.5
	5	9	8.6	8	south	ebb	30.7	34.0	6.0
	6	10	8.9	5	south	low	30.0	47.4	6.0
	6.5	11	9.0	4	south	flood	29.9	41.5	6.0
	7	11	10.0	5	south	flood	28.5	46.0	5.0
	8	12	9.8	3	south	flood	28.4	28.3	4.0
7/18	8	10	9.7	2	west	ebb	28.7	28.9	3.5
	7	11	9.6	2	south	ebb	28.8	45.3	4.0
	6.5	11	9.6	1	south	ebb	28.8	43.1	4.0
	6	10	9.6	4	south	ebb	29.0	47.4	5.5
	5	10	9.0	6	southeast	ebb	30.2	32.8	8.5
	4	11	9.0	4	south	ebb	31.0	24.4	9.0

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Date	Sta	Air Temp (c)	Water Temp (c)	Wind Vel. (knots)	Wind Dir	Tide Stage	Salinity (ppt)	Water Depth (f)	Secchi (m)
7/19	4	11	8.5	1	south	ebb	31.0	23.1	9.0
	5	10	8.8	2	southeast	low	30.7	34.8	8.0
	6	11	8.3	2	south	low	30.3	47.9	6.0
	6.5	11	9.0	2	south	flood	30.0	43.0	5.5
	7	11	9.6	3	south	flood	29.5	46.5	6.0
	8	12	10.7	2	south	flood	28.8	27.8	3.0
7/20	8	11	9.8	7	southeast	flood	29.1	32.0	4.0
	7	11	9.7	17	south	flood	29.4	45.5	4.0
	6.5	10	9.6	15	south	high	29.5	43.8	5.0
	6	-	-	-	-	-	-	-	-
	5	-	-	-	-	-	-	-	-
	4	10	8.5	15	southeast	flood	31.0	23.0	8.8
7/21	4	9	8.7	12	south	ebb	30.9	24.3	6.5
	5	9	9.2	15	south	ebb	30.0	34.3	5.0
	6	10	9.5	14	south	ebb	29.4	44.8	4.0
	6.5	10	9.7	11	south	flood	29.3	40.5	4.0
	7	-	-	-	-	-	-	-	-
	8	10	9.8	13	south	flood	29.1	26.0	3.0
7/22	8	10	9.6	8	northwest	flood	29.3	32.3	4.0
	7	9	9.0	7	south	high	30.2	43.5	5.5
	6.5	10	8.8	9	south	ebb	31.4	43.9	7.0
	6	10	8.5	13	south	ebb	30.8	48.1	4.0
	5	10	8.6	14	southeast	ebb	30.8	32.6	5.0
	4	10	8.7	9	southeast	ebb	30.1	22.5	8.0
7/23	4	10	8.6	2	southeast	low	31.0	25.5	10.0
	5	10	8.7	4	southeast	low	30.8	35.4	8.0
	6	10	9.5	6	south	ebb	29.4	48.2	4.5
	6.5	10	10.2	8	south	ebb	29.1	39.1	4.5
	7	10	10.1	11	southeast	ebb	29.3	44.7	4.0
	8	10	10.0	10	southeast	ebb	29.3	28.8	4.0
7/24 [a]	4	-	-	-	-	-	-	-	-
	5	-	-	-	-	-	-	-	-
	6	-	-	-	-	-	-	-	-
	6.5	-	-	-	-	-	-	-	-
	7	-	-	-	-	-	-	-	-
	8	-	-	-	-	-	-	-	-

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Date	Sta	Air Temp (c)	Water Temp (c)	Wind Vel. (knots)	Wind Dir	Tide Stage	Salinity (ppt)	Water Depth (f)	Secchi (m)
7/25	8	12	9.9	8.0	northwest	high	29.1	27.8	3.0
	7	12	9.7	10.0	north	flood	29.4	45.9	3.5
	6.5	12	9.3	12.0	north	flood	30.0	43.8	5.0
	6	11	8.7	7.0	northwest	flood	30.1	50.0	6.5
	5	11	8.8	5.0	northeast	flood	30.8	37.4	7.5
	4	11	8.8	6.0	north	flood	30.9	25.3	9.0
7/26	4	10	8.9	10	south	high	30.9	26.1	8.0
	5	10	8.7	13	south	flood	31.0	37.5	7.0
	6	10	8.7	14	southwest	flood	30.9	48.5	9.0
	6.5	-	-	-	-	-	-	-	-
	7	-	-	-	-	-	-	-	-
	8	11	10.0	15	southwest	flood	29.3	32.0	4.0
7/27	8	10	9.8	8	south	ebb	29.2	29.5	4.0
	7	10	10.3	7	south	low	28.4	44.8	4.5
	6.5	10	10.4	10	southwest	flood	28.2	43.0	4.5
	6	10	10.7	7	southwest	flood	27.5	48.4	4.0
	5	12	9.2	2	southwest	flood	29.7	36.2	8.0
	4	11	9.0	3	northeast	flood	30.9	24.9	9.0
7/28	4	9	9.1	9	southeast	flood	30.7	24.4	9.0
	5	10	9.2	8	southeast	flood	30.6	37.2	7.0
	6	10	10.4	7	southeast	flood	28.5	48.4	6.0
	6.5	10	10.7	4	southeast	flood	28.2	43.3	7.0
	7	11	11.0	6	south	flood	28.1	43.9	5.0
	8	12	11.1	3	south	flood	28.6	30.9	5.0
7/29	8	12	10.4	2	southeast	ebb	28.8	30.0	4.0
	7	11	11.4	2	southeast	ebb	26.8	43.9	4.0
	6.5	11	11.1	6	south	ebb	27.5	41.8	4.0
	6	13	10.0	0	south	flood	29.4	46.1	6.5
	5	13	9.3	2	south	flood	30.7	38.2	9.0
	4	11	9.1	5	northeast	flood	30.7	26.1	9.5
7/30	4	11	9.3	8	southeast	low	30.6	22.8	8.5
	5	11	9.3	7	southeast	flood	30.6	33.6	8.0
	6	11	9.4	6	southeast	flood	30.4	49.3	5.0
	6.5	11	10.7	6	east	flood	27.7	43.3	4.0
	7	11	11.5	8	southeast	flood	27.9	45.1	3.5
	8	13	10.2	5.0	southeast	flood	29.3	32.4	5.0

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Date	Sta	Air Temp (c)	Water Temp (c)	Wind Vel. (knots)	Wind Dir	Tide Stage	Salinity (ppt)	Water Depth (f)	Secchi (m)
7/31	8	11	10.4	6	southeast	ebb	28.8	30.5	3.5
	7	11	10.3	6	southeast	ebb	28.8	42.0	3.5
	6.5	11	9.1	11	southeast	ebb	29.1	42.3	4.0
	6	11	9.5	13	southeast	ebb	30.1	45.0	5.0
	5	11	9.2	17	southeast	ebb	30.7	35.6	9.0
	4	-	-	-	-	-	-	-	-
Averages		10.5	9.3	6.3	south	ebb	29.7	37.3	5.3
Max		13.0	11.5	17.0	8.0	4.0	39.7	50.0	11.5
Min		9.0	7.6	0.0	0.0	1.0	26.3	22.5	3.0
Avg		10.5	9.3	6.3	4.8	3.2	29.7	37.3	5.3

[a] Stations with no data were not fished due to inclement weather.

Appendix A15.–Yearly mean values of physical observations made during the conduct of the 1999–2008 offshore test fish project.

Sta	Year	Air Temp (c)	Water Temp (c)	Wind Vel. (knots)	Wind Dir	Salinity (ppt)	Water Depth (f)	Secchi (m)
4	1999	13.1	9.6	10.6	SE	31.4	24.3	7.6
	2000	13.8	9.7	10.0	SE	31.5	23.5	10.0
	2001	12.9	9.8	11.1	SE	31.5	23.6	8.4
	2002	12.6	9.5	12.6	S	31.4	23.6	8.1
	2003	14.1	10.6	12.0	S	31.2	23.4	8.3
	2004	10.7	9.6	7.1	E	31.3	23.8	7.9
	2005	12.9	10.9	6.2	S	31.0	24.5	7.4
	2006	11.1	9.9	6.0	SE	30.7	23.9	7.7
	2007	10.8	8.6	4.7	SE	31.2	23.9	8.1
	2008	11.0	9.3	8.0	SE	30.6	22.8	8.5
	Avg	12.3	9.7	8.8	SE	31.2	23.7	8.2
5	1999	13.4	10.0	12.9	SE	30.6	38.9	6.2
	2000	13.5	10.1	11.8	SE	30.7	35.9	7.1
	2001	12.9	10.1	11.2	SE	31.0	35.5	6.9
	2002	12.8	9.7	13.9	S	30.9	35.8	6.3
	2003	14.0	11.0	13.3	SE	30.6	35.7	6.3
	2004	10.7	9.9	7.2	SE	30.7	34.7	7.1
	2005	13.1	11.1	5.9	S	30.6	36.3	6.5
	2006	11.1	10.2	7.6	S	30.2	35.4	5.6
	2007	10.8	8.7	4.6	S	30.9	35.4	7.2
	2008	10.4	8.8	6.7	SE	30.4	35.4	6.4
	Avg	12.3	10.0	9.5	SE	30.7	35.9	6.6
6	1999	13.5	10.3	12.5	SE	29.8	44.4	4.3
	2000	13.5	10.6	11.1	SE	29.9	45.4	4.9
	2001	12.8	10.7	10.7	S	30.5	46.2	5.2
	2002	12.8	10.1	13.4	S	30.4	45.1	4.2
	2003	14.7	11.5	12.9	S	29.5	46.4	4.9
	2004	10.6	10.3	8.0	SE	30.1	46.6	4.6
	2005	12.8	11.6	8.0	S	29.4	45.8	4.7
	2006	12.8	11.6	8.0	S	29.8	45.8	4.7
	2007	11.0	9.5	6.0	S	30.0	47.2	4.8
	2008	10.4	9.3	6.2	S	29.5	47.3	5.0
	Avg	12.5	10.6	9.7	S	29.9	46.0	4.7
6.5	1999	13.4	10.5	13.0	SE	29.7	43.2	3.5
	2000	13.6	10.8	13.0	S	29.7	42.9	3.7
	2001	12.8	11.1	11.8	S	29.4	42.7	4.0
	2002	12.6	10.4	13.7	S	30.0	42.6	3.3
	2003	14.4	11.7	14.9	S	29.1	41.3	4.1
	2004	10.7	10.8	10.1	SE	29.4	41.6	3.6
	2005	13.2	12.2	7.4	S	28.7	42.8	4.2
	2006	11.2	10.3	8.5	SE	29.7	41.6	3.4
	2007	11.1	9.7	6.2	S	29.8	42.9	4.3
	2008	10.4	9.6	6.3	S	29.2	42.3	4.4
	Avg	12.3	10.7	10.5	S	29.5	42.4	3.8

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Sta	Year	Air Temp (c)	Water Temp (c)	Wind Vel. (knots)	Wind Dir	Salinity (ppt)	Water Depth (f)	Secchi (m)
7	1999	13.3	10.6	13.0	S	29.5	42.7	2.9
	2000	13.1	10.9	13.6	S	29.4	43.3	3.0
	2001	13.1	11.4	9.9	SE	29.0	43.6	3.5
	2002	12.4	10.4	12.4	SE	29.9	44.0	2.8
	2003	14.3	11.6	13.0	S	29.0	44.3	3.6
	2004	10.6	11.0	9.7	SE	28.8	44.7	2.7
	2005	12.9	12.3	7.6	S	28.3	44.8	3.6
	2006	10.8	9.9	6.8	S	29.4	42.4	3.1
	2007	11.2	9.9	6.2	S	29.5	45.5	3.8
	2008	10.6	9.8	6.2	S	29.4	44.9	4.2
	Avg	12.2	10.8	9.8	S	29.2	44.0	3.3

Sta	Year	Air Temp (c)	Water Temp (c)	Wind Vel. (knots)	Wind Dir	Salinity (ppt)	Water Depth (f)	Secchi (m)
8	1999	13.6	10.5	11.8	SE	30.0	25.9	2.6
	2000	13.2	11.0	14.0	S	29.5	29.1	2.6
	2001	12.8	11.3	9.5	SE	29.0	28.9	3.1
	2002	12.1	10.3	11.8	SE	30.0	29.4	2.4
	2003	13.7	11.2	11.6	SE	28.1	28.9	3.1
	2004	10.8	11.0	9.1	SE	29.3	28.7	2.4
	2005	12.8	12.1	7.7	S	28.5	29.8	3.3
	2006	11.8	10.5	6.7	S	29.0	30.4	3.0
	2007	11.2	9.9	5.5	S	29.5	29.8	3.2
	2008	10.9	9.7	5.9	SW	29.2	29.9	3.7
	Avg	12.3	10.8	9.4	S	29.2	29.1	2.9

Appendix A16.–Yearly mean values for selected chemical and physical variables collected during conduct of the offshore test fish project, 1979–2008.

Year	Air Temp. (c)	Water Temp. (c)	Wind Vel. (knots)	Salinity (ppt)	Secchi (m)
1979	12.4	12.2	5.9	25.0	5.7
1980	12.4	10.0	8.2	24.8	4.2
1981	13.4	11.0	10.1	23.1	4.1
1982	12.0	8.5	9.0	20.3	5.0
1983	14.9	10.9	9.4	20.6	4.7
1984	13.5	10.8	9.1	14.3	5.3
1985	10.8	8.2	9.2	28.0	5.5
1986	10.6	9.1	8.2	-	5.4
1987	12.6	10.1	4.1	28.4	5.1
1988	14.2	9.1	8.9	30.2	4.7
1989	13.1	10.0	4.4	27.7	4.7
1990	12.3	11.4	8.5	21.3	4.6
1991	10.9	9.9	6.6	13.1	4.1
1992	12.0	11.1	5.4	28.4	4.3
1993	13.5	10.5	6.9	26.2	5.0
1994	13.0	10.0	9.3	29.0	6.0
1995	13.1	9.5	7.9	26.5	4.6
1996	12.6	10.0	9.1	30.8	4.7
1997	13.8	10.5	10.0	30.6	4.0
1998	12.5	10.3	8.3	30.0	5.4
1999	13.4	10.3	12.4	30.2	4.5
2000	13.5	10.5	12.2	30.1	5.2
2001	12.9	10.7	10.7	30.1	5.2
2002	12.5	10.1	13.0	30.4	4.5
2003	14.2	11.3	12.9	29.6	5.0
2004	10.7	10.4	8.5	30.0	4.7
2005	13.0	11.7	7.1	29.4	5.0
2006	11.3	10.3	7.2	28.4	4.6
2007	11.0	9.4	5.5	30.2	5.3
1992–2007 Avg	12.7	10.4	9.2	29.4	4.9
2008	10.5	9.3	6.3	29.7	5.3