Regional Information Report No. 1J16-10

Thomas Bay Baseline Investigation

by

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and

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November 2016

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

Symbols and Abbreviations

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Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

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This document should be cited as follows:
Fowler, P. A., and T. S. Thynes. 2016. Thomas Bay baseline investigation. Alaska Department of Fish and Game, Divisions of Sport Fish and Commercial Fisheries, Regional Information Report No. 1J16-10, Douglas.

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ABSTRACT

Commercial purse seine gear was used to conduct baseline sampling in Thomas Bay following a request by Northern Southeast Regional Aquaculture Association (NSRAA) to use Thomas Bay as a release site for hatchery reared summer run chum salmon. The Alaska Department of Fish & Game and NSRAA worked cooperatively to sample Thomas Bay using a commercial purse seine vessel during one day of each statistical week 27–30 for a total of 28 sets. Low numbers of salmon were captured with a total of 18 chum, 16 pink, and 3 sockeye salmon, and an average 1.3 salmon per set. No Chinook or coho salmon were captured. Otoliths of sockeye and chum salmon were examined for thermal marks which identified the proportion of the catch originating from Alaska hatcheries.

Key words: Thomas Bay, purse seine, chum salmon, Hidden Falls Hatchery.

INTRODUCTION

In December 2015, Northern Southeast Regional Aquaculture Association (NSRAA) submitted a permit alteration request (PAR) to the Alaska Department of Fish and Game (ADF&G) to establish Thomas Bay as a remote release site for Hidden Falls Hatchery stock summer chum salmon (*Oncorhynchus keta*). Under this proposed action, up to 40 million chum salmon eggs would be collected, incubated, and reared at Hidden Falls Hatchery then transported to Thomas Bay as fry and held for imprinting before being released within Thomas Bay. At full production of 40 million chum salmon eggs, using average survival assumptions, NSRAA estimated that 750,000–800,000 adults could be expected to return to Thomas Bay (*December 2015 Joint Southeast Regional Planning Team [JSERPT] meeting minutes, unpublished*). Adult returns to this new release location would likely be harvested in existing fisheries in the Chatham Strait/Fredrick Sound corridor, and a terminal harvest area/special harvest area would be created in Thomas Bay to manage terminal fisheries.

The Northern Southeast Regional Planning Team (NSERPT) reviewed this proposal at the regularly scheduled meeting in December 2015. Discussion during the meeting ranged across a variety of topics related to the merits and concerns of using Thomas Bay as a remote release site. The primary concern identified was the potential for incidental harvest of non-targeted salmon stocks, particularly Chinook salmon (*O. tshawytscha*), to occur in terminal fisheries. ADF&G proposed conducting a baseline investigation in partnership with NSRAA in order to determine the species and relative abundance of salmon present within Thomas Bay during the time of expected adult chum salmon returns, and to identify their stock of origin when possible.

The final action by the NSERPT was to table the discussion on the use of Thomas Bay as a new release site for summer chum salmon, with the intention that additional data would be collected through baseline sampling efforts authorized under a fish resource permit, and additional information would also be collected on competing uses of the bay (*December 2015 JSERPT meeting minutes, unpublished*). Because the PAR was not officially withdrawn, the request was further processed and denied by the Commissioner's designees (Directors of the Divisions of Sport Fish and Commercial Fisheries) due to the lack of information regarding salmon stocks, and uncertainty regarding the level of existing sport and traditional troll fisheries in the area (*2016-3-2 HFH Thomas Bay chum NPA, 2016-3-29 HFH Thomas Bay chum PAR letter*). The denial letter included language stating that baseline information gathered from this investigation would be required for future PARs to establish Thomas Bay as a release site. During the summer of 2016, ADF&G and NSRAA planned (Fowler and Thynes 2016) and conducted the baseline investigation, and this report presents the results.

OBJECTIVES

The objectives of this project were to:

1. Identify the salmon species present, and their quantity, location, and timing within Thomas Bay during the timeframe consistent with the Hidden Falls Hatchery summer chum salmon stock run timing.
2. Collect biological samples useful for stock identification of harvested salmon, including coded wire tags, otoliths, and genetic samples.

METHODS

STUDY DESIGN

A commercial purse seine vessel was contracted by NSRAA under the terms of a cooperative agreement (COOP 16-085) to conduct purse seine sets at eight designated locations within Thomas Bay (Figure 1). Set locations were selected prior to the start of the study, although set locations could be modified as a result of onsite conditions or fish observations in order to maximize catch. Sampling events were scheduled for one day of each statistical week between statistical weeks 27 and 31 (26 June–30 July), which corresponded with the expected run timing of the proposed hatchery stock to be released at Thomas Bay (Hidden Falls Hatchery summer chum salmon). Seven sets were made during each sampling event, with one set conducted at each sampling location 1–7. Sampling location 8 was excluded due to high use of the area by recreational boaters (accessing the Swan Lake cabin and hiking trail) and commercial Dungeness crab pots in the area. Fishing was conducted during daylight hours between early morning and late afternoon, using standard commercial purse seine gear (full length net, with $4^{1/4}$ strips in depth) and techniques for targeting chum salmon (e.g., approximately 20 minute tows, deeper pursing, etc.). Each set was also fished in a manner that was thought to be the most effective given the tide stage and bathymetry. For example, strong currents were observed during certain tide stages in location 1, which made it difficult to maintain an effective set; therefore, that location was fished near the slack tide of each sampling event. The geographic coordinates of each set, time, tide stage, weather conditions, and comments were recorded on a data form.

SAMPLING PROCEDURES

During each sampling event, ADF&G biologists onboard the seine vessel recorded the catch and collected biological samples. After each set was complete, all Chinook, coho (*O. kisutch*), chum, and sockeye (*O. nerka*) salmon encountered were sampled according to a sampling schedule (Table 1). Pink Salmon (O. *gorbuscha*) and all non-salmon species were enumerated and released immediately. The quantity of fish that might be caught was not known before this study was conducted; therefore, the sampling schedule was developed to sample appropriate portions of fish captured within each seine set, depending on the total number of fish caught. Fish were to be sampled for tissues (Chinook and sockeye salmon), otoliths (sockeye and chum salmon), and coded wire tags (Chinook and coho salmon) to determine the stock of origin when possible. While the plan included sampling Chinook and coho salmon (Fowler and Thynes 2016), no coho or Chinook salmon were caught.

All adult chum and sockeye salmon that were caught were sacrificed and the heads were retained in order to examine otoliths for hatchery thermal marks. Chum salmon heads were shipped to NSRAA for removal of otoliths and were examined for thermal marks. After the initial reading

by NSRAA, chum salmon otoliths were then delivered to Douglas Island Pink and Chum, Inc. (DIPAC) for a second reading. A third and final reading was completed by the ADFG Mark, Tag, and Age Laboratory (MTAL). Sockeye salmon heads were shipped to the ADFG MTAL for removal of otoliths and reading of thermal marks. Carcasses of sacrificed fish were donated to a local charity.

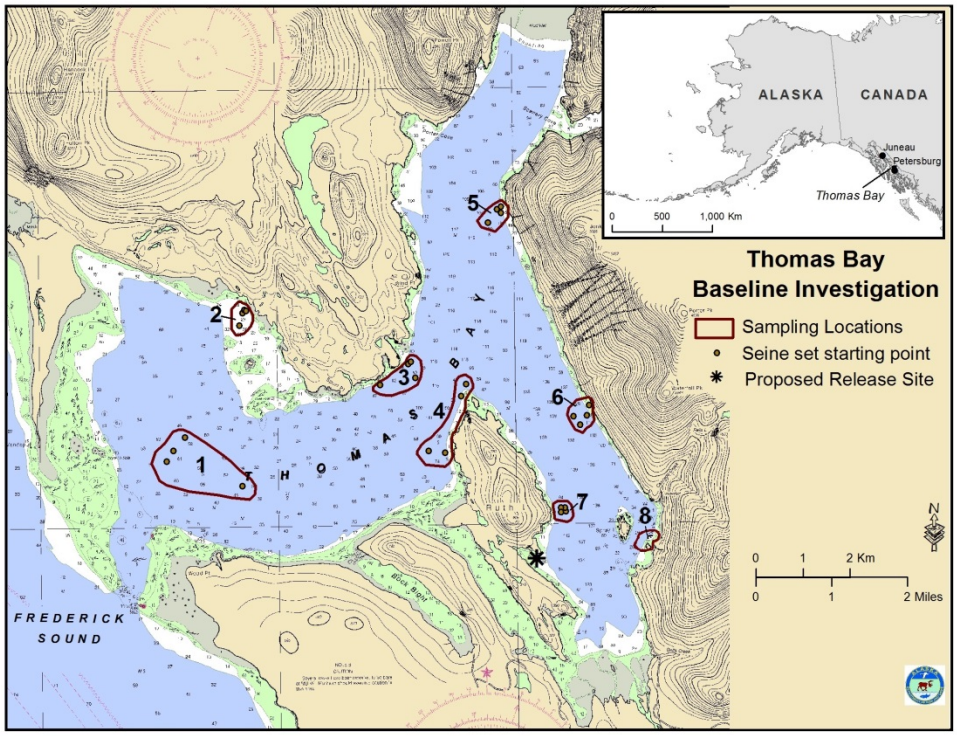

Figure 1.–Sampling locations in Thomas Bay.

Table 1.–Sampling objectives for Thomas Bay baseline investigation survey sets.

Species	Number of individuals captured in a set			
	1–10		**>10**	
Chinook salmon	100% examined for CWT Adipose fin absent (sacrificed) collect head for CWT 100% genetic samples 100% otolith samples	Adipose fin present-(released alive) 100% genetic samples	100% examined for CWT Adipose fin absent (sacrificed) Collect head for CWT 100% genetic samples 100% otolith samples	Adipose fin present-(released alive) 20% genetic samples (minimum 10)
Coho salmon	100% examined for CWT Adipose fin absent (sacrificed) collect head for CWT	Adipose fin present-(released alive)	100% examined for CWT Adipose fin absent (sacrificed) collect head for CWT	Adipose fin present-(released alive)
Chum salmon	100% sacrificed and sampled for otolith		20% sacrificed and sampled for otolith (minimum 10)	
Sockeye salmon	100% sacrificed and sampled for otolith and genetics		20% sacrificed and sampled for otolith and genetics	

RESULTS

A total of 4 sampling events were conducted between 28 June and 19 July 2016. Sampling occurred either on Tuesday or Wednesday of each statistical week, from statistical week 27 to 30. A fifth sampling event planned for statistical week 31 was cancelled, because very low numbers of salmon were caught during statistical weeks 28 and 29 (Table 2)—the weeks that represent the peak run timing of Hidden Falls Hatchery summer chum salmon. Seine operations were conducted effectively, and no major problems were encountered that would have impacted catch. Weather conditions were good during all sampling events, with calm seas and either clear or overcast skies. A total of 37 salmon were caught (an average 1.3 salmon per seine set). Salmon were caught at all sampling locations; the lowest catch rates were observed at location 4, and the highest catch rates were observed at location 3 (Table 3). The highest catch rates were also observed in the last two sampling events, during statistical weeks 29 and 30. Small numbers of non-target species were also caught, primarily starry flounder (*Platichthys stellatus*), Dolly Varden (*Salvelinus malma*), and walleye pollock (*Theragra chalcogramma*). No Chinook or coho salmon were captured.

Table 2.–Salmon catch by date.

Date	Statistical week	Chinook salmon	Coho salmon	Sockeye salmon	Pink salmon	Chum salmon
6/28/2016	27	0	0	0	0	0
7/5/2016	28	0	0	0[a]	0	2
7/12/2016	29	0	0	0	5	10
7/19/2016	30	0	0	3	11	6[b]
	Total	0	0	3	16	18

[a] One juvenile sockeye approximately 130 mm in length was captured and released.
[b] One adult chum salmon included here was captured but escaped before sampling.

Table 3.–Salmon catch by set location.

	Set location						
Species	1	2	3	4	5	6	7
Pink salmon	3	1	6	1	2	1	2
Chum salmon	1	4	4	0	6	2	1
Sockeye salmon	0	1	1	0	0	1	0
Total salmon	4	6	11	1	8	4	3

STOCK IDENTIFICATION

In total, 3 sockeye and 17 chum salmon were sacrificed and the heads retained to examine otoliths for thermal marks. Otoliths were successfully removed from 16 of the 17 chum salmon; 4 of those fish had been marked and reared at the Southern Southeast Regional Aquaculture Association (SSRAA) Burnett Inlet Hatchery facility and released in Anita Bay. One of the 3 sockeye salmon had been marked and reared at the DIPAC Snettisham Hatchery facility and

released in Speel Arm (Table 4). Although the proportion of the catch that originated from Alaska hatcheries was 25% for chum salmon and 33% for sockeye salmon, the results should be viewed with caution due to the very small sample sizes. The origins of all pink salmon and unmarked chum and sockeye salmon are unknown.

The results of the analysis of chum salmon otolith samples were inconsistent among the 3 independent labs for 4 of the samples. Two of the samples in question were identified as an unknown mark by both the NSRAA and DIPAC labs, but further polishing of the otoliths by the ADFG MTAL resulted in them being identified as SSRAA Burnett Inlet/Anita Bay hatchery fish. Another sample was identified as a NSRAA Gunnuk/Southeast Cove hatchery fish by the NSRAA lab, but the same otolith was identified as not marked by the DIPAC lab and the ADFG MTAL. That sample was assigned as not marked, since 2 of 3 labs agreed that no mark was present. Finally, the last sample in question was identified as a NSRAA Medvejie/Deep Inlet hatchery fish by the NSRAA lab, but this sample was determined to have a SSRAA Burnett Inlet/Anita Bay thermal mark by both the DIPAC lab and the ADFG MTAL. That sample was assigned as a SSRAA Burnett Inlet/Anita Bay hatchery fish, since 2 of 3 labs concurred on the identification of the thermal mark.

Tissue samples were collected from sockeye salmon for genetic analysis. The analysis was not conducted, however, due to the extremely small sample size (2 unmarked individuals).

Table 4.–Thermal marks found on chum and sockeye salmon otoliths.

Species	Sampled date	Statistical week	Sample number	Disposition	Hatchery facility	Release location
Chum	7/5/2016	28	1	Not Marked		
	7/5/2016	28	2	Marked	Burnett Inlet	Anita Bay
	7/10/2016	29	3	Not Marked		
	7/10/2016	29	4	Marked	Burnett Inlet	Anita Bay
	7/10/2016	29	5	Not Marked		
	7/10/2016	29	6	Marked	Burnett Inlet	Anita Bay
	7/10/2016	29	7	Marked	Burnett Inlet	Anita Bay
	7/10/2016	29	8	Not Marked		
	7/10/2016	29	9	Not Marked		
	7/10/2016	29	10	Not Marked		
	7/10/2016	29	11	Not Marked		
	7/10/2016	29	12	Not Marked		
	7/19/2016	30	13	Not Marked		
	7/19/2016	30	14	Not Marked		
	7/19/2016	30	15	Not Marked		
	7/19/2016	30	16	Not Marked		
	7/19/2016	30	17	Otoliths not recovered		
Sockeye	7/19/2016	30	1	Not marked		
	7/19/2016	30	2	Not marked		
	7/19/2016	30	3	Marked	DIPAC	Speel Arm

DISCUSSION

While the scope of this project was not exhaustive, only small numbers of salmon were caught in Thomas Bay. The interannual variation in the abundance of particular salmon stocks and the variation in salmon migration patterns could impact the results of this study. Consequently, results should be considered in the context of the 2016 salmon season.

Pink salmon runs in the Northern Southeast Inside (NSEI) subregion, which includes salmon runs to inside waters north of Sumner Strait, were very poor in 2016. There was very little commercial pink salmon harvest in this subregion, and the NSEI pink salmon escapement index, of which Thomas Bay is a part, was poor (A. W. Piston, ADF&G Commercial Fishery Biologist, Ketchikan, personal communication). However, escapement targets were met for the pink salmon stock groups surrounding Thomas Bay (Portage Bay, Farragut Bay, Totem Bay, and the Stikine River). There are 3 known wild pink salmon streams within Thomas Bay (Johnson and Litchfield 2016), but these streams are not monitored as index streams and they were not surveyed in 2016.

Summer chum salmon escapement in the NSEI summer chum escapement index was poor in 2016 (A. W. Piston, ADF&G Commercial Fishery Biologist, Ketchikan, personal communication). However, an above average peak survey count was obtained for the index stream immediately adjacent to Thomas Bay (Dry Bay Creek). Chum salmon harvest in NSEI was mediocre. Thomas Bay contains 2 known wild chum salmon streams (Johnson and Litchfield 2016), but these streams are not monitored as index streams and they were not surveyed in 2016.

The lack of coho salmon captured in this study is not surprising. Peak marine catch rates of coho salmon typically occur later in the season than the period when this investigation was conducted, although other factors (type of gear used, locations fished) could have also impacted the catch of coho salmon.

Sockeye salmon catches were lower than what might be expected. Although there are no known runs of sockeye salmon in Thomas Bay, several sockeye salmon stocks are present in the surrounding area and it is logical to expect that some of these fish may temporarily stray into Thomas Bay and be captured. The most prominent sockeye salmon stocks in the area originate from the Stikine River and its tributaries (approximately 35 miles distant). Stikine River sockeye salmon runs were well above average in 2016, and were at peak run timing during the period this investigation was conducted.

Chinook salmon catches, or the lack thereof, was lower than what might be expected. Although there are no known spawning populations of Chinook salmon in Thomas Bay, Chinook salmon have historically been caught within Thomas Bay in sport and commercial troll fisheries. Thomas Bay is utilized by “feeder” Chinook salmon from a multitude of stocks originating from Southeast Alaska and beyond. Historically, 40% of the coded-wire tagged Chinook salmon recovered from Thomas Bay were from southern U.S. and Canadian stocks. These southern stocks are currently experiencing above average Chinook salmon production, and recently accounted for 50% of the coded-wire tagged Chinook salmon recovered in Thomas Bay; therefore, one might have expected the abundance of those fish to be higher than normal in Thomas Bay in 2016. There are also several Chinook salmon stocks that originate from areas near Thomas Bay, the most prominent being stocks in the Stikine River. Returning Stikine River Chinook salmon may temporarily stray into Thomas Bay and be subjected to harvest; however,

this study was conducted during the latter part of the run timing of Stikine River Chinook salmon, when the chance of interception was less. In addition, Chinook salmon escapements in Southeast Alaska were the worst on record in 2016, and escapements in 9 of 11 index streams, including the Stikine River, fell short of formal escapement goals (E. L. Jones, ADF&G Fish and Game Coordinator, Douglas, personal communication). The lack of Chinook salmon captured during this study could also be due to other factors such as the type of fishing gear that was used or the seasonal variation in abundance.

There are several other limitations to this study that should be considered. A terminal hatchery fishery in Thomas Bay will likely involve additional gear types (troll and drift gillnet), which may have different catch rates for different species and result in different catches than those observed with using purse seine gear in this study. Similarly, the type of gear and vessels within the purse seine fleet varies greatly. Vessels and purse seines of various types and sizes will likely have different catch rates. However, the purse seine vessel and equipment used during this investigation were thought to have been a good representation of the seine fleet. Additionally, set locations were chosen as logical places to fish for incoming chum salmon. These locations may not be where fishing actually occurs once observations of chum salmon returning to Thomas Bay are possible. Finally, seven sets is considered a minimum number to determine the presence and abundance of salmon throughout the relatively large Thomas Bay.

The potential conflicts which a terminal hatchery fishery in Thomas Bay might create with existing users were also discussed at the 2015 fall RPT meeting. It was suggested that during the course of this baseline investigation, observations of sport and recreational vessels operating in Thomas Bay could be documented. The number of vessels that were either sport fishing (sport fishing gear deployed) or which appeared to be recreating but not actively sport fishing was recorded each day that sampling was conducted. Additional vessels were observed but not tallied (e.g., commercial vessels participating in the Dungeness crab fishery). An average of 3.5 sport fishing vessels and 4.8 recreational vessels were observed each day of sampling. This count should be viewed with caution, however, as a formal study was beyond the scope of this investigation: sampling days were not selected to represent times of high recreational use (e.g., weekend days), the entirety of Thomas Bay could not be observed at all times, and the true intention of each vessel was unknown but assumed through observation. A more thorough study on recreational uses of Thomas Bay was conducted in 2010 as part of the supporting research for the proposed Cascade Creek Hydroelectric project (Kleinschmidt 2011). Sport fishing vessels were most frequently observed near the mouth of Thomas Bay on what is locally known as halibut (*Hippoglossus stenolepis*) fishing grounds. Preliminary estimates of sport fishing effort and harvest collected through angler interviews in the Marine Boat Sport Fish Harvest Studies Project[1], confirmed that in 2016 the majority of sport fishing effort in Thomas Bay targeted bottomfish (60%), and fishing for bottomfish occurs most frequently between mid-June and late August. Sport fishing for Chinook salmon generally occurs earlier in the season with peak effort occurring between mid-May and early June.

In conclusion, the lack of capture or low catch rates of a particular species in this investigation does not preclude that species from being intercepted, or intercepted at higher rates, in the more

[1] Diana Tersteeg and Mike Jaenicke, Southeast Alaska Marine Boat Harvest Studies Project, Unpublished data, 2016.

intense fishing effort that would take place in a terminal hatchery fishery in Thomas Bay, but may provide an indication of relative abundance. A multiyear investigation across varying abundance levels and environmental conditions would provide a more comprehensive investigation of the occurrence of salmon in Thomas Bay, but it is unknown how results would change.

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