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Southeast Alaska Steelhead, Trout, and Dolly Varden Management

by

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and

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

Symbols and Abbreviations

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

Weights and measures (metric)

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

Weights and measures (English)

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

Time and temperature

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

Physics and chemistry

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

General

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

Mathematics, statistics

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

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TABLE OF CONTENTS

Page

LIST OF TABLES iii

LIST OF Figures iii

LIST OF APPENDICES iii

ABSTRACT 1

INTRODUCTION 1

Statewide Policy and Plan for Management of Sustainable Wild Trout Fisheries 1

Federal Subsistence Program for Steelhead, Trout, and Char 2

Review of Literature Relating to conservation of Steelhead, Trout, and Char 2

STEELHEAD 3

Distribution and Life History 3

Stock Status and Management Prior to 1994 4

Management Planning and Board Actions 4

Effect of the New Regulations 6

Commercial Harvest of Steelhead 8

TROUT 10

CUTTHROAT TROUT 10

Distribution and Life History 10

Stock Status and Management Prior to 1994 11

Management Planning and Board Actions 12

Effect of the New Regulations 14

DOLLY VARDEN 19

Distribution and Life History 19

Stock Status and Management 19

Management Planning and Board Actions 20

U.S. Forest Service Recreational Cabin Survey 21

ACKNOWLEDGEMENTS 27

REFERENCES CITED 27

APPENDIX A. COMMERCIAL HARVEST OF STEELHEAD 33

APPENDIX B REGULATORY HISTORY OF STEELHEAD TROUT AND DOLLY VARDEN 37

LIST OF TABLES

Table **Page**

1. Regulatory proposals submitted to the Alaska Board of Fisheries, 2011–2012, dealing with steelhead and trout. 1
2. Counts from steelhead snorkel surveys conducted in index stream in Southeast Alaska, 1997–2011. 7
3. Assessment of steelhead escapement utilizing weirs in Southeast Alaska (all numbers are immigrant weir counts unless otherwise noted). 9
4. Abundance estimates for short-term studies of resident populations of coastal cutthroat trout in Alaska. ... 17
5. Counts of emigrating sea-run coastal cutthroat trout in Alaska from short-term and long-term (5 or more years) studies. 18
6. Emigrant Dolly Varden and cutthroat trout weir counts by system and year for Southeast Alaska. 20
7. Number of registered parties, responding parties, and total estimated effort (angler-days and angler-hours) by target species, fish kept and released at USFS recreational cabins in Southeast Alaska during 2009 23
8. Number of registered parties, estimated number of total catch (released + harvest) for trout (rainbow and cutthroat trout) and total catch (released + harvest) of steelhead by system compiled from previous surveys at USFS recreational cabins in Southeast Alaska between 1992 and 2009. 25

LIST OF FIGURES

Figure **Page**

1. Steelhead harvests in Southeast Alaska, 1977–2010 from the Alaska Department of Fish and Game, Division of Sport Fish Statewide Harvest Survey. 5
2. Southeast Alaska freshwater fishing effort from the Alaska Department of Fish and Game, Division of Sport Fish Statewide Harvest Survey, 1977–2010. 5
3. Location of the 10 current index streams in Southeast Alaska and the Situk River. 6
4. Steelhead catch (harvested plus released) in Southeast Alaska, 1990–2010 from the Alaska Department of Fish and Game, Division of Sport Fish Statewide Harvest Survey. 10
5. Southeast Alaska peak steelhead snorkel surveys and the deviation of these counts from the median count combined with a trend line, 1997–2011. 13
6. Cutthroat trout harvests in Southeast Alaska, 1977–2009 from the Alaska Department of Fish and Game, Division of Sport Fish Statewide Harvest Survey. 13
7. Cutthroat trout total catch (harvest plus released) in Southeast Alaska, 1990–2010 from the Alaska Department of Fish and Game, Division of Sport Fish Statewide Harvest Survey. 16
8. The estimated abundance of cutthroat trout in Turner, Baranof, Florence and Auke Lakes, Alaska. Vertical bars depict the standard error of the estimate. 16
9. The number of wild sea-run cutthroat trout emigrating through the Auke Creek weir, 1980–2011 17
10. Dolly Varden harvests in Southeast Alaska, 1977–2010 from the Alaska Department of Fish and Game, Division of Sport Fish Statewide Harvest Survey. 22

LIST OF APPENDICES

Appendix **Page**

A1. Reported commercial harvest of steelhead by gear type in Southeast Alaska, 1969 – 2011. 34
A2. Reported commercial harvest of steelhead trout in districts 101, 104, 106, and 111 compared to total Southeast Alaska harvest, 1969–2011. 35
B1. History of general regulations affecting steelhead fisheries in Southeast Alaska. 38
B2. History of general regulations affecting trout fisheries in Southeast Alaska. 38

ABSTRACT

This report provides a summary of steelhead and trout issues in Southeast Alaska (SEAK) for which the Alaska Board of Fisheries (board) is considering proposals in February 2012. Life history, stock status and history, and past board actions are presented. An overview of steelhead, trout, and Dolly Varden fisheries in Southeast Alaska and Yakutat management areas is also provided and includes regulatory history, stock status, life history, and species distribution. Summary results of a postal survey that censuses catch and harvest of steelhead and trout by parties reserving United States Forest Service recreational cabins located in Southeast is also provided.

Keywords: Harvest, catch, effort, steelhead, cutthroat trout, Dolly Varden, Alaska Board of Fisheries, sport fish, Southeast Alaska, , sport fisheries overview, angling regulations, stock status, *Oncorhynchus mykiss, O. clarkii, Salvelins malma,* recreational cabin survey

INTRODUCTION

The Alaska Board of Fisheries (board) will consider 6 regulatory proposals at its February 2012 meeting that deal with steelhead and trout (Table 1). The purpose of this paper is to explain the regulatory history and stock status of steelhead, trout, and Dolly Varden. This report briefly describes the distribution and life history of steelhead, trout, and Dolly Varden in SEAK, and recounts the conservation concerns that led up to adoption of the current steelhead and trout regulations. It also summarizes the effects of the recent regulations on steelhead and trout fisheries and stocks, and presents the results of pertinent ADF&G steelhead and trout research.

Steelhead, rainbow, and cutthroat trout, along with Dolly Varden, occur in streams and lakes throughout most of Southeast Alaska (SEAK) and Yakutat, and are available to anglers year-round. Trout (including steelhead) and Dolly Varden are harvested incidentally in Southeast Alaska's commercial fisheries and targeted in marine and freshwater sport and state and federal subsistence fisheries.

The Alaska Department of Fish and Game (ADF&G) and members of the public became concerned about the status of trout and steelhead in SEAK during the late 1980s and early 1990s. This concern stemmed largely from angler effort and harvest estimates observed in the ADF&G Statewide Harvest Survey (SWHS), stream survey observations, and reduced abundance reported by members of the public and sport fishing guides throughout the region. These factors indicated a SEAK-wide decline in abundance of cutthroat trout and steelhead, presumably due in part to harvest levels that may have been unsustainable. In January 1994, the board adopted new regulations for steelhead, rainbow, and cutthroat trout in SEAK. The regulations were based on results of ADF&G research, published literature on trout, and an extensive public review of angler preferences for trout and steelhead management.

Table 1.–Regulatory proposals submitted to the Alaska Board of Fisheries, 2011–2012, dealing with steelhead and trout.

Proposal #	Effect
254	Allow youth and disabled anglers to use bait in high use cutthroat lakes.
257	Prohibit the use of bait in Cowee Creek.
263	Prohibit the use of bait in the Klawock River.
264	Allow the use of bait in the Klawock River.
265	Repeal Klawock River regulations applying to adipose clipped steelhead.
294	Require reporting of commercially caught salmon and steelhead retained for personal use.

STATEWIDE POLICY AND PLAN FOR MANAGEMENT OF SUSTAINABLE WILD TROUT FISHERIES

The board adopted the Policy for the Management of Sustainable Wild Trout Fisheries (5 ACC 75.222), and the Statewide Management Standards for Wild Trout (5 ACC 75.220) in March 2003. The policy provides principles and criteria to ensure conservation, sustainability, and optimal sustained yield of wild trout and benefits for wild trout, and provides direction to the board and ADF&G as to how those principles and criteria are to be applied in the regulatory process. The plan ensures conservative management of wild trout fisheries while recognizing existing plans and policies that guide management of wild trout in SEAK.

FEDERAL SUBSISTENCE PROGRAM FOR STEELHEAD, TROUT, AND CHAR

Prior to 1999, all subsistence harvests of steelhead, trout, and char in SEAK occurred under State of Alaska regulations. Under state regulations, only trout and char harvested incidentally under the terms of a subsistence salmon permit were allowed to be kept, but the numbers had to be reported on permit calendars (5 AAC 01.730). The state also managed a subsistence fishery for steelhead that allowed an annual harvest of up to 300 steelhead in the Situk and Ahrnklin rivers. At its onset the federal subsistence management program permitted subsistence fisheries on waters within and adjacent to federal lands. Initially the federal subsistence program only permitted harvest of steelhead on Prince of Wales (POW)/Kosciusko islands systems, Situk and Ahrnklin rivers near Yakutat, and Hamilton Bay and Kadake Bay rivers near Petersburg. Subsequent to the 2003 board meeting, the Federal Subsistence Board significantly expanded federal subsistence harvest opportunities for steelhead, trout and char. These expanded subsistence fisheries allow the use of bait and have the potential to cause stock declines of steelhead and trout, and therefore may affect management of state fisheries. Sport fishery regulations allow a limited harvest of steelhead, trout, and char, but are very conservative compared to federal subsistence regulations. Under the expanded federal subsistence regulations, all fresh waters in SEAK are open for federally-qualified users to harvest trout, Dolly Varden and steelhead. ADF&G has opposed, without success, almost all of the federal increases in subsistence harvest opportunity for trout and steelhead on the basis that they are not sustainable, and that the federal board has not defined the subsistence need, or developed proven methods with which to monitor the subsistence harvest and stock status.

REVIEW OF LITERATURE RELATING TO CONSERVATION OF STEELHEAD, TROUT, AND CHAR

The scientific literature is periodically reviewed for pertinent information that was not available at the time the board adopted the trout regulations in 1994. Review of the scientific literature provides updates to catch and release (C&R) mortality related to hook types and bait use, as well as relevant new topics. No new scientific articles were recently found that would significantly alter the current management practices for trout, steelhead and char in SEAK. No new information was found to recommend to the board to either eliminate or expand the use of bait in freshwater fisheries, or adopt specific hook types.

Most post-release C&R mortality is strongly related to metabolic exhaustion or lethal injury, e.g., bleeding gills, and usually occurs within 24–48 hours after capture. Exposure to warm air and water temperatures continues to be identified as prominent factors affecting the stress and hooking mortality of catch-and-release angling (Gingerich et al. 2007). Anglers need to minimize the time to successfully land and release a fish in order to reduce stress to the fish, particularly when warmer water temperatures occur (Meka and McCormick 2005). Other studies confirmed that there is generally no significant difference between hooking mortality of resident trout (i.e., nonanadromous salmonids) caught with barbed or barbless hooks, and either single or treble hooks, regardless of whether artificial flies, lures, or organic bait are used (Dubois and Pleski 2007). C&R angling appears to have little effect on growth and mortality of rainbow trout hooked in the mouth (Pope et al. 2007). Computer simulations of brook trout populations show that as angler effort increases, C&R mortality might significantly impact the age and size structure of populations, thereby reducing trophy angling potential (Jackson 2009).

Several articles were reviewed regarding the use of circle hooks in fresh water. Circle hooks have proven to be an effective conservation tool in marine fisheries by decreasing injury and mortality rates without reducing capture efficiency rates (Cooke and Suski 2005). However, the performance of circle hooks in freshwater sport fisheries is much less clear. Cooke et al. (2003) hypothesized that circle hooks in fresh water may help reduce injuries and mortality rates if hook size is matched to a specific size of fish. Cooke and Suski (2005) suggests that when using intermediate-sized circle hooks, a reasonable trade-off between injury and capture efficiency may be obtained. If further research confirms that

circle hooks used in freshwater can significantly increase survival of C&R fish, management agencies may begin recommending that anglers use intermediate-sized circle hooks while passively fishing with bait (i.e., hook with bait fished relatively stationary). This may provide an extra measure of protection for smaller species (i.e., trout and char) during periods in the fall when bait is allowed during freshwater coho salmon fishing). However, Cooke and Suski (2004) caution management agencies to recommend circle hooks only when appropriate scientific data exists, and at this time there are not enough studies to support recommending circle hooks.

Several scientific articles stressed the need for proper angler education, including the importance of proper hook removal techniques to reduce C&R mortality (Meka 2004). Anglers often look to government natural resource agencies for guidance on how to handle and release fish properly (Pelletier et al. 2007). Although no article specifically made the statement, it was implied that educating anglers on proper C&R techniques may increase survival of released fish as much as regulations restricting certain gear types. However, the outreach agencies must stay current on proper C&R techniques as well as implementing new research results.

Several articles expanded on the importance of proper C&R angling practices. Such proper practices ranged from avoidance of injury and mortality of fish to include minimizing the physiological and behavioral responses of fish (Davie and Kopf 2006). Several articles discussed the concept of fish welfare or a fish's ability to feel and sense pain, stress, and fear. Davie and Kopf recommend that future research focus on how the welfare of fish is influenced by different types of angling equipment and methods of capture. Currently there is insufficient information to make absolute statements regarding the neurological capabilities of fish to pain and consciousness (Davie and Kopf 2006), but this topic is controversial and research is ongoing. Both physical and physiological impacts of fish caught and released can be minimized by using correct fishing tackle, handling procedures, and training of angle(Olsen et al. 2010).

STEELHEAD

DISTRIBUTION AND LIFE HISTORY

Steelhead are found in coastal streams of Alaska from Dixon Entrance, north and westward around the Gulf of Alaska to the Cold Bay area on the Alaska Peninsula. SEAK has 309 watersheds known to support annual escapements of steelhead. Most of the known steelhead streams in SEAK are believed to contain 200 or fewer adults. However, some of the larger systems, like the Karta River on Prince of Wales Island, may have once supported annual escapements >1,000 adult steelhead, while the Thorne River watershed, also on Prince of Wales, is still believed to have an annual escapement >1,000. The largest known steelhead producer in SEAK is the Situk River near Yakutat, which has annual kelt counts (adult emigrants) that vary from 3,000 to just over 15,000 adults.

Steelhead in Alaska generally spend 2 to 5 years in fresh water before migrating to the ocean as smolt; a 3-year freshwater residency is most common. Adult steelhead typically return to spawn after spending 2 to 3 years at sea. Steelhead are often grouped or classified by the time of year they return to their natal stream, i.e., spring, summer, or fall. Spring-run steelhead return to streams in SEAK between March and early June but are generally concentrated between mid-April through May. The rare summer-run fish may return to fresh water during July. Fall-run steelhead enter the freshwater systems as adults in September, October, and November, and possibly throughout the winter. In SEAK, the spring run form is the most common, but fall run steelhead do comprise a significant component of some populations.

Regardless of when they return to fresh water, all steelhead spawn during the spring months when daily water temperatures reach 6–9°C, usually about mid-April through May to early June. Adult steelhead that survive spawning (kelts) migrate back to sea from mid-May through June. Steelhead that have spawned as many as 5 times have been documented in some SEAK systems. Repeat-spawning fish usually compose 20% to 33% (sampled range = 11% to 46%) of the total adult return (Love et al. *In prep*; Lohr and Bryant 1999

VanHulle 1985[1]), and 65% to 80% of repeat spawners are female. In general, first-time spawning fish are evenly comprised of males and females.

STOCK STATUS AND MANAGEMENT PRIOR TO 1994

The regionwide sport fishing regulations prior to 1994 allowed the harvest of 5 trout (in combination) per day and 10 in possession, of which only 1 per day and 2 in possession could be greater than 16 inches (i.e., steelhead). The use of bait was allowed year-round, but there were regulations that restricted bag limits at a few specific locations in SEAK.

ADF&G and the fishing public became concerned that steelhead stocks in SEAK had been declining for several years prior to the regulation changes in 1994. Harvest of steelhead increased after 1977, peaked in 1986, and then began to decline (Figure 1). At the same time, total freshwater fishing effort (angler days) was steadily increasing but effort specifically targeting steelhead could not be estimated (Figure 2).

Steelhead escapement counts in the early 1990s on the Situk River (the region's largest steelhead fishery and the only river with long-term kelt counts) were showing a dramatic downturn. In 1991 ADF&G responded by issuing an emergency order (EO) that closed the Situk River to steelhead retention and restricted the use of bait. During the same time period, anglers were also reporting reduced abundance and harvest of steelhead in numerous streams throughout the region. In response, ADF&G issued an EO in the spring of 1992 that closed 24 streams to the retention of steelhead, and restricted the use of bait. In 1993, ADF&G closed 48 steelhead streams to the retention of steelhead (also with bait restrictions).

Snorkel surveys have been used since 1997 (Table 2) to monitor annual steelhead escapements in a number of index systems dispersed across SEAK (Figure 3). These surveys provide a peak annual escapement count for each system. Snorkel surveys do not estimate total escapement (like a weir count), but provide a relative index of abundance. These snorkel surveys now serve as the primary stock-monitoring tool for steelhead abundance in SEAK.

MANAGEMENT PLANNING AND BOARD ACTIONS

Based on concerns for sustainability of the steelhead and trout fisheries, the Division of Sport Fish initiated a planning process in 1993 to evaluate trout and steelhead regulations and public attitudes about future management strategies. Prior to 1994 the steelhead regulations allowed a daily bag limit of 1 fish with 2 in possession, and no minimum size limit. The Commissioner of ADF&G appointed a 9-member citizen committee to make recommendations on how to manage steelhead in SEAK. Committee members included steelhead anglers from Anchorage, Yakutat, Juneau (2 members), Sitka, Petersburg, Ketchikan (2 members), and Prince of Wales Island. This committee developed a survey that was sent to 1,768 steelhead anglers. The list of anglers surveyed included all respondents to the ADF&G Statewide Harvest Survey (SWHS) who had fished on a steelhead system in SEAK in 1992 or 1993.

Returned surveys confirmed that most anglers (81%) felt steelhead in SEAK were declining, and 78% thought that if more restrictive regulations were deemed necessary, then steelhead should be managed more conservatively to rebuild abundance and provide continued fishing opportunity. When asked why anglers fish for steelhead, most answered that they liked to fish (55%) and enjoy the outdoors (35%) as prime reasons, while keeping a trophy or eating a steelhead were minor considerations (<10%). If restrictive regulations were necessary (i.e., steelhead populations continue to decline), many respondents preferred catch-and-release-only management (42% of the residents and 49% of the nonresidents); reducing the total harvest (daily bag limit) was the second most popular option (36% of the residents and 32% of the nonresidents). If there was a harvestable surplus of steelhead, the most preferred management options were: an annual bag limit (38% of the residents and 34% of nonresidents) and gear restrictions (34% of the residents and 32% of the nonresidents).

[1] Alaska steelhead workshop, ADF&G Division of Sport Fish, Juneau.

Figure 1.–Steelhead harvests in Southeast Alaska, 1977–2010 from the Alaska Department of Fish and Game, Division of Sport Fish Statewide Harvest Survey.

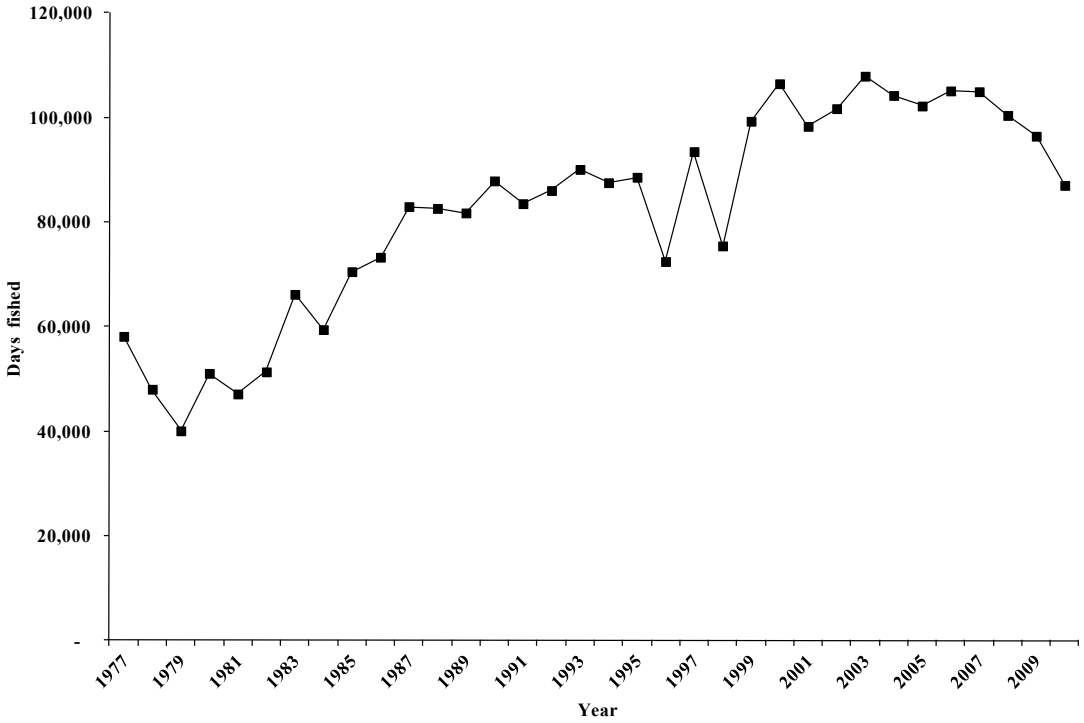

Figure 2.–Southeast Alaska freshwater fishing effort from the Alaska Department of Fish and Game, Division of Sport Fish Statewide Harvest Survey, 1977–2010.

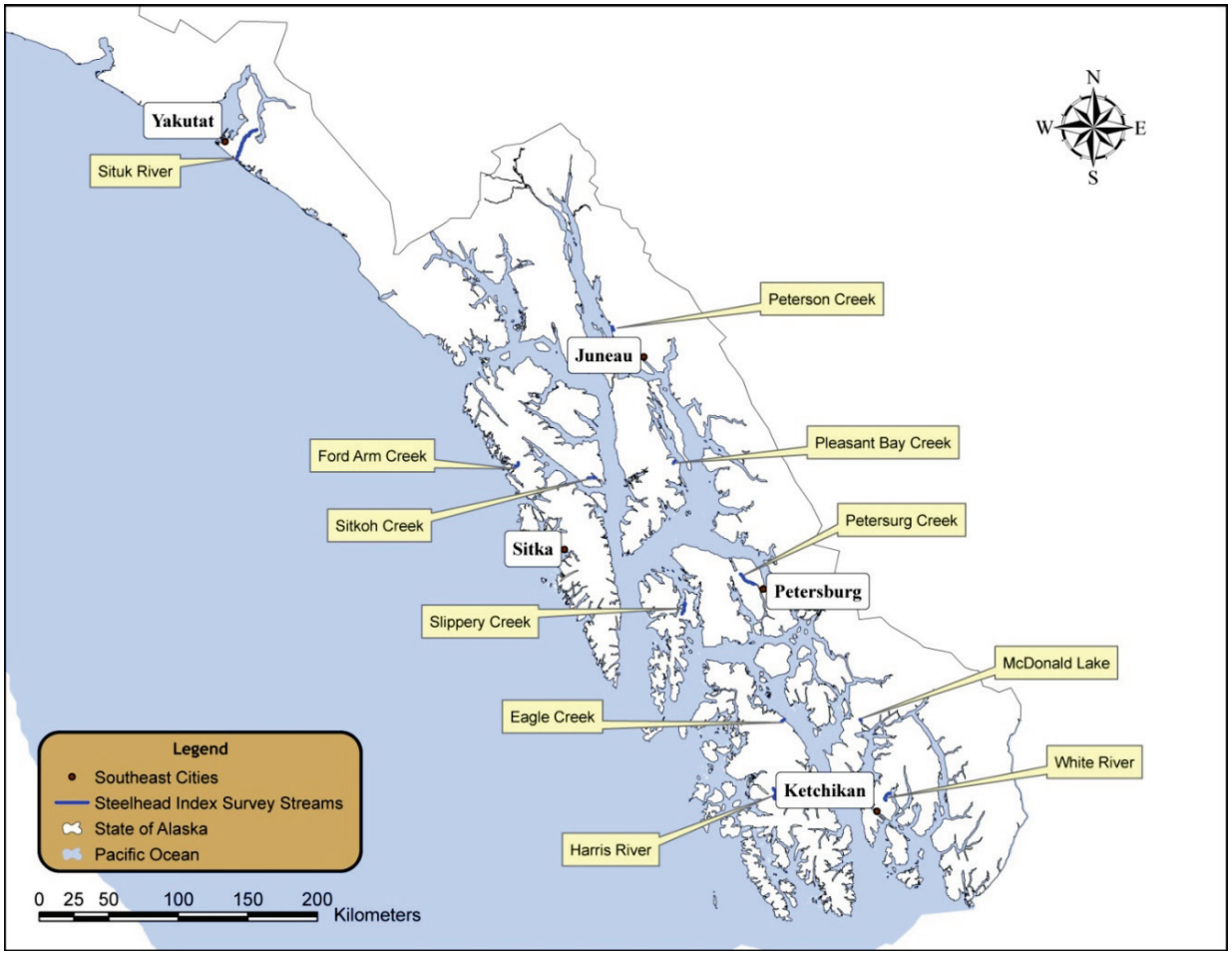

Figure 3.–Location of the 10 current index streams in Southeast Alaska and the Situk River.

In subsequent board meetings, a few changes to steelhead regulations have been implemented. In 1997, the board prohibited the use of bait year-round in 26 streams with fall runs of steelhead, and adopted a proposal making the steelhead regulations at Sitkoh Creek identical to the regionwide regulations.

At its 2000 and 2003 meetings the board considered, but did not adopt, various proposals to eliminate existing minimum size limits for steelhead, and require anglers to cease fishing once their annual bag limit of 2 was reached. During the 2003, 2006, and 2009 board meetings proposals were discussed, but not adopted, that would have implemented catch-and-release only fishing for steelhead throughout SEAK. Also at its 2009 meeting the board discussed, but did not adopt, a proposal to prohibit removing steelhead under 36 inches from the water.

However, the board did adopt regulations at its 2009 meeting that prohibited the retention of steelhead in the fall steelhead drainages, Ward Creek, Thorne River, Karta River, and all streams crossed by the Juneau road system.

EFFECT OF THE NEW REGULATIONS

Harvest of steelhead in the sport fishery declined following the 1994 action taken by the board, and annual harvest from 1994 through 2009 averaged 95% less than harvest in years prior to the regulatory action (1982–1992). Steelhead harvest during 1993 was also significantly reduced as 48 streams were closed to retention through EO action. Since 1994, annual harvests have remained low (Figure 1). An average of 105 steelhead trout were harvested annually in the SEAK sport fishery between 2000 and 2010, while an average of 16,951 steelhead were caught each year.

Table 2.–Counts from steelhead snorkel surveys conducted in index stream in Southeast Alaska, 1997–2011. Peak count (bold) is defined as a bracketed count or a count having a lower count before and after the high or "peak" count; high count (italicized) is defined as an unbracketed count and is the highest count for that year/system.

		Year														
Management area	Stream name	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Juneau	Peterson Creek	**26**	*29*	*38*	*27*	**41**	**13**	**36**	*39*	**22**	**36**	**26**	**26**	**22**	**35**	**27**
	Pleasant Bay (Seymour)	*155*	**81**	*132*	**48**	*48*	**36**	**50**	**51**	*47*	*59*	**94**	**53**	**64**	**51**	**94**
Ketchikan	Humpback Creek	**91**	*24*	*4*	*7*	*101*	*94*	**105**	*65*	**38**	*112*	*18*	NA	*23*	**19**	NA
	Ketchikan Creek	*48*	*47*	*19*	**15**	*24*	*5*	**60**	*53*	*94*	NA	NA	NA	*14*	NA	NA
	McDonald Lake	**145**	**86**	*100*	**47**	*74*	*14*	**79**	*76*	**134**	**100**	*25*	*45*	NA	**88**	ND
	White River	*84*	**93**	*60*	**38**	**48**	**37**	*77*	*35*	*67*	**41**	**85**	**45**	**45**	**42**	**47**
Petersburg	Petersburg Creek	*123*	**152**	**115**	*68*	*64*	*41*	**146**	**330**	**369**	**241**	**289**	**251**	**198**	**221**	**131**
	Bear (Big) Creek	NA	NA	NA	NA	NA	NA	NA	NA	**132**	NA	NA	NA	NA	NA	NA
	Marten Creek	*14*	*17*	*18*	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Slippery Creek	NA	NA	NA	NA	*41*	*31*	*76*	*92*	NA	*79*	**68**	**46**	**86**	**66**	*52*
Prince of Wales	Eagle/Luck Creek	*90*	**56**	*118*	**82**	NA	**36**	*95*	*67*	*102*	**154**	*134*	*8*	**137**	**69**	*54*
	Harris River	*104*	**156**	*192*	**79**	*53*	*200*	*195*	**124**	**122**	**92**	**128**	*122*	**90**	**95**	*58*
Sitka	Ford Arm Creek	*296*	*103*	*89*	**134**	*28*	*122*	**181**	**379**	**459**	**428**	**673**	**266**	**194**	**99**	**169**
	Sitkoh Creek	*329*	*154*	*120*	*112*	*115*	*65*	**296**	**354**	**259**	**213**	*70*	**167**	**201**	*35*	**68**

Over 17 years (approximately 3 steelhead life cycles) have elapsed since the implementation of the 1994 regulations, but no consistent trend in steelhead abundance has been observed. Snorkel survey counts generally dropped for several years after the initial survey year in 1997. Between 2003 and 2007, snorkel index counts were, on average, similar or higher than those during 2000 to 2002, and 6 of the 10 index streams had record snorkel counts between 2004 and 2007 (Table 2). Since 2008 snorkel counts have remained near the overall averages with some annual variation in individual streams. Collectively these counts suggest that the steelhead stocks surveyed have been stable for the last 4 years. The 2008 counts show a slight decrease in numbers from the recent high years, but the index counts are still generally higher than the late 1990s counts (Table 2).

The emigrant count of steelhead through the Situk River weir between 2004 and 2007 exceeded 12,000 and was roughly twice the emigrant counts recorded between 2000 and 2002 (Table 3). The 2010 Situk emigrant count (5,335) was about 5,000 less than the 2004 to 2007 counts and was the lowest count observed. However, the 2011 count rebounded and was very similar to the 2008 and 2009 counts (>7,000).

Sitkoh Creek, located on Chichagof Island, supports one of the largest steelhead runs in northern SEAK. Adult steelhead returning to Sitkoh Creek have been counted through a weir 13 times (1936–1937, 1982, 1990, 1993, 1996, and 2003–2009; Table 3). Escapement counts for Sitkoh have ranged from 392 to 1,108, and averaged approximately 640 fish; weir counts below this average have occurred during the last 5 years of weir operation (2005–2009).

Total freshwater fishing effort throughout SEAK steadily increased from 1979 through 2007, but has trended downward between 2008 and 2010 (Figure 2). Since implementation of the more restrictive steelhead regulations, steelhead harvest has stabilized at a much lower level (Figure 1) and has annually averaged <100 fish since 2002. Steelhead catch, which includes harvested and released fish, reached an all time peak of over 26,000 in 2008 before dropping to <10,000 in 2009 and 2010 (Figure 4).

The reported subsistence harvest of steelhead on Prince of Wales Island (POW) obtained from Federal permit holders has averaged about 30 fish annually during the spring fishery between 2003 and 2011 (USFWS 2011). Throughout the rest of SEAK there is an average of an additional 7 fish harvested annually during the spring fishery. Using household interviews conducted in various communities on POW from 1996 to 1998, the State of Alaska estimated the cumulative subsistence harvest of steelhead on POW was closer to 500 (Turek 2005).

A research project was initiated in 2007 that focused on evaluating the discrepancies between harvest estimates generated from household surveys and from Federal permit returns (Christianson et al. *In prep*). The report of this study is nearing completion and will soon be available per Cathy Needham, Owner, Kai Environmental Consulting Services; personal communication Juneau, Alaska.

In summary, steelhead trout abundance was generally higher than average between 2003 and 2007, and since 2008 the counts have declined and are at or near average levels (Figure 5). There are systems where steelhead escapement still remains below historic levels. ADF&G believes that the current conservative sport fish regulations provide for sustainability of steelhead stocks while allowing for a limited harvest opportunity.

COMMERCIAL HARVEST OF STEELHEAD

Steelhead are incidentally harvested throughout marine waters in SEAK by various marine commercial fisheries. Reported harvests of steelhead were <100 from 2008 through 2011, but were as high as 11,598 in 1986 (Appendix A1). Most of the reported catch of steelhead between 1969 and 1993 was caught in the drift gill net and purse seine fisheries. Between 1990 and 1996, the majority of reported harvest of steelhead occurred from stat week 25 to 40 (approx June 12 to September 25) and is nearly identical to the time period reported in the Pacific Salmon Commission, Northern Boundary Technical Committee (TCNB) Report (1991) for 1980 through 1989. After 1996 no discernible time or spatial pattern is clear due to a paucity of data, i.e., low number of reported steelhead. Most of the reported commercial catches of steelhead have occurred in commercial fishing districts 101 and 104 near the southern boundary of SEAK, and in districts 106 and 111 near the Stikine and Taku rivers, respectively (Appendix A2).

Table 3.–Assessment of steelhead escapement utilizing weirs in Southeast Alaska (all numbers are immigrant weir counts unless otherwise noted).

Year	Situk River[a]	Sitkoh Creek	Karta River	Harris River	Ratz Creek	Eagle Creek	Twelve Mile Creek	Ward Creek	Cable Creek	Natzuhin Creek	Petersburg Creek[b]	Peterson Creek	Sashin Creek	Lake Eva	Windfall Creek
1936		760													
1937		1,108													
1952	25,000–30,000[c]														
1971											806				
1972											536				
1973											401				
1974											369				
1975			872[d]								326				
1982		690													
1989			1,220									222			
1990		661										179			
1991												215			
1992			347[e]												
1993		520						337 (51)[f]							
1994	7,854							412 (12)[f]							
1995														35	
1996	8,510	926											32		
1997	7,328												63		53
1998	5,786												27		
1999	9,204												24		
2000	6,709												29		
2001	6,400												26		
2002	6,113												36		
2003	7,964	682[g]					97 (2)[f]						12		
2004	12,462	780[g]					87						47		
2005	12,265	574[g]	481[d]	172[d]	399[d]								34		
2006	15,003	416[g]				299[d]			134[d]				75		
2007	12,438	416[g]			284[d]					78[d]			21		
2008	7,320	511[g]	186[f]										15		
2009	7,302	408[g]											9		
2010	5,335				378							114	31		
2011	7,572				526							133	26		

[a] Situk River are emigrant or downstream weir counts only.
[b] All numbers reported in Jones 1976b as "estimated number of adult steelhead," but mark–recapture details unavailable.
[c] Situk River 1952, "estimate" by observation of weir crew for steelhead emigrants; 6,000 were counted down in a single night.
[d] Minimum spawning escapement (MSE); weir immigrant count incomplete (i.e., MSE = # of immigrants plus # unmarked emigrants).
[e] Emigrant count.
[f] Incomplete immigrant and emigrant count.
[g] Modified Chapman estimate.

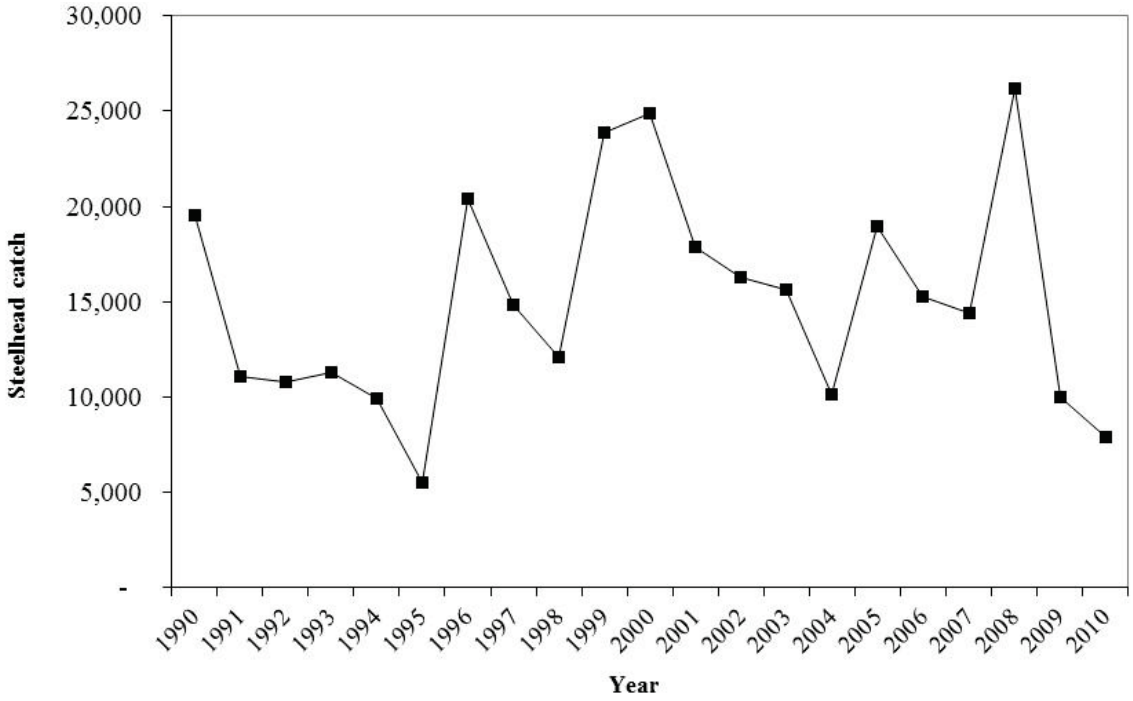

Figure 4.–Steelhead catch (harvested plus released) in Southeast Alaska, 1990–2010 from the Alaska Department of Fish and Game, Division of Sport Fish Statewide Harvest Survey.

A complete analysis of the reported catch of steelhead in the commercial fisheries is difficult because of data gaps and incomplete records. The TCNB (1991) report states that: "steelhead harvests reported through landing records should be considered minimum estimates of the actual harvest".

The sale of steelhead caught in commercial gillnet and purse seine fisheries has been prohibited since 1994 (5 AAC 33.394). However, steelhead taken in a commercial fishery may be retained for personal use, but not bartered (5 AAC 39.010), and must be recorded on a fish ticket.

TROUT

CUTTHROAT TROUT

DISTRIBUTION AND LIFE HISTORY

Coastal cutthroat trout on the West Coast range from Humboldt Bay in northern California to Prince William Sound in Southcentral Alaska. There are 2 main types of cutthroat trout populations in SEAK: resident and sea-run (anadromous). Resident cutthroat trout spend their lives entirely in fresh water and are found primarily in landlocked lakes, but may also be found in many streams. Sea-run cutthroat trout typically reside in lakes during the winter, and mature adults and smolts migrate to saltwater feeding areas and spawning streams during the early spring.

Cutthroat trout spawn in the spring from March to early June and young fish rear in small streams for 1 to 2 years. Resident cutthroat trout then move into lakes and larger streams where they spend the remainder of their lives. Sea-run cutthroat trout migrate as smolt (age 2 or 3) into salt water to feed during the summer, and then move back into lakes to overwinter. Sea-run cutthroat trout migrate to sea once or twice before becoming sexually mature.

Resident and sea-run populations of cutthroat trout in SEAK grow slowly. A 4-year-old fish typically measures 8 inches and it takes at least 12 years for a cutthroat to reach trophy size (20 inches). There are resident populations of cutthroat trout in SEAK that grow slowly throughout their lives and seldom exceed 11 inches. Cutthroat trout in SEAK first mature at age 3 and by age 7 nearly all have reached

maturity. When a cutthroat trout population is reduced to low levels, recovery is slow. In Idaho, it took a severely depressed stock more than 10 years to recover under ideal conditions; in less productive systems with low recruitment, it may take up to 50 years for the population to recover (Rieman and Apperson 1989).

STOCK STATUS AND MANAGEMENT PRIOR TO 1994

Harvest of cutthroat trout in SEAK declined significantly from a peak of nearly 23,000 in 1980 to approximately 13,000 in 1993 (Figure 6). Given that sport fishing effort was increasing during this period (Figure 2), ADF&G was concerned that existing regulations (5 fish bag and 10 fish possession limit, of which only one per day and 2 in possession could be over 16 inches) were not adequate to prevent overharvest. Trout are often caught in freshwater by anglers targeting salmon thus, increasing angling effort could result in more trout catch and harvest.

ADF&G initiated a stock-monitoring program in the late 1980s to evaluate the ability of cutthroat trout populations to sustain the existing level of fishing pressure. Abundance estimates at several popular cutthroat trout lakes confirmed that population levels were low and that existing harvest rates were not sustainable. Based on this information, increasing angler concerns, and declining harvests of trophy-size cutthroat trout, ADF&G issued EOs in 1991 for non-retention of cutthroat trout at three of the largest cutthroat trout lakes in the region (Turner Lake near Juneau, and Wilson and Reflection lakes near Ketchikan). These EOs also prohibited the use of bait in those lakes. ADF&G staff and the public recognized a need to evaluate existing trout regulations and develop new management strategies and regulations to protect trout resources in SEAK, while providing maximum fishing opportunity.

A review of the existing literature and contacts with other trout and steelhead managers revealed that cutthroat trout are the most easily caught of the trout species. Cutthroat trout are aggressive feeders and can be caught on a wide variety of gear types. They are particularly vulnerable to bait. Studies show that mortality rates for cutthroat trout caught and released using natural bait are as high as 48% (Mongillo 1984; Wright 1992; Taylor and White 1992; Pauley and Thomas 1993), whereas mortalities from artificial gear (lures, flies, etc.) are lower than 5%. Mortality rates for rainbow trout caught with bait and released were 28%, still much higher than artificial gear types (7%).

Hunt (1970) stated that size limits, if wisely applied, are the best regulations for preventing excessive angler harvest because they apply to every fish caught and can be related to specific biological parameters. Wright (1992) expanded on this in his review of the state of Washington's regulatory strategy: to maintain a trout population's reproductive potential, the minimum size limit should be set at a level that provides an opportunity for a full age-class of females to spawn at least once. However, because sport fishing regulations are based on length and not age-class, minimum size limits need to protect all female trout until they reach the length at which they are mature. Males typically mature when they are somewhat younger and smaller (Downs et al. 1997), thus any minimum size limit regulation designed to protect females would also protect males.

Length-at-maturity data for Alaska cutthroat trout stocks were limited to a few years of information collected during the 1970s from sea-run fish in Petersburg Creek (Jones 1976).

Other sources used in establishing minimum size regulations came from literature on landlocked populations in Mosquito Lake in the Queen Charlotte Islands, British Columbia (de Leeuw 1987) and trout populations in Washington and Oregon (Wright 1992). Information from these sources suggested that a 12-inch minimum size limit would allow approximately 85% of cutthroat trout in SEAK an opportunity to spawn at least once, and a 14-inch size limit would allow nearly all fish an opportunity to spawn at least one time.

One concern with size limits is the potential adverse effect of long-term size selectivity on heritable traits. However, ADF&G biologists believed that as long as "an adequate number" of fish above the minimum size limit are not harvested and allowed to spawn multiple times, then the genetic structure would not adversely change.

At the time the regulations were developed, ADF&G biologists knew of no sport fishery in SEAK that was so intense that an adequate number of fish above the minimum legal size limit would not be maintained.

ADF&G also realized this might change and that ongoing monitoring would be necessary to maintain genetic integrity of trout stocks.

Upon completion of a review of all available literature through 1993, ADF&G biologists agreed that 2 key trout (cutthroat and rainbow) management actions were needed: (1) establishing an appropriate minimum size limit, and (2) restricting use of bait. A minimum size limit could be effective only if hooking mortality was low, and it would be meaningless without concurrent bait restrictions. Hence, a ban on bait in fresh water was an essential element of the new regulations. Further, because SEAK has thousands of remote lakes and streams, abundance could be estimated in only a few. Therefore, the new trout regulations needed to cover a wide range of situations and levels of angler pressure. Many of the trout populations were known to be small and unable to sustain much harvest. Thus, a minimum size limit that protected the majority of fish until they had the opportunity to spawn at least once made the most sense to ADF&G biologists.

One concern was that the public might view new hatchery production as an option for increasing trout harvest. After reviewing the literature and history of trout hatcheries and associated problems, there was internal agreement that stocking of hatchery trout or steelhead into SEAK lakes and streams that contain native fish had a high likelihood of causing harm to the wild stocks. A recent report emphasizes that minimizing or avoiding interactions between wild and hatchery steelhead is the best long-term conservation strategy for wild populations (Chilcote et al. 2011). Thus, the emphasis needed to be, and should continue to be, on implementing regulations that protect and ensure perpetuation of existing wild stocks.

Management Planning and Board Actions

During February and March of 1993, ADF&G biologists held 14 public meetings in large and small communities throughout SEAK to discuss their concerns and determine if the angling public had information and/or similar concerns for trout stocks. Additionally, over 7,000 copies of an informational leaflet were distributed in newspapers around SEAK that briefly outlined trout life history and management concerns. ADF&G set up booths at each of the main boat shows in SEAK to talk with anglers and distribute the informational leaflet. The leaflet was also distributed to everyone who reserved a U.S. Forest Service cabin at a cutthroat lake in 1992, along with a questionnaire, requesting opinions on proposed management options for trout.

Public response was generally supportive of more restrictive regulations. Anglers concurred with ADF&G's concerns and agreed that there was a problem with declining numbers and/or sizes of trout. Many anglers also highlighted specific systems where they had seen declining catches and/or sizes of cutthroat trout and steelhead. At the end of each public presentation, the trout questionnaire was distributed to evaluate public opinion and solicit suggestions on potential management options.

A total of 192 responses to the trout questionnaire were received. Most questionnaires (81%) were from Alaska residents; 19% were from nonresident anglers. Nearly 76% of the respondents favored a 14-inch minimum size limit, and support for bait restrictions was even stronger (80%) for cutthroat trout in fresh water. Over 70% of the respondents were in favor of making all sea-run cutthroat populations catch-and-release only. Nearly 60% favored special restrictions for the 13 lakes in SEAK that are known for their trophy-size cutthroat trout.

ADF&G had developed a set of draft trout regulations by fall 1993 and through another series of public meetings, presented the management package to all Southeast communities with local Fish and Game Advisory Committees.

The new SEAK trout regulations were adopted by the board in early 1994 combining bag limits, size limits, and bait restrictions. A 12-inch minimum size limit for cutthroat and rainbow trout was implemented throughout the region to: (1) provide protection for juvenile steelhead and sea-run cutthroat trout before they emigrate to the ocean, and (2) protect cutthroat and rainbow trout until the majority can spawn at least once. A larger size limit (14-inch minimum size) was adopted for areas with developed access and/or intensive fisheries, i.e., "high use." This more restrictive limit was intended to protect all female cutthroat trout from harvest until they have the opportunity to spawn at least one time.

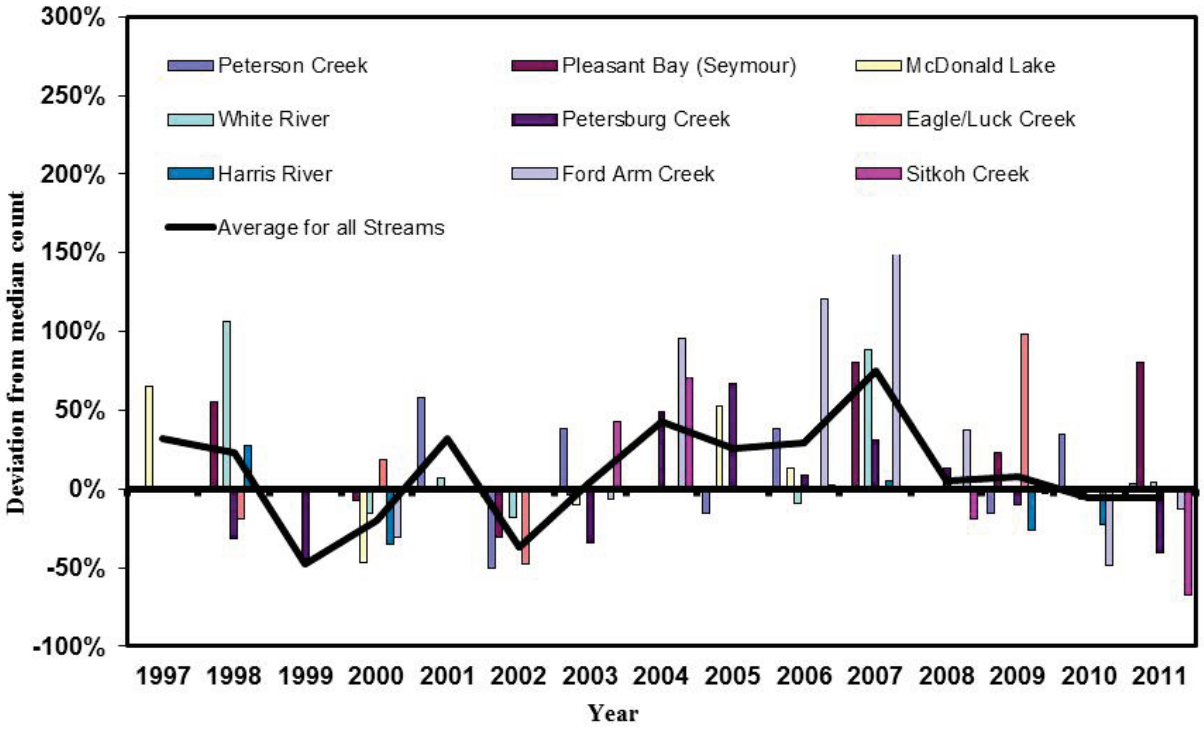

Figure 5.–Southeast Alaska peak steelhead snorkel surveys and the deviation of these counts from the median count combined with a trend line, 1997–2011. Only peak counts were used and only for systems surveyed since 1997, i.e., not Slippery Creek.

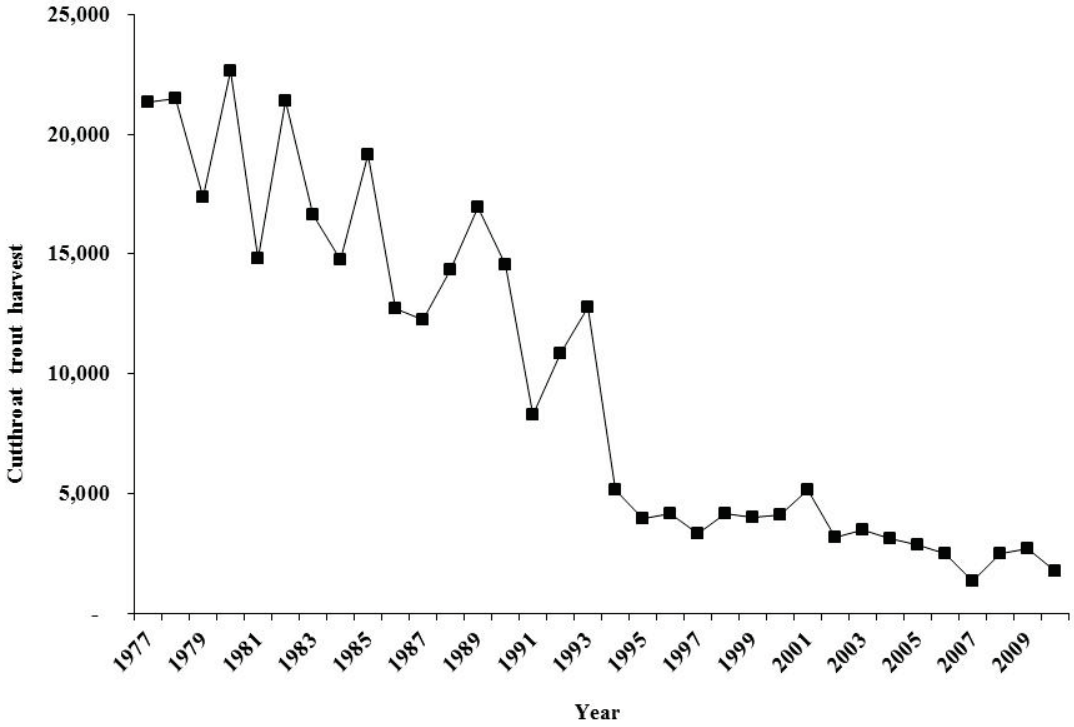

Figure 6.–Cutthroat trout harvests in Southeast Alaska, 1977–2009 from the Alaska Department of Fish and Game, Division of Sport Fish Statewide Harvest Survey.

A maximum size limit of 22 inches (fish greater than this size cannot be legally harvested) was also implemented to protect returning adult steelhead. In addition, a 10-month (November 16 through September 14) ban on fishing with bait was implemented in freshwater systems to reduce hooking mortality on trout and steelhead. The 2-month period in which bait is allowed provides anglers the opportunity to use bait when adult coho salmon are present in fresh water. A year-round bait ban was adopted in a majority of areas where the 14-inch minimum size was implemented.

The regionwide minimum size limit provides a practical and cost-effective way to manage the numerous trout populations throughout Southeast Alaska without the need for detailed biological data on each system. However, because of diverse management situations, the board also provided several exceptions to the regionwide minimum size limit, including "high-use," "trophy" (25-inch minimum size limit), "stocked lakes," "small lakes" (9-inch minimum size limit), and "special lakes" (1 catch-and-release-only lake and 1 lake with less restrictive harvest regulations).

The board again considered trout and steelhead regulations in SEAK in 1997. Thirty proposals related to trout and steelhead were submitted and discussed. One of the primary concerns expressed by the public was that young anglers could not use bait and were being excluded from fishing. The board implemented a provision that allowed each of the primary communities in SEAK to designate a nearby lake at which the use of bait would be allowed. In 1997, the board also asked ADF&G to evaluate cutthroat trout length-at-maturity in more lakes and report the results during the next meeting in 2000.

The only public trout proposal adopted by the board made unbaited, single hook, and artificial lures the only legal gear in the Karta River drainage. Karta River is one of the most heavily fished steelhead streams in southern SEAK.

ADF&G staff submitted a proposal requesting the board to reduce the regionwide trout minimum size length limit from 12 inches to 11 inches. The board adopted the 11-inch minimum length limit primarily because the ADF&G maturity study indicated that the majority of female cutthroat trout are mature at 11 inches. The board also enacted 3 trout regulations during its 2000 meeting relating to the "high-use" (14-inch minimum size limit) category. The board adopted regulations that: (1) extended the "high-use" area along the Juneau road system to a line ¼-mile offshore; (2) moved 3 Prince of Wales Island lakes into the "high-use" category; and (3) removed Thayer Lake on Admiralty Island and 3 Sitka area streams from the "high-use" category, and placed them under general regionwide trout regulations.

During the 2003 board meeting, 9 proposals dealing with trout and/or steelhead were discussed; 4 were submitted by ADF&G. Most of the public proposals sought more restrictive gear regulations in trout and salmon waters, i.e., fly-fishing or single barbless hooks only. All but one of the ADF&G proposals submitted during the 2003 board meeting were adopted by the board.

Only 1 proposal dealing with cutthroat trout was submitted to the board for consideration at its 2006 meeting. This proposal requested that the bag and possession limits in remote trophy lakes be increased to 2 fish with a 9-inch minimum size limit. This proposal was not adopted.

No trout proposals were submitted for consideration during the 2009 board meeting.

EFFECT OF THE NEW REGULATIONS

Annual harvest of cutthroat trout declined substantially following the 1994 board action (Figure 6). Average harvest following the regulatory change (1994–1999) was 67% less than prior harvests (1989–1993). The majority of the post-1994 harvest reduction is attributed to the regulatory changes alone.

Estimates of total sport catch, which includes fish harvested as well as those released, declined to 26,935 in 1995 but increased to approximately 46,000 to 47,000 during 2000 and 2001. Between 2002 and 2010, however, the estimated number of cutthroat trout caught has trended downward and in 2007, the all time low of 13,357 was estimated. Since 2007 the estimated numbers have varied between just over 23,000 to 32,350 (Figure 7). Between 1999 and 2008, the total freshwater fishing effort has been at or near 100,000 angler-days but declined to 87,019 in 2010 (Figure 2).

Information on population trends for cutthroat trout exists for very few resident or sea-run systems in Alaska. Short-term studies (1–2 years) have been conducted on several populations (Table 4), however their limited duration does not allow for assessment of trends in abundance.

Trends in abundance are available for only 4 populations with resident populations of cutthroat trout: Turner Lake, Baranof Lake, Florence Lake, and Auke Lake. In general, these populations appear to be relatively stable but exhibit annual fluctuations in abundance (Figures 8). Turner Lake was closed to the retention of cutthroat trout in 1991 because of a perceived depression in abundance related to over harvest (Harding and Jones 2005). Despite 14 years of catch-and-release management regulations, the population does not appear to be increasing (Figure 8).

The abundance of sea-run cutthroat trout has been estimated by weir studies in 12 systems. However long-term data (≥5 years) are available only for Auke and Jordan creeks near Juneau and Sitkoh Creek on Chichagof Island. The number of wild cutthroat trout emigrating from Auke Creek generally increased from 1983 through 1996, at which point the number of emigrants began to significantly decline (Harding et al. 2006; Figure 9). The low number of emigrants in the early to mid 1980s may have been caused by overharvest in the sport fishery (S. G. Taylor, NMFS, personal communication), but the only harvest estimated by the Statewide Harvest Survey was 112 in 1986. The cause of the more recent decline is unknown but the impacts of urbanization (Shaul et al. 2003) and environmental changes (e.g., warm water temperatures, Taylor *Unpublished*) are potential factors.

Jordan Creek is listed as a Section 303(d) impaired water body by the Alaska Department of Environmental Conservation for failure to meet sediment, debris, and dissolved oxygen standards. The number of sea-run cutthroat trout has rapidly declined to near elimination since monitoring began in 2000 (Table 5). Possible causes of the decline include low flow or dewatering events, warm water temperatures, pollution, and handling or weir effects. Acute mortality events involving several hundred coho salmon smolt were observed in late spring (May–June), 2003 to 2005. The mortality events were similar in that they occurred during the first significant rainfall following a week or more of generally dry weather (and subsequent low stream flows). Analysis of water samples collected during a mortality event in 2004 revealed the presence of acetone in the water (ADF&G, unpublished data, Douglas office, S\ Trout\Jordan_Duck\Water_Quality\Jordan_June 2004_analytica_report.pdf). The number of sea-run cutthroat emigrants at Sitkoh Creek ranged from 1,442 in 1996 to 4,588 in 2003 (Table 5). At Eva Creek the number of cutthroat trout emigrating in 1995 (n = 2,556) was nearly twice the annual counts from the early 1960s (Yanusz and Schmidt 1996). However, there can be significant inter-annual variability in the number of emigrating cutthroat trout (e.g., in Sitkoh Creek there were 50% more emigrants in 2004 than in 2005, Table 5), which suggests that assessment of temporal trends in abundance may not be robust when few annual estimates are available.

The status of cutthroat and rainbow trout populations throughout SEAK appears to be stable, with some localized and annual fluctuations. This assessment is based on ADF&G observations at a handful of locations making it difficult to generalize population status across the wide geographic scope of SEAK. However, the fishing public has not actively been expressing concerns to ADF&G staff about declining trout populations in specific areas as was the case in the late 1980s and early 1990s (Harding and Jones 2005). As with other native western trout populations, habitat protection remains a vital component of maintaining healthy trout populations. ADF&G believes that the current conservative sport fish regulations provide for sustainability of trout stocks while allowing for a limited harvest opportunity, provided trout habitat is protected.

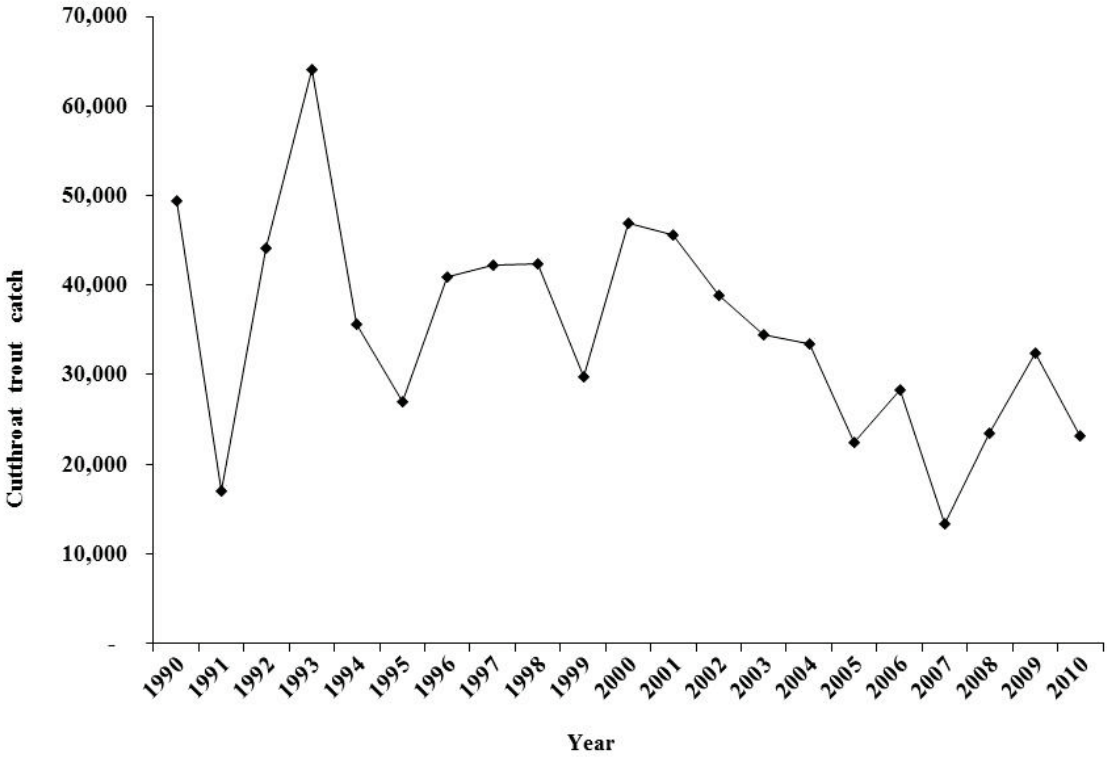

Figure 7.–Cutthroat trout total catch (harvest plus released) in Southeast Alaska, 1990–2010 from the Alaska Department of Fish and Game, Division of Sport Fish Statewide Harvest Survey.

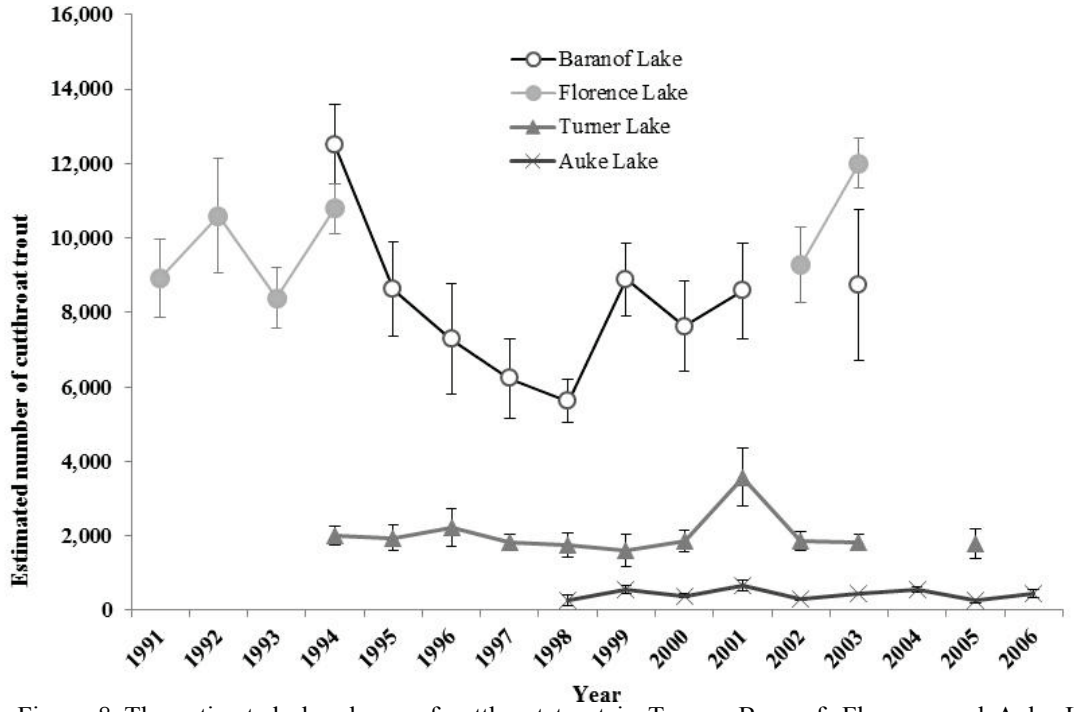

Figure 8–The estimated abundance of cutthroat trout in Turner, Baranof, Florence and Auke Lakes, Alaska. Vertical bars depict the standard error of the estimate (Rosenkranz et al. 1999; Harding et al. 2009b; Harding et al. 2010).

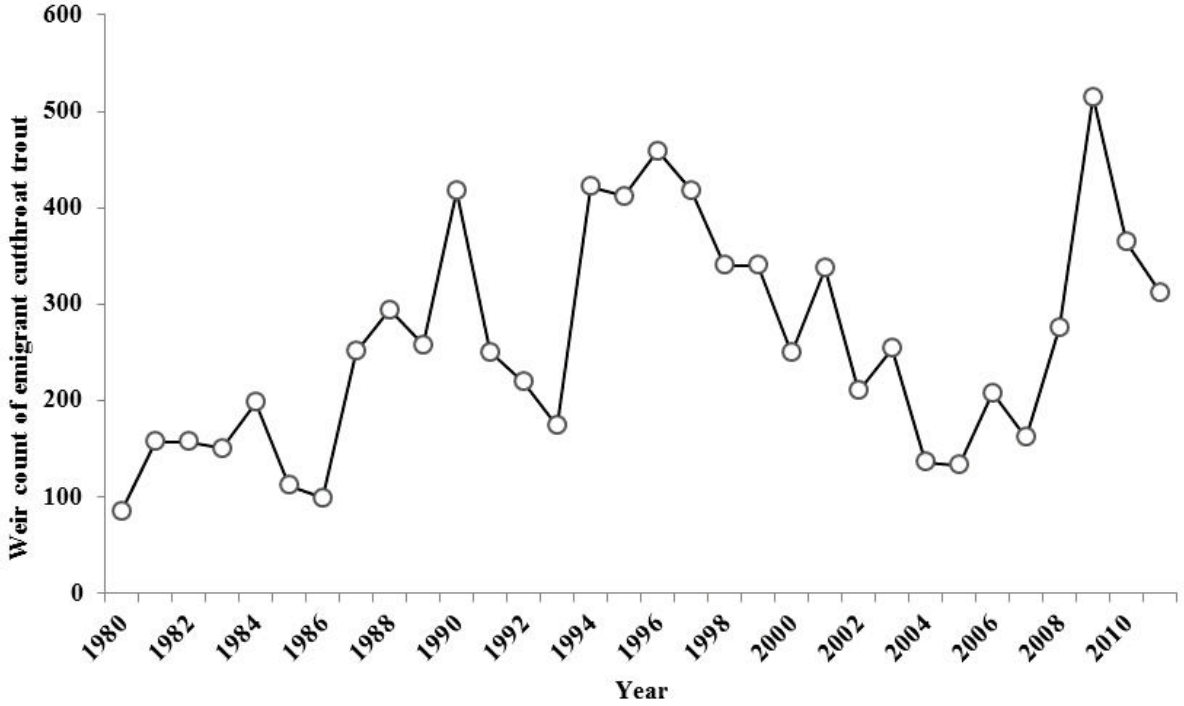

Figure 9.–The number of wild sea-run cutthroat trout emigrating through the Auke Creek weir, 1980–2011.

Table 4.–Abundance estimates for short-term studies of resident populations of coastal cutthroat trout in Alaska (* indicates that the confidence interval was estimated by multiplying the standard error by 1.96).

Lake	Year	Estimate	95% Confidence interval	Reference
Alexander	1995	2,180	939–3,420*	Harding unpublished memo[a]
Harvey	1979	669	NA	Jones 1982
Hasselborg	1991	10,839	7,754–13,924*	Laker 1994
Jims	1981	2,785	2,511–3,126	Jones 1981
Eva	1995	2,154	1,617–2,691*	Yanusz and Schmidt 1996
Eva	1996	1,487	578–2,396*	Schmidt et al. 1998
Little Lake Eva	1993	380	325–435*	Schmidt 1994
Lower Leask	1988	327	54–991	Hubartt and Bingham 1989
Lower Wolf	1987	196	125–287	Hubartt and Bingham 1989
Margaret	1996	1,709	1,179–2,239	McCurdy and Bryant 1997
McKinney	1996	3,756	3,172–4,340*	Harding et al. 1999b
Mirror	1985	5,633	5,118–6,263	Jones unpublished report[b]
Neck	1998	2,742	2,266–3,218*	Harding et al. 1999a
Patching	2005	2,220	1,803 – 2,809	Bangs 2007
Shelter	1982	2,718	2,326–3,011	ADF&G (unpublished data[c])
Sitkoh	1997	1,481	967–1,995*	Brookover et al. 1999
Upper Wolf	1993	1,233	1,012–1,454*	Schmidt 1994
Virginia	1979	5,631	4,710–6,998	Jones 1982
Virginia	1996	3,620	2,807–4,433*	Freeman et al. 1998
Wilson	1993	7,314		Hoffman and Marshall 1994
Young	1994	1,562	1,199–1,925*	Harding 1995

[a] ADF&G, Douglas Office: S:\Trout\ALEXANDE\ALEX95\NSE_MEMO.WORD; Harding, unpublished memo. 1996. Data summary and accomplishments during the 1995 field season. Accessed 10/17/2011.

[b] ADF&G, Douglas Office Trout Bibliography Reports Record # 32: Darwin E. Jones. Recreational surveys of selected lakes in southern Southeast Alaska – Mirror Lake, 1985. Accessed 10/17/2011.

[c] ADF&G, Douglas Office Trout Bibliography Reports Record # 237; 1982. Shelter Lake population estimate and raw data. Accessed 10/17/2011.

Table 5.–Counts of emigrating sea-run coastal cutthroat trout in Alaska from short-term and long-term (5 or more years) studies.

System	Year	Estimate	Reference
Chilkat	1990	987	Ericksen and Marshall 1991
Dredge	2002	174	ADF&G (unpublished data)[a]
Dredge	2004	136	ADF&G (unpublished data)[b]
Duck Creek	2002	1	ADF&G (unpublished data)[c]
Duck Creek	2003	0	Briscoe et al. 2008
Duck Creek	2004	12	Briscoe et al. 2008
Duck Creek	2005	0	Coyle and Love 2009
Eva	1962	1,594	Armstrong 1971
Eva	1963	1,210	Armstrong 1971
Eva	1964	1,233	Armstrong 1971
Eva	1995	2,562	Yanusz and Schmidt 1996
Jordan	2001	110	ADF&G (unpublished data)[c]
Jordan	2002	143	Lum and Glynn 2007
Jordan	2003	14	Briscoe et al. 2008
Jordan	2004	7	Briscoe et al. 2008
Jordan	2005	1	Briscoe et al. 2008
Kook	1994	345	ADF&G (unpublished data)[d]
Kook	1995	564	ADF&G (unpublished data)[d]
Petersburg	1971	202	Jones 1976a
Petersburg	1972	837	Jones 1976a
Petersburg	1973	501	Jones 1976a
Petersburg	1974	584	Jones 1976a
Petersburg	1975	691	Jones 1976a
Ratz Creek	2010	643	Love et al. *in prep.*
Ratz Creek	2011	617	Love et al. *in prep.*
Sitkoh	1996	1,442	Yanusz 1997
Sitkoh	2003	4,588	Love and Harding 2008
Sitkoh	2004	4,095	Love and Harding 2008
Sitkoh	2005	2,787	Love and Harding 2009
Sitkoh	2006	2,491	Love and Harding 2009
Sitkoh	2007	2,011	Love and Harding *In prep-a*, *b*
Sitkoh	2008	2,323	Love et al. *in prep* a
Sitkoh	2009	2,610	Love et al. *in prep* b
Windfall	1997	661	Jones and Harding 1998

[a] ADF&G, Douglas Office: S:\Trout\DREDGE\2002\Dredge Creek daily_2002.xls, accessed 10/17/2011.
[b] ADF&G, Douglas Office:\Trout\DREDGE\2004\Dredge_daily_04.xls accessed 8/9/2011
[c] ADF&G, Douglas Office:\Trout\Jordan_Duck\2002\Spring\Duck xls, accessed 10/17/2011.
[d] Dave Barto retired Fisheries Biologist, file located at ADF&G Region I Commercial Fisheries office in Douglas, Alaska.

DOLLY VARDEN

DISTRIBUTION AND LIFE HISTORY

Dolly Varden are found throughout SEAK and range from the Arctic coast of Alaska south tosouthern British Columbia (Blackett 1968; Morrow 1980). Both anadromous and non-anadromous populations can be found within streams and lakes throughout their range. Whenever Dolly Varden are present in fresh water they are usually abundant, but because of their migration patterns the abundance may fluctuate tremendously throughout the year (Morrow 1980).

The majority of Dolly Varden growth takes place between May and September each year, and anadromous fish may double their weight in this time. Most Dolly Varden in SEAK reach maturity at age 5 or 6, and at this age they may be 12–16 inches long and may weigh from 0.5 to 1 pound. Dolly Varden in SEAK are believed to spawn annually once they reach maturity.

Dolly Varden return to spawn in their natal stream at maturity and spawning may occur from mid-August to the end of November, but most spawning occurs in September and October. Young Dolly Varden rear in freshwater for several years. When they are about 5 inches long, they make their first seaward migration, usually in April through June. Anadromous Dolly Varden typically overwinter in lakes, but may also overwinter in rivers and typically spend the rest of their lives wintering in and migrating to and from fresh water.

Migration patterns of the Dolly Varden can be complex. In SEAK, a migration of smolts and adults out of the lakes where they overwintered begins in the early spring and continues into July.

After a period of as little as a couple of weeks or as long as 7 months, the fish return to spawn in the streams and overwinter in lakes. Uniquely tagged Dolly Varden in SEAK have been recaptured in salt water 153 km (95 mi) from their natal system (Armstrong 1965) and in freshwater systems 146 km (91 mi) from their natal systems (Ericksen et al. 1990). Some Dolly Varden may enter streams to spawn, then leave and enter a lake-stream system to overwinter. Immature fish often enter several streams after their migration to the sea. About 40% to 50% of the fish overwintering in a lake are fish that originated there; the remaining overwintering fish are of unknown origin. Homing of adult spawners to their natal stream is very high (Morrow 1980).

STOCK STATUS AND MANAGEMENT

From 1921 through 1939, efforts were undertaken to reduce the abundance of Dolly Varden because it was believed that this species preyed heavily on young salmon. A bounty ranging from 2 to 5 cents was paid for each Dolly Varden tail turned into officials. It was thought that by controlling Dolly Varden, the survival of juvenile salmon populations would greatly increase. It is now known that Dolly Varden were not responsible for declines in salmon populations. However, 6 million tails were turned in for payment before the program ended in 1939. In 1962, the Division of Sport Fish initiated several studies to investigate the life history of Dolly Varden (i.e., Armstrong 1965; Heiser 1966; and Blackett 1968). The impetus for these studies was lack of life history information about this species and concern regarding the impact the bounty may have had on SEAK Dolly Varden populations.

Estimates of the annual harvest of Dolly Varden in SEAK have declined since it peaked at over 42,500 in 1986 (Figure 10). Even though Dolly Varden regulations were not modified with the more conservative trout regulations in 1994, the annual harvest of Dolly Varden has a similar pattern as cutthroat trout, i.e., harvest since 1994 has remained low (between 4,000 and 14,000; Figure 10).

The general trend in catch estimates of Dolly Varden show annual fluctuations between 40,000 and 90,000 from 1990 to 2010. There was a sharp decline of catch estimates by nearly a third between 90,000 in 2003 to 32,000 in 2007 (Figure 11) before rebounding to 77,000 in 2008. Dolly Varden emigrants have been enumerated with a weir in 7 SEAK systems since statehood (Table 6).

Table 6.–Emigrant Dolly Varden and cutthroat trout weir counts by system and year for Southeast Alaska.

System	Year	Dolly Varden	Cutthroat trout
Lake Eva Creek	1962	38,957	1,594
Lake Eva Creek	1963	93,303	1,210
Lake Eva Creek	1995	117,821	2,562
Sitkoh Creek	1996	48,252	1,442
Sitkoh Creek	2003	52,884	4,588
Sitkoh Creek	2004	62,409	4,095
Sitkoh Creek	2005	38,422	2,787
Sitkoh Creek	2006	29,820	2,491
Sitkoh Creek	2007	27,534	2,011
Sitkoh Creek	2008	18,790	2,323
Sitkoh Creek	2009	20,372	2,610
Windfall Creek	1997	34,109	661
Auke Creek	1970	6,249	90
Auke Creek	1980	3,110	85
Auke Creek	1981	6,461	157
Auke Creek	1982	4,136	157
Auke Creek	1983	3,718	149
Auke Creek	1984	4,512	198
Auke Creek	1985	3,052	112
Auke Creek	1986	4,358	99
Auke Creek	1987	6,443	250
Auke Creek	1988	6,770	294
Auke Creek	1989	7,230	259
Auke Creek	1990	6,425	417
Auke Creek	1991	5,579	237
Auke Creek	1992	6,839	219
Auke Creek	1993	5,074	174
Auke Creek	1994	7,600	422
Auke Creek	1995	11,732	412
Auke Creek	1996	11,323	462
Auke Creek	1997	10,506	418
Auke Creek	1998	7,532	336
Auke Creek	1999	6,393	351
Auke Creek	2000	5,254	249
Auke Creek	2001	7,356	337
Auke Creek	2002	4,858	210
Auke Creek	2003	5,067	254
Auke Creek	2004	3,955	136
Auke Creek	2005	3,544	133
Auke Creek	2006	4,977	208
Auke Creek	2007	4,300	162
Auke Creek	2008	5,364	276
Auke Creek	2009	5,319	515
Auke Creek	2010	4,625	364
Auke Creek	2011	4,054	312
Ratz Creek	2010	10,326	643
Ratz Creek	2011	13,130	617
Duck Creek	2002	18	1
Duck Creek	2003	118	0
Duck Creek	2004	219	12
Duck Creek	2005	13	0
Jordan Creek	2001	204	110
Jordan Creek	2002	1,133	143
Jordan Creek	2003	151	14
Jordan Creek	2004	77	7
Jordan Creek	2005	159	1

Source: (ADF&G, Douglas Office: S:\Trout\REGIONCT\ Abund_est.xls, accessed 1/4/2012.

Emigrant weir counts vary between years by as much as 50%, but are generally stable over multiple years. Estimates of abundance for Dolly Varden in lakes have been generated by 2 ADF&G projects: Chilkat Lake at 46,700 (SE = 17,300; Ericksen et al. 1990); and in Chilkoot Lake at 109,152 (SE = 21,065) (Ericksen 2000).

Length composition for anadromous Dolly Varden populations in SEAK have been collected during spring emigrations at several ADF&G weir sites; Auke Creek (1970, 1980–1985, 1987–2005), Sitkoh Creek (1996, 2003–2005), Lake Eva (1963, 1995), and Windfall Lake (1997). Less than 1% of the Dolly Varden sampled in these populations were greater than 20 inches in length.

MANAGEMENT PLANNING AND BOARD ACTIONS

The current SEAK sport fishing regulations allow a bag and possession limit of 10 Dolly Varden and no size limit; the use of bait is allowed between September 15 and November 15. Between 1971 and 1979 regulations were implemented to limit the harvest of Dolly Varden >20 inches (Appendix B3).

Regulations for Dolly Varden conservation have been adopted in the Juneau area and in the Chilkoot River drainage following sharp declines in sport harvests. For the Chilkoot River, the board reduced the bag and possession limit from 10 to 2 fish in 1994, but increased the limit to 4 fish in 2003 based on subsequent research and analysis (Ericksen 2000). In the Juneau area, bag limits for both fresh and saltwater areas were reduced to 5 fish per day in 1978, and then further reduced to 2 per day in 1980, along with closures in all fresh waters during September–May and in salt waters within ¼ mile of the shoreline during April–May. In 1983, the seasonal closures for most areas were lifted (the April–May saltwater shoreline closures were left in place along Eagle Beach and the head of Auke Bay), but year-round non-retention regulations for Auke and Mendenhall lakes were established.

Several proposals regarding Dolly Varden regulations were discussed at the 2003, 2006, and 2009 board meetings. These public proposals primarily focused on establishing special management areas (including single hook only regulations) for Dolly Varden, and reducing the daily bag and possession limits. The stock status

of Dolly Varden in SEAK appears to be stable, but there are some localized and annual fluctuations. As with steelhead and trout population status, it is difficult to generalize Dolly Varden staus based on very few department observations. However, there have generally only been positive angler comments suggesting stable Dolly Varden populations in most locations. The only long-term data set (Auke Creek weir) also suggests stable populations in the Juneau area. ADF&G believes that the current sport fish regulations provide for sustainability of Dolly Varden stocks.

U.S. Forest Service Recreational Cabin Survey

ADF&G conducts regular postal surveys of U.S. Forest Service (USFS) recreational cabin users in an effort to monitor and assess fishing impacts on trout, Dolly Varden, and steelhead systems throughout SEAK. The objective of the USFS recreational cabin survey is to estimate angler catch and harvest of steelhead, trout (cutthroat and rainbow combined) by stream or lake for parties who register to use USFS cabins. The long-term goal of ADF&G has been to conduct this survey prior to the SEAK board meeting and to provide the board with angler trends for 79 important trout and steelhead systems.

The overall response rate during the most recent (2009) cabin survey (Harding *In prep*) was 83% (1,013 of 1,285 parties that reserved USFS cabins in SEAK). Approximately 83% (840) of the 1,013 parties that responded to the survey reported they used their cabin reservation during 2009. The average size of responding parties that used their cabin reservation was 3.5 (SD = 1.6) members. The number of nights the cabins were reserved by parties who used their reservation ranged from 1 to 10 nights (maximum allowed) and averaged 2.7 (SD = 2.0). Approximately 60% (503) of the 840 respondents using their reservation reported they had fished during their stay.

Users from 38 different US states and 4 foreign countries reserved the USFS recreational cabins in SEAK included in our survey. Approximately 72% gave an Alaska address when the reservation was made and are assumed to be Alaska residents. Other parties reserving cabins in SEAK during 2009 were from Germany, Canada, Italy, and Czech Republic.

A total of 3,298 nights were reserved at USFS recreational cabins during 2009 at the 79 cabins that were surveyed (Table 7). At the time the reservations were made, party heads reported that 4,290 people would be using these reservations. The total trout harvest by cabin users was an estimated 1,176 trout (SE = 4) and 25 steelhead (SE = 1) (Table 7). These anglers also released 12,383 trout (SE = 35) for a retention rate of nearly 9%; 441 steelhead (SE = 3) were also caught and released for a retention rate of approximately 5%.

Estimates of harvest and catch of trout and steelhead were highly variable throughout SEAK, and some sites were more popular than others (Table 7). The two systems with the highest number number of reservations, Peterson and Windfall lake cabins (both on the Juneau road system), together produced modest trout catches (5% of the survey total), but accounted for 22% of the reservations and 3% of the trout harvested. The system with the most harvest of trout was Virginia Lake near Wrangell where an estimated 136 (SE = 5) trout were harvested and another 737 (SE = 30) were released. Steelhead harvest was reported, and thus estimated, from only 3 systems (Heckman, Karta, and Windfall). The total estimated harvest of steelhead was 23 (SE = 1), while an additional 441 (SE = 3) were caught and released in 17 different systems (Table 7).

Previous recreational cabin surveys (Jones 1993, 1994, 1995; Jones and Kondzela 2001; Harding et al. 2005 Harding et al. 2009a) have estimated angler effort and subsequently catch per unit effort (CPUE) for trout and steelhead for each system. Because no specific angler harvest questions were asked in 2009, the "standard" effort for comparison purposes was redefined as the number of reservations made by party heads. Table 8 was developed to provide consistency of effort (number of reservations) and total catch estimates (released+ harvest) across surveys for each system and this should allow resource managers to track trends within a specific system as well as region wide.

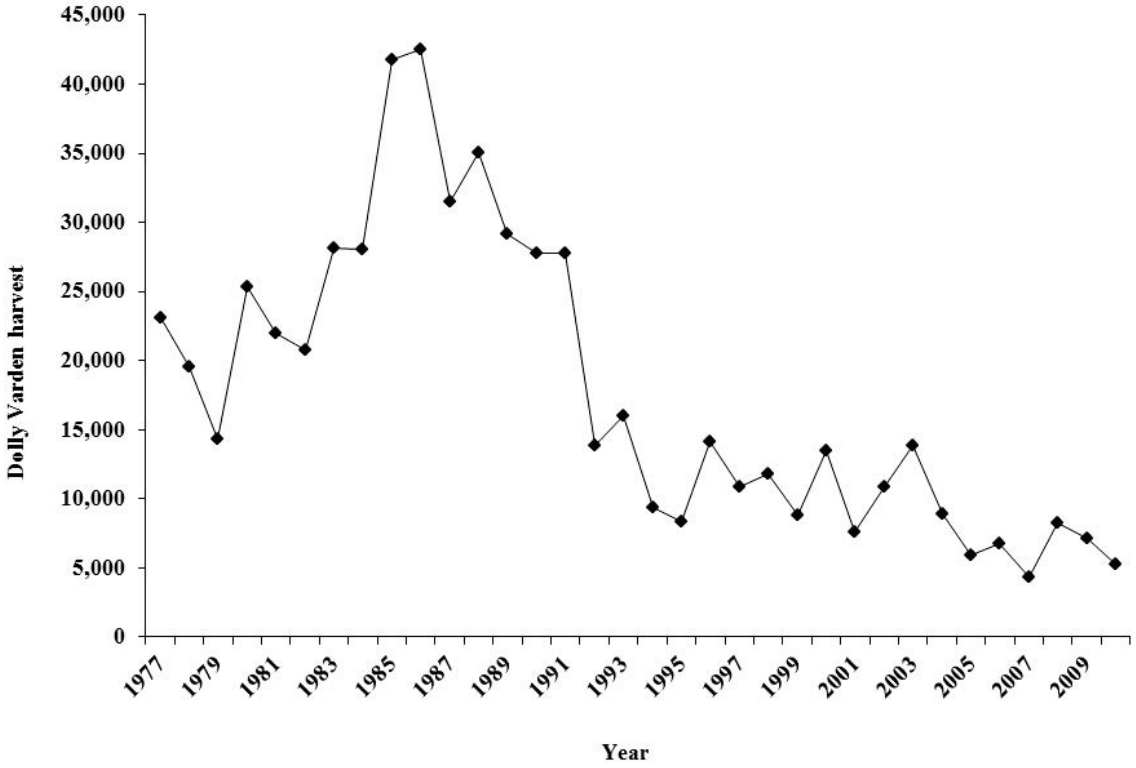

Figure 10.–Dolly Varden harvests in Southeast Alaska, 1977–2010 from the Alaska Department of Fish and Game, Division of Sport Fish Statewide Harvest Survey.

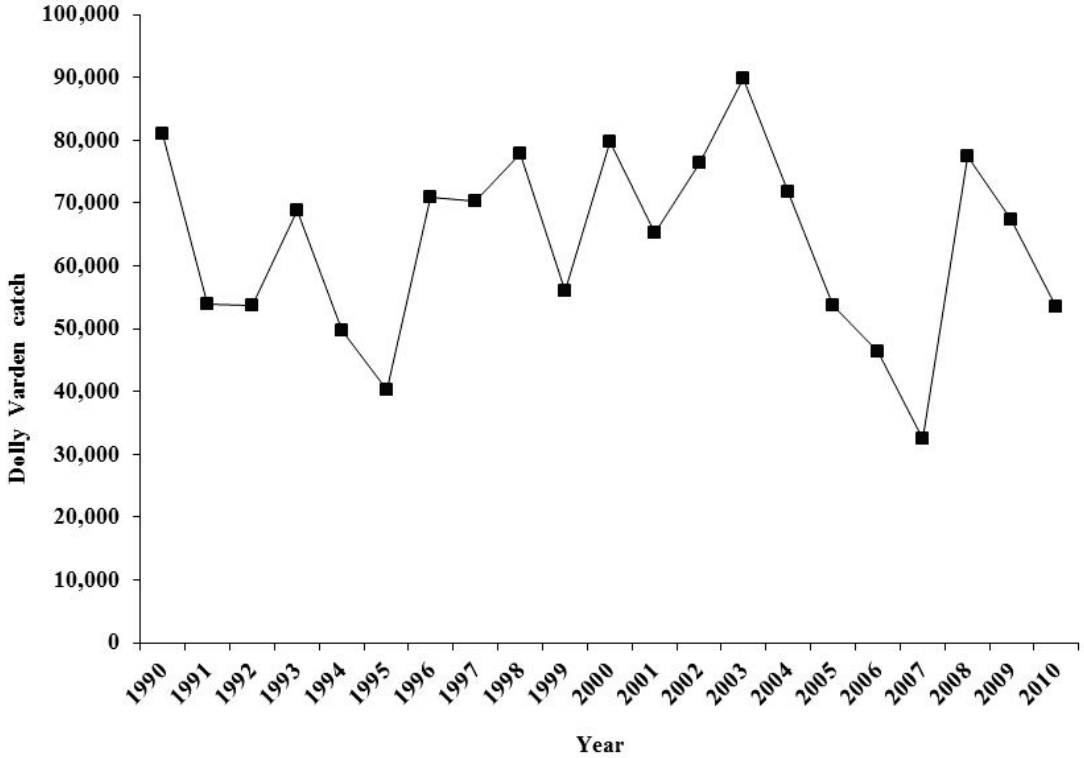

Figure 11.–Dolly Varden total catch (harvest plus released) in Southeast Alaska, 1990–2010 from the Alaska Department of Fish and Game, Division of Sport Fish Statewide Harvest Survey.

Table 7.–Number of registered parties, responding parties, and total estimated effort (angler-days and angler-hours) by target species, fish kept and released at USFS recreational cabins in Southeast Alaska during 2009

System[a]	Number registered	Number responded	Number that fished	Number nights reserved	Number in party	Trout (cutthroat and rainbow)				Steelhead			
						Harvest	SE harvest	Released	SE released	Harvest	SE harvest	Released	SE released
Admiralty Cove	47	41	14	116	159	1	1	32	13	0	0	9	1
Anan Bay	28	24	4	66	93	0	0	21	19	0	0	0	0
Avoss Lake	2	2	1	8	5	0	0	0	0				0
Bakewell Lake	0												
Baranof Lake	5	5	2	8	12	0	0	8	3				0
Black Bear Lake	8	6	3	19	25	24	8	107	35				0
Castle River, 2	49	39	23	163	208	76	13	534	81	0	0	2	0
Checats Lake	3	2	2	9	8	8	4	53	4				0
Control Lake	16	11	6	26	86	9	3	65	30				0
Davidof Lake	1	1	1	6	3	1	0	4	0				0
De Boer Lake	2	2	0	8	3								0
Distin Lake, 2	9	7	2	31	23	0	0	5	4				0
Duncan Salt Chuck	13	12	6	41	46	25	0	276	24	0	0	0	0
Eagle Lake	4	4	1	12	9	3	0	40	0				0
Ella Lake	6	5	3	20	26	35	11	43	9				0
Essowah Lake	0												
Fish Creek	48	41	30	115	175	12	3	245	80	0	0	23	2
Florence Lake	5	5	3	26	21	0	0	41	15				0
Goulding Lake	7	4	1	23	24	0	0	5	0				0
Harding River	7	3	3	31	17	0	0	0	0	0	0	23	5
Harvey Lake	9	7	4	15	34	0	0	6	0				0
Hasselborg Lake, 3	38	37	25	133	127	60	62	1,892	306				0
Heckman Lake	27	19	16	98	108	95	36	620	134	9	6	63	8
Honker Lake	3	2	0	10	9								0
Hugh Smith Lake	2	2	2	6	8	6	0	30	0				0
Humpback Lake	5	5	4	20	16	28	8	363	59				0
Jim's Lake	3	2	1	13	9	0	0	150	0				
Jordan Lake	39	29	20	107	121	42	10	629	457	0	0	78	20
Kadake Creek	8	8	6	39	32	1	0	75	0	0	0	63	0
Kah Sheets Creek	17	15	6	36	53	0	0	32	11	0	0	0	0
Kah Sheets Lake	19	16	12	58	67	33	12	89	10	0	0	5	2
Karta, 3	56	48	32	271	182	131	17	753	91	11	6	64	12

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Table 7.–Page 2 of 2.

System[a]	Number registered	Number responded	Number that fished	Number nights reserved	Number in party	Trout (cutthroat and rainbow)				Steelhead			
						Harvest	SE harvest	Released	SE released	Harvest	SE harvest	Released	SE released
Kathleen Lake	11	9	3	45	37	0	0	32	4				
Kegan Creek, 2	11	9	4	31	45	5	3	34	18	0	0	0	0
Kook Lake	4	3	2	25	13	6	0	60	0				
Lake Alexander	10	8	1	37	24	0	0	32	0				
Lake Eva	19	16	14	74	59	38	12	408	35	0	0	3	0
Manzanita Lake, 2	11	8	5	31	35	17	8	211	59				
Marten Lake	2	2	1	4	3	8	0	8	0				
McDonald Lake	16	13	9	78	58	18	6	332	102	0	0	21	0
Orchard Lake	4	3	3	7	7	17	4	123	4				
Patching Lake	7	6	5	25	19	41	11	223	44				
Petersburg Lake	22	18	9	77	66	39	13	149	58	0	0	71	22
Peterson Lake	110	82	18	136	411	12	7	182	89				
Plotnikof Lake	3	3	2	21	10	0	0	6	3				
Rainbow Lake	0												
Red Bay Lake	8	8	5	35	35	11	0	52	17	0	0	2	0
Reflection Lake	8	8	6	35	22	25	0	395	0	0	0	0	0
Salmon Bay Lake	10	9	6	47	36	30	5	233	39	0	0	0	0
Salmon Lake – Sitka	51	39	15	91	176	30	7	124	26	0	0	1	1
Sarkar Lake	25	23	14	64	82	6	2	217	79				
Shipley Bay	5	4	4	30	18	13	0	92	9				
Sitkoh Lake, 2	9	9	5	24	28	2	0	15	0	0	0	0	0
Staney Creek	38	31	10	129	111	6	5	73	413	0	0	3	29
Suloia Lake	5	4	3	10	20	17	1	33	4				
Swan Lake	16	12	11	71	48	19	3	148	45				
Sweetwater Lake	31	23	13	77	118	13	9	151	67	0	0	2	2
Turner Lake, 2	26	25	17	70	101	1	0	250	58				
Twin Lakes	32	26	8	77	130	21	10	133	56				
Virginia Lake	35	30	21	110	118	136	21	737	137				
Wilson Lake, 2	19	16	14	40	62	12	3	1,107	106				
Windfall Lake	159	136	30	202	596	26	7	377	147	5	3	8	5
Winstanley Lake	4	4	2	10	10	14	7	180	14				
Young Lake, 2	24	22	10	51	83	5	5	151	27				
Total[b]	1,221	1,013	503	3,298	4,290	1,176	87	12,383	789	25	19	441	57

[a] If there is more than 1 cabin in a given system, the number of cabins in that system follows the site name.

[b] Totals may vary slightly due to rounding error.

Table 8.–Number of registered parties, estimated number of total catch (released + harvest) for trout (rainbow and cutthroat trout) and total catch (released + harvest) of steelhead by system compiled from previous surveys at USFS recreational cabins in Southeast Alaska between 1992 and 2009.

	Registered parties							Trout catch							Steelhead catch						
System	1992	1993	1994	1999	2002	2006	2009	1992	1993	1994	1999	2002	2006	2009	1992	1993	1994	1999	2002	2006	2009
Admiralty Cove	28	67	59	55	54	51	47	87	442	44	157	91	34	33	0	5	55	5	0	1	9
Anan Bay	15	15	25	22	20	24	28	15	107	368	10	58	13	21	35	10	0	3	6	9	0
Avoss Lake						5	2						27	0						0	0
Baranof Lake	22	16	16	7	9	11	5	1,800	500	997	104	63	77	8		0	0	0	0	0	0
Black Bear Lake				3	13	11	8			0	71	128	16	131			0	0	0	0	0
Castle River	48	29	43	36	34	32	49	663	802	108	1,040	413	625	610	23	281	1,667	5	0	10	2
Checats Lake				4	5	2	3			0	156	192	48	60			0	0	0	0	0
Control Lake			25	24	30	33	16			430	378	407	106	75			0	14	16	0	0
Davidof lake				2	2	3	1			0	7	11	31	5			0	0	0	0	0
De Boer Lake							2			0				0			0				0
Distin Lake	16	29	29	11	6	5	9	270	154	674	94	17	144	5		0	0	0	0	0	0
Duncan Salt Chuck				18	12	21	13			0	33	320	70	301			0	0	0	0	0
Eagle Lake		5	9	7	4	1	4		9	14	342	33	0	43		0	0	0	0	0	0
Ella Lake	29	86	35	13	7	6	6	803	2,539	913	449	104	290	78		0	2	0	0	0	0
Fish Creek	45	74	60	51	55	54	48	493	474	520	524	730	269	257	86	474	2,182	160	107	10	23
Florence Lake	18	27	27	18	18	10	5	1,019	2,187	1,465	405	481	106	41		0	0	0	0	0	0
Goulding Lake	5	9	11	6	9	7	7	99	76	425	287	169	48	5		0	0	0	0	0	0
Harding River	4	9	14	16	6	9	7		34	43	0	7	2	0			2	0	5	0	23
Harvey Lake						9	9			0			16	6			0			0	0
Hasselborg Lake	51	87	69	26	31	27	38	1,955	2,992	1,897	1,595	2,584	3,092	1,951		0	0	0	0	80	0
Heckman Lake		33	31	21	3	35	27		1,267	827	434	11	571	715		20	13	20	3	5	71
Honker Lake			14	3	8	6	3			353	147	89	239	0			0	0	8	0	0
Hugh Smith Lake	11	11	9	3	3	6	2	153	8	86	48	74	158	36	9	0	267	0	0	0	0
Humpback Lake	15	33	21	7	7	9	5	2,323	2,818	1,037	776	1,812	2,018	390		0	0	0	62	0	0
Jim's Lake	23	29	33	20	11	4	3	1,014	835	629	373	293	45	150		0	0	0	0	0	0
Jordan Lake	26	36	45	26	31	31	39	1,476	283	497	691	600	285	671	149	33	70	43	69	83	78
Kadake Creek	7	7	24	7	9	7	8	462	75	311	32	140	38	76	49	0	1,122	52	65	158	63
Kah Sheets Creek	18			23	0	24	17	142		0	92	0	50	32	11		0	12	0	11	0
Hugh Smith Lake	11	11	9	3	3	6	2	153	8	86	48	74	158	36	9	0	267	0	0	0	0
Humpback Lake	15	33	21	7	7	9	5	2,323	2,818	1,037	776	1,812	2,018	390		0	0	0	62	0	0
Jim's Lake	23	29	33	20	11	4	3	1,014	835	629	373	293	45	150		0	0	0	0	0	0
Jordan Lake	26	36	45	26	31	31	39	1,476	283	497	691	600	285	671	149	33	70	43	69	83	78
Kadake Creek	7	7	24	7	9	7	8	462	75	311	32	140	38	76	49	0	1,122	52	65	158	63
Kah Sheets Creek	18			23	0	24	17	142		0	92	0	50	32	11		0	12	0	11	0
Kah Sheets Lake	-	44	55	20	33	23	19	-	319	239	114	215	109	122		5	319	27	18	23	5

- continued –

Table 8.–Page 2 of 2.

System	Registered parties							Trout catch							Steelhead catch						
	1992	1993	1994	1999	2002	2006	2009	1992	1993	1994	1999	2002	2006	2009	1992	1993	1994	1999	2002	2006	2009
Karta	59	112	75	46	75	75	56	1,634	3,125	919	1,313	1,951	1,576	884	266	327	1,429	200	944	12	75
Kathleen Lake			17	10	7	9	11			0	8	0	0	32			0	0	0	0	0
Kegan Creek	20	48	33	26		31	11	307	1,047	1,133	228		73	38		0	284	0	-	0	0
Kook Lake	10	14	14	8	8	3	4	606	141	497	506	102	0	66		0	0	0	0	0	0
Lake Alexander		31	25	9	4	4	10		550	1,068	122	0	0	32		0	0	0	0	0	0
Lake Eva		38	39	20	23	17	19		477	697	1,616	726	415	446		0	19	0	9	0	3
Manzanita Lake		61	37	15	20	20	11		1,247	1,182	2,392	694	649	229		0	2	2	15	1	0
Marten Lake				5	2	2	2			0	55	315	243	16			0	0	0	0	0
McDonald Lake	20	33	28	16		23	16	398	282	1,729	831		558	350	87	216	504	7		0	21
Orchard Lake	17	18	13	6	6	10	4	665	1,274	418	198	135	560	139		0	0	0	0	0	0
Patching Lake	10	25	18	7	17	9	7	287	1,639	542	76	398	629	264		0	2	0	0	0	0
Petersburg Lake	22	21		17	3	27	22	271	17	0	153	160	322	188	76	0	0	23	26	1	71
Peterson Lake			18	110	102	106	110			542	128	67	49	194			2	0	0	0	0
Plotnikof Lake				6	7	7	3			0	91	503	70	6			0	2	0	0	0
Red Bay Lake	3	18	15	9	24	35	8	3	32	0	40	252	199	63		0	0	0	61	0	2
Reflection Lake	15	20	26	12	7	17	8	403	121	253	249	832	1,132	420		0	0	0	0	1	0
Salmon Bay Lake	15	29	9	15	10	10	10	290	646	478	728	333	73	263		38	5	44	0	0	0
Salmon Lake - Sitka		42	49	30	41	48	51		463	931	327	102	183	154		0	0	0	0	0	1
Sarkar Lake		51	45	26	26	30	25		175	490	263	210	252	223		0	0	3	2	0	0
Shipley Bay				4	7	4	5			0	132	0	0	105		-	0	2	0	0	0
Sitkoh Lake	16	35	35	22	18	29	9	721	342	517	821	234	690	17	15	5	217	80	22	0	0
Staney Creek	46	76	57	34	30	53	38	72	666	6	80	37	83	79	13	0	69	0	2	2	3
Suloia Lake						7	5			0			46	49			0			0	0
Swan Lake						17	16			0			330	167			0			0	0
Sweetwater Lake		74	56	12	31	5	31		986	330	78	92	10	164		0	72	0	0	7	2
Turner Lake	54	77	70	40	50	50	26	312	752	948	797	1,152	660	252		0	0	0	0	0	0
Twin Lakes				14	10	15	32			0	43	0	29	154		-	0	0	0	0	0
Virginia Lake		19	25	20	24	22	35		1,201	524	1,263	919	522	873		0	0	0	0	0	0
Wilson Lake	9	42	24	17	18	22	19	1,243	4,410	2,306	4,299	1,937	3,556	1,119		0	5	0	2	0	0
Windfall Lake				158	155	186	159			0	163	297	274	403			0	3	0	0	13
Winstanley Lake			14	8	7	3	4			356	118	153	83	194			0	0	0	0	0
Young Lake		68	63	37	37	38	24		721	566	864	329	1,517	156		0	0	17	65	0	0
Grand total [a]	697	1,598	1,459	1,208	1,189	1,400	1,221	19,986	36,235	28,309	26,341	20,973	23,310	13,558	819	1,414	8,309	724	1,509	414	466
Number of systems surveyed	33	43	47	58	56	62	63														

[a] Totals may vary slightly due to rounding error.

The estimated total freshwater catch of trout (cutthroat and rainbow trout combined) from the 2009 SWHS for SEAK totaled 41,640 (Jennings et al. 2009). Estimated total trout catch from the 2009 USFS cabin survey was 13,558. This suggests that the USFS cabin users surveyed during 2009 generated an appreciable portion of the total cutthroat and rainbow trout catch in the region. Results from previous USFS cabin surveys (1999, 2002, and 2006) show that cabin users accounted for a substantial portion of the trout catch in SEAK.

The overall trend in total trout catch since 1992, based on previous surveys, has been relatively stable with annual fluctuations, but there was a significant decrease of nearly 10,000 trout between 2006 and 2009 (Table 8). The systems with the highest estimated total trout catch (released + harvest) in 2009 was Hasselborg, Wilson, Virginia, and Karta. These same four systems were also highest in 2006, but two other systems with estimated catches >1,500 in 2006 dropped significantly in 2009 (Humpback from 2,018 to 390; and Young from 1,517 to 156). The total steelhead catch in 2009 is similar to 2006 (466 and 414, respectfully) but significantly below the 1,509 estimated in 2002. The number of cabin reservations during 2009 was approximately 15% lower than in 2006 but well within the range of past surveys. It is unknown why cabin reservations have trended slightly downward, but higher air charter costs due to increased fuel and insurance costs along with a general economic downtrend and fewer visitors to Alaska (McDowell Group 2010) may be contributing factors.

The retention rate for trout during 2009 was approximately 9%, which is up from the 6% in 2006 but still less than the 15% estimated in 2002 (Harding et al. 2005, 2009). Anglers reported harvesting 5% of their steelhead catch during 2009, which is essentially unchanged from 4% in 2006 and 3% in 2002 (Harding et al. 2005, 2009); during 1999 only 1% of the steelhead catch was retained (Jones and Kondzela 2001).

Results from the 2009 cabin survey supports ADF&G's assessment that trout and steelhead populations in SEAK appear to be stable, but with localized fluctuations. Although catch and harvest estimates by themselves are not a reliable indicator of stock status, they can create an informative time series and supplement other information. Cabin survey results can aid resource managers by identifying systems where significant harvest occurs (e.g., the Karta and Heckman systems, where 80% of the 2009 estimated steelhead harvest occurred).

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REFERENCES CITED

Armstrong, R. H. 1965. Some migratory habits of the anadromous Dolly Varden *Salvelinus malma* (Walbaum) in southeast Alaska. Alaska Department of Fish and Game Research Report 3:1-36, Juneau.

Armstrong, R. H. 1971. Age, food, and migration of sea run cutthroat trout, *Salmo clarki* in Eva Lake, Southeastern Alaska. Transactions of the American Fisheries. Society 100(2):302-306.

Bangs, P. D. 2007. Abundance and length composition of cutthroat trout in Patching Lake, Southeast Alaska, 2005. Alaska Department of Fish and Game, Fishery Data Series No. 07-32, Anchorage.

Blackett, R. F. 1968. Spawning behavior, fecundity, and early life history of anadromous Dolly Varden, *Salvelinus malma* (Walbaum) in Southeastern Alaska. Alaska Department of Fish and Game, Research Report No. 6, Juneau.

Briscoe, R. J., J. L. Lum, and D. C. Love. 2008. Coho salmon smolt production, adult harvest, and escapement from Jordan and Duck Creeks, Southeast Alaska, 2003–2005. Alaska Department of Fish and Game, Fishery Data Series No. 08-18, Anchorage.

Brookover, T. E., P. A. Hansen, and R. D. Harding. 1999. Population status of summer resident cutthroat trout at Sitkoh Lake, Southeast Alaska. Alaska Department of Fish and Game, Fishery Data Series No. 99-30, Anchorage.

Chilcote, M. W., K. W. Goodson, and M. R. Falcy. 2011. Reproductive recruitment performance in natural populations of anadromous salmonids associated with hatchery-reared fish. Canadian Journal of Fisheries and Aquatic Sciences 68:511-522.

Christianson, A., C. A. Needham, P. Petrivelli, and J. Reeves. *In prep*. Prince of Wales steelhead trout subsistence harvest study. US Fish and Wildlife Service, Office of Subsistence Management, Final Report for Study 08-650, Anchorage.

Cooke, S. J., and C. D. Suski. 2004. Are circle hooks an effective tool for conserving marine and freshwater recreational catch-and-release fisheries? Aquatic Conservation: Marine and Freshwater Ecosystems 14(3):299-326.

Cooke, S. J., and C. D. Suski. 2005. Do we need species-specific guidelines for catch-and-release recreational angling to effectively conserve diverse fishery resources? Biodiversity and Conservation 14:1195-1209.

Cooke, S. J., C. D. Suski, B. L. Barthel, K. G. Ostrand, B. L. Tufts, and D. P. Philipp. 2003. Injury and mortality induced by four hook types on bluegill and pumpkinseed. North American Journal of Fisheries Management 23:883-893.

Coyle, C. L., and D. C. Love. 2009. Coho salmon smolt production, adult harvest, and escapement in Jordan and Duck Creeks, Southeast Alaska, 2005–2006. Alaska Department of Fish and Game, Fishery Data Series No. 09-29, Anchorage.

Davie, P. S., and R. K. Kopf. 2006. Physiology, behavior and welfare of fish during recreational fishing and after release. New Zealand Veterinary Journal 54(4):161-172.

de Leeuw, A. D. 1987. Observations on cutthroat trout of the Mosquito Lake system, Queen Charlotte Islands. Skeena Fisheries Report #57. British Columbia Ministry of the Environment, Fisheries Branch, Smithers, B. C.

Downs, C. C., R. G.White, and B. B. Shephard. 1997. Age at sexual maturity, sex ratio, fecundity, and longevity of isolated headwater populations of westslope cutthroat trout. North American Journal of Fisheries Management 17(1):85-92.

Dubois, R. B., and J. M. Pleski. 2007. Hook shedding and mortality of deeply hooked brook trout caught with bait on barbed and barbless hooks. North American Journal of Fisheries Management 27:1203-1207.

Ericksen, R. P. 2000. Stock assessment of Dolly Varden in the Chilkoot Lake drainage, 1997-1998. Alaska Department of Fish and Game, Fishery Data Series No. 00-14, Anchorage.

Ericksen, R. P., and R. P. Marshall. 1991. Evaluation of the recreational fishery for cutthroat trout in Chilkat Lake, Alaska, 1990. Alaska Department of Fish and Game, Fishery Data Series No. 91-51, Anchorage.

Ericksen, R. P., A. E. Schmidt, and R. Marshall. 1990. Northern southeast Alaska Dolly Varden research and creel surveys in Haines and Sitka, 1988-1989. Alaska Department of Fish and Game, Fishery Data Series No. 90-46, Anchorage.

Freeman, G. M., R. P. Marshall, and R. D. Harding. 1998. Cutthroat trout studies at Virginia Lake, Southeast Alaska. Alaska Department of Fish and Game, Fishery Data Series No. 98-42, Anchorage.

Gingerich, A. J., S. J. Cooke, K. C. Hanson, M. R. Donaldson, C. T. Hasler, C. D. Suski, and R. Arlinghaus. 2007. Evaluation of the interactive effects of air exposure duration and water temperature on the condition survival of angled and released fish. Fisheries Research 86:169-178.

Harding, R. 1995. Abundance and length composition of cutthroat trout in Florence, Turner, and Young Lakes, Southeast Alaska, 1994. Alaska Department of Fish and Game, Fishery Data Series No. 95-43, Anchorage.

Harding, R., P. Bangs, and C. Hoover. 2006. Southeast Alaska steelhead, trout, and Dolly Varden management. Alaska Department of Fish and Game Report to the Board of Fisheries, Ketchikan, Alaska.

Harding, R. D. *In prep*. Survey of Anglers using Southeast Alaskan recreational cabins during 2009. Alaska Department of Fish and Game, Fisheries Data Series, Anchorage.

Harding, R. D., R. E. Chadwick, and G. M. Freeman. 1999a. Abundance, length composition, and annual mortality of cutthroat trout at Neck Lake, Southeast Alaska, 1996 through 1998. Alaska Department of Fish and Game, Fishery Data Series No. 99-42. Anchorage.

Harding, R. D., C. L. Hoover, and R. P. Marshall. 2010. Abundance of cutthroat trout in Auke Lake, Southeast Alaska, in 2005 and 2006. Alaska Department of Fish and Game, Fishery Data Series No. 10-82, Anchorage.

Harding, R. D., and J. D. Jones. 2005. The development and evaluation of conservative trout regulations in southeast Alaska based on length at maturity. Wild Trout VIII Symposium Proceedings, Yellowstone National Park, WY.

Harding, R. D., K. A. Kondzela, and R. P. Marshall. 2009a. Survey of anglers using Southeast Alaska recreational cabins during 2006. Alaska Department of Fish and Game, Fishery Data Series No. 09-60, Anchorage.

Harding, R. D., K. A. Kondzela, and R. S. Mullen. 2005. Southeast Alaska recreational cabin survey, 2002. Alaska Department of Fish and Game, Fishery Data Series No. 05-11, Anchorage.

Harding, R. D., M. Laker, and R. P. Marshall. 1999b. Abundance and length, trap avoidance, and short-term spatial movement of cutthroat trout at McKinney Lake, Southeast Alaska, 1996. Alaska Department of Fish and Game, Fishery Data Series No. 99-20, Anchorage.

Harding, R. D., R. P. Marshall, and P. D. Bangs. 2009b. Abundance, length, age, mortality, and maximum sustained yield of cutthroat trout at Turner and Baranof lakes, Southeast Alaska, 1994 through 2003. Alaska Department of Fish and Game, Fishery Data Series No. 09-69, Anchorage.

Heiser, D. W. 1966. Age and growth of anadromous Dolly Varden char Salvelinus malma (Walbaum) in Eva Creek, Baranof Island, Southeastern Alaska. Alaska Department of Fish and Game, Research Report No. 5, Juneau.

Hoffman, S. H., and R. P. Marshall. 1994. Abundance and size of cutthroat trout in Wilson Lake, 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-48, Anchorage.

Hubartt, D. J., and A. E. Bingham. 1989. Evaluation of population size, status of fish populations, and the lake characteristics for three lakes in the vicinity of Ketchikan, Alaska, during 1988. Alaska Department of Fish and Game, Fishery Data Series No. 110, Juneau.

Hunt, R. L. 1970. A compendium of research on angling regulations for brook trout conducted on Lawrence Creek, Wisconsin. Wisconsin Department of Natural Resources, Report 54, Madison.

Jackson, C. A. L. 2009. Fishing, water regulation, and competition: the past, present, and future of brook trout in the Rapid River, Maine. Master's Thesis, University of Maine, Orono.

Jennings, G. B., K. Sundet, and A. E. Bingham. 2009. Estimates of participation, catch, and harvest in Alaska sport fisheries during 2006. Alaska Department of Fish and Game, Fishery Data Series No. 09-54, Anchorage.

Jones, D. E. 1976. Life history of cutthroat trout. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1975-1976, F-9-8(17)AFS-42-4b, Juneau.

Jones, D. E. 1981. Development of techniques for enhancement and management of cutthroat trout in Southeast Alaska. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1980-1981, Project AFS-42(22)AFS-42-9B, Juneau.

Jones, D. E. 1982. Development of techniques for enhancement and management of cutthroat trout in Southeast Alaska. Alaska Department of Fish and Game. Federal Aid in Fish Restoration, Annual Performance Report, 1981-1982, Project AFS-42, 23 (AFS-42-10-B), Juneau.

Jones, J. D. 1993. Southeast Alaska recreational cabin survey. Alaska Department of Fish and Game, Fishery Data Series No. 93-53, Anchorage.

Jones, J. D. 1994. Harvest surveys at U.S. Forest Service public use cabins in Southeast Alaska, 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-39, Anchorage.

Jones, J. D. 1995. Southeast Alaska recreational cabin survey, 1994. Alaska Department of Fish and Game, Fishery Data Series No. 95-32, Anchorage.

Jones, J. D., and R. D. Harding. 1998. Juneau roadside cutthroat trout studies: Windfall Creek Weir and Windfall Lake, 1997. Alaska Department of Fish and Game, Fishery Data Series No. 98-44, Anchorage.

Jones, J. D., and K. Kondzela. 2001. Southeast Alaska Recreational Cabin Survey, 1999. Alaska Department of Fish and Game, Fishery Data Series No. 01-09, Anchorage.

Laker, M. W. 1994. Evaluation of models and assumptions for closed population abundance estimators for cutthroat trout mark-recapture data. Master's Thesis, University of Alaska, Fairbanks.

Lohr, S. C., and M. D. Bryant. 1999. Biological characteristics and population status of steelhead (Oncorhynchus mykiss) in southeast Alaska. General Technical Report PNW-GTR-407. U.S Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, OR.

Love, D. C., and R. D. Harding. 2008. Steelhead trout production studies at Sitkoh Creek, Alaska, 2003–2004. Alaska Department of Fish and Game, Fishery Data Series No. 08-44, Anchorage.

Love, D. C., and R. D. Harding. 2009. Steelhead trout production studies at Sitkoh Creek, Alaska, 2005–2006. Alaska Department of Fish and Game, Fishery Data Series No. 09-68, Anchorage.

Love, D. C., and R. D. Harding. *In prep-a*. Steelhead trout production studies at Sitkoh Creek, Alaska, 2007-2008. Alaska Department of Fish and Game, Fisheries Data Series, Anchorage.

Love, D. C., and R. D. Harding. *In prep-b*. Steelhead trout production studies at Sitkoh Creek, Alaska, 2009. Alaska Department of Fish and Game, Fisheries Data Series, Anchorage.

Love, D. C., D. J. Reed, and R. D. Harding. *In prep*. Steelhead trout production studies at Big Ratz Creek, Alaska, 2010-2011. Alaska Department of Fish and Game, Fishery Data Series, Anchorage.

Lum, J. L., and B. J. Glynn. 2007. Coho salmon smolt production, adult harvest, and escapement from Jordan and Duck Creeks, Southeast Alaska, 2002-2003. Alaska Department of Fish and Game, Fishery Data Series No. 07-31, Anchorage.

McCurdy, S., and M. D. Bryant. 1997. The Margaret Lake monitoring program:assessment of resident cutthroat trout, Dolly Varden and anadromous salmonids. Progress Report for 1996. USDA Forest Service, PNW Research Station, Juneau.

McDowell Group. 2010. Alaska visitor statistics program V, interim visitor volume report summer 2009; prepared for State of Alaska. State of Alaska, Department of Commerce, Community, and Economic Development, Juneau.

Meka, J. M. 2004. The influence of hook type, angler experience, and fish size on injury rates and the duration of capture in an Alaska catch-and-release rainbow trout fishery. North American Journal of Fishery Management 24(4):1309-1321.

Meka, J. M., and S. D. McCormick. 2005. Physiological response of wild rainbow trout to angling: impact of angling duration, fish size, body condition, and temperature. Fisheries Research 72:311-322.

Mongillo, P. E. 1984. A summary of salmonid hooking mortality. Washington Department of Fish and Game, Fish Management Division, Olympia, Washington.

Morrow, J. E. 1980. The freshwater fishes of Alaska. Alaska Northwest Publishing Company, Anchorage.

Olsen, R. E., T. F. Naesje, T. Poppe, L. Sneddon, and J. Webb. 2010. Risk assessment of catch and release. Opinion of the Panel on Animal Health and Welfare of the Norwegian Scientific Committee for Food Safety, Oslo, Norway.

Pauley, G. B., and G. L. Thomas. 1993. Mortality of anadromous coastal cutthroat trout caught with artificial lures and natural bait. North American Journal of Fisheries Management 13:337-345.

Pelletier, C., K. C. Hanson, and S. J. Cooke. 2007. Do catch-and-release guidelines from state and provincial fisheries agencies in North America conform to scientifically based best practices? Environmental Management 39:760-773.

Pope, K. L., G. R. Wilde, and D. W. Knabe. 2007. Effect of catch-and-release angling on growth and survival of rainbow trout, *Oncorhynchus mykiss*, 2007. Nebraska Cooperative Fish and Wildlife Research Unit - Staff Publications. Paper 72. http://digitalcommons.unl.edu/ncfwrustaff/72

Rieman, B. E., and K. A. Apperson. 1989. Status and analysis of salmonid fisheries, westslope trout synopsis and analysis of fishery information. Idaho Department of Fish and Game Project F-73-R-11, Subproject No. II, Job No. 1, Boise.

Rosenkranz, G., R., P. Marshall, R. D. Harding, and D. R. Bernard. 1999. Estimating natural mortality and abundance of potamodromous lake dwelling cutthroat trout at Florence Lake, Alaska. Alaska Department of Fish and Game, Fishery Manuscript No. 99-1, Anchorage.

Schmidt, A. E. 1994. Size and abundance of cutthroat trout in small southeast Alaska lakes 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-06, Anchorage.

Schmidt, A. E., R. P. Marshall, and R. D. Harding. 1998. Lake Eva cutthroat trout population status, 1996. Alaska Department of Fish and Game, Fishery Data Series No. 98-28, Anchorage.

Shaul, L., S. McPherson, E. Jones, and K. Crabtree. 2003. Stock status and escapement goals for coho salmon stocks in Southeast Alaska. Alaska Department of Fish and Game, Special Publication No. 03-02, Anchorage.

Taylor, M. J., and K. R. White. 1992. A meta-analysis of hooking mortality of nonanadromous trout. North American Journal of Fisheries Management 12:760-767.

Taylor, S. G. *Unpublished*. Auke Creek weir 2006 annual report, operations, fish counts, and historical summaries, 2007. National Marine Fisheries Service, Auke Bay Laboratory, Juneau.

TCNB (Northern Boundary Technical Committee). 1991. Review of steelhead stock status, harvest patterns, enhancement and migrations in the northern boundary area. Pacific Salmon Commission Northern Panel 9101. http://www.psc.org/pubs/TCNB91-1.pdf,

Turek, M. F. 2005. Prince of Wales Island subsistence steelhead harvest and use pattern. U. S. Fish and Wildlife Service, Office of Subsistence Management, Subsistence Fisheries Resource Monitoring Program Final Report for Study 03-651. Alaska Department of Fish and Game, Subsistence Division, Juneau.

USFWS (US Fish and Wildlife Service). 2011. Federal subsistence permit system database. US Fish and Wildlife Service, Office of Subsistence Management, Anchorage.

Wright, S. 1992. Guidelines for selecting regulations to manage open-access fisheries for natural populations of anadromous and resident trout in stream habitats. North American Journal of Fisheries Management 12(3):517-527.

Yanusz, R. J. 1997. Status of sea-run cutthroat trout, sea-run Dolly Varden, and steelhead populations at Sitkoh Creek, Southeast Alaska, during 1996. Alaska Department of Fish and Game, Fishery Data Series No. 97-23, Anchorage.

Yanusz, R. J., and A. E. Schmidt. 1996. Sea-run and resident cutthroat trout and sea-run Dolly Varden population status at Lake Eva, Southeast Alaska, during 1995. Alaska Department of Fish and Game, Fishery Data Series No. 96-47, Anchorage.

APPENDIX A. COMMERCIAL HARVEST OF STEELHEAD

Appendix A1.–Reported commercial harvest of steelhead by gear type in Southeast Alaska, 1969 – 2011.

Year	Purse seine	Drift gillnet	Set gillnet	Power troll	Other[a]	Totals
1969	1,095	1,209	0	0	71	2,375
1970	387	1,933	6	0	33	2,359
1971	148	1,639	2	0	13	1,802
1972	20	1,638	0	0	5	1,663
1973	290	1,501	7	0	10	1,808
1974	629	1,232	5	0	55	1,921
1975	34	485	0	14	0	533
1976	153	864	0	8	3	1,028
1977	274	686	0	1	6	967
1978	362	1,239	0	6	3	1,610
1979	210	780	0	20	6	1,016
1980	619	617	0	3	2	1,241
1981	315	613	0	6	0	934
1982	365	1,593	1	21	0	1,980
1983	2,133	1,932	0	9	1	4,075
1984	2,551	2,610	0	21	4	5,186
1985	1,955	7,485	0	34	0	9,474
1986	5,610	5,784	2	184	18	11,598
1987	363	3,104	55	83	16	3,621
1988	1,572	2,293	209	92	18	4,184
1989	837	2,073	242	54	7	3,213
1990	852	2,252	114	52	14	3,284
1991	365	992	135	82	11	1,585
1992	1,197	2,740	135	23	7	4,102
1993	493	810	192	0	0	1,495
1994	4	639	194	0	0	837
1995	0	270	183	0	0	453
1996	0	430	271	0	0	701
1997	0	0	159	53	0	212
1998	1	28	173	1	0	203
1999	0	1	274	4	0	279
2000	10	6	211	4	0	231
2001	0	1	77	6	0	84
2002	0	20	21	3	0	44
2003	0	1	47	2	0	50
2004	0	11	160	108	0	279
2005	0	9	98	57	0	164
2006	1	34	93	10	0	138
2007	0	24	117	14	0	155
2008	0	13	58	5	0	76
2009	0	29	25	11	0	65
2010	0	32	13	12	1	58
2011	0	24	2	28	0	54
Totals	22,845	49,676	3,281	1,031	304	77,137

[a] Other includes hand line, jig, trap, and unidentified.

Appendix A2. Reported commercial harvest of steelhead trout in districts 101, 104, 106, and 111 compared to total Southeast Alaska harvest, 1969–2011.

Year	District 101	104	106	111	Total from 4 districts	Southeast Alaska total harvest	% Total harvest from 4 districts
1969	169	1,044	576	369	2,158	2,375	91
1970	521	324	481	824	2,150	2,359	91
1971	180	103	597	593	1,473	1,802	82
1972	42	7	724	553	1,326	1,663	80
1973	381	281	476	554	1,692	1,808	94
1974	377	650	313	468	1,808	1,921	94
1975	155	25	223	89	492	533	92
1976	154	125	130	511	920	1,028	89
1977	202	226	68	367	863	967	89
1978	585	316	204	397	1,502	1,610	93
1979	219	190	320	228	957	1,016	94
1980	311	560	92	219	1,182	1,241	95
1981	146	274	187	262	869	934	93
1982	781	326	282	476	1,865	1,980	94
1983	1,582	1,847	274	183	3,886	4,075	95
1984	1,969	2,024	468	347	4,808	5,186	93
1985	6,389	1,375	1,022	499	9,285	9,474	98
1986	4,220	5,075	1,328	529	11,152	11,598	96
1987	2,358	306	494	273	3,431	3,621	95
1988	1,432	1,554	593	230	3,809	4,184	91
1989	1,474	788	407	215	2,884	3,213	90
1990	942	776	995	310	3,023	3,284	92
1991	716	350	196	62	1,324	1,585	84
1992	2,383	1,147	187	166	3,883	4,102	95
1993	622	424	124	52	1,222	1,495	82
1994	32	4	95	449	580	837	69
1995	4		110	128	242	453	53
1996	7		130	240	377	701	54
1997						212	0
1998			15	13	28	203	14
1999				1	1	279	0
2000		10	6		16	231	7
2001				1	1	84	1
2002			2	18	20	44	45
2003			1		1	50	2
2004			2	9	11	279	4
2005	1			6	7	164	4
2006			3	9	12	138	9
2007			2	6	8	155	5
2008						76	0
2009		2	10	9	21	65	32
2010			3	21	24	58	41
2011		1	16	8	25	54	46

APPENDIX B
REGULATORY HISTORY OF STEELHEAD TROUT AND DOLLY VARDEN

Appendix B1.–History of general regulations affecting steelhead fisheries in Southeast Alaska.

1940s – 1959	Twenty trout, grayling, and char daily, three of which may be over 20 inches (508 mm).
1960 – 1974	Fifteen trout, grayling, and char daily, tree of which may be over 20 inches.
1975 – 1979	Ten trout, grayling and char daily, two of which may be over 20 inches; possession limit of two daily bag limits.
1980 – 1982	Steelhead considered separately for first time. One steelhead 16 inches or over daily; possession limit of one daily bag limit.
1983 – 1993	Five rainbow, cutthroat, and steelhead in combination, one of which may be over 16 inches; possession limit of two daily bag limits with two over 16 inches.
1994 – 1996	One steelhead 36 inches or over daily; possession limit of two daily bag limits; annual limit of two fish; only unbaited artificial lures allowed from November 16th through September 14th.
1997 – 2008	One steelhead 36 inches or over daily; possession limit of two daily bag limits; annual limit of two fish; only unbaited artificial lures allowed from November 16th through September 14th. Only unbaited artificial lures may be used year-round in 26 fall steelhead drainages.
2009 – present	The use of bait year-round and retention of steelhead is prohibited in 23 fall-run steelhead streams.

Appendix B2.–History of general regulations affecting trout fisheries in Southeast Alaska.

1940s – 1959	Twenty trout, grayling, and char daily, three of which may be over 20 inches (508 mm).
1960 – 1974	Fifteen trout, grayling, and char daily, three of which may be over 20 inches.
1975 – 1979	Ten trout, grayling and char daily, two of which may be over 20 inches; possession limit of two daily bag limits.
1980 – 1982	Four rainbow trout, cutthroat trout daily, one of which may be over 16 inches; possession limit of one daily bag limit. Steelhead considered separately (see Appendix A2).
1983 – 1993	Five rainbow, cutthroat, and steelhead in combination, one of which may be over 16 inches; possession limit of two daily bag limits with two over 16 inches.
1994 – 1999	Two rainbow and cutthroat trout in combination with a minimum size limit of 12 inches and a maximum size limit of 22 inches; possession limit of one daily bag limit. Steelhead considered separately (see Appendix A2). Use of bait prohibited in fresh water from November 16 through September 14.
2000 – present	Two rainbow and cutthroat trout in combination with a minimum size limit of 11 inches and a maximum size limit of 22 inches; possession limit of one daily bag limit. Steelhead considered separately (see Appendix A2). Use of bait prohibited in fresh water from November 16 through September 14.

Appendix B3.–History of general regulations affecting Dolly Varden fisheries in Southeast Alaska.

Years	Saltwater bag limit	Additional restrictions	Possession limit
1971–1974	15	Only 3 over 20 inches	2 daily bag limits
1975–1977	10[a]	Only 2 over 20 inches	2 daily bag limits
1978–1979	10[b]	Only 2 over 20 inches	2 daily bag limits
1980–1982	10[c]	No size limit	1 daily bag limit
1983–1984	10[d]	No size limit	1 daily bag limit
1985–1993	10[e]	No size limit	1 daily bag limit
1994–2011	10[f]	No size limit	1 daily bag limit

[a] In the Juneau area–Auke Creek closed to fishing from Auke Bay boundary markers upstream to Glacier Hwy.

[b] In the Juneau area–Auke Creek closed to fishing from Auke Bay boundary markers upstream to Glacier Hwy. All lakes and streams from Pt. Bishop north to Sawmill Creek (3 miles north of Echo Cove), including all of Douglas Island: the bag and possession limit is 5 Dolly Varden, only 2 over 12 inches. All saltwater areas ¼ mile offshore between Pt. Bishop and Sawmill Creek, including ¼ mile around Douglas Island: the bag and possession limit is 5 Dolly Varden, only 2 over 12 inches.

[c] In the Juneau area–Auke Creek closed to fishing from Auke Bay boundary markers upstream to Glacier Hwy. All lakes and streams from the tip of Pt. Bishop north to Sawmill Creek, including all of Douglas Island, are closed to the taking of Dolly Varden September 1–May 30. Freshwater bag and possession limit is 2 Dolly Varden of any size. Montana Creek, including McGinnis Creek, closed to the taking of Dolly Varden. Saltwater, ¼ mile offshore between the tip of Pt. Bishop and Sawmill Creek, including ¼ mile saltwater zone around Douglas Island, closed to the taking of Dolly Varden April 1–May 31. Daily bag and possession limit is 2 Dolly Varden of any size remainder of year.

[d] In the Juneau area–Juneau roadside fresh waters restricted to 2 Dolly Varden per day and in possession. Auke Bay, east of line from mouth of Waydelich Creek to a department marker located ¼ mile south of the mouth of Auke Creek, closed to Dolly Varden fishing April 1–May 31; 2 per day and in possession the remainder of the year. Auke Creek, below Glacier Highway is closed to all fishing. Auke Lake, its tributaries, and the outlet downstream from Glacier Highway closed to Dolly Varden fishing. Eagle River beach from the Boy Scout Camp north to a department marker at the latitude of Sentinel Island light, to a distance ¼ mile offshore, closed to Dolly Varden fishing April 1–May 31; 2 per day and in possession the remainder of the year. Mendenhall Lake, Montana Creek and McGinnis Creek closed to Dolly Varden fishing.

[e] In the Juneau area–Juneau roadside fresh waters restricted to 2 Dolly Varden per day and in possession. Auke Bay, east of line from mouth of Waydelich Creek to a marker ¼ mile south of the mouth of Auke Creek, closed to Dolly Varden fishing April 1–May 31; 2 per day in and possession the remainder of the year. Auke Creek, below Glacier Highway, closed to all fishing. Auke Lake and Mendenhall Lake closed to Dolly Varden fishing. Eagle River beach from the Boy Scout Camp north to a department marker at the latitude of Sentinel Island light, to a distance ¼ mile offshore, closed to Dolly Varden fishing April 1–May 31; 2 per day and in possession the remainder of the year. Montana Creek, including McGinnis Creek, 2 per day and in possession, opened to fishing with artificial unbaited lures only.

[f] In the Juneau area–Juneau roadside fresh waters restricted to 2 Dolly Varden per day and in possession. Auke Bay, east of line from mouth of Waydelich Creek to a marker ¼ mile south of the mouth of Auke Creek, closed to Dolly Varden fishing April 1–May 31; 2 Dolly Varden per day and in possession the remainder of the year. Auke Creek, below Glacier Highway, closed to all fishing. Auke Lake, its tributaries and the outlet stream downstream to Glacier Highway, and Mendenhall Lake closed to Dolly Varden fishing. Montana Creek, including McGinnis Creek, 2 per day and in possession, opened to fishing with artificial unbaited lures only. All salt waters adjacent to CBJ road system to ¼ mile offshore, 2 Dolly Varden per day and in possession.