

**Northern Chatham Strait Sockeye Salmon: Updated
Stock Status, Fishery Management, and Subsistence
Fisheries**

by

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ABSTRACT

Staff of the Alaska Department of Fish and Game updated available technical information related to sockeye salmon (*Oncorhynchus nerka*) stocks in the northern Chatham Strait area. Detailed information was synthesized for Kanalku Lake, Sitkoh Lake, Kook Lake, Hasselborg River/Salt Lake, and Hanus Bay (Lake Eva) sockeye salmon stocks, which are important traditional subsistence stocks for the community of Angoon. Although escapement estimates were available for Sitkoh Lake for six years before 2001, for Kook Lake for two years before 2001, and for Lake Eva for four years before 2001, our core escapement time series started in 2001 (no escapement estimates are available for Hasselborg River in any year). We provide a detailed description of the State of Alaska's management of the subsistence fishery, together with estimates of subsistence harvest in Angoon. Additionally, we developed extensive information about the northern Chatham Strait commercial purse seine fisheries, including a description of management, and time and area catch statistics.

Key words: Angoon, Basket Bay, Chatham Strait, escapement, fishery management, Hasselborg Lake, Kanalku Lake, Kook Lake, Lake Eva, *Oncorhynchus nerka*, Salt Lake, Sitkoh Lake, sockeye salmon, stock status, subsistence.

INTRODUCTION

The status of sockeye salmon (*Oncorhynchus nerka*) stocks in Northern Chatham Strait area has been the subject of ongoing discussions since 2001, when very low escapements were documented at Kanalku Lake, the preferred subsistence location for the community of Angoon. In October of 2006, United States Department of Agriculture (USDA) Forest Service and Alaska Department of Fish and Game (ADF&G) personnel met to share perspectives on the status of northern Chatham sockeye salmon stocks. After that meeting, ADF&G staff completed a report that provided detailed information on sockeye salmon stock assessment and management in the Chatham Strait corridor (Geiger et al. 2007). This report is intended as a concise update of the 2007 report, including information on escapement and run timing, subsistence harvest, commercial harvest and management, and sport fish harvest.

Since 2001, ADF&G and the USDA Forest Service, in cooperation with the Angoon Community Association, have implemented studies to estimate escapements of sockeye salmon at sites important to the community of Angoon. These studies examined three of the five sockeye-producing systems near Angoon (Figure 1). Kanalku Lake, closest to the village, is accessible by small boat via the sheltered waters of Mitchell Bay, and is the area most village residents prefer for subsistence fishing for sockeye salmon. Sitkoh Lake is located directly across Chatham Strait from Angoon, and Kook Lake/Basket Bay is located across Chatham Strait northwest of Angoon. The two additional systems utilized by residents of Angoon are the Hasselborg/Salt Lake system, also located within Mitchell Bay, and Lake Eva (Hanus Bay), located inside Peril Strait, seven miles to the west of Sitkoh Bay.

On 10 May 2010, Kootznoowoo, Inc. filed a petition with the Secretaries of the U.S. departments of Interior and Agriculture requesting extraterritorial jurisdiction over State of Alaska managed fisheries in order to address concerns about subsistence fisheries important to the community of Angoon. On 23 August 2012, the Secretaries responded that final action on the petition would be deferred for three years in order to allow stakeholder discussions to promote locally developed solutions. In response to the Secretaries' recent action, and in support of forthcoming discussions, this report is provided by the State of Alaska to help facilitate those discussions.

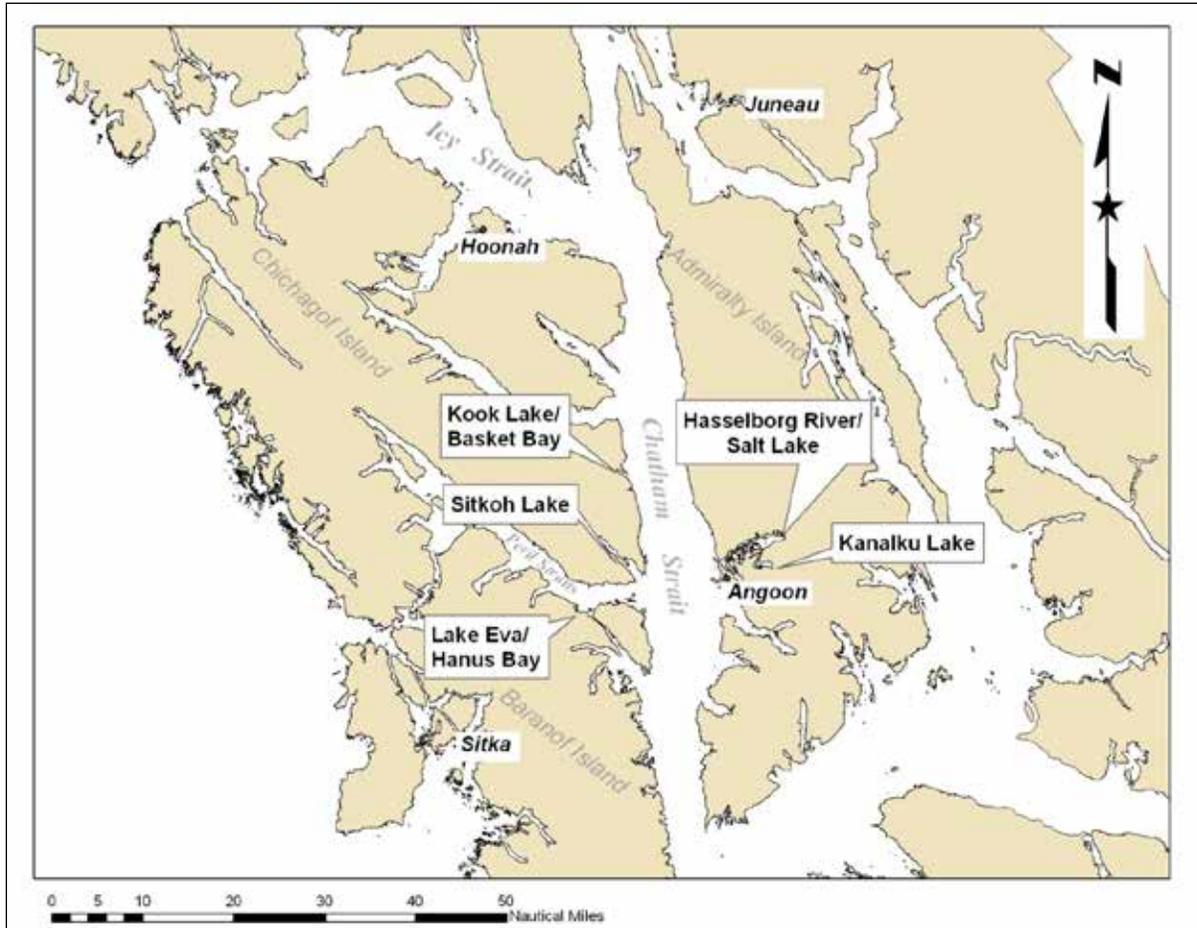


Figure 1.—Map of Southeast Alaska showing the location of Kanalku, Kook, and Sitkoh Lakes, Lake Eva, Hasselborg River, and the village of Angoon.

MEASURES OF ESCAPEMENT

In consideration of their importance to subsistence fisheries, a substantial amount of information has been collected since 2001 about escapements to northern Chatham Strait sockeye salmon systems. Estimates of sockeye salmon escapement are available for Kanalku Lake 2001–2012; Kook Lake in 1994, 1995, 2005–2007, and 2010–2012 (and partial estimates in 2001 and 2002); and Sitkoh Lake in 1996–2006, 2010–2012 (Table 1). Only a limited amount of escapement information exists for Hasselborg River and Lake Eva.

ADF&G also has escapement statistics for some of the larger stocks that likely also contribute to Chatham Strait commercial sockeye salmon harvests. Escapements for some large stocks, such as Chilkoot and Chilkat lakes in Upper Lynn Canal, and the Taku River, have been measured going back in some cases to the 1970s (Appendix A). In addition to these wild stocks, the Snettisham Hatchery, operated by Douglas Island Pink and Chum, Inc., has made significant contributions to the sockeye salmon returns to northern Southeast Alaska since 1996. This addition to wild production of sockeye salmon has contributed to the seine harvest of sockeye salmon in the area. ADF&G has published these escapement statistics in several places (e.g., Heinl et al. 2011).

Table 1.—Escapements of sockeye salmon at four Angoon-area lakes estimated from weirs, mark-recapture studies, a combination of both, or “expanded mark-recapture” estimates.

Lake	Year	Type of Estimate	Estimated Escapement ^a	Citation
Kanalku	2001	expanded mark-recapture	250	Conitz and Cartwright 2005
	2002	expanded mark-recapture	1,600	Conitz and Cartwright 2005
	2003	expanded mark-recapture	280	Conitz and Cartwright 2005
	2004	expanded mark-recapture	1,250	Conitz and Cartwright 2007
	2005	expanded mark-recapture	1,100	Burril and Conitz 2007
	2006	expanded mark-recapture	1,300	Conitz and Burril 2008
	2007	weir with mark-recapture	630	Vinzant et al. 2009
	2008	weir with mark-recapture	1,200	Vinzant et al. 2010
	2009	weir with mark-recapture	2,664	Vinzant and Bednarski 2010
	2010	weir with mark-recapture	2,970	Vinzant et al. 2011
	2011	weir with mark-recapture	728	ADF&G unpublished data
	2012	weir with mark-recapture	1,123	ADF&G unpublished data
Kook	1994	weir count	1,812	Conitz and Cartwright 2005
	1995	weir count	5,817	Conitz and Cartwright 2005

	2001	expanded mark-recapture	380 ^b	Conitz and Cartwright 2005
	2002	expanded mark-recapture	3,600 ^b	Conitz and Cartwright 2005

	2005	weir with mark-recapture	1,994	Van Alen 2008
	2006	weir with mark-recapture	10,165	Van Alen 2008
	2007	weir with mark-recapture	2,958	Van Alen 2008

2010	net-video weir	6,565	Van Alen and Mahara 2011a	
2011	net-video weir	2,701	Van Alen and Mahara 2011b	
2012	net-video weir	7,630	USDA USFS unpublished data	
Sitkoh	1982	weir count	7,228	ADF&G unpublished data

	1996	weir with mark-recapture	16,336	Kelley and Josephson 1997
	1997	mark-recapture	5,979	Crabtree 2000
	1998	expanded mark-recapture	6,649	Crabtree 2000; Crabtree 2001
	1999	expanded mark-recapture	10,499	Crabtree 2001
	2000	expanded mark-recapture	17,040	Crabtree 2001
	2001	expanded mark-recapture	15,200	Conitz and Cartwright 2005
	2002	expanded mark-recapture	11,900	Conitz and Cartwright 2005
	2003	expanded mark-recapture	8,500	Conitz and Cartwright 2005
	2004	expanded mark-recapture	3,700	Conitz and Cartwright 2007
	2005	expanded mark-recapture	13,400	Burril and Conitz 2007
	2006	expanded mark-recapture	14,800	Conitz and Burril 2008

2010	expanded mark-recapture	15,324	Van Alen and Mahara 2011c	
2011	expanded mark-recapture	3,347	Van Alen and Mahara 2011d	
2012	expanded mark-recapture	10,441	USDA USFS unpublished data	
Lake Eva	1962	weir count	13,847	Blackett and Armstrong 1965
	1963	weir count	2,925	Blackett and Armstrong 1965
	1964	weir count	1,428	Blackett and Armstrong 1965

	1995	weir count	7,605 ^c	Yanusz and Schmidt 1996

^a Estimated escapement numbers were rounded in Geiger et al. (2007).

^b Kook Lake sockeye salmon escapement estimates in 2001 and 2002 were not complete (Conitz and Cartwright 2005).

^c In 1995, Lake Eva weir was operated through 31 July; escapement estimate in that year is not complete.

KANALKU LAKE

Kanalku Lake (Anadromous Waters Catalogue [AWC] stream no. 112-67-10600-0020; 57° 29.21' N, 134° 21.10' W) is located in the Kootznoowoo Wilderness, on Admiralty Island, about 20 km east of Angoon (Figure 1). The Kanalku Lake watershed area is approximately 32 km², with one major inlet stream draining into the east end of the lake. The lake elevation is about 28 m, its surface area is 113 ha, average depth is 15 m, and maximum depth is 22 m. The outlet stream, Kanalku Creek (AWC stream no. 112-67-10600), flows west 1.7 km into the east end of Kanalku Bay. Sockeye salmon spawn in the lake and are not known to spawn in the inlet stream (Vinzant et al. 2009). In addition to the sockeye salmon run, large numbers of pink salmon (*O. gorbuscha*) spawn in the lower part of the outlet creek and intertidal area. A few coho (*O. kisutch*) and chum salmon (*O. keta*) spawn in the Kanalku system, and resident populations of cutthroat trout (*O. clarkii*), Dolly Varden char (*Salvelinus malma*), and sculpin (*Cottus* sp.) are found in the lake. A waterfall, approximately 8–10 m high and about 0.8 km upstream from the tidewater, forms a partial barrier to migrating sockeye salmon.

From 2001 to 2006, ADF&G and its cooperators, under contract to USDA Forest Service, estimated sockeye salmon escapement into Kanalku Lake using expanded mark-recapture methods. Since 2007, a weir/mark-recapture project has been operated at the outlet of Kanalku Lake to estimate salmon escapements (Table 1). Kanalku Lake sockeye salmon escapements averaged 1,260 fish, and ranged from a minimum of 250 fish in 2001 to a maximum of 2,970 fish in 2010. On average, 50% of the sockeye salmon escapement passed the weir by 2 August (range 20 July 2009 to 6 August 2008).

We caution that weir counts can be used to assess run timing at the lake outlet; however, this run timing does not accurately reflect run timing to the terminal area, because the weir is located above the partial barrier falls that delays fish passage to the lake, particularly in years of relatively higher water flow. In 2008, 2009, and 2012, weir counts of sockeye salmon at the lake outlet were compared to counts made below the barrier falls at a net-video weir operated by the USDA Forest Service (2008 and 2009) and ADF&G (2012; Figure 2). In 2008, a year of relatively high water flow, sockeye salmon movement above the falls was considerably delayed (Figure 2). An estimated 1,000 sockeye salmon had already entered the system below the falls by 10 July but it took another 22 days before 1% of those 1,000 fish arrived at the upper weir. The upper weir (above the falls) was in place for 33 days (29 June–31 July) before any fish passed into the lake. Daily weir counts at the lower weir showed that 50% of the run entered the Kanalku system by 19 July 2008, 16 July 2009, and 28 July 2012, and more than 75% of the run by 29 July 2008, 26 July 2009, and 1 August 2012.

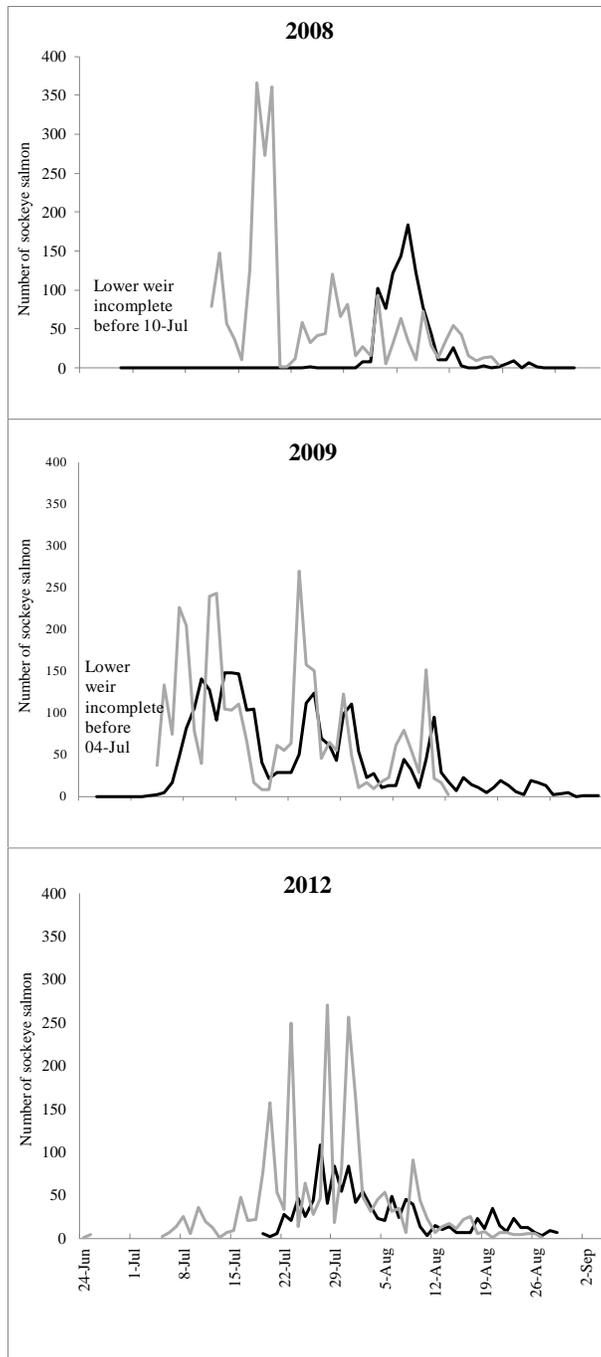


Figure 2.—Sockeye salmon weir counts above partial barrier falls (black line) and below partial barrier falls (gray line) in Kanalku Creek, 2008, 2009, and 2012. Note: the lower weir was not in operation until 10 July 2008 and 4 July 2009.

KOOK LAKE (BASKET BAY)

Kook Lake (AWC stream no. 112-12-10250-0010; 57° 39.91' N, 134° 59.04' W) is located on the east side of Chichagof Island, about 26 km northeast of Angoon (Figure 1). The Kook Lake watershed area is about 54 km², and two main inlet streams enter the southwest end of the lake. The lake elevation is about 13 m, its surface area is 240 ha, average depth is 30 m, and maximum

depth is 44 m. The outlet stream, Kook Creek (AWC stream no. 112-12-10250), flows east 1.2 km into Basket Bay, in Chatham Strait. Salmon must swim through at least two natural caves, each about 150–300 m long, formed in the carbonate bedrock along the Kook Creek channel, to reach the lake. Sockeye salmon spawn in the main inlet stream (earlier-running fish) and at several areas in the lake (late-running fish; Van Alen 2008). The lake also supports runs of coho, chum, and pink salmon; resident fish include Dolly Varden char, cutthroat trout, threespine stickleback (*Gasterosteus aculeatus*), and sculpin. The Kook Lake watershed was extensively clear-cut and crossed by a logging road system, which connects with the Corner Bay logging camp in Tenakee Inlet.

From 2001 to 2003, ADF&G and its cooperators, under contract to USDA Forest Service, attempted to estimate sockeye salmon escapement into Kook Lake using modified mark-recapture methods. Imprecise, or “rough”, escapement estimates were obtained in 2001 (380 fish) and 2002 (3,600 fish), and no estimate was obtained in 2003 (Conitz and Cartwright 2005). As a result, those escapement estimates are probably not comparable to estimates obtained from weir or mark-recapture studies in other years. ADF&G and the USDA Forest Service operated a weir at the outlet of Kook Lake in 1994 and 1995, and the USDA Forest Service, Angoon Community Association, and ADF&G, cooperatively conducted weir/mark-recapture studies in 2005–2007, and net-video weirs in 2010–2011. Sockeye salmon escapement estimates during those years ranged from a minimum of 1,812 fish in 1994 to a maximum of 10,165 fish in 2006 (Table 1). Daily weir counts show that, on average, 50% of the sockeye salmon escapement passed into the lake by 28 July (Figure 3).

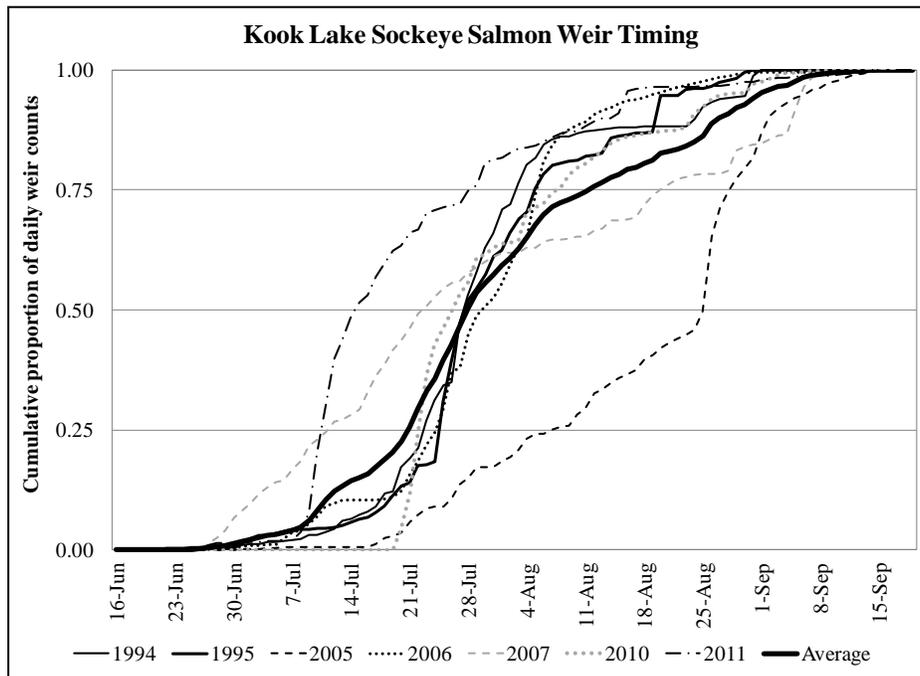


Figure 3.—Cumulative daily proportions of Kook Lake sockeye salmon weir counts, 1994, 1995, 2005–2007, and 2010–2011.

SITKOH LAKE

Sitkoh Lake (AWC stream no. 113-59-10040-0010; 57° 30.45' N, 135° 4.47' W) is located on the southeastern tip of Chichagof Island, about 30 km west of Angoon (Figure 1). The Sitkoh Lake

watershed area is about 31 km². Several steep-gradient inlet streams enter the lake on the north and south sides, ending in productive alluvial fans on the lakeshore. The lake elevation is about 59 m, its surface area is 189 ha, average depth is 20 m, and maximum depth is 39 m. The outlet stream, Sitkoh Lake Creek (AWC stream no. 113-59-10040), is about six km long, has at least two tributaries, and drains east into Sitkoh Bay. The sockeye salmon run consists entirely of lake spawners. The lake also supports runs of coho, pink, and chum salmon, a run of as many as 50,000 anadromous Dolly Varden char, several thousand sea-run cutthroat trout, smaller numbers of summer resident cutthroat trout, and a moderately large steelhead (*O. mykiss*) run. The Sitkoh drainage was extensively clear-cut between 1969 and 1974.

ADF&G operated an adult sockeye salmon enumeration weir in Sitkoh Creek in 1982 and 1996. The sockeye salmon escapement, based only on weir counts (i.e., not verified through mark-recapture) was 7,228 fish in 1982 (ADF&G unpublished data). In 1996, a mark-recapture study was conducted in association with the weir project. The sockeye salmon escapement based on the mark-recapture study was 16,336 fish in 1996 (Cook 1998). Sockeye salmon escapements were estimated using expanded mark-recapture methods in 1998–2006 (ADF&G) and 2010–2012 (Van Alen and Mahara 2011c; USDA USFS unpublished data). Escapements during those years ranged from a minimum of 3,347 fish in 2011 to a maximum of 17,040 fish in 2000 (Table 1). Daily counts from the two years of weir data show that 50% of the sockeye salmon passed into the lake by 29 August 1982 and 11 August 1996 (Figure 4).

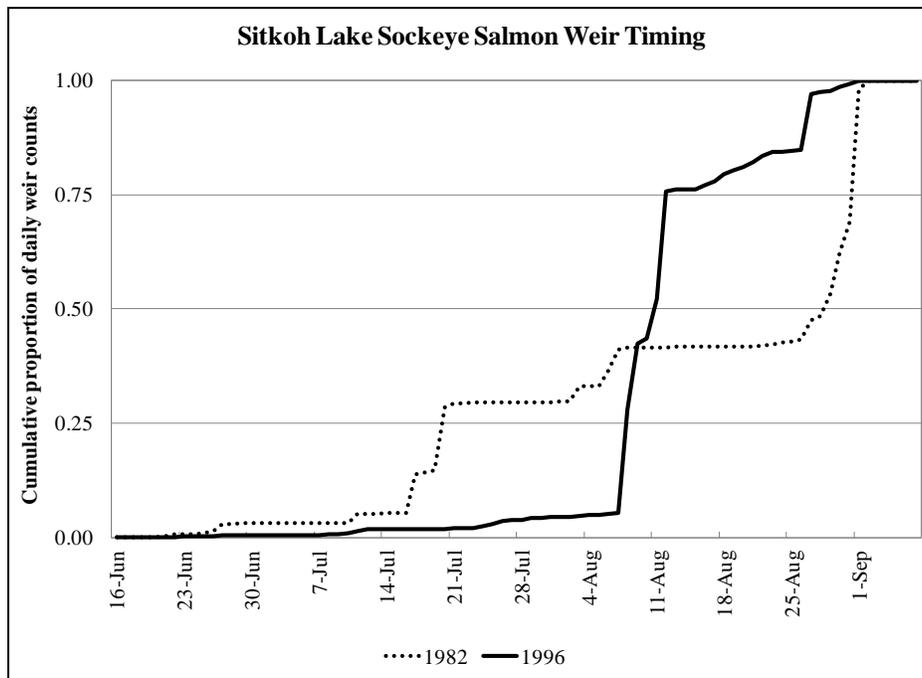


Figure 4.—Cumulative daily proportions of Sitkoh Lake sockeye salmon weir counts, 1982 and 1996.

HASSELBORG RIVER (SALT LAKE)

Hasselborg Lake (5,500 ha) is the largest lake in a series of lakes covering 55 km² in the interior of Admiralty Island, in the Kootznoowoo Wilderness. The outlet stream, Hasselborg River (AWC stream no. 112-67-10350), flows 13.3 km southwest into the Salt Lake estuary (at 57° 35.53' N, 134° 19.85' W) at the extreme east end of Mitchell Bay. Two waterfalls on Hasselborg River prevent sockeye and other salmon from reaching the lake. The lower falls, about 1.8 km

upstream of Salt Lake, is about 5.5 m high and forms a partial barrier to fish passage; some migrating salmon are able to successfully jump the falls. The upper falls, in a steep section of the valley about 2.5 km upstream of the lower falls, is 9.2 m high and forms a total barrier to fish passage. Salt Lake, a brackish water estuary, is separated from the rest of Mitchell Bay by a tidal falls, and can only be reached by boat during high tide. Sockeye, pink, chum, and coho salmon spawn in the Hasselborg River, and it is the largest coho salmon producing system on Admiralty Island. Steelhead, cutthroat trout, and Dolly Varden char are also present.

Sockeye salmon escapement information for the Hasselborg/Salt Lake system is limited to survey counts conducted in various years by boat, airplane, helicopter, and on foot. These surveys are not considered reliable estimates of total escapement. Sockeye and coho salmon were usually present in the survey area together, and surveyors frequently commented on the difficulty of distinguishing the two species. Peak counts ranged from 2 to 9,000 sockeye salmon (Conitz and Cartwright 2002). The Hasselborg River was included in a subsistence sockeye salmon stock assessment project led by ADF&G in 2001, but field crews were unable to effectively sample fish and estimate total escapement (Conitz and Cartwright 2002).

LAKE EVA (HANUS BAY)

Lake Eva (AWC stream no. 113-52-10040-0010; 57 23.96'N; 135 6.44' W) is located on northeast Baranof Island, about 32 km southwest of Angoon (Figure 1). The Lake Eva watershed area is about 47.7 km², with one major inlet stream draining into the head of the lake. The lake elevation is about 14 m, its surface area is 98 ha, and maximum depth is 22 m. The outlet stream, Eva Creek (AWC No. 113-52-10040), flows 1.5 km northeast into Hanus Bay, in Peril Strait. Sockeye salmon spawn in the inlet stream. The system also supports chum, coho, and pink salmon, and steelhead (Johnson and Blanche 2011), and is an important over-wintering site for Dolly Varden char and anadromous cutthroat trout populations (Heiser 1966; Armstrong 1971).

Sockeye salmon escapement information for the Lake Eva system is limited to weir counts made in conjunction with trout and Dolly Varden char studies conducted at Eva Creek in 1962–1964 and 1995 (Table 1). The 1960s escapements ranged from 1,400 to 13,600 fish (Blackett and Armstrong 1965), and 7,605 sockeye salmon were counted through the weir in 1995 (Yanusz and Schmidt 1996).

SUBSISTENCE MANAGEMENT AND HARVEST

ADF&G manages subsistence salmon fisheries in Southeast Alaska under the terms of subsistence fishing permits [5 AAC 01.730]. Subsistence salmon fishing permits establish harvest limits, allowable gear types, fishing seasons, and other general harvest requirements. Permit stipulations are reviewed annually by area and regional salmon managers. In some cases harvest limits and fishing seasons are modified for specific fishing areas depending upon perceptions of sockeye salmon abundance based on recent trends in harvests and escapements. Data on harvest, harvest timing, and gear type are collected on catch calendars that must be filled out for each fishing day. The Federal subsistence management program for sockeye salmon fishing in Southeast Alaska relies heavily on the State's subsistence fishing permit system. State subsistence permits are valid in Federal jurisdiction, unless specifically superseded by Federal regulation.

Each spring, ADF&G staff travels to the community of Angoon to issue subsistence salmon permits for the upcoming season and collect permits from the past season. This meeting with

members of the public provides an opportunity to discuss issues and collect feedback from Angoon residents and is an important part of the department’s management approach toward the subsistence fisheries in Chatham Strait.

SUBSISTENCE HARVEST

Information about subsistence harvest was derived from ADF&G subsistence permits. There are known problems with using the sum of reported harvests to represent the actual magnitude of the harvest (Walker 2009). First, the sum of the reported harvests captures information from returned permits only. Some harvest was likely taken by individuals who did not return a permit. In addition, those that did return permits may have under-reported their harvest (Walker 2009). Although reported subsistence harvest tends to under-represent the true community harvest when compared with information generated from household surveys, the reported harvests are useful for examining trends in subsistence catch (Geiger et al. 2007).

As discussed above, there are five small systems in the northern Chatham Strait area that support subsistence fisheries for sockeye salmon: Kook (Basket Bay) and Sitkoh lakes on Chichagof Island, Kanalku Lake and Hasselborg River on Admiralty Island, and Lake Eva (Hanus Bay) on Baranof Island. Under the State Subsistence Salmon Permits in 2011, a household in Angoon could harvest 170 sockeye salmon in the Angoon traditional area (Tables 2 and 3; Figure 5). The average annual reported harvest of sockeye salmon by Angoon residents during the period 1985–2011 was 947 fish (Table 4). The average total reported subsistence harvest by all communities from all five systems combined for the period 1985–2011 was 1,530 sockeye salmon (Table 5; Figure 6).

Table 2.–Subsistence salmon fishing permit stipulations for Kanalku Lake, Sitkoh Lake, and Hanus Bay (Lake Eva) sockeye salmon, 1988–2011. The individual (indiv.) or possession (poss.) limit is the maximum number of fish a person may have in their possession if the fish have not been processed. The Household (house.) or annual limit is the entire season limit.

Year	Kanalku Lake ^a			Sitkoh Lake			Hanus Bay (Lake Eva)		
	Season	Limits		Season	Limits		Season	Limits	
		Indiv.	House.		Indiv.	House.		Indiv.	House.
1988–1991	1 Jun–31 Jul	25	25	1 Jun–31 Jul	10	10	None		
1992–2000	1 Jun–31 Jul	25	25	1 Jun–31 Jul	10	10	1 Jun–31 Jul	10	10
2001	1 Jun–31 Jul	25	25	1 Jun–31 Aug	15	15	1 Jun–1 Aug	15	15
		Poss.	Annual		Poss.	Annual		Poss.	Annual
2002	1 Jun–31 Jul	25	25	1 Jun–31 Aug	50	50	1 Jun–15 Aug	50	50
2003	1 Jun–31 Jul	25	25	1 Jun–31 Aug	50	50	1 Jun–15 Aug	50	50
2004	1 Jun–31 Jul	25	25	1 Jun–31 Aug	50	50	1 Jun–15 Aug	50	50
2005	1 Jun–31 Jul	25	25	1 Jun–31 Aug	50	50	1 Jun–15 Aug	50	50
2006	20 Jul–15 Aug	15	15	1 Jun–31 Aug	50	50	1 Jun–15 Aug	50	50
2007	1 Jun–31 Jul	15	15	1 Jun–31 Aug	50	50	1 Jun–15 Aug	50	50
2008	1 Jun–31 Jul	15	15	1 Jun–31 Aug	50	50	1 Jun–15 Aug	50	50
2009	1 Jun–31 Jul	15	15	1 Jun–31 Aug	50	50	1 Jun–15 Aug	50	50
2010	1 Jun–31 Jul	15	15	1 Jun–31 Aug	50	50	1 Jun–15 Aug	50	50
2011	1 Jun–31 Jul	15	15	1 Jun–31 Aug	50	50	1 Jun–15 Aug	50	50

^a A voluntary closure agreement was in place for Kanalku Lake with the community of Angoon, 2002–2005.

Table 3.—Subsistence salmon fishing permit stipulations for Basket Bay (Kook Lake) and Hasselborg River (Salt Lake) sockeye salmon, 1988–2011. The individual (indiv.) or possession (poss.) limit is the maximum number of fish a person may have in their possession if the fish have not been processed. The Household (house.) or annual limit is the entire season limit.

Year	Season	Basket Bay (Kook Lake)		Hasselborg/Salt Lake		
		Limits		Season	Limits	
		Indiv.	House.		Indiv.	House.
1988–1991	1 Jun–31 Jul	25	25		None	
1992–2000	1 Jun–31 Jul	10	20		None	
2001	1 Jun–31 Jul	10	20		None	
		Poss.	Annual		Poss.	Annual
2002	1 Jun–31 Jul	15	15	1 Jun–15 Aug	25	25
2003	1 Jun–31 Jul	15	15	1 Jun–15 Aug	25	25
2004	1 Jun–31 Jul	15	15	1 Jun–15 Aug	25	25
2005	1 Jun–31 Jul	15	15	1 Jun–15 Aug	25	25
2006	1 Jun–31 Jul	15	15	1 Jun–15 Aug	25	25
2007	1 Jun–31 Jul	15	30	1 Jun–15 Aug	25	25
2008	1 Jun–31 Jul	15	30	1 Jun–15 Aug	25	25
2009	1 Jun–31 Jul	15	30	1 Jun–15 Aug	25	25
2010	1 Jun–31 Jul	15	30	1 Jun–15 Aug	25	25
2011	1 Jun–31 Jul	15	30	1 Jun–15 Aug	25	25

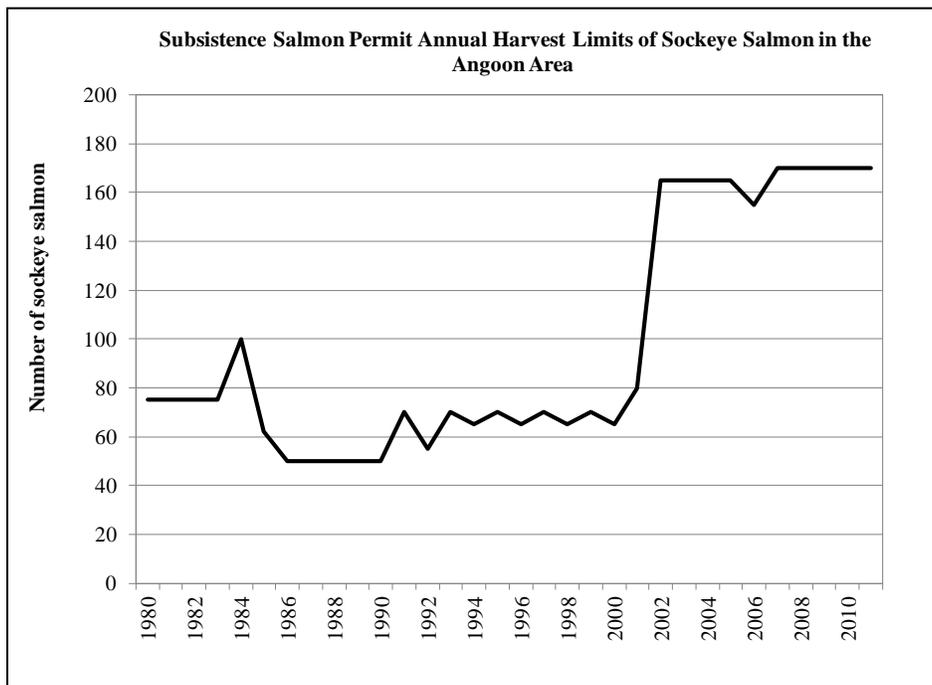


Figure 5.—Cumulative annual sockeye salmon subsistence permit harvest limits per household for the five subsistence sockeye salmon systems near Angoon, 1980–2011.

Table 4.–Subsistence salmon harvest reported from permits by residents of Angoon, 1985–2011.

Year	Sockeye	Chinook	Coho	Pink	Chum
1985	732	0	300	250	140
1986	1,047	0	250	0	370
1987	646	0	105	85	50
1988	226	0	12	75	53
1989	407	1	90	55	0
1990	882	0	89	25	29
1991	541	0	140	75	20
1992	769	0	160	50	0
1993	901	0	425	0	1
1994	1,300	0	223	90	103
1995	936	0	243	115	64
1996	1,408	0	350	198	95
1997	1,495	0	437	184	130
1998	1,554	0	367	100	50
1999	1,620	0	291	32	3
2000	1,344	0	147	19	50
2001	1,147	1	213	133	83
2002	751	0	40	67	21
2003	1,496	0	36	6	2
2004	1,479	0	107	107	58
2005	261	0	12	25	0
2006	658	0	20	9	0
2007	56	1	47	62	0
2008	637	0	120	0	15
2009	942	0	70	55	5
2010	1,332	0	155	112	29
2011	997	8	186	10	11
Average	947	0	172	72	51

Table 5.—Reported annual sockeye salmon subsistence harvest from five systems in northern Chatham Strait, 1985–2011.

Year	Location					Total
	Hanus Bay	Hasselborg	Kanalku ^a	Kook	Sitkoh	
1985	0	0	473	450	313	1,236
1986	88	60	931	1,427	677	3,183
1987	0	45	645	1,233	636	2,559
1988	10	0	258	316	322	906
1989	0	0	425	493	248	1,166
1990	36	25	762	477	181	1,481
1991	0	50	556	406	0	1,012
1992	0	0	571	602	90	1,263
1993	80	25	901	475	0	1,481
1994	36	87	1,282	348	36	1,789
1995	59	45	936	387	10	1,437
1996	50	78	1,627	302	50	2,107
1997	53	110	1,538	187	60	1,948
1998	158	67	1,482	327	16	2,050
1999	60	60	1,666	418	36	2,240
2000	0	40	1,443	252	75	1,810
2001	0	40	951	279	276	1,546
2002	99	50	14 ^a	645	184	992
2003	95	70	90 ^a	941	647	1,843
2004	2	25	60 ^a	691	1,055	1,833
2005	0	44	50 ^a	169	275	538
2006	67	20	51	507	350	995
2007	55	15	10	136	0	216
2008	97	0	708	172	101	1,078
2009	31	50	600	170	676	1,527
2010	118	180	571	553	164	1,586
2011	171	32	419	414	362	1,398
Average	51	45	818	473	253	1,527

^a A voluntary closure agreement was in place at Kanalku Lake, 2002–2005.

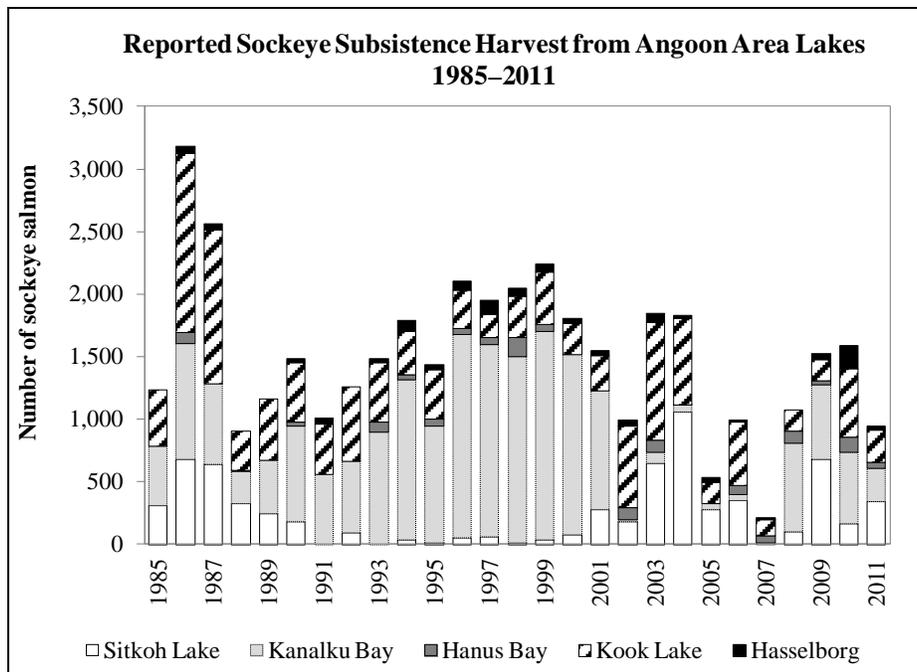


Figure 6.—Reported annual sockeye salmon subsistence harvest for five Angoon area sites, 1985–2011.

Subsistence Harvest by Gear Type

As much as 95% of the reported subsistence sockeye salmon harvested in the Angoon area was taken with gear used in marine waters (based on ADF&G subsistence use permits, 1985–2011; Table 6). Beach seines, purse seines, and gillnets were used in marine waters, whereas cast nets, gaffs, and dip nets were used in freshwater. Beach seines were the most common gear used to harvest subsistence sockeye salmon, accounting for 83% of the total harvest. The importance of beach seines for harvesting subsistence sockeye salmon has also been documented in traditional ecological studies on subsistence salmon fishing in Southeast Alaska (George and Bosworth 1988; Turek et al. 2005; Walker 2009).

Table 6.—Estimated proportion of reported sockeye salmon subsistence harvest in marine and freshwater by gear type for the five subsistence sockeye salmon systems near Angoon, 1985–2011. Total is based on total fish by gear type by total fish harvested.

Location	Saltwater gear types			Total	Freshwater gear types			Total
	Beach Seine	Gillnet	Purse Seine		Cast Net	Dip Net	Gaff	
Hanus Bay	50%	26%	3%	80%	1%	19%	0%	20%
Hasselborg River	90%	3%	2%	95%	1%	4%	0%	5%
Kanalku Bay	88%	4%	2%	94%	0%	6%	0%	6%
Kook Lake	76%	21%	1%	99%	0%	1%	0%	1%
Sitkoh Lake	88%	9%	0%	97%	0%	3%	0%	3%
Total	83%	10%	1%	95%	0%	5%	0%	5%

Kanalku Lake

Kanalku Bay is the area most Angoon residents prefer for subsistence harvest of sockeye salmon. From 1985 to 2001, an average 85% of reported sockeye salmon subsistence harvest by residents of Angoon occurred at Kanalku Bay. During that time, reported annual sockeye salmon subsistence harvest and participation at Kanalku increased substantially: from an average of approximately 580 fish and 24 permits, 1985–1992, to an average of approximately 1,300 fish and 58 permits, 1993–2001 (Figure 7; Table 5).

Following the high sockeye salmon harvests in the late 1990s and subsequent low returns to Kanalku, the department determined there was an immediate need for conservation of Kanalku sockeye salmon. This concern was shared by the residents of Angoon. During a task force meeting held in Sitka on 5 March 2002, the department and the Angoon Community Association developed a plan to rebuild the Kanalku stock. This plan was in place for the 2002–2005 seasons. The centerpiece of the plan was a voluntary closure—an agreement by Angoon residents to forgo harvests at Kanalku in order to rebuild the run. Standard practice by the department in this circumstance is to implement a subsistence fishing closure on the subsistence fishing permit or by emergency order. In order to provide ample opportunity for Angoon residents to fulfill their subsistence needs, the department liberalized annual permit limits for sockeye salmon from the traditionally used systems of Sitkoh and Hanus Bay (Table 2; Figure 5). Sockeye salmon harvest limits for Hasselborg/Salt Lake (Table 3) were also added to the permit, further expanding the allowed annual harvest of sockeye salmon provided by the permit. This voluntary slow-down was generally observed from the 2002 through the 2005 season. In 2006, the department and the community agreed to end the voluntary closure at Kanalku. The annual limit for Kanalku was reduced from 25 to 15 fish per household (Table 2) to allow a conservative harvest and continue rebuilding the run. From 1985 to 2011, an average 80% of subsistence harvest in the terminal area of Kanalku Lake was completed by 19 July.

Kook Lake (Basket Bay)

From 1985 to 2011, reported annual sockeye salmon harvest from Basket Bay (Kook Lake) averaged approximately 470 fish and participation averaged 29 permits (Figure 8; based on returned ADF&G subsistence permits). During that time, the annual harvest by Angoon residents averaged approximately 150 fish and participation averaged eight permits. Participation by Angoon residents increased from an average of four permits from 1985 to 2001 to an average of 23 permits from 2002 to 2005 and the average annual harvest of sockeye salmon increased from around 75 to 430 fish. The increase in participation was likely a response to the voluntary closure of Kanalku. Also, annual subsistence harvest limits were increased in 2007 (Table 3). From 1985 to 2011, an average 80% of subsistence harvest in Kook Bay was completed by 20 July.

Sitkoh Lake

From 1985 to 2011, reported annual sockeye salmon harvest from Sitkoh Bay averaged approximately 250 fish and participation averaged 15 permits (Figure 9; based on returned ADF&G subsistence permits). During that time, the annual harvest by Angoon residents averaged approximately 170 fish and participation averaged five permits. Participation by Angoon residents increased from an average of two permits from 1985 to 2001 to an average of 18 permits from 2002 to 2005, and the average annual harvest of sockeye salmon increased from 110 to 470 fish. The increase in participation was likely a response to the voluntary closure of

Kanalku. From 1985 to 2011, an average 80% of subsistence harvest in Sitkoh Bay was completed by 22 July.

Hasselborg River (Salt Lake)

In 1981 Salt Lake, at the mouth of the Hasselborg River, was designated as one of the two subsistence coho salmon fisheries in Southeast Alaska (George and Kookesh 1982) and was originally restricted to Angoon residents. In 2002, Hasselborg River/Salt Lake sockeye salmon was added to the State Subsistence Salmon Permit to provide additional fishing opportunity in response to the voluntary closure at Kanalku (Table 3). Subsistence sockeye salmon harvests reported prior to 2002 were incidental catches during subsistence coho fishing. From 1985 to 2011, reported annual subsistence harvests averaged about 40 sockeye and 130 coho salmon (Figure 10; Table 5; based on returned ADF&G subsistence permits). During that time, the annual harvest by Angoon residents averaged approximately 40 fish and participation averaged 8 permits. Participation by Angoon residents decreased from an average of 11 permits per year from 1985 to 2001 to an average of three permits per year from 2002 to 2011, although the average annual harvest of sockeye salmon stayed about the same (42 fish).

Lake Eva (Hanus Bay)

Sockeye salmon harvests have been reported from Hanus Bay since 1986 (Figure 11; Table 5). From 1985 to 2011, the total reported harvest averaged 50 sockeye salmon per year (based on returned ADF&G subsistence permits). Harvests by Angoon residents were reported only in 2010 (20 fish) and 2011 (14 fish).

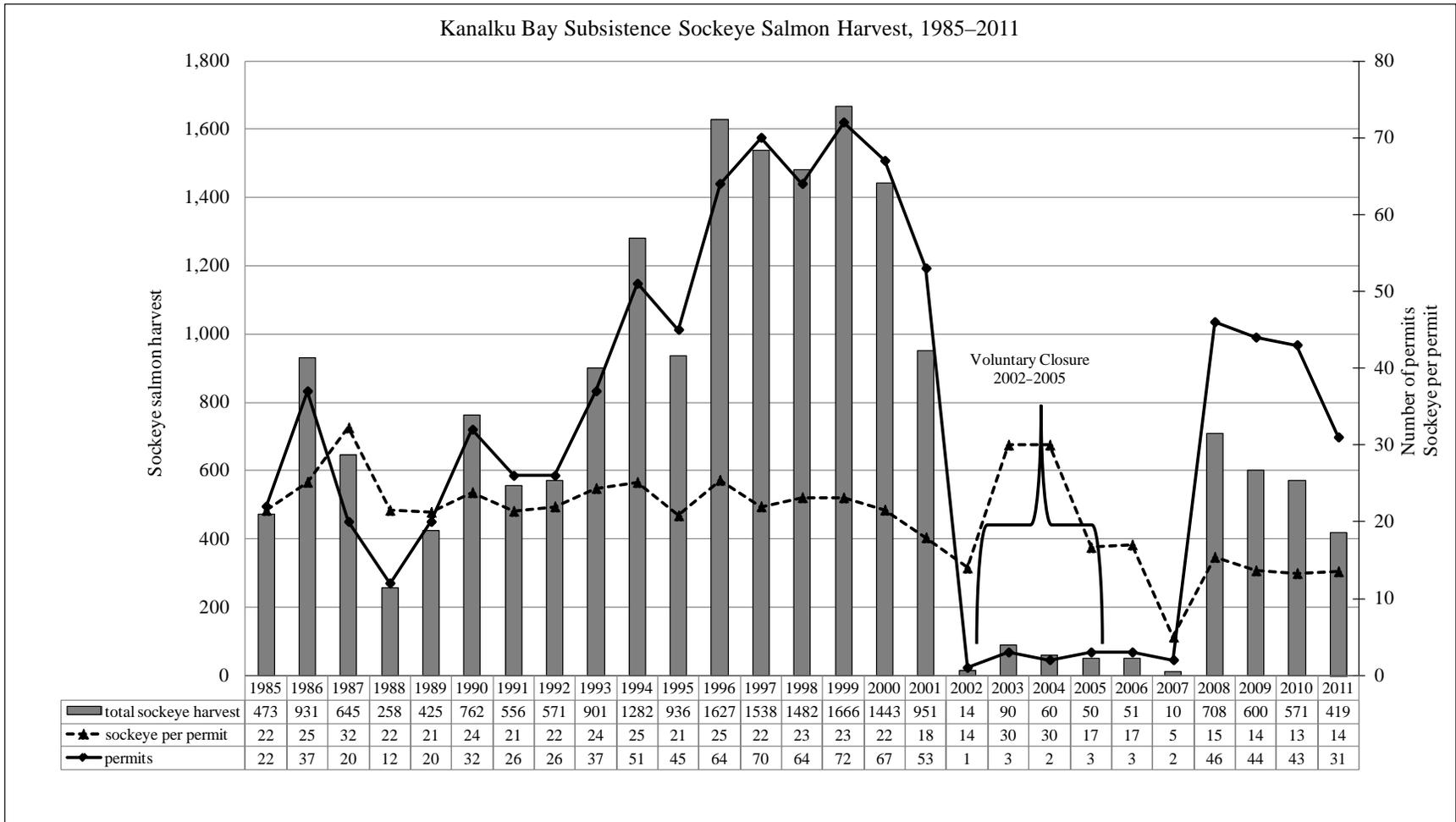


Figure 7.— Reported sockeye salmon subsistence harvest, number of permits fished, and number of sockeye salmon harvested per permit at Kanalku Bay, 1985–2011.

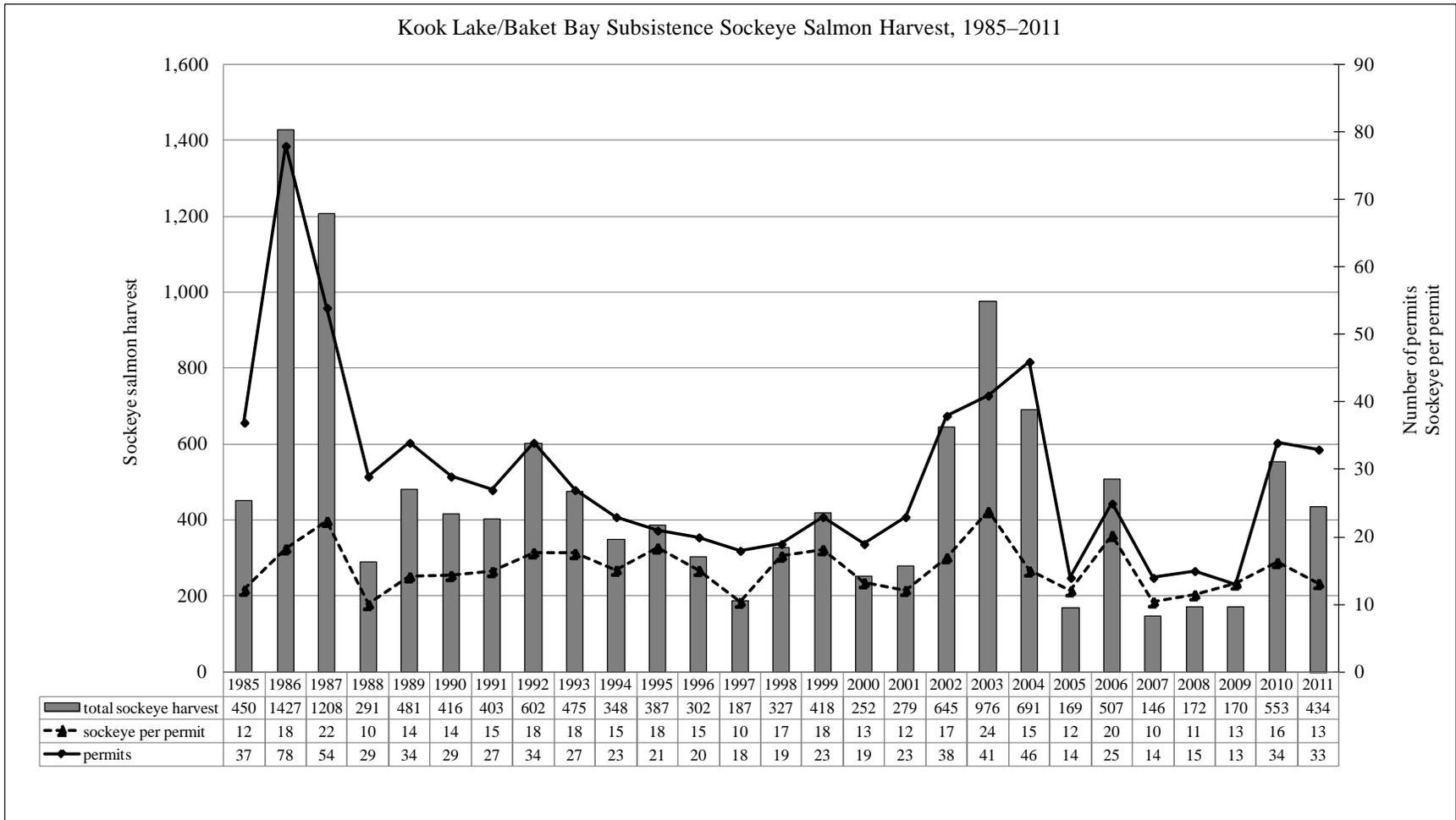


Figure 8.—Reported sockeye salmon subsistence harvest, number of permits fished, and number of sockeye salmon harvested per permit at Kook Lake/Basket Bay, 1985–2011.

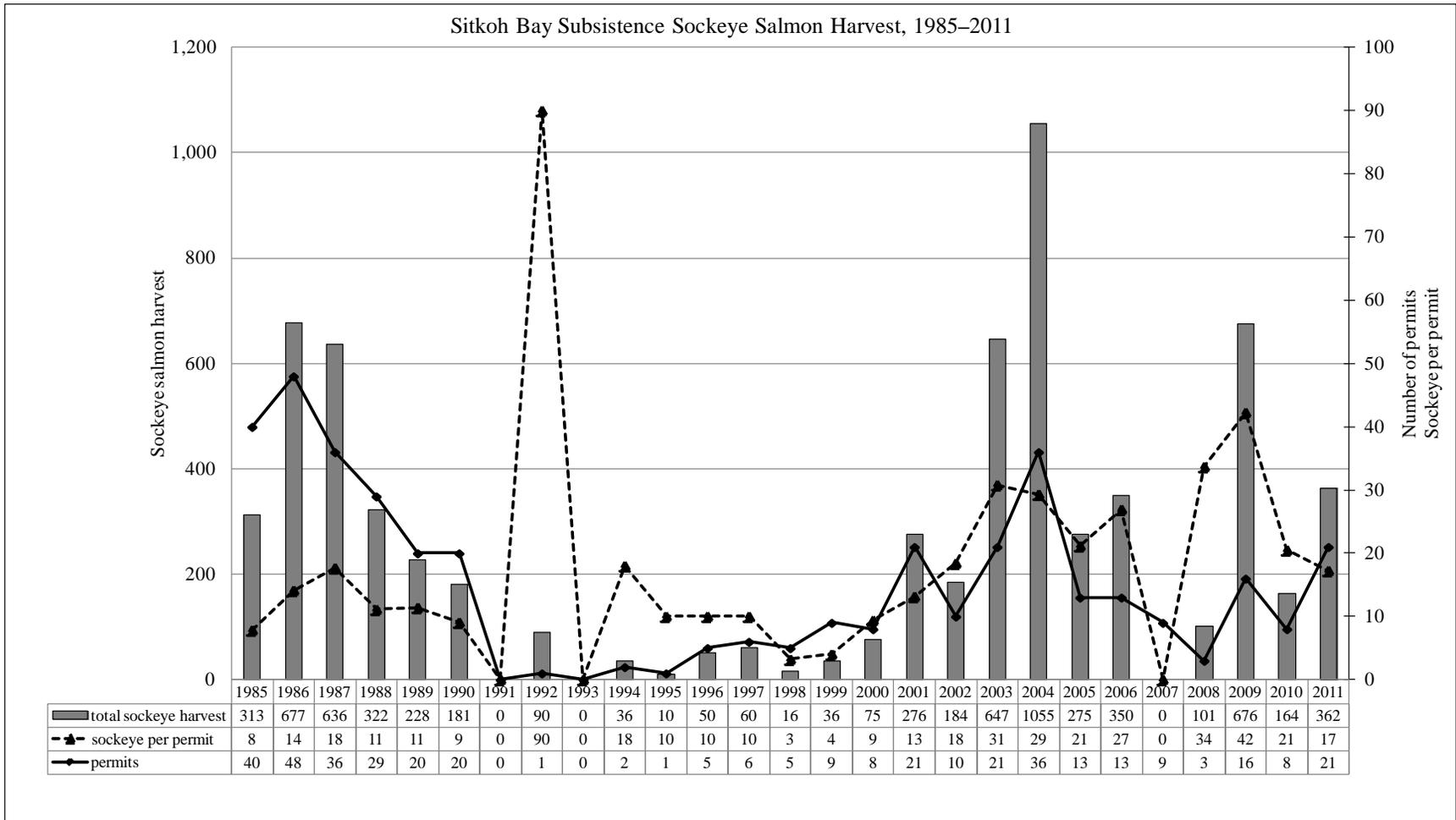


Figure 9.—Reported sockeye salmon subsistence harvest, number of permits fished, and number of sockeye salmon harvested per permit at Sitkoh Bay, 1985–2011.

Hasselborg River/Salt Lake Subsistence Sockeye Salmon Harvest, 1985–2011

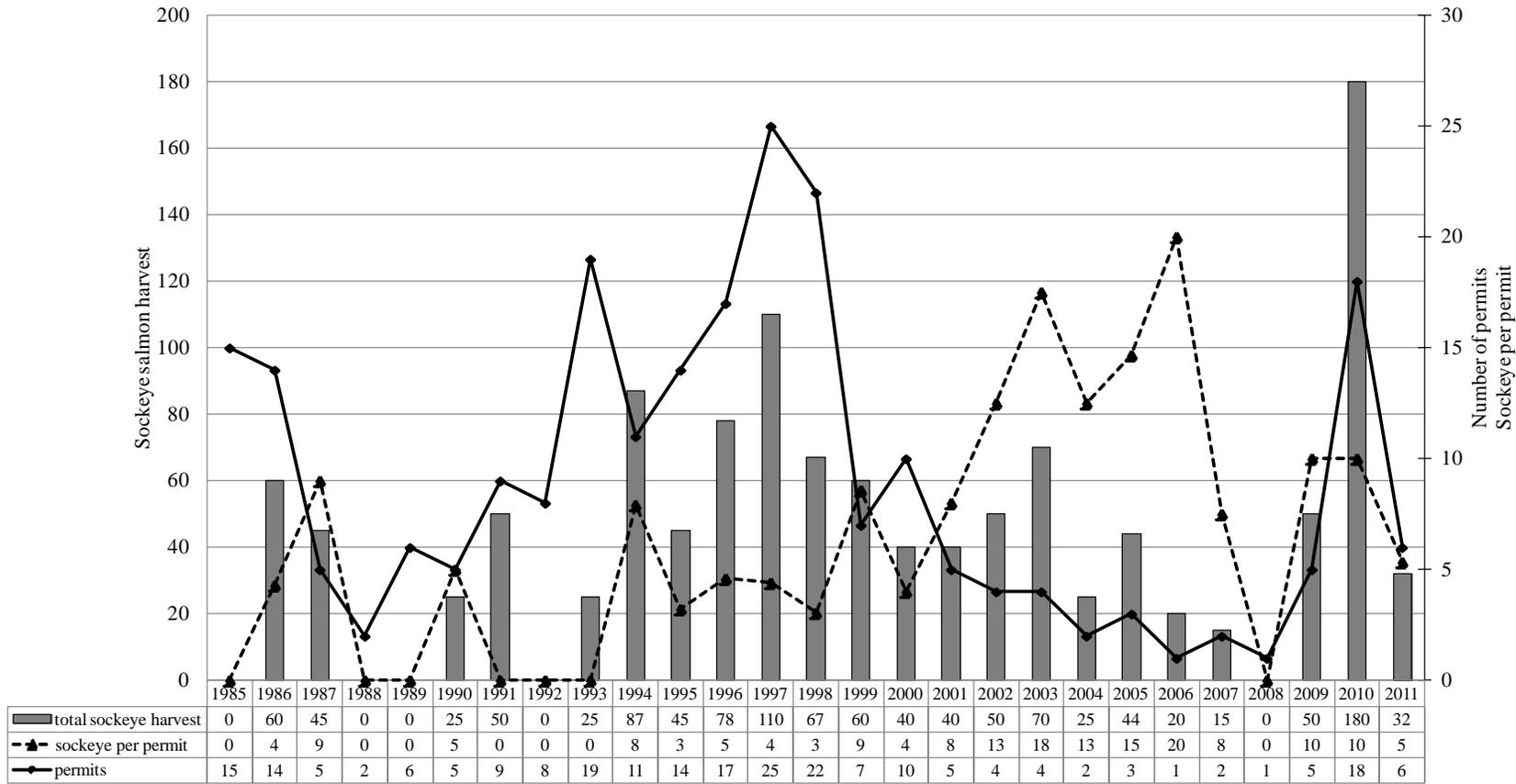


Figure 10.—Reported sockeye salmon subsistence harvest, number of permits fished, and number of sockeye salmon harvested per permit at Hasselborg River/Salt Lake, 1985–2011.

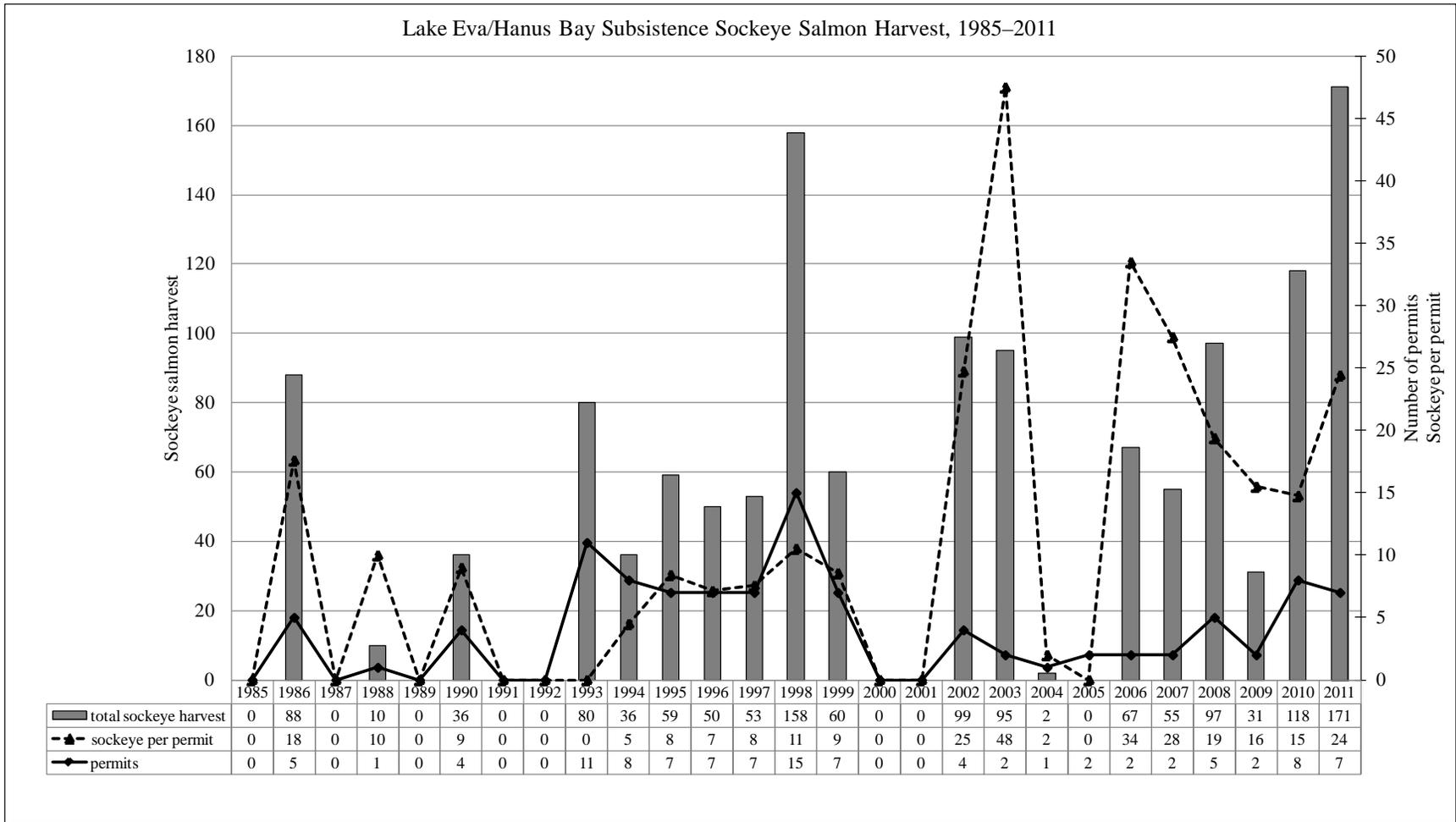


Figure 11.—Reported sockeye salmon subsistence harvest, number of permits fished, and number of sockeye salmon harvested per permit at Lake Eva/Hanus Bay, 1985–2011.

Angoon Subsistence Salmon Harvests and Participation in Commercial Fisheries

The Angoon community has historically participated in commercial fishing and cannery work in Chatham Strait. Families would harvest a portion of their subsistence salmon for home use while participating in commercial fisheries, on the way to or from distant locations and job sites, or during breaks from cannery work (George and Bosworth 1988). This distributed subsistence harvest effort over a larger area that included a number of small sockeye salmon systems. A 1984 household survey of Angoon residents reported that 27% of salmon harvested per household was harvested using commercial gear (power seine, power troll, and hand troll; George and Bosworth 1988). However, the retention of subsistence salmon caught in the commercial harvest is likely species specific. A greater number of Chinook (66%) salmon (*O. tshawytscha*) were caught with commercial gear, whereas a greater number of coho (72%), sockeye (95%), pink (54%), and chum (87%) salmon were caught with non-commercial gear; the most productive gear used to harvest household salmon was the beach seine (George and Bosworth 1988).

More recently, the Angoon community's subsistence activities have been concentrated closer to home. This is likely due to the loss of canneries and fish buying facilities in the area, and the steady decline in commercial fishing participation in the community which has reduced the available number of functional larger boats in the Angoon community (Turek et al. 2005). Angoon community participation in commercial fishing activities experienced a dramatic decline from 1980 to the present, as documented in Commercial Fisheries Entry Commission census reports¹ (Figure 12). In 1980, 90 Angoon residents fished 134 commercial fisheries permits. By 1990, 76 Angoon residents fished 119 permits. By 2000, 37 Angoon residents fished 46 commercial permits. In 2010, only six Angoon residents fished six commercial permits. Between 1980 and 2010, the most significant decline of participation by Angoon residents has been in the hand troll fishery, declining from 79 Angoon owned permits participating in 1980 to one in 2010. The number of fished seine permits during this time went from five to zero, and the number of power troll permits fished was never more than five and declined to one in 2010.

The loss in regional mobility has often been associated with the decline in seine boats/permits in Angoon (Geiger et al. 2007); however, it is likely that the more numerous hand troll vessels provided mobility to a greater portion of the community than the smaller number of Angoon-based seine boats did. The small open boats most people have now are not well suited for traveling on the open exposed waters of Chatham Strait to access sockeye salmon at Kook and Sitkoh lakes. This loss of mobility as well as the loss of opportunity to retain fish caught while commercial fishing has likely contributed to increased subsistence harvest pressure on Kanalku and other Angoon-area sockeye systems.

¹ Permit data retrieved from the Commercial Fisheries Entry Commission website April 2012: http://www.cfec.state.ak.us/fishery_statistics/earnings.htm.

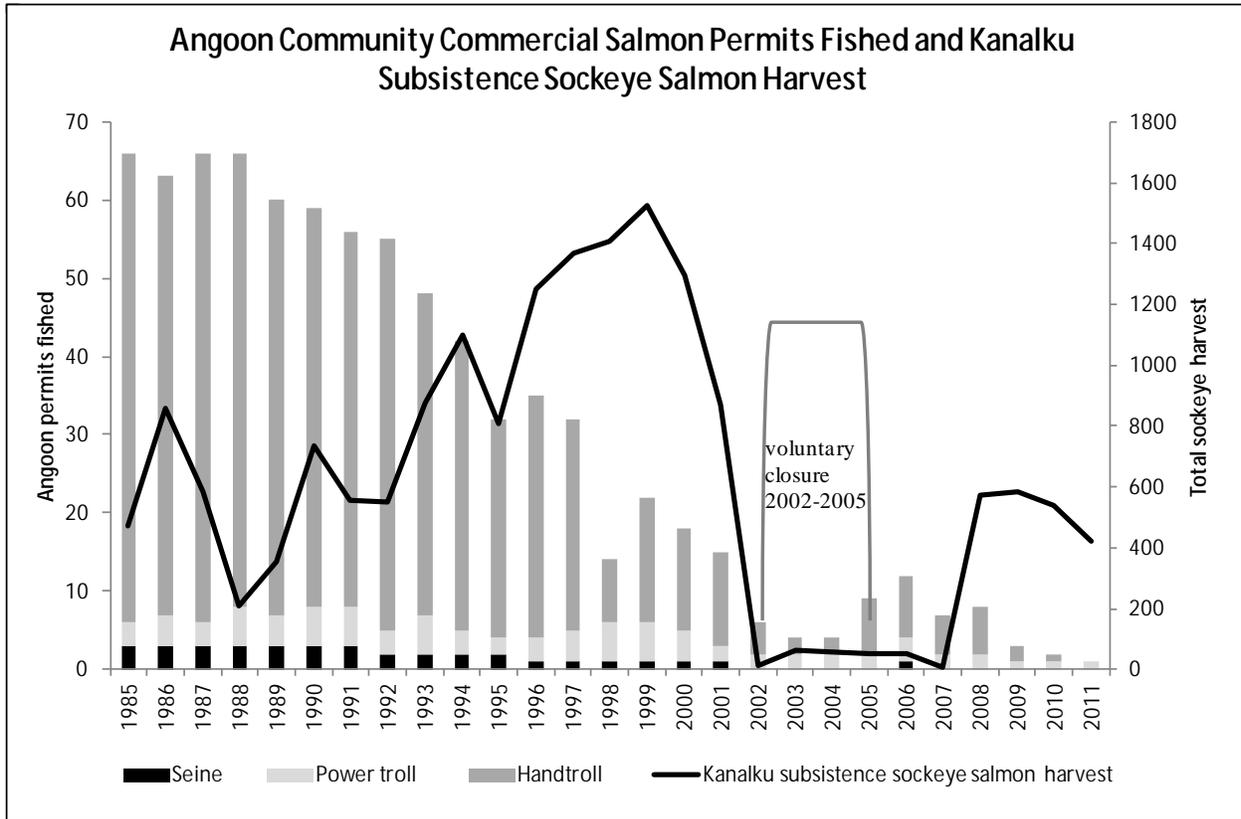


Figure 12.—The number of commercial salmon fishing permits by gear type fished each year by the Angoon community, and Angoon community yearly total subsistence harvest of Kanalku Lake sockeye salmon.

COMMERCIAL PURSE SEINE HARVEST AND MANAGEMENT

Accurate commercial catch information is available from detailed records, which in some cases extend back to the 19th Century. Commercial transactions are used for tax records, bank records, and many other business purposes, so the commercial catch statistics are a reliable record of the actual catch level. In modern times, failure to report commercial catches involves criminal penalties. ADF&G maintains a database of commercial catch records going back to 1960, containing detailed statistics on time and area of harvest, and time and areas of fishery openings.

Commercial purse seine fisheries in District 12, the upper Chatham Strait area, can take place within approximately 700 square miles of State of Alaska managed marine waters extending from the latitude of Point Couverden south to Point Gardner and including Tenakee Inlet. With the exception of the Hidden Falls Hatchery chum salmon fishery, the purse seine fisheries in District 12 are directed at the harvest of pink salmon, and Chinook, chum, sockeye, and coho salmon are harvested incidentally. District 12 pink salmon harvests averaged 5.2 million fish from 1985 to 2011 (Appendix A1). Sockeye salmon harvests in District 12 averaged less than 1% of pink salmon harvests (62,500 fish; Appendix A1). District 12 purse seine fisheries initially open in late June, and the total annual commercial harvest is apportioned into 21 subdistricts or statistical areas (Figure 13). For example, statistical area 112-16 refers to District 12, Sub-district 16 (Figure 13). Since salmon harvests are reported by statistical area we will examine each in turn below.

District 12 Chatham Strait Purse Seine Fishing Area

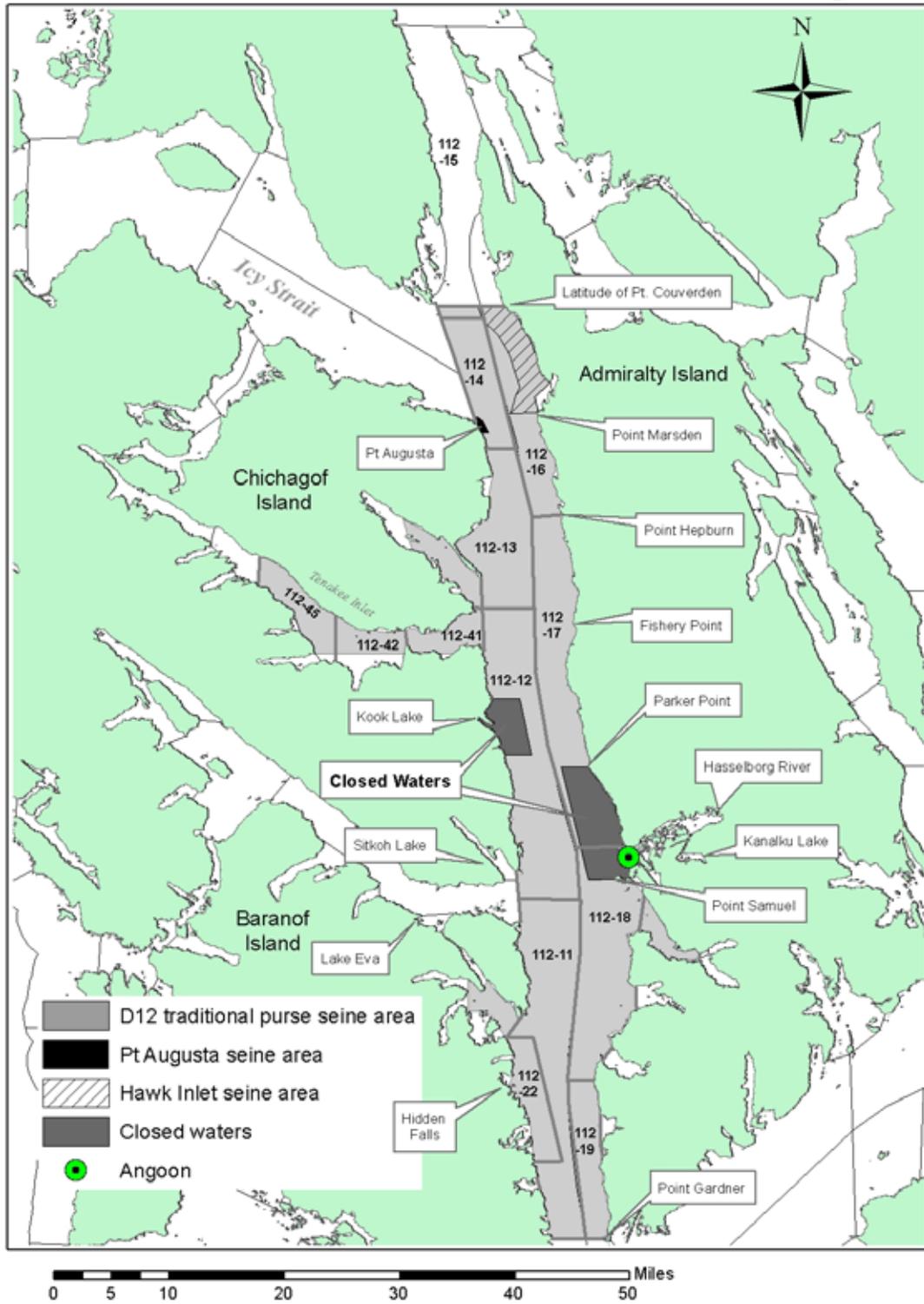


Figure 13.—District 12 purse seine fishing statistical areas in northern Southeast Alaska.

STATISTICAL AREA 112-16

Purse seine openings in statistical area 112-16 occur along the west Admiralty shoreline from Point Hepburn north to the latitude of Point Couverden. The portion of this area north of Point Marsden is known as the Hawk Inlet shoreline. This area is managed in July in accordance with the *Northern Southeast Seine Salmon Fishery Management Plan* (5 AAC 33.366), which addresses conservation of salmon stocks in the area. This plan stipulates that any portion of the area north of Point Marsden may be opened when a harvestable surplus of pink salmon is observed. Also, the plan specifically limits the harvest of wild sockeye salmon to 15,000 fish in July. In years when the Hawk Inlet shoreline was opened, the area was closed for the remainder of July once the 15,000 wild fish harvest limit was reached as required by the plan (Appendix A2). From 2001 to 2011, the average July sockeye salmon harvest (in years fished) along the Hawk Inlet shoreline was approximately 13,300 fish, of which 10,100 fish were estimated to be wild; about 80% of the catch (Figure 13; Appendix A2). The harvest limit of 15,000 wild fish harvested in July was exceeded only in 2011 (Appendix A2; Davidson et al. 2012). Several tools are used to assess the run strength of northbound (District 11 and 15) pink salmon, including a test fishery conducted along the Hawk Inlet shoreline from late June to early July (Ingledue 1989). From 1985 to 2011, the harvest of sockeye salmon in the Hawk Inlet test fishery averaged 715 fish.

In early July, openings in statistical area 112-16 generally consist of 8-, 10-, or 15-hour fishing periods once or twice per week. From 1985 to 2011, the average date of the first commercial purse seine opening in this area was 19 July. The recent 10-year average purse seine sockeye salmon harvest in this statistical area was 41,000 fish (Table 7; Figure 14). Historically, fisheries in this statistical area account for 65% of all sockeye salmon harvested in District 12, which is not unexpected because the major north-migrating sockeye salmon stocks, Chilkoot, Chilkat, Taku, and Snettisham hatchery, migrate through this area, and these stocks account for the vast majority of the total sockeye salmon harvest in northern Southeast Alaska (Eggers et al. 2010; Appendix 1). In 2011, 58% of the total District 12 seine sockeye salmon harvest came from this statistical area.

STATISTICAL AREA 112-17

Statistical area 112-17, the continuation of the west Admiralty shoreline to the south, may be open to commercial seining from Point Hepburn south to Parker Point, approximately six miles north of the entrance of Kootznahoo Inlet. Southern boundaries for the seine fishery typically are extended south by steps into statistical area 112-17, first from Point Hepburn to Fishery Point and then to Parker Point in the last week of July or in August. From 1985 to 2011, the average date of the first commercial purse seine opening in this area was 28 July. The recent 10-year average sockeye salmon harvest was approximately 3,800 fish, or 6% of the total District 12 sockeye salmon harvest (Table 7).

STATISTICAL AREA 112-14

The Point Augusta pink salmon index fishery takes place along a one-mile stretch of the Chatham Strait shoreline on the northeast corner of Chichagof Island in statistical area 112-14. This area has been opened annually since 1992, between late June and mid-July, to monitor incoming pink salmon run strength into northern Chatham Strait. From 1985 to 2011, the average date of the first commercial purse seine opening in this area was 22 June. The recent 10-year

average sockeye salmon harvest was approximately 4,600 fish, or 7% of the total District 12 sockeye salmon harvest (Table 7).

STATISTICAL AREA 112-13

The False Bay/Freshwater Bay fishery takes place along the northeast Chichagof Island shoreline in statistical area 112-13. From 1985 to 2011, the average date of the first commercial purse seine opening in this area was 5 August, and the area has only been opened in 3 of the past 10 years. Early openings are very rare, and harvests accounted for only about 1% of the total District 12 sockeye salmon harvest (Table 7).

STATISTICAL AREA 112-12

The Basket Bay fishery takes place along the Chichagof Island shoreline south of Tenakee Inlet in statistical area 112-12 and targets returns of pink salmon to Tenakee Inlet, Peril Strait, and local streams. This area is rarely open before the last week of July. From 1985 to 2011, the average date of the first commercial purse seine opening in this area was 29 July. The recent 10-year average sockeye salmon harvest was approximately 2,000 fish, or 3% of the total District 12 sockeye salmon harvest (Table 7).

STATISTICAL AREA 112-22

The Hidden Falls hatchery fishery takes place in statistical area 112-22. Openings typically begin after the third week of June and continue through July. From 1985 to 2011, the average date of the first commercial purse seine opening in this area was 24 June. Common property seine fisheries are typically restricted to one or two days per week through mid-July, while cost recovery harvest often occurs throughout the week. The recent 10-year average harvest of sockeye salmon in common property fisheries was approximately 3,000 fish. The recent 10-year average harvest of chum salmon was 1.41 million fish. An average 100 sockeye salmon were also harvested annually in cost recovery fisheries. Over the last 10 years, the average total sockeye salmon harvest at Hidden Falls accounted for 5% of the total District 12 purse seine sockeye salmon harvest (Table 7). Fishing effort has declined in the Hidden Falls fishery since the mid-1990s, due both to declining chum salmon returns and an overall reduction in the number of permits participating in the Southeast Alaska seine fishery.

MANAGEMENT OVERVIEW

To understand what the available harvest data tell us, one needs to know how purse seine fisheries are prosecuted throughout Southeast Alaska. In the case of Chatham Strait, understanding the timing and location of the openings is imperative to understanding the impact purse seining may have on individual sockeye salmon stocks. In Southeast Alaska, sockeye salmon production is the result of run strength to many small stocks and a few very large stocks. To prevent over fishing of individual stocks, the majority of the purse seine effort is directed into mixed stock areas, held to conservative levels, and spread over as many stocks as possible. Van Alen (2000) maintained that this style of management “effectively moderates exploitation rates and reduces the risk of overexploiting individual runs or temporal segments of runs, as occurred historically.”

Although we have no data on the purse seine interception of Kanalku Lake, Kook Lake, and other small sockeye salmon stocks in upper Chatham Strait, management is based on the assumption that this interception is minimal. Further time and area management actions in

statistical areas 112-17 and 112-12 have been designed and implemented specifically to provide conservation measures for these small but important stocks.

TIMING AND LOCATION

The District 12 commercial purse seine fisheries in northern Chatham Strait begin in mid- to late June. During June through mid-July only three areas are open to seining, and these opening are usually limited to 15 hours on Sundays: the Point Augusta index area (statistical area 112-14), Tenakee Inlet (statistical area 112-41), and the Hidden Falls Hatchery Terminal Harvest area (statistical area 112-22). This means that in a typical week from June through mid-July, the District 12 purse seine fishery is open 9% of the available time in approximately 12% of the total available fishing area. As the pink salmon run progresses, and if the pink run is strong, the time and area available for fishing is conservatively increased.

In years of high pink salmon abundance, the first expansion of the purse seine fishery occurs in mid- to late July with the addition of statistical area 112-16, the southern boundary of which is approximately 40 nautical miles north of Kanalku Bay. This area is managed in July in accordance with the *Northern Southeast Seine Salmon Fishery Management Plan* (5 AAC 33.366), which stipulates that any portion of the area north of Point Marsden may be opened when a harvestable surplus of pink salmon is observed. Also, the plan specifically limits the harvest of wild sockeye salmon to 15,000 fish in July. In late July, further expansion of the District 12 purse seine fishery area includes statistical areas 112-17 and 112-12. Fishing time is also increased with the start of a 2-day-on and 2-day-off fishing regime if pink salmon abundance is sufficient.

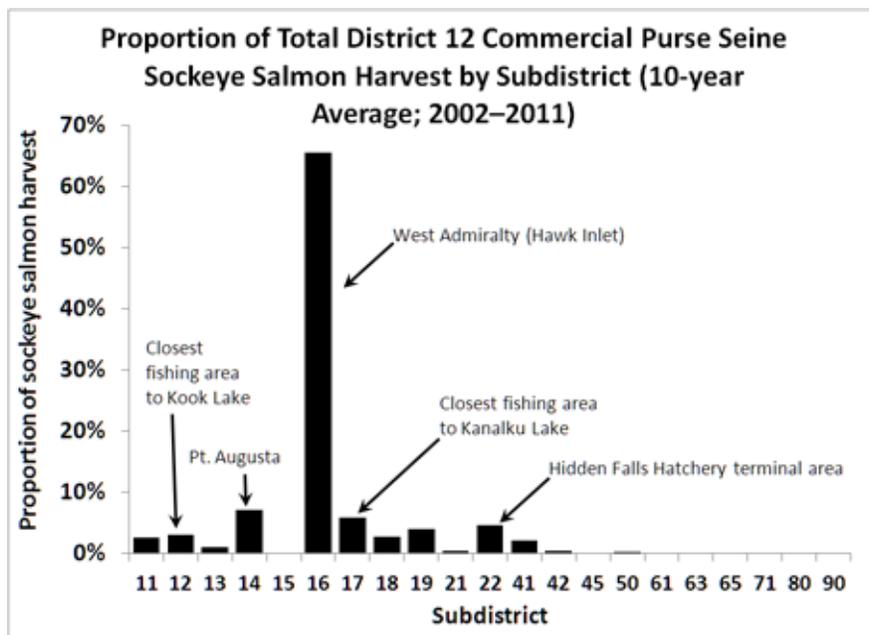


Figure 14.—Average distribution of the total District 12 commercial purse seine sockeye salmon harvest by statistical area, 2002–2011.

Table 7.—Total District 12 commercial sockeye salmon purse seine harvest by statistical area, 2002–2011.

Statistical area Name	Statistical Area											10-yr	Percent of
		2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Avg.	10-yr Avg. Harvest
Outer Kelp Bay	11	354	1,345	3,076	5,322	372	904	0	861	0	3,978	1,621	3%
Basket Bay	12	384	0	6,998	2,021	1,131	1,237	0	580	0	7,317	1,967	3%
False Bay	13	0	0	0	958	0	0	0	271	0	5,221	645	1%
Pt. Augusta	14	3,517	7,432	4,461	5,481	3,112	7,737	2,594	2,212	2,640	6,526	4,571	7%
S. Lynn Canal	15	0	0	0	0	0	0	0	0	0	0	0	0%
W. Mans. Peninsula	16	14,155	44,795	132,061	74,111	17,074	31,925	0	31,836	0	60,946	40,690	65%
Angoon to Hepburn	17	650	5,697	9,259	6,440	0	441	0	3,108	0	11,984	3,758	6%
Angoon to Whitewater	18	153	1,879	3,261	3,248	53	2,333	0	3,584	0	2,703	1,721	3%
Wilson Cove Area	19	793	3,858	5,165	13,262	0	458	0	1,137	0	596	2,527	4%
Kelp Bay	21	0	395	0	532	30	3	0	247	0	1,454	266	<1%
Hidden Falls	22	2,741	2,891	6,124	1,374	6,618	2,704	1,323	2,762	2,351	331	2,922	5%
Outer Tenakee	41	775	82	1,954	3,203	2,169	2,473	57	364	266	2,102	1,345	2%
Tenakee Springs	42	247	156	573	43	904	155	14	138	0	458	269	<1%
Central Tenakee	45	98	0	434	8	315	1	2	8	0	33	90	<1%
Freshwater Bay	50	0	0	0	0	0	0	0	0	0	1,163	116	<1%
Howard Bay	61	0	0	0	0	0	0	0	0	0	0	0	0%
Funter Bay	63	0	0	0	0	0	0	0	0	0	0	0	0%
Hawk Inlet	65	0	0	0	0	0	0	0	0	0	0	0	0%
Outer Hood Bay	71	0	0	0	0	0	0	0	241	0	0	24	<1%
Chaik Bay	80	0	0	0	0	101	1	0	0	0	164	27	<1%
Whitewater Bay	90	0	0	0	145	0	0	0	0	0	0	15	<1%
Total		23,867	68,530	173,366	116,148	31,879	50,372	3,990	47,349	5,257	104,976	62,573	100%

Note: does not include test fishery harvest.

Kanalku Lake

Both the timing of commercial fishery openings and the distance of the openings from Kanalku Lake allow purse seine fishing to target pink salmon returns while protecting Kanalku Lake sockeye salmon. The majority of the District 12 sockeye salmon commercial harvest, 65%, is taken in statistical area 112-16. Since 1985, the average date of the first commercial purse seine opening in statistical area 112-16 was 19 July, 40 nautical miles distant from Kanalku Bay. Subsistence permit harvest data indicates an average 80% of the subsistence harvest in Kanalku Bay is completed by this date (1985–2011; Figures 15 and 16). Statistical area 112-17, Point Hepburn to Danger Point, is nearer to Angoon and to Kanalku Lake than 112-16. Since 1985, the average opening date for statistical area 112-17 was 28 July. Subsistence permit harvest data indicates an average 98% of the subsistence harvest in Kanalku Bay is completed by this date (1985–2011; Figures 15 and 16). In the two years that a weir was operated in lower Kanalku Creek, at least 50% of the run had entered the Kanalku system by 19 July 2008 and 16 July 2009, and more than 75% of the run by 29 July 2008 and 26 July 2009 (Figure 2). Further, 50% of the escapement entered freshwater by July 19 in 2008, and by July 16 in 2009. By July 29 in 2008 and by July 26 in 2009, 75% of the run had entered freshwater.

In recent years, ADF&G has taken additional conservation measures to protect Kanalku sockeye salmon beyond time restrictions on commercial fishery openings. Since 1999, the Admiralty Island shoreline along an area of approximately nine nautical miles from Parker Point to Point Samuel, west and north of Kootznahoo Inlet and the community of Angoon and Kanalku Inlet, has been closed to the purse seine fishery (Figure 13). The area from Point Samuel south to Point Gardner typically opens in August, well after the majority of the Kanalku sockeye salmon are inside the bay or lake.

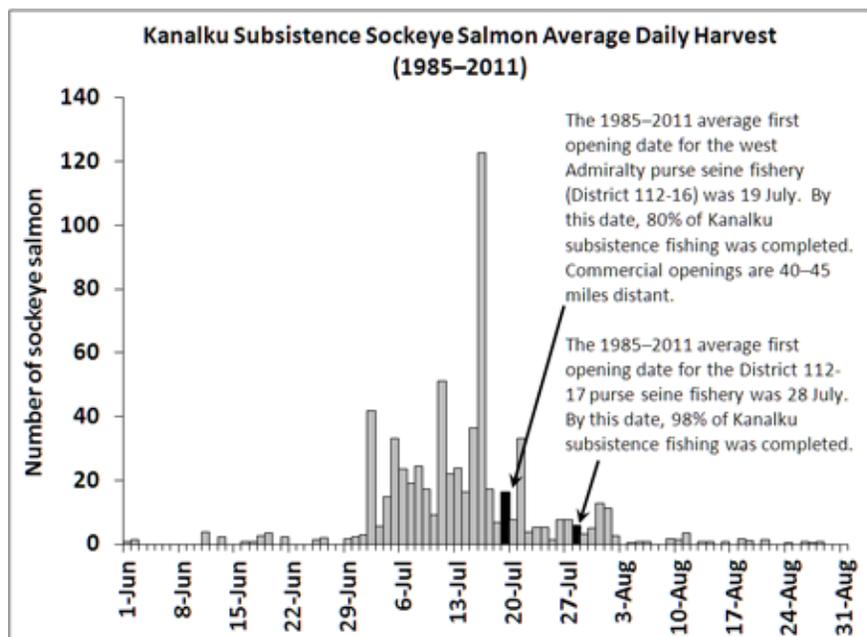


Figure 15.—Average daily subsistence harvest of Kanalku Lake sockeye salmon, 1985–2011.

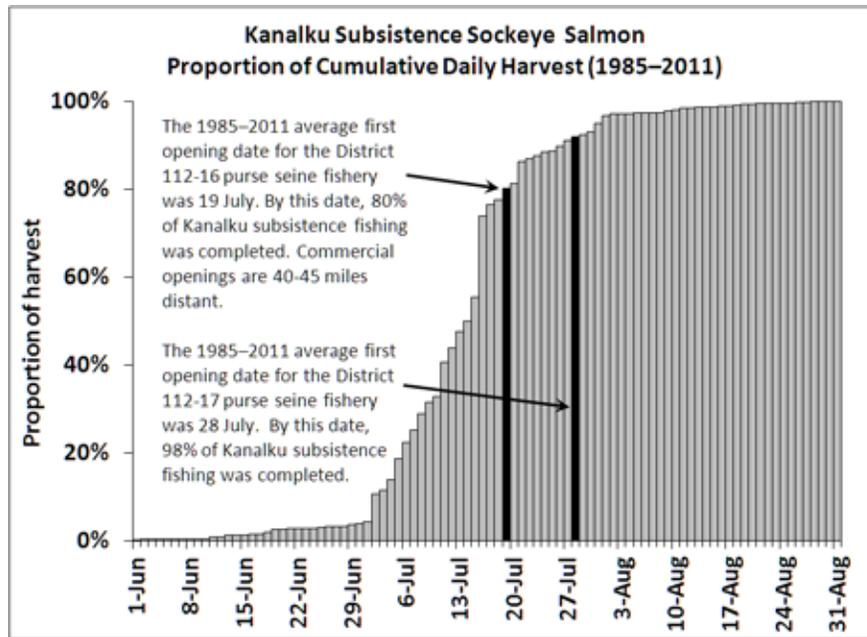


Figure 16.—Daily proportion of the cumulative subsistence harvest of Kanalku Lake sockeye salmon compared to the average opening date of the statistical area 112-16 and 112-17 purse seine fisheries, 1985–2011.

Kook Lake (Basket Bay)

Since 1985, the average first purse seine opening along the Chichagof Island shoreline in statistical area 112-12 was 29 July. Subsistence permit harvest data indicates an average 93% of the Basket Bay sockeye salmon subsistence harvest is completed by this date (1985–2011; Figure 17 and 18). In addition, an average 50% of the Kook Lake sockeye salmon escapement had entered the system by 28 July, based on seven years of weir operations at the lake (1994, 1995, 2005–2007, and 2010–2011; Figure 3). In recent years, ADF&G has taken additional action to protect Kook Lake (Basket Bay) sockeye salmon. Since 2003, the Chichagof Island shoreline along an area of approximately four nautical miles in statistical area 112-12 around the entrance to Basket Bay has been closed to the purse seine fishery (Figure 13) to conserve Basket Bay sockeye salmon milling in Chatham Strait.

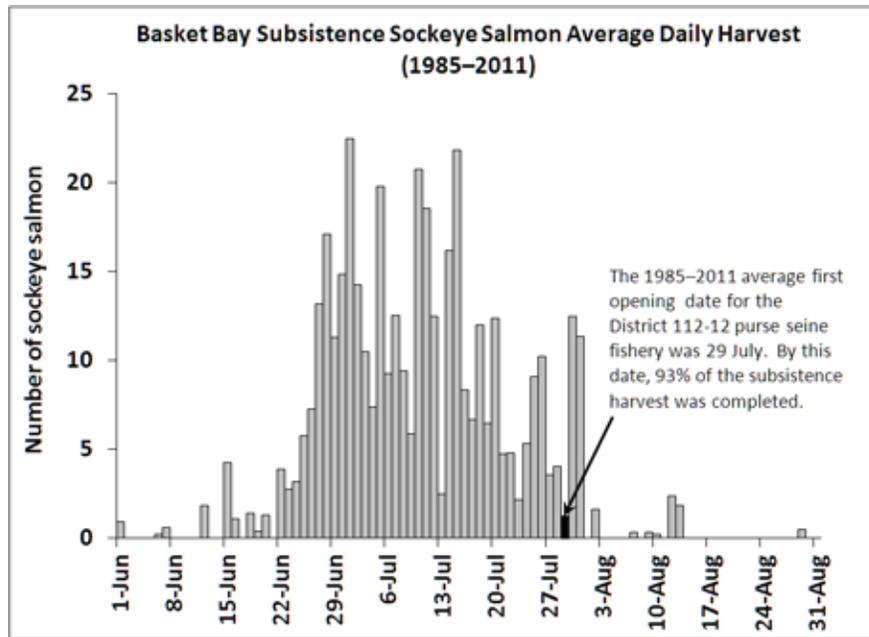


Figure 17.—Average daily subsistence harvest of Basket Bay (Kook Lake) sockeye salmon, 1985–2011.

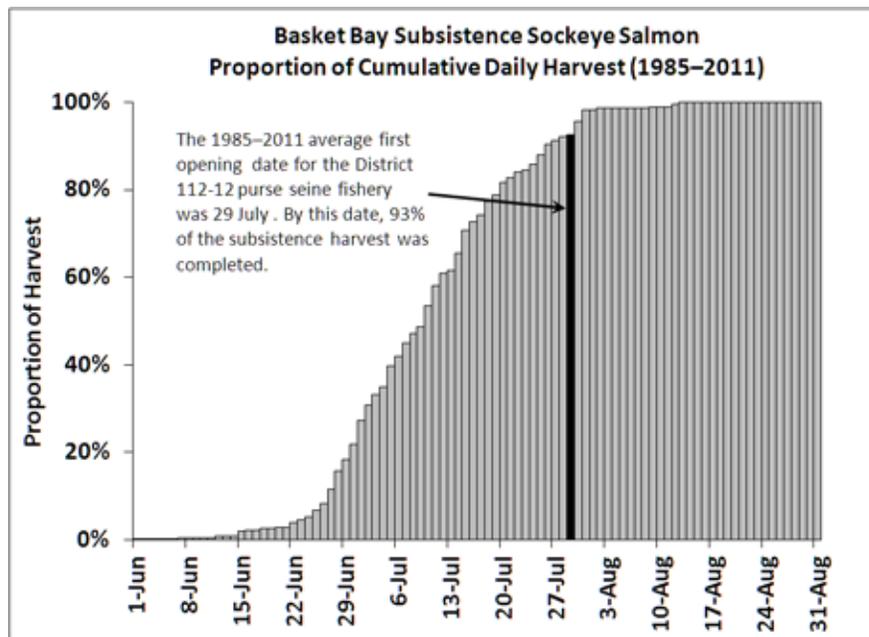


Figure 18.—Daily proportion of the cumulative subsistence harvest of Basket Bay (Kook Lake) sockeye salmon compared to the average opening date of the statistical area 112-12 purse seine fishery, 1985–2011.

TRENDS IN COMMERCIAL PURSE SEINE EFFORT

Participation in Southeast Alaska commercial purse seine fisheries has declined over the past 15 years. In 1997, 351 permits were fished compared to 277 permits fished in 2011. Participation in the Southeast Alaska purse seine fishery reached its lowest level in 2008 with 212 purse seine permits fished, and has varied annually depending on the strength of the pink salmon return to

the region. Fishing effort in the primary sub-districts fished in District 12, however, has been relatively stable over the last 10 years, with upward and downward swings related to pink salmon abundance. Figure 19 shows the annual effort from 1990 to 2011 in District 12 based on analysis of fish ticket data. Boat days were calculated as the sum of boats times one day for each day that a boat actually reported catching fish; any calendar day counts as one boat day, even if the opening was only 6, 8, 12, or 15 hours in duration. The traditional method of determining boat days is to simply multiply the number of boats times the number of days open for a specific fishing period. During multi-day openings, however, processors sometimes put seine boats on harvest limits or did not buy fish for all the days in the opening; therefore, all boats did not necessarily fish each day of an opening. Because of this, the traditional method of calculating boat days can overstate actual effort.

The processors' influence on fishing effort has changed in recent years due to increased processing capacity, and harvest limits have been imposed less frequently on the seine fleet. The department has compensated for the increased fishery efficiency by minimizing the use of extended openings.

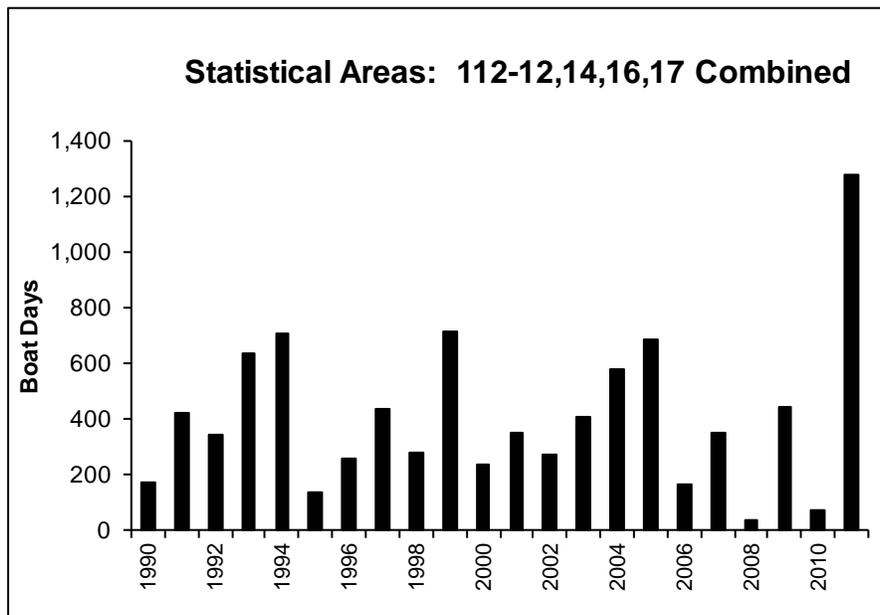


Figure 19.—Purse seine effort in boat-days for District 12 statistical areas 12, 14, 16, 17 combined; 1990–2011. Note the boat-days axis for the combined chart is different than for specific statistical areas.

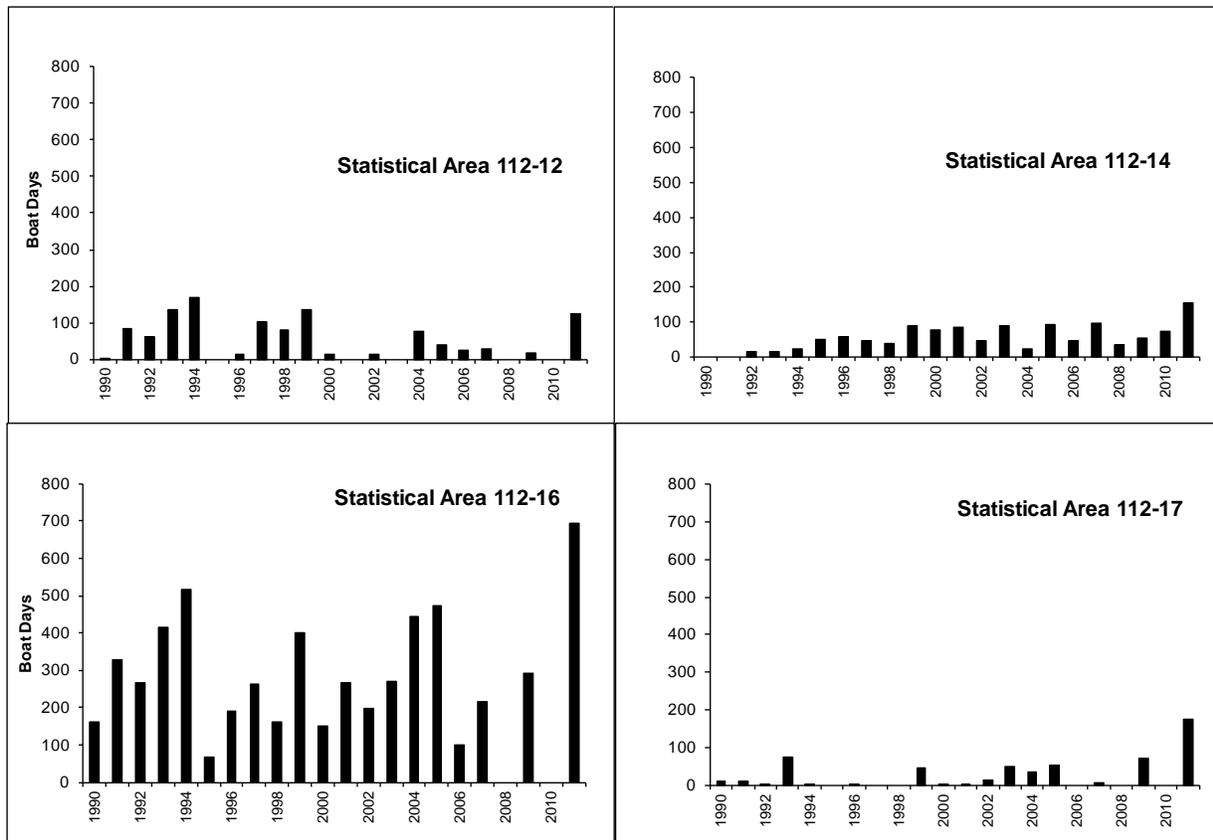


Figure 20.—Purse seine effort in boat-days for District 12 statistical areas 12, 14, 16, and 17; 1990–2011. Note the boat-days axis for the combined chart is different than for specific statistical areas.

SPORT FISHERY HARVEST AND MANAGEMENT

Harvest data for sockeye salmon from the Chatham Strait area sport fishery were extracted from the ADF&G Statewide Angler Harvest Survey database for the years 1996–2010. The data query included Kanalku Bay and Lake, Salt Lake, Mitchell Bay, Hasselborg Creek, Kook Lake and Creek, Basket Bay, Sitkoh Creek, and “Angoon Area”. As is typical for small fisheries and remote drainages, the number of survey respondents for the site-specific bays and drainages was either nonexistent or so low that expanded harvest estimates were not useful, with the exception that few or no angler responses suggest low levels of fishing effort. Of the sites that were queried, no responses were found for Kanalku Lake, Kanalku Creek or Kanalku Bay.

Angler responses for the “Angoon Area” were sufficient to generate harvest estimates for that site (Table 8). The sockeye salmon harvest numbers presented for Angoon included boat and shore anglers and resident and nonresident angler harvests. Because very few respondents reported a harvest of sockeye salmon, it is likely that most angler effort was directed at species other than sockeye salmon (e.g., Chinook and coho salmon and halibut *Hippoglossus stenolepis*).

Charter harvest of sockeye salmon for the Chatham Strait area was extracted from the Saltwater Charter Logbook database for the period 1999–2010 (Table 9). The total annual sockeye salmon harvest averaged only 45 fish. The largest reported harvests occurred in areas near the west side of Point Retreat (statistical area 112-15), adjacent to Funter Bay and Hawk Inlet (statistical area 112-16), and adjacent to Angoon (statistical area 112-18).

The regional ADF&G sport fish bag limit of six sockeye salmon daily with a possession limit of 12 fish applies in both fresh and salt waters. Over the last 10 years there have been no emergency orders restricting traditional sport fishing for salmon within any of the drainages located proximate to the community of Angoon. There have been no significant biological concerns forwarded to ADF&G that would precipitate sport angler restrictions in the Chatham area based upon existing levels of effort or harvest.

Table 8.—Estimated sockeye salmon harvest by recreational anglers within the Angoon Area, 1996–2010.

Year	Number of Respondents	Estimated Effort (angler days)	Estimated Harvest
1996	72	3,278	334
1997	76	4,322	21
1998	57	2,921	0
1999	74	6,334	409
2000	80	7,782	0
2001	74	6,173	449
2002	76	4,585	151
2003	60	5,801	251
2004	46	3,550	11
2005	57	8,789	36
2006	38	3,100	0
2007	34	3,582	32
2008	39	3,810	252
2009	46	4,517	347
2010	28	2,558	0
Average	56	4,723	153

Table 9.—Reported sockeye salmon harvest by chartered anglers in the Chatham Strait area, 1999–2010.

Statistical Area	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Ave.
112-11	0	1	0	0	0	4	0	0	0	0	1	0	1
112-12	16	4	0	0	0	0	0	0	0	1	0	1	2
112-13	0	0	0	0	0	0	0	0	0	0	0	0	0
112-14	0	0	0	0	0	1	0	0	5	0	0	0	1
112-15	8	6	30	19	9	17	47	70	57	15	18	13	26
112-16	0	9	8	2	2	8	28	16	17	6	16	8	10
112-17	0	0	1	0	1	0	1	0	0	0	0	0	0
112-18	0	25	0	2	4	1	6	0	3	12	1	0	5
112-19	4	0	7	0	0	0	0	1	0	0	0	0	1
112-21	0	0	0	0	0	0	0	0	0	0	0	0	0
112-22	0	0	1	0	0	3	1	0	0	0	0	0	0
112-65	0	0	0	0	0	0	0	0	0	0	0	0	0
112-67	0	0	0	0	0	0	0	1	0	0	0	0	0
112-71	0	0	0	0	0	0	0	0	0	0	0	0	0
112-72	0	0	0	0	0	0	0	0	0	0	0	0	0
112-80	0	0	0	0	0	0	0	0	0	0	0	0	0
112-90	0	0	0	0	0	0	0	0	0	0	0	0	0
District 12 Total	28	45	47	23	16	34	83	88	82	34	36	22	45
113-59 Sitkoh Bay	0	0	0	0	0	0	0	0	0	0	0	0	0

HABITAT ASSESSMENT

We were unable to find any fully developed habitat assessments for the drainages supporting the key sockeye salmon stocks in northern Chatham Strait. The Sitkoh watershed has been extensively logged. About 20% of the 5,000 hectare drainage was affected by logging and there are about 30 km of roads in this watershed. The Kook Lake watershed was also logged in the 1970s and 1980, and about 18% of the watershed was affected. The outlet stream and sections of the inlet stream were clear-cut to the riverbanks. This system is unique in that some portions of the outlet stream flow through at least two subterranean caverns. The upstream entrances to these caverns have at times been partially blocked with logs and woody debris, which we assume is likely a result of the logging. The USDA Forest Service documented possible fish blockages to the underground cavern entrances in the early 2000s (Conitz and Cartwright 2005; Van Alen 2008). Both the Hasselborg River and Kanalku Lake are in the Kootznoowoo Wilderness, and we assume they have been minimally affected by habitat alterations.

The effect of the partial barrier falls in Kanalku Creek has been an ongoing concern. Kanalku Lake sockeye salmon must ascend this falls to reach spawning grounds in the lake. Sockeye salmon sit in pools below the falls for variable lengths of time, depending on water flow, where they are subjected to high rates of predation and additional physical stress as they repeatedly attempt to scale the falls. In 1970, the USDA Forest Service and ADF&G blasted four shallow step pools on the left side apron of Kanalku falls to improve fish passage (Geiger et al. 2007, USFS 2011). The effect of the barrier modification in 1970 is not known, since no pre- or post-modification studies were conducted to assess sockeye salmon passage over the falls. In 2012,

ADF&G conducted a pilot study to estimate the total escapement of sockeye salmon into the Kanalku system and estimate the mortality rate at the Kanalku falls. A total of 2,259 sockeye salmon were counted at a weir operated below the falls and only 1,123 sockeye salmon were counted through a weir above the falls at the lake outlet (ADF&G unpublished data; 6 September 2012). Thus, the potential sockeye salmon escapement into Kanalku Lake was reduced by more than 1,200 fish; an inriver mortality rate of 50%.

It is quite possible that existing zooplankton production in Kanalku Lake could support more sockeye salmon fry, should further modification of the partial barrier falls successfully increase escapement. A limnology study conducted at Kanalku Lake in 1995 revealed that Kanalku Lake ranks relatively high in macrozooplankton abundance compared to other sockeye salmon rearing lakes in Southeast Alaska (Barto and Cook 1996). Similar high levels of zooplankton abundance were documented at Kanalku Lake from 2001 to 2003 and 2007 (Conitz and Cartwright 2005, Vinzant et al. 2009). Barto and Cook (1996) concluded that “the existing carrying capacity of the lake is vastly underutilized by juvenile sockeye salmon.”

Barto and Cook (1996) further concluded that Kanalku Lake would not be a good candidate for nutrient enrichment (lake fertilization), based on guidelines for lake enrichment projects established by ADF&G in 1979. Those guidelines stipulated that the mean depth of the lake should be greater than the depth of the euphotic zone (the depth to which light penetrates the water), the lake water residence time should be greater than one year, and the shoreline should be steep with little littoral zone vegetation. Kanalku Lake is shallow and the mean depth (only 15 m) is approximately equal to the euphotic zone depth (Barto and Cook 1996, Vinzant et al. 2009), the water residence time was approximately 0.18 years in 1995 (Barto and Cook 1996), and the shoreline is shallow with abundant littoral zone vegetation located near existing sockeye salmon spawning areas (Vinzant et al. 2009).

FUTURE PROJECTS

CHATHAM COMMERCIAL FISHERY STOCK COMPOSITION

In 2012, ADF&G initiated a 4-year study using genetics to estimate stock composition of sockeye salmon harvested in Chatham and Icy straits. Mixed stock fishery samples will be collected from selected purse seine harvest from 112-16, 112-14, 112-17, 114-27, and drift gillnet harvest from District 15. Fishery harvests will be sampled to achieve levels of precision and accuracy sufficient for fishery management. Concurrently, genetic baseline samples will be collected from several stocks in the area that are not adequately represented in the current sockeye salmon genetic baseline (Kook, Hasselborg, Eva, Kutlaku, Sitkoh, Gut, and Pavlov).

KANALKU FALLS

ADF&G and the USDA Forest Service have been working cooperatively to improve fish passage and increase sockeye salmon production from the drainage. The Alaska State Legislature allocated \$200,000 in capital funds to begin work on further barrier modification of the falls. A National Environmental Protection Act (NEPA) review of the drainage has been completed, and a Finding of No Significant Action (FONSI) was signed by the USFS Supervisor in February 2012. In spring 2013, a modification of the falls is planned that will potentially reduce mortality caused by the partial barrier.

KANALKU TOTAL ESCAPEMENT

Assessments of total run size and harvest rates for Kanalku Lake sockeye salmon will also require a better accounting of the mortality rate at the Kanalku falls. In 2012, ADF&G conducted a pilot study to estimate the total escapement of sockeye salmon into the Kanalku system and to estimate the mortality rate at the Kanalku falls. Preliminary results suggest that 50% of the run was unable to ascend the falls—a significant proportion given the small size of recent spawning populations (average spawning escapement 1,270 fish, 2001–2011). ADF&G has applied for a grant with the Alaska Sustainable Salmon Fund to continue this work for three additional years. This project will provide precise estimates of the mortality rate at the falls and much-needed information on fish passage prior to or after any further modification of the falls. ADF&G has current funding from the Office of Subsistence Management through the USDA Forest Service to operate the upper Kanalku weir through the 2013 field season.

SUBSISTENCE HARVEST INFORMATION

ADF&G Subsistence division is conducting a study to update subsistence harvest information for District 12 and District 14. Quantitative and qualitative methods will be used to collect subsistence harvest information from Angoon and Hoonah residents, the principal subsistence users of the waters of Districts 12 and 14. The subsistence information to be collected will include harvest amounts, location, methods and means, as well as changes in the subsistence salmon fisheries. The information gathered can be used by managers to help maintain salmon populations necessary for subsistence fishing. In addition, this study will provide much needed current information to address any potential changes to the amount reasonably necessary for subsistence (ANS) for the Juneau management area at the next Southeast Board of Fisheries meeting (2014/2015).

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APPENDICES

Appendix A 1.—Total run (and percent) of primary northern Southeast Alaska sockeye stocks and total District 12 commercial purse seine harvest, 1985–2011.

Year	Total Run					Percent of Total Production				District 12 Total Harvest		
	Snettisham	Taku	Chilkat	Chilkoot	Total	Snettisham	Taku	Chilkat	Chilkoot	Sockeye	Pink	Boat Days
1985	0	198,703	193,227	221,350	613,280	0%	32%	32%	36%	36,043	5,731,979	2,049
1986	0	175,689	192,000	198,454	566,143	0%	31%	34%	35%	5,336	256,477	945
1987	0	149,882	119,000	430,180	699,062	0%	21%	17%	62%	41,667	1,410,372	1,602
1988	0	118,408	104,000	335,242	557,650	0%	21%	19%	60%	2,300	559,000	767
1989	0	177,434	300,000	346,763	824,197	0%	22%	36%	42%	48,053	5,388,783	1,087
1990	0	226,858	207,000	252,188	686,046	0%	33%	30%	37%	13,950	1,186,472	734
1991	0	259,720	113,000	314,679	687,399	0%	38%	16%	46%	39,692	7,976,543	1,350
1992	0	288,551	210,000	207,790	706,341	0%	41%	30%	29%	45,867	2,938,485	1,253
1993	0	284,200	310,000	103,251	697,451	0%	41%	44%	15%	64,623	6,905,856	1,924
1994	0	229,642	276,000	62,830	568,472	0%	40%	49%	11%	62,387	8,948,148	2,461
1995	0	238,434	248,000	15,155	501,590	0%	48%	49%	3%	10,215	566,958	2,251
1996	34,000	322,263	359,000	69,600	784,863	4%	41%	46%	9%	26,961	2,633,789	1,963
1997	65,000	174,565	309,000	73,167	621,732	10%	28%	50%	12%	22,182	4,697,979	1,514
1998	55,000	139,824	430,000	14,541	639,365	9%	22%	67%	2%	24,503	3,335,238	1,639
1999	40,000	176,764	399,000	23,542	639,306	6%	28%	62%	4%	48,069	13,692,320	2,289
2000	162,137	246,954	210,000	58,229	677,320	24%	36%	31%	9%	22,443	2,441,122	1,748
2001	286,433	396,678	191,000	143,785	1,017,897	28%	39%	19%	14%	54,067	3,286,084	1,273
2002	116,375	251,634	182,000	82,636	632,646	18%	40%	29%	13%	20,772	4,252,098	1,272
2003	224,368	328,884	167,000	106,778	827,031	27%	40%	20%	13%	65,657	6,780,300	1,226
2004	514,616	204,015	178,000	142,133	1,038,764	50%	20%	17%	14%	166,783	9,124,834	1,365
2005	231,905	188,245	108,000	80,498	608,648	38%	31%	18%	13%	114,868	16,356,886	1,604
2006	327,721	232,368	89,150	215,464	864,703	38%	27%	10%	25%	24,859	2,637,656	1,085
2007	129,624	169,364	82,226	204,889	586,102	22%	29%	14%	35%	47,668	4,225,041	928
2008	90,642	160,982	116,043	40,440	408,107	22%	39%	28%	10%	2,667	50,301	896
2009	112,231	118,610	237,948	50,584	519,373	22%	23%	46%	10%	44,654	6,146,745	1,249
2010	66,024	158,143	146,821	103,543	474,531	14%	33%	31%	22%	2,906	192,676	808
2011	144,288	203,761	79,215	92,693	519,957	28%	39%	15%	18%	104,851	19,906,931	2,037
Averages:												
Total	162,523	215,577	205,801	147,793	665,481	13%	33%	32%	22%	43,113	5,245,521	1,456
Pre-snet. 85–95	0	213,411	206,566	226,171	646,148	0%	33%	32%	34%	33,648	3,806,279	1,493
10-year	195,779	201,601	138,640	111,966	647,986	28%	32%	23%	17%	59,569	6,967,347	1,247
Difference 10-year to pre snet.		-11,810	-67,926	-114,205	1,838	28%	-1%	-10%	-17%	25,920	3,161,067	-246
Percent difference		0.94	0.67	0.50	1.00	96%	71%	50%	50%	177%	183%	84%

Appendix A 2.—July commercial purse seine openings and salmon harvest, including estimated wild and hatchery sockeye salmon harvest, on the Hawk Inlet shoreline, 1989–2011.

Year	July purse seine openings				July salmon harvest					
	First	Last	Number	Total hours	Total sockeye salmon	Hatchery sockeye salmon ^a	Wild sockeye salmon	Percent wild sockeye salmon	Pink salmon	Chum salmon
1989	9-Jul	16-Jul	2	54	15,032	---	15,032	100%	671,590	19,186
1990	Not Open	---	---	---	---	---	---	---	---	---
1991	Not Open	---	---	---	---	---	---	---	---	---
1992	23-Jul	---	1	15	12,529	---	12,529	100%	218,873	18,673
1993	11-Jul	---	1	12	6,120	---	6,120	100%	80,471	30,325
1994	15-Jul	18-Jul	2	23	10,323	---	10,323	100%	408,913	52,912
1995	Not Open	---	---	---	---	---	---	---	---	---
1996	Not Open	---	---	---	---	---	---	---	---	---
1997	Not Open	---	---	---	---	---	---	---	---	---
1998	Not Open	---	---	---	---	---	---	---	---	---
1999	18-Jul	21-Jul	2	23	5,876	1,035	4,841	80%	597,674	46,365
2000	Not Open	---	---	---	---	---	---	---	---	---
2001	19-Jul	---	1	12	10,579	2,962	7,617	70%	194,624	16,508
2002	Not Open	---	---	---	---	---	---	---	---	---
2003	10-Jul	13-Jul	2	20	10,186	970	9,216	90%	178,219	38,693
2004	8-Jul	15-Jul	3	40	17,490	5,374	12,116	70%	625,243	173,633
2005	7-Jul	17-Jul	4	55	15,763	5,690	10,073	60%	1,708,714	123,181
2006	6-Jul	27-Jul	7	56	12,603	1,243	11,360	90%	339,697	172,259
2007	Not Open	---	---	---	---	---	---	---	---	---
2008	Not Open	---	---	---	---	---	---	---	---	---
2009	12-Jul	30-Jul	6	102	17,401	3,168	14,233	80%	1,505,408	55,816
2010	Not Open	---	---	---	---	---	---	---	---	---
2011	7-Jul	18-Jul	4	75	25,315	5,075	20,240	80%	2,509,400	157,632
Average			3	41	13,268	3,190	11,142	84%	753,236	75,432

^a 1996 was the first year adult Snettisham hatchery sockeye salmon returned.