CHAPTER 5: CHUM SALMON STOCK STATUS AND ESCAPEMENT GOALS IN SOUTHEAST ALASKA

by

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ABSTRACT

The annual harvest of chum salmon in Southeast Alaska commercial fisheries averaged more than 12 million fish per year over the most recent 10-year period, 1995–2004. Hatchery-produced fish comprised an average of 75% of this recent harvest. Estimated harvests of wild chum salmon appear to have rebounded somewhat from an historic average low of about 1 million fish per year in the 1970s, to an average of 3 million fish per year over the most recent 10-year period, 1995–2004. There are currently no chum salmon stocks in Southeast Alaska with information of sufficient quality to establish formal escapement goals. Examination of 21 years of peak survey estimates for 82 chum salmon index streams showed that escapements of most wild-stock chum salmon appear to be stable or increasing: 60 (73%) index streams exhibited stable or increasing trends, while 22 (27%) exhibited declines (8 of which we considered biologically meaningful). The stock status of five other systems or areas were updated using a variety of information including multiple foot surveys, fish wheel catches, and near-terminal area harvests: Fish Creek (Hyder), Tenakee Inlet, Cholmondeley Sound, Taku River, and Chilkat River. Although declines in Chilkat and Taku fall-run chum salmon warrant attention, the Alaska Department of Fish and Game does not recommend any chum salmon stocks in Southeast Alaska be considered as candidates for *stock of concern* status under the Sustainable Salmon Fisheries Policy, primarily because of a lack of reliable escapement measures.

Key words: Chum salmon, *Oncorhynchus keta*, escapement, escapement goals, escapement index, stock status, Chilkat River, Cholmondeley Sound, Disappearance Creek, Fish Creek, Lagoon Creek, Taku River, Taku Inlet, Lynn Canal, Tenakee Inlet.

INTRODUCTION

Chum salmon *Oncorhynchus keta* are known to spawn in approximately 1,500 streams in Southeast Alaska. Annual commercial harvests of chum salmon in Southeast Alaska were historically at high levels in the early to mid-1900s, then gradually declined to their lowest levels in the 1960s and 1970s (at which time fishing was fairly restricted). Chum salmon harvests increased dramatically in the 1990s. However, much of this increase is due to the production of hatchery fish by Southern Southeast Regional Aquaculture Association (SSRAA) at Nakat Inlet, Earl West Cove, Neets Bay, Anita Bay and Kendrick Bay; by Northern Southeast Regional Aquaculture Association (NSRAA) at Hidden Falls and Deep Inlet; by Douglas Island Pink and Chum, Inc. (DIPAC) at Amalga Harbor, Gastineau Channel and Limestone Inlet; and through combined DIPAC/NSRAA releases at Boat Harbor; and Kake Nonprofit Fisheries Corporation (KNFC) releases at Gunnuck Creek and Southeast Cove. Hatchery fish accounted for an average of 75% of the commercial harvest of chum salmon over the 10 years from 1995 to 2004. Over that same 10-year period, the total exvessel value of the commercial chum salmon harvest averaged $27 million a year (range: $15 million–$42 million), and the chum salmon harvest was more valuable than the harvest of any other species in 7 of those 10 years. Chum salmon are harvested primarily in commercial net fisheries (see Appendix 4.A, in Chapter 4 of this volume for extensive detail on ADF&G management districts for the commercial fisheries), and to a lesser extent by commercial troll fisheries, as well as sport, personal use, and subsistence fisheries.

The Sustainable Salmon Fisheries Policy (5 AAC 39.222) requires the Alaska Department of Fish and Game (ADF&G) to conduct an assessment of the status of salmon stocks in Southeast Alaska and Yakutat. The Policy for Statewide Escapement Goals (5 AAC 39.223) directs ADF&G to document existing salmon escapement goals, to establish goals when the department can reliably estimate escapement levels, and to perform an analysis when these goals are created or modified. The first assessment of Southeast Alaska and Yakutat chum salmon was conducted by Heinl et al. (2004). They did not identify any chum salmon stocks in Southeast Alaska and Yakutat for which existing information was sufficient to establish escapement goals. The vast majority of the available information about the region's chum salmon escapements comes from aerial surveys, often obtained in conjunction with aerial surveys directed primarily at estimating

numbers of spawning pink salmon. ADF&G has long-term, standardized survey programs to estimate an index of spawning abundance for only a handful of chum salmon streams. In addition, stock-specific harvest information is not available for the vast majority of wild chum salmon stocks in Southeast Alaska, which are predominantly harvested in mixed-stock fisheries far from their spawning grounds.

Below, I provide an update of the Heinl et al. (2004) report on the status of chum salmon in Southeast Alaska. This update will be presented in two parts: 1) an overview of trends in Southeast Alaska chum salmon streams, based on trends in escapement survey measures, and 2) an overview and update of chum salmon systems that have been monitored more intensely, support directed fisheries, or warrant more attention (Fish Creek summer chum, Tenakee Inlet summer chum, Cholmondeley Sound fall chum, Taku River fall chum, and Chilkat-Klehini River fall chum).

OVERALL STOCK STATUS

HARVEST

Stock-specific harvest information is not available for the vast majority of wild chum salmon stocks in Southeast Alaska, which are predominantly harvested in mixed-stock fisheries in the region. The annual total harvest of wild chum salmon in Southeast Alaska was roughly estimated by simply subtracting the estimated contribution of hatchery fish to the common property fisheries from the total commercial harvest of chum salmon. Much of the contribution of hatchery chum salmon is taken in terminal fisheries near hatcheries or remote release sites. The annual estimated contributions of hatchery fish to the commercial fisheries were obtained from ADF&G Alaska salmon enhancement program annual reports (e.g., Farrington 2004; White 2005; and previous reports in that series). The estimated hatchery contribution was not yet available for the 2005 season. Although harvest levels are assumed to be known without substantial error, there is certainly some error in these estimates.

Hatchery operators are required to provide ADF&G with estimates of the total number of adult fish harvested for cost recovery purposes and broodstock, and to provide estimates of the contribution of their fish to the common property fisheries, broken out by gear group. A variety of methods have been used to assemble this information. DIPAC has used thermal otolith marks for over a decade to identify chum salmon harvested in commercial fisheries in Lynn Canal and Taku Inlet (Rick Focht, DIPAC, Juneau, personal communication). SSRAA has used coded wire tags to identify their fish in southern Southeast Alaska commercial fisheries, but has recently switched to thermal otolith marks (Gary Freitag, SSRAA, Ketchikan, personal communication). NSRAA has consulted with ADF&G commercial fisheries management biologists in the Sitka management area to determine where and when their fish are harvested in northern Southeast Alaska and to estimate contribution to the common property fisheries (Chip Blair, NSRAA, Sitka, personal communication). Fish harvested in terminal harvest areas were assumed to be 100% hatchery fish. Incubation facilities for the three largest chum salmon producers in the region, NSRAA, SSRAA and DIPAC, are now upgraded to permit thermal marking of almost all of their chum salmon releases. In 2004, 83% of all chum salmon released from hatcheries in Southeast Alaska were thermal marked (Bruce White, ADF&G, Juneau, personal communication).

Annual commercial harvests of chum salmon in Southeast Alaska were historically at high levels in the early 1900s (maximum, 9.4 million in 1918), then steadily declined to their lowest levels

in the 1970s when the average annual harvest was 1.4 million (minimum, 600 thousand in 1969). The annual harvest increased dramatically in the 1990s, with an all-time maximum harvest of 16 million fish in 1996 (Figure 5.1). This recent increase was due largely to the production of hatchery fish, which have accounted for an average of 75% of the commercial harvest of chum salmon over the 10 years from 1995 to 2004, with a peak contribution of 12.7 million fish in 2000. Although not as high as harvests of the 1910s to the 1940s, annual commercial harvests of wild chum salmon have increased considerably since the mid-1970s, and averaged 3 million fish over the last 10 years, 1995–2004 (Figure 5.2).

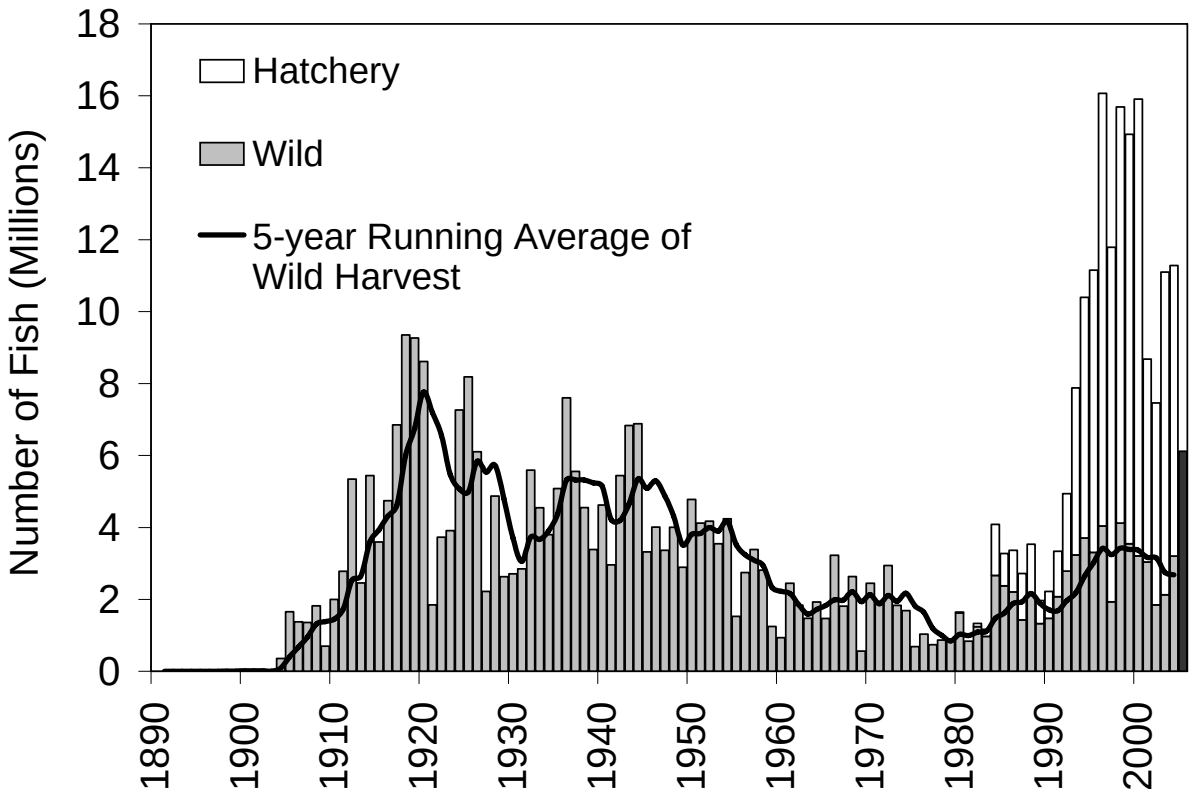

Figure 5.1–Annual harvest of chum salmon in Southeast Alaska from 1890 to 2005, showing the harvest of both hatchery-produced and wild chum salmon. (2005 catch as of 18 September 2005; hatchery contribution not available.)

ESCAPEMENT

There are about 1,200 streams and rivers in Southeast Alaska for which ADF&G has a record of at least one adult chum salmon count, in at least one year, since 1960. The survey types include foot, boat, and helicopter surveys, and weir counts. The vast majority of those 1,200 streams do not have a long time series of survey information—probably because most are not significant producers of chum salmon, and survey effort has been directed at the more productive chum salmon streams. In their review of available ADF&G chum salmon escapement survey observations from 1960 to 2002, Heinl et al. (2004) identified 82 streams which had sufficient information to be useful for assessing trends in spawning populations: 76 summer-run chum salmon streams and six fall-run chum salmon streams. I have updated this index through the

2004 season; complete 2005 survey data were not available at the time of this writing (Appendix 5.A.1).

Heinl et al. (2004) also pointed out the many limitations to the usefulness of these survey counts. Aerial escapement surveys are conducted by ADF&G Commercial Fisheries Division management staff, primarily to estimate escapements of pink salmon *O. gorbuscha* in conjunction with management of the purse seine fishery. The purse seine fishery is generally directed at pink salmon. Thus, most estimates of chum salmon have been obtained incidentally to surveys conducted for the purpose of managing the pink salmon fishery. Chum salmon are most easily observed early in the season when there are few pink salmon in the streams. Large numbers of pink salmon in a stream will mask chum salmon escapements in many areas (Van Alen 2000). Perhaps the primary limitation is that these subjective, raw survey estimates can only be used as is, in that we have no way to standardize them or adjust them to account for bias among observers. The maximum escapement measures used here can only be considered a relative indicator of escapement level, as the escapement level has changed from year to year. The analysis of escapement survey measures and estimated wild harvest presented here is intended primarily to provide a broad, region-wide gauge of the overall abundance of spawning chum salmon in Southeast Alaska.

TRENDS IN HARVEST AND ESCAPEMENT

Salmon populations, like populations of most living things, do not remain constant through time—salmon recruitment is strongly influenced by oceanographic and other processes that cause the populations to periodically increase or decrease (Quinn and Marshall 1989; Beamish and Bouillon 1993; Adkison et al. 1996; Mantua et al. 1997, and many others). Although Southeast Alaska salmon populations have exhibited various historical trends, we are most interested in detecting recent changes, and in particular, we would like to determine if a recent decline in a specific stock is meaningful or not.

I used a non-parametric approach described by Geiger and Zhang (2002) to assess trends over the most recent 21 years of catch and escapement index values. This method employs a simple regression that is robust to outliers that are common to data series of widely fluctuating salmon populations, and provides a means of relating stock decline to an underlying population level, so that the decline can be put into some kind of context. I regressed escapement (and catch) on year using a resistant regression line, and used the estimated *y*-intercept of this regression line as a back-cast estimate of what the underlying population level was at the start, or "year zero," of the series. The slope of the line was a robust estimate of the stock's decline (or increase) relative to the year-zero reference point. Geiger and Zhang (2002) suggested that a decline be considered *biologically meaningful* when the estimated underlying annual decline was more than 3% of the back-cast year-zero reference point over a 21-year series. A sustained 21-year, overall decline that is 3% of the back-cast year-zero reference point would result in the stock declining by more than 60%.

In the previous chum salmon stock status report, Heinl et al. (2004) simply summed the raw annual survey counts over all 82 index streams to assess trends in chum salmon spawning populations from 1982 to 2002. For the current analysis, I converted the index values to stream-specific ranks over time (Conover 1999, p. 269–271). This was done to make the analysis more robust to statistical outliers and to prevent atypical values in index streams that support very large populations of chum salmon from driving the estimated trend in the index as a whole.

Changing the units of the index from numbers of fish to a rank value also removes the appearance that the result is an estimate of total escapement, rather than a series that is appropriately used to gauge the relative rank of each year's escapement. I ranked the annual escapement measure for each of the 82 index streams from 1 to 21 over the most recent 21-year period, 1984–2004, then weighted each stream by its median value over the 21-year period. I examined trends in the ranked survey data using the Geiger and Zhang (2002) method for the entire weighted index as a whole, for the weighted index broken out by management district, and for each of the individual index streams.

Taken as a whole, the combined 82-stream chum salmon index showed an increasing trend of 2.3% of the year-zero reference point per year over the most recent 21 years, 1984–2004 (Figure 5.2). Heinl et al. (2004) reported a slightly larger increase in chum salmon escapement for the 21-year period from 1982 to 2002, but the indices were calculated differently between the two analyses. Using the same Geiger and Zhang (2002) method to assess trends in the annual harvest of wild chum salmon showed a similar increase of 3.8% of the year-zero reference point per year over the most recent 21 years, 1984–2004 (Figure 5.2).

The trend for escapement survey data for most management districts was generally stable or increasing, with the exception of the District 107, 108, and 109 indices, which showed declining trends in survey data over the past 21 years (Table 5.1). District 101 streams also showed a decline of 0.3% of the year-zero reference point per year—which is essentially stable.

A total of 60 (73%) of the chum salmon index streams were stable or increasing, while 22 (27%) exhibited declining trends in survey measures over the most recent 21-year period, 1984–2004 (Appendix 5.A.1). The number of streams exhibiting declining trends is double the total of 11 streams that exhibited declining trends in the 2003 stock status report (Heinl et al. 2004). Eight of those streams exhibited declines of greater than 3% of the year-zero reference point per year, which we considered to be *biologically meaningful* declines:

1. Tombstone Creek (ADF&G stream number 101-15-019),
2. Port Camden South Head (ADF&G stream number 109-43-006),
3. Port Camden West Head (ADF&G stream number 109-43-008),
4. Sample Creek (ADF&G stream number 109-62-014),
5. Dry Bay Creek (ADF&G stream number 110-13-004),
6. East of Snug Cove Creek (ADF&G stream number 110-23-040),
7. Clear River (ADF&G stream number 112-21-005), and
8. St. James Bay NW Side (ADF&G stream number 115-10-042).

Four of these eight index streams also showed declines in the 2003 stock status report: Tombstone, Port Camden West Head, Port Camden South Head, and Clear River (Heinl et al. 2004). Conversely, two streams that exhibited *biologically meaningful* declines in the 2003 report no longer exhibited declines of greater than 3% of the year-zero reference point: Hidden Inlet (ADF&G Stream Number 101-11-101), and Tyee Head East (ADF&G Stream Number 109-30-016).

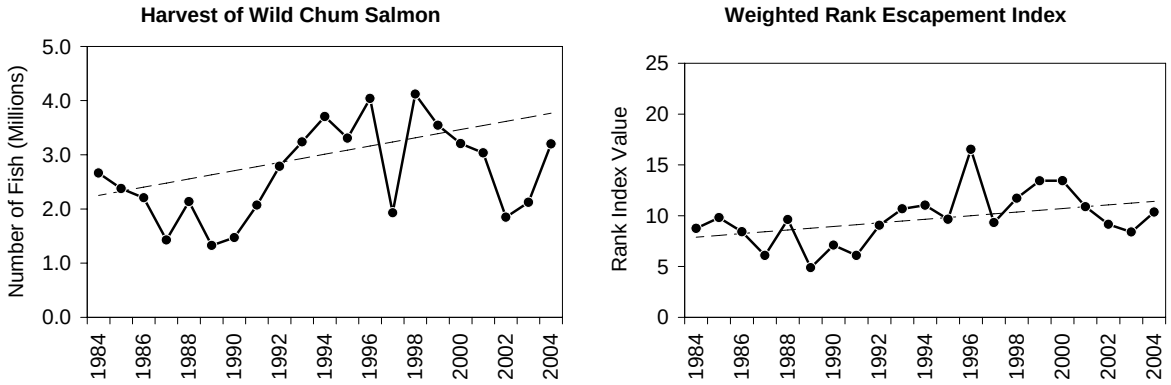

Figure 5.2–Annual estimated commercial harvest and overall escapement index of wild chum salmon in Southeast Alaska, 1984–2004. The dashed line is found by the "resistant regression," and the slope of the line is a robust estimate of increase or decline relative to the size of the harvest or escapement index at the beginning of the series. These data show annual increase of 3.8% the year-zero reference point per year in the harvest, and 2.3% in the escapement. The 2005 data were not available at the time of this writing.

EXAMINATION OF SPECIFIC STOCKS

The following section provides a review of available information on several stocks or groups of stocks of chum salmon in Southeast Alaska that were reported on by Heinl et al. (2004). Specifically included are stock groups that support directed commercial fisheries, stocks with better assessment information, and stocks that appear to have experienced declines in production in recent years.

FISH CREEK SUMMER CHUM SALMON

The summer-run chum salmon at Fish Creek (ADF&G Stream Number 101-15-085), in Portland Canal, near Hyder, has been studied by the National Marine Fisheries Service since the early 1970s (Helle 1984; Helle and Hoffman 1995, 1998). ADF&G conducted a coded-wire tagging study there from 1988 to 1995 (Heinl et al. 2000) to determine the harvest rate and distribution of this stock in the commercial fisheries of both Alaska and Canada. Harvest data do not exist for other years, and there is not sufficient information to establish a formal biological escapement goal for Fish Creek chum salmon. Foot surveys have been conducted for many years at Fish Creek (Helle and Hoffman 1998), and a rough estimate of the total escapement has been estimated annually from a series of three foot surveys conducted over the course of the season (Heinl et al. 2000). Estimated escapements of Fish Creek chum salmon have been highly variable, ranging from 3 thousand (1997) to 93 thousand (2004), and show a downward (but not *biologically meaningful*) trend over the most recent 21 years, 1985–2005 (Figure 5.3).

TENAKEE INLET SUMMER CHUM SALMON

Tenakee Inlet, located along the Chatham Strait shoreline of Chichagof Island (District 112), is among the largest producers of wild summer chum salmon in the Alexander Archipelago, and supports one of the few directed commercial purse seine fisheries on wild summer-run chum salmon in Southeast Alaska. Early season management of the Tenakee Inlet commercial purse seine fishery is based primarily on chum salmon returns from late June through early July (thereafter, management emphasis for the fishery switches to pink salmon).

Table 5.1–Median escapement survey counts (in thousands) of chum salmon, by year and ADF&G district, 1982–2004.

District	101	102	107	108	109	110	111	112	113	114	115
Number of Index Streams	8	2	2	1	9	12	9	19	6	9	5
1982	0.5	NA	2.8	0.8	0.7	0.1	0.5	0.5	0.5	1.2	2.5
1983	2.2	3.5	14.1	0.8	0.7	0.2	0.2	2.9	2.3	2.3	0.8
1984	6.0	14.0	8.7	3.5	2.1	1.1	1.8	1.8	17.0	3.3	0.8
1985	5.4	18.5	10.3	1.8	1.7	0.6	2.4	2.5	3.8	4.0	1.7
1986	3.3	14.0	1.2	1.1	4.5	0.6	0.9	2.0	3.3	3.1	0.6
1987	5.0	22.1	5.3	1.0	1.6	0.6	0.4	1.0	3.5	2.2	0.8
1988	18.8	18.6	6.5	1.3	1.2	3.4	0.6	1.6	3.5	1.0	0.8
1989	5.8	17.4	14.0	0.4	1.3	0.5	0.3	1.0	1.6	0.9	0.2
1990	2.8	15.2	1.7	4.1	1.0	1.5	0.6	1.5	3.3	1.8	0.8
1991	5.0	23.0	14.9	0.3	1.8	0.7	0.2	1.0	1.2	1.5	0.9
1992	7.6	18.3	7.8	0.7	2.0	0.9	0.7	4.0	1.6	2.7	0.5
1993	5.5	29.0	16.4	0.9	1.1	1.3	0.5	6.0	1.8	4.1	0.8
1994	7.8	21.4	2.3	0.7	0.6	1.0	3.5	2.5	3.0	3.4	1.9
1995	6.5	17.5	5.5	0.6	1.2	0.5	0.7	4.2	2.7	4.3	0.1
1996	12.0	30.8	15.3	2.5	3.2	2.2	6.6	21.0	5.4	9.2	5.7
1997	4.5	15.4	NA	1.4	2.0	0.8	1.3	5.3	8.0	5.6	0.5
1998	10.0	29.3	3.6	NA	1.1	0.6	3.3	3.1	2.5	4.0	1.1
1999	5.0	50.0	14.0	NA	1.4	0.7	1.6	9.5	8.0	6.5	0.6
2000	7.5	15.8	7.2	2.3	2.2	2.9	2.3	9.0	28.5	4.0	0.3
2001	8.0	22.5	8.0	0.8	1.0	1.1	1.2	3.8	9.2	6.1	6.0
2002	3.0	15.0	2.5	0.9	0.3	1.1	3.0	8.0	4.3	4.5	2.9
2003	5.4	37.5	3.1	0.6	0.5	0.9	1.2	3.7	5.0	3.0	5.0
2004	5.0	30.0	3.1	0.8	2.0	2.5	3.8	4.1	7.6	3.1	1.9
Estimated Year-Zero Level, 1984–2004[a]	8	2	13	13	12	6	5	7	8	6	7
Robust Estimate of Annual Decline	0.0	-0.7	0.2	0.4	0.2	-0.2	-0.3	-0.4	-0.1	-0.4	-0.1
Decline as percent of Year-Zero Level	0.3%	---	1.7%	2.8%	1.2%	---	---	---	---	---	---
Increase as percent of Year-Zero Level	---	43.7%	---	---	---	3.2%	6.3%	5.2%	1.9%	6.9%	0.8%

[a] Decline as a percent of the year-zero reference point shows the size of a stock decline (or increase) relative to the size of the stock trend at the beginning of the series, based on ranked index values. Districts 107 and 108 show declines of 1.5% and 2.9% respectively; all other Districts showed stable or increasing trends over the most recent 21-years, 1984–2004.

Chum salmon harvests in the purse seine fishery in Tenakee Inlet have increased substantially since the late 1970s. Catches averaged 58 thousand chum salmon in the 1980s but increased to an average of 152 thousand in the 1990s, including two years when catches exceeded 300 thousand (Figure 5.4). Catches declined from 2001 to 2003, but were higher in 2004 and 2005. Increased chum salmon production at the Hidden Falls hatchery may have contributed to the increase in commercial harvest of chum salmon at Tenakee Inlet. Stock composition estimates of chum salmon catches at Tenakee Inlet are not available, but it is possible that catches in the outer portions of the inlet have included Hidden Falls Hatchery chum salmon that sagged into the inlet on their return migration to the hatchery.

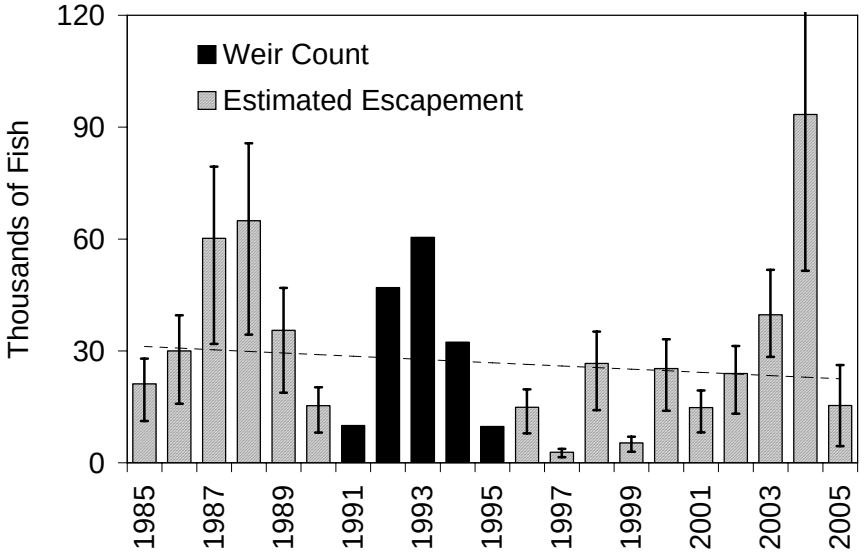

Figure 5.3–Annual estimated escapements and weir counts of chum salmon in Fish Creek (ADF&G stream number 101-15-085), 1985–2005. Vertical lines represent the 95% prediction range for estimated escapements. The dashed line represents a "resistant regression." The slope of the line is a robust estimate of increase or decline relative to the size of the harvest at the beginning of the series (Geiger and Zhang 2002); these data show an annual decline of 1.4% of the year-zero reference point.

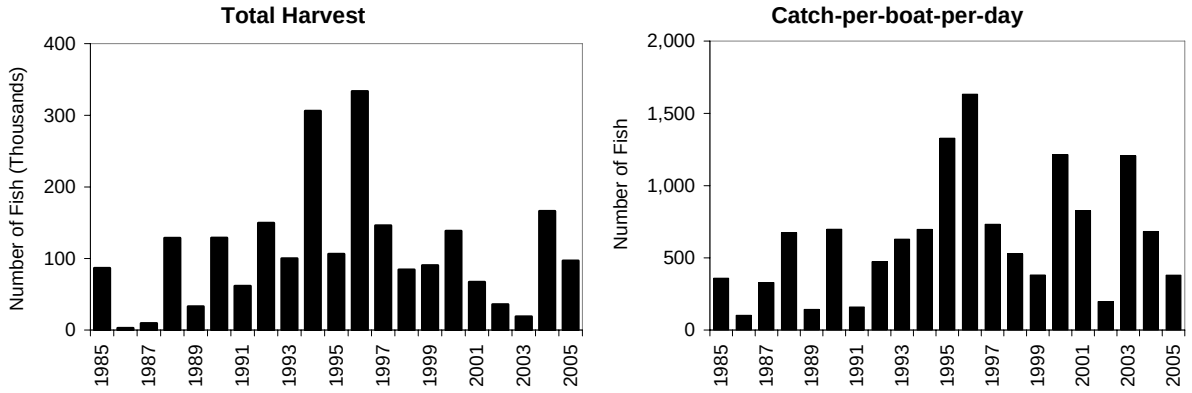

Figure 5.4–Annual harvest and catch-per-boat-per-day of chum salmon in the Tenakee Inlet commercial purse seine fishery, 1985–2005 (Management District 112; Subdistricts 41, 42, and 45).

Aerial surveys are the primary method for monitoring escapements to eight of the major Tenakee Inlet chum salmon systems: Kadashan River, Saltery Bay, Seal Bay, Long Bay Head, Big Goose, Little Goose, West Bay Head and Tenakee Inlet Head (Appendix 5.A.1). Median survey counts to those systems over the past 21 years range from 1,000 chum salmon in Little Goose Creek, to 10,000 chum salmon in Long Bay Head. Aerial survey data show a large increase in the annual peak estimates for all of the chum salmon index streams in the inlet, with the exception of Big Goose Creek. A weighted rank escapement index for those streams shows an increasing trend in survey data over the most recent 21 years, 1985–2005 (Figure 5.5).

CHOLMONDELEY SOUND FALL CHUM SALMON

Cholmondeley Sound located on the eastern side of Prince of Wales Island, in southern Southeast Alaska (Subdistrict 102-40), supports an annual commercial purse seine fishery on fall chum salmon. This fishery targets chum salmon returns to Disappearance Creek (ADF&G stream number 102-40-043) and Lagoon Creek (ADF&G stream number 102-40-060). Harvests of fall chum salmon in Cholmondeley Sound increased from an average of 44 thousand fish in the 1970s and 1980s to an average of 122 thousand fish a year from 1991 to 2004, including a peak catch of 359 thousand in 1998 (Figure 5.6).

Aerial surveys are used to monitor escapements to Disappearance and Lagoon creeks (Heinl et al. 2004). Peak survey estimates have ranged from 16 thousand to 50 thousand fish in Disappearance Creek and 4 thousand to 50 thousand fish in Lagoon Creek (Appendix 5.A.1). weighted rank escapement index for those streams shows an increasing trend in survey data over the 21 years, 1985–2005 (Figure 5.7). In 2005, the abundance of fall chum salmon at Cholmondeley Sound was poor, and the fishery was quickly closed after only one opening was conducted. Although the total harvest has dropped in recent years, the escapement and commercial harvest measures indicate that these stocks have been stable over the past two decades.

CHILKAT RIVER FALL CHUM SALMON

The Chilkat River drainage, near Haines, supports one of the largest fall chum salmon runs in the region. Most of the spawning takes place in the mainstem and side channels of the Chilkat River (ADF&G Stream Number 115-32-025) and its major tributary, the Klehini River (ADF&G Stream Number 115-32-046). Chilkat River fall chum salmon stocks are primarily harvested in the Lynn Canal (District 115) commercial drift gillnet fishery. Harvests and fisheries performance measures for the Chilkat River fall chum stock declined during the 1990s (Figure 5.8). Catches have been lower in recent years, due in part to fishery restrictions specifically implemented to protect this stock by reducing effort in the fishery (Bachman 2005).

The chum salmon escapement to the Chilkat River drainage was historically monitored via aerial surveys; however, ADF&G considers historic aerial surveys of the drainage to be unreliable primarily due to the highly glacial nature of the system. Fish wheels operated by ADF&G on the river since 1994 have provided some evidence that escapements have improved since the mid-1990s (Figure 5.9). From 2002 to 2005, ADF&G conducted in-river mark-recapture studies designed to estimate the spawning population of chum salmon, and relate those estimates to the fish wheel catches and aerial surveys of the primary spawning areas. The total spawning population estimate in 2002 was 206 thousand fish (Bachman 2005), and in 2003 and 2004 estimates were 166 thousand and 329 thousand fish (Randy Bachman, ADF&G unpublished data).

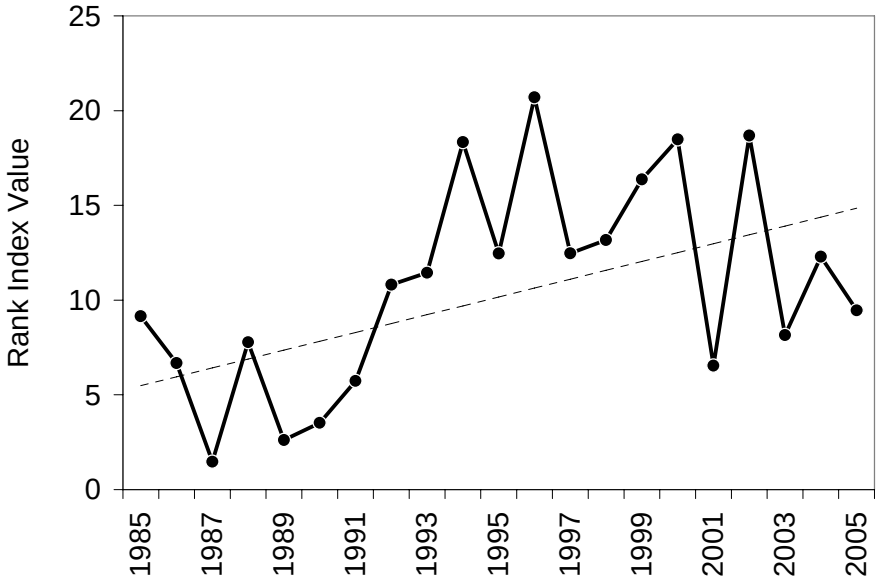

Figure 5.5–Weighted rank index of annual peak aerial survey estimates of chum salmon in eight Tenakee Inlet (Management District 112; Subdistricts 42, 44, 46, 47, and 48) chum salmon streams, 1985–2005. The dashed line represents a "resistant regression," and the slope of the line is a robust estimate of increase or decline relative to the size of the escapement index at the beginning of the series (Geiger and Zhang 2002).

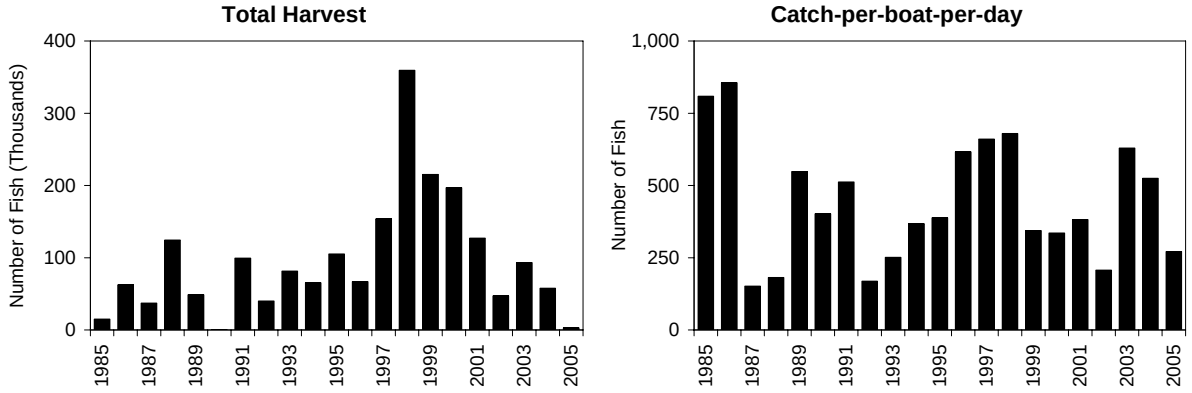

Figure 5.6–Annual harvest and catch-per-boat-per-day of chum salmon in the Cholmondeley Sound commercial fall chum salmon purse seine fishery, 1985–2005 (Subdistrict 102-40).

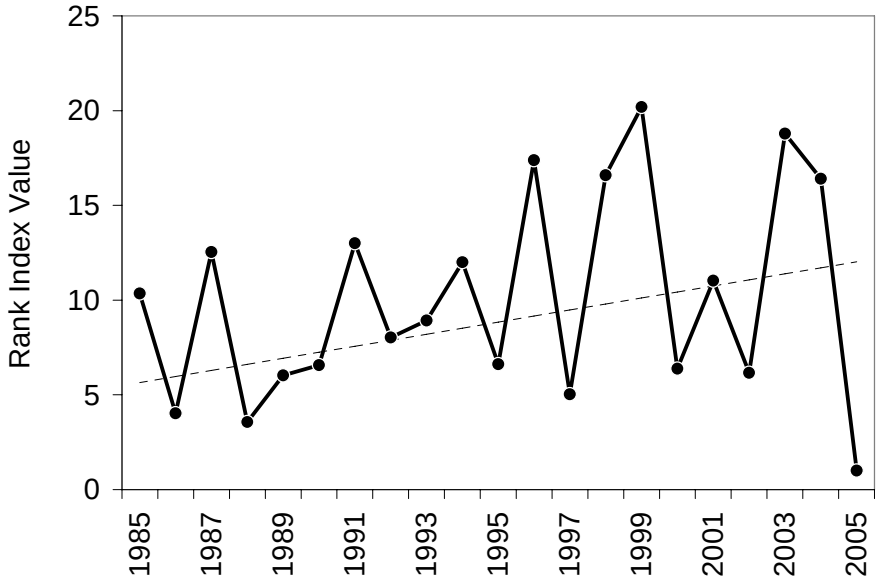

Figure 5.7–Weighted rank index of annual peak aerial survey estimates of chum salmon in Disappearance Creek (ADF&G stream number 102-40-043) and Lagoon Creek (ADF&G stream number 102-40-060), Cholmondeley Sound, 1985–2005. The dashed line represents a "resistant regression," and the slope of the line is a robust estimate of increase or decline relative to the size of the escapement index at the beginning of the series (Geiger and Zhang 2002).

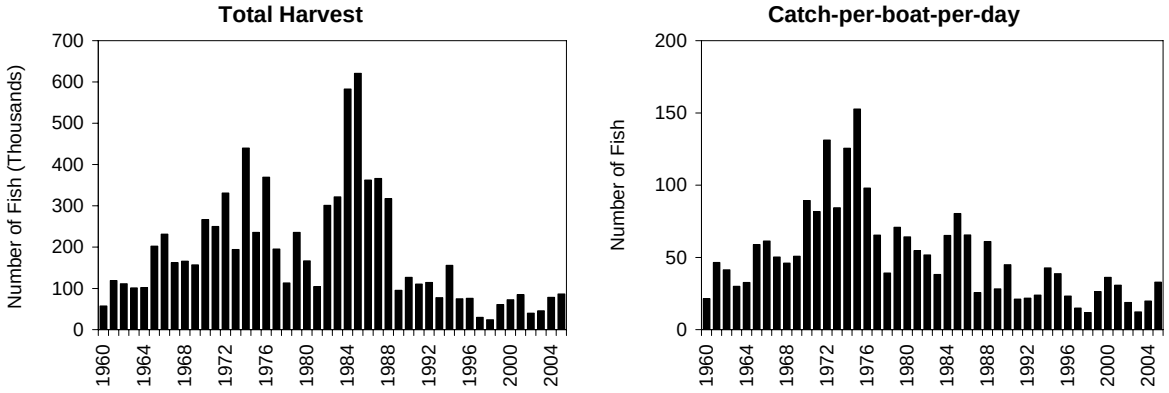

Figure 5.8–Annual harvests and catch-per-boat-per-day of fall-run chum salmon in the Lynn Canal (Management District 115) commercial drift gillnet fishery, 1960–2005. All chum salmon harvested in Statistical Week 32 (average mid-week date 6 August) and later are considered fall-run fish.

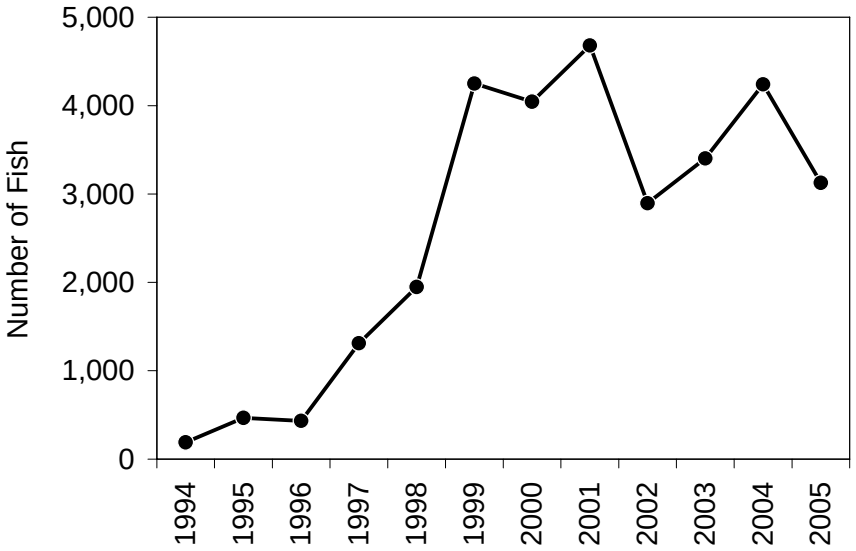

Figure 5.9–Annual fish wheel catches of chum salmon on the Chilkat River, 1994–2004. (2005 survey data were not available.)

The preliminary 2005 estimate was about 134 thousand fish (Randy Bachman, ADF&G, Haines, personal communication). Assuming all chum salmon harvested in the Lynn Canal drift gillnet fishery from Statistical Week 32 (average mid-week date 6 August) through the end of the fishing season are bound for the Chilkat River, harvest rates on Chilkat River chum salmon in the Lynn Canal fishery from 2002 to 2005 varied from 16% to 39%.

Given the limited amount of reliable escapement information and current lack of an escapement goal, ADF&G did not recommend Chilkat River chum salmon as a candidate stock of concern, as identified in the Sustainable Salmon Fisheries Policy (Heinl et al. 2004).

TAKU RIVER FALL CHUM SALMON

The transboundary Taku River (ADF&G Stream Number 111-32-032) supports a fall run of chum salmon that spawns in Canada. Taku River fall chum salmon stocks are primarily harvested in the Alaska Taku Inlet (Subdistrict 111-32) commercial drift gillnet fishery, but these fish are also harvested incidentally in the Canadian inriver coho salmon drift gillnet fishery. The harvest of fall-run Taku River chum salmon in District 111 increased in the 1970s, and averaged 54,000 fish in the 1970s and 1980s. Beginning in the late 1980s, however, the harvest declined steadily to very low levels, and over the past 10 years the harvest in District 111 averaged only 8% (4,200 fish) of the 1970s to 1980s average (Figure 5.10). Catches have been lower in recent years, due in part to fishery restrictions specifically implemented to protect this stock by reducing effort in the fishery. Fish wheel counts, the only escapement indicator for the Taku River, also declined in the early 1990s and have since remained stable at lower levels (Figure 5.11).

Fish wheel counts, the only escapement indicator for the Taku, also declined in the early 1990s and have since remained stable at lower levels (Figure 5.11).

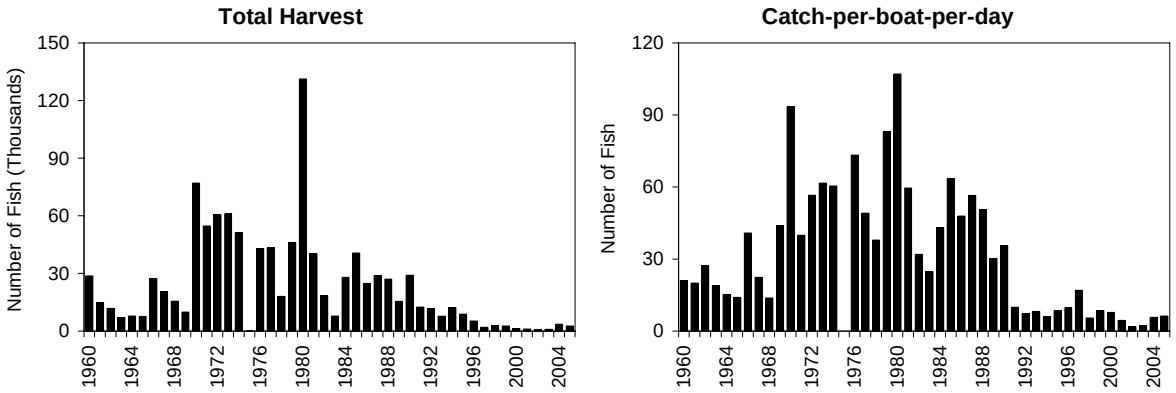

Figure 5.10–Annual harvests and catch-per-boat-per-day of fall-run chum salmon in the Taku Inlet (Management District 111-32) commercial drift gillnet fishery, 1960–2005. All chum salmon harvested in Statistical Week 34 (average mid-week date 20 August) and later are considered fall-run fish.

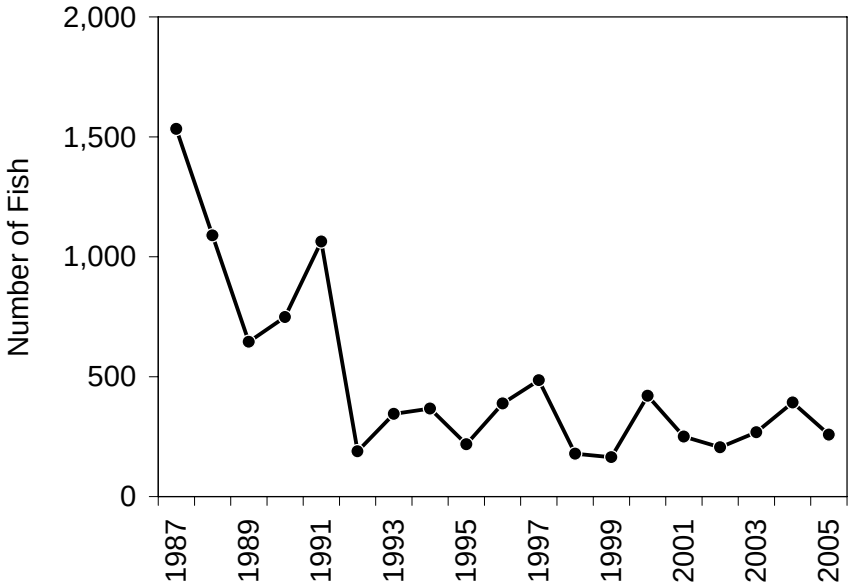

Figure 5.11—Annual fish wheel catches of chum salmon on the Taku River, 1987–2005.

In the future, ADF&G intends to continue to limit harvest of this stock through conservative fishery management. ADF&G conducted a radio-telemetry study in 2004 to identify the primary chum salmon spawning areas within the Taku River drainage (James Andel, ADF&G, Douglas, personal communication). The department has also worked cooperatively with the University of Alaska and the National Marine Fisheries Service, Auke Bay Lab, to assess marine survival of chum salmon fry in the Taku Inlet-Stephens Passage area. Among other things, these studies will examine predator-prey relationships, and near-shore marine interactions of wild and hatchery chum salmon. These studies are ongoing and results have not yet been published. Given the

current lack of reliable escapement information and lack of a meaningful escapement goal, ADF&G did not recommend Taku River chum salmon as a candidate stock of concern (Heinl et al. 2004).

ESCAPEMENT GOALS

At this time, there are currently no chum salmon stocks in Southeast Alaska with sufficient information to establish formal escapement goals under the Sustainable Salmon Fisheries Policy (5 AAC 39.222). The quality of existing escapement and stock-specific production measures would need to be significantly improved to develop meaningful and technically supportable escapement goals for specific streams or areas.

DISCUSSION

The analysis of escapement survey measures and estimated wild harvest presented here was intended primarily to provide a broad, region-wide gauge of the overall abundance of chum salmon in Southeast Alaska. The majority of the Southeast Alaska chum salmon stocks for which we have reasonable survey information appear to be stable or increasing over the past two decades (Figure 5.2, Appendix 5.A.1). Likewise, annual harvests of wild chum salmon appear to have increased since the 1970s (Figures 5.1 and 5.2). Even so, chum salmon harvest levels and total population levels have not rebounded to nearly the same degree as pink salmon (Zadina et al. 2004) and wild coho salmon (*O. kisutch*; Shaul et al. 2004), and are still well below harvest levels of the early 20th century (Van Alen 2000). Other recent stock status assessments of Southeast Alaska chum salmon have also noted that most stocks for which we have sufficient information appear to be stable or exhibit increasing trends (Baker et al. 1996; Van Alen 2000; Heinl et al. 2004).

This region-wide analysis of escapement survey measures also points to some areas where chum salmon streams have exhibited declines in peak survey estimates over the past 21 years (e.g., District 101, 107, 108 and 109, Table 5.1). It should be noted, however, that the majority of these survey measures have not been collected or synthesized in a standardized manner and do not represent total escapements. At best, this analysis has identified stocks that may warrant more attention, particularly the chum salmon streams in Port Camden (District 109), which showed some of the largest declines in escapement measures, and also exhibited declines in the last chum salmon stock status report (Heinl et al. 2004).

The declines in survey measures in some areas have clearly been a result of the increased abundance of pink salmon, rather than real declines in chum salmon abundance. The increase in the pink salmon population has masked the abundance of chum salmon and greatly limited ADF&G's ability to estimate numbers of chum salmon in many or most streams in Southeast Alaska (Van Alen 2000). As an example, the high abundance of pink salmon in mainland areas of District 101 has made it impossible to estimate numbers of chum salmon in some of the index streams there; no surveys were obtained for the Marten River over the past three years, and no surveys were obtained for King Creek or the Wilson River over the past two years (Appendix 5.A.1). The inability to separate chum salmon from pink salmon has also become a problem recently in the Sitka area, where pink salmon runs have exhibited substantial increases over the past 15 years (Zadina et al. 2004).

The Chilkat and Taku rivers were historically two of the largest fall chum salmon producers in the region (Heinl et al. 2004; Bachman 2005). Reasons for the decline of both stocks in the 1980s

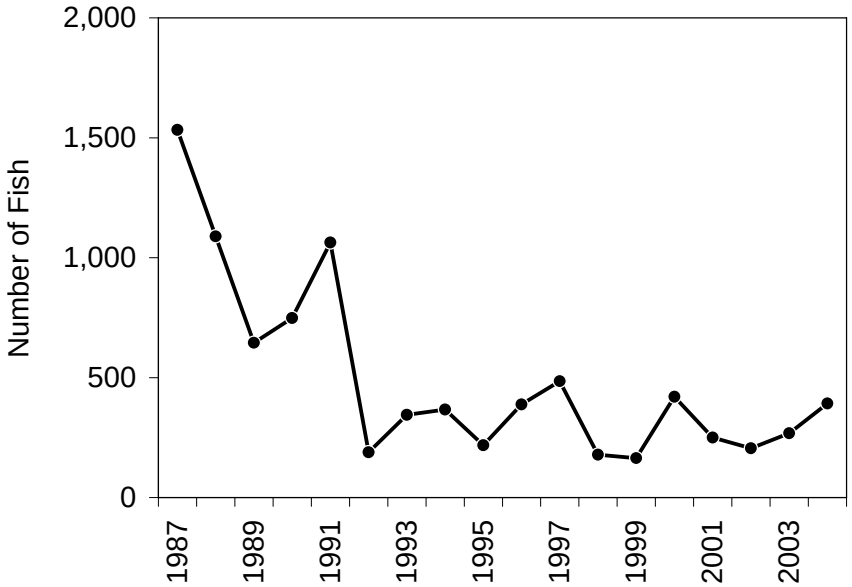

Figure 5.12–Annual fish wheel catches of chum salmon on the Taku River, 1987–2004. (2005 survey data were not available.)

are not well understood, but could include a combination of natural changes in spawning habitat, over-fishing, interactions with other species of fish, and interactions with the increased production of hatchery fish. The decline in both stocks is also interesting in light of the fact that chum salmon stocks in Tenakee Inlet and Cholmondeley Sound were stable, or even exhibited increasing trends over the same time period, despite supporting directed purse seine fisheries (Heinl et al. 2004).

As already noted, we currently do not possess information of sufficient quality to establish *biological escapement goals* for chum salmon in Southeast Alaska. The general lack of quality information about escapements and stock specific harvests is not a problem that is likely to change any time soon without significant, long-term cost and effort. We could develop *sustainable escapement goals* the stocks, or groups of stocks, for which escapements and harvests have been monitored most intensively, and ADF&G will examine this matter prior to the next Board of Fisheries meeting in 2009. The recent studies to estimate the spawning population of Chilkat River chum salmon will be used to develop a reliable and greatly needed index of annual abundance (Bachman 2005), and could potentially be useful for developing an escapement goal for that stock.

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APPENDIX 5.A

Appendix 5A.1–Peak escapement index series for select chum salmon streams in Southeast Alaska, 1982–2004. (2005 survey data not yet available.)

District	101	101	101	101	101	101	101	101	102	102	107	107
Area	Ketchikan	Ketchikan	Ketchikan	Ketchikan	Ketchikan	Ketchikan	Ketchikan	Ketchikan	Ketchikan	Ketchikan	Petersburg	Petersburg
Survey Type	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial
Run-timing	Summer	Summer	Summer	Summer	Summer	Summer	Summer	Summer	Fall	Fall	Summer	Summer
Stream No.	101-11-101	101-15-019	101-30-030	101-30-060	101-45-078	101-55-020	101-55-040	101-71-04K	102-40-043	102-40-060	107-40-025	107-40-049
Stream Name	Hidden Inlet	Tombstone	Keta River	Marten River	Carroll Creek	Wilson River	Blossom	King Creek	Disappearance Creek	Lagoon Creek	Oerns Creek	Harding River
1982	550	550	3,000	300	8,000	500	200	500			280	5,300
1983	3,600	18,500	800	500	3,500	300				3,500		14,100
1984	800	9,250	16,500	300	11,000		4,100	6,000		14,000	1,080	16,400
1985	1,400	5,000	30,000	1,200	5,850	10,700	8,000	5,000	26,000	11,000	590	20,000
1986	430	10,000	46,000	1,000	600	10,000		3,300	16,000	12,000		1,200
1987	1,500	12,800	10,100	1,000	5,000				32,500	11,700	1,300	9,300
1988	1,400	20,000	47,000	17,500	44,000	28,000	5,000	10,000	21,000		490	12,520
1989	500	12,100	11,000			10,800	800	300	19,800	15,000	4,000	24,000
1990	650	4,400	30,000			10,000	1,100	800	22,000	8,300	530	2,800
1991	150	5,500	11,000		5,000	5,000	5,000	300	25,000	21,000	700	29,000
1992	500	2,600	20,000	6,000	13,000	10,000	4,000	9,200	21,000	15,500	150	15,500
1993		22,800	28,000	3,500	5,500	5,000	3,500	7,000	29,000		800	32,000
1994	1,500	7,500	40,100	2,500	3,200	23,000	8,000	15,000	22,700	20,000	50	4,500
1995	5,000	5,000	20,000	950	25,000	800	12,000	8,000	20,000	15,000	900	10,000
1996	2,700	5,200	90,000	4,000	30,000		12,000	12,000	38,000	23,500	1,600	29,000
1997	160	5,500	15,000	1,500	3,500	18,000	1,500	10,000	18,000	12,800		
1998	4,300	8,000	43,000	10,100	8,500	10,000	10,000	35,000	32,500	26,000	1,100	6,000
1999	800	3,000	20,000	1,000	10,000	5,000	5,000	8,000	50,000	50,000	2,900	25,000
2000	600	4,000	22,000	1,000	14,000	16,000	2,000	11,000	21,500	10,000	500	13,800
2001	3,800	4,000	45,000	200	20,000	15,000	12,000	4,000	22,000	23,000	1,000	15,000
2002	700	3,000	20,000		2,000	9,000	5,000	1,500	22,000	8,000	50	5,000
2003	1,200	5,400	16,000						45,000	30,000	200	6,000
2004	550	14,000	8,000		2,500		5,000		30,000	30,000	30	6,200
Robust Estimate of Annual[a] Decline												
Decline as percent of Year-Zero Level		4.3%	2.9%			2.9%					2.4%	1.6%
Increase as percent of Year-Zero Level	0.0%			0.0%	1.3%		1%	4.6	14.6%	27.3%		

[a] Decline as a percent of year-zero level shows the annual size of a stock decline (or increase) relative to the size of the stock trend at the beginning of the series. (Blank cells denote lack of sufficient survey data.)

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Appendix 5A.1–(Page 2 of 7)

District	108	109	109	109	109	109	109	109	109	109	110	110
Area	Petersburg	Petersburg	Petersburg	Petersburg	Petersburg	Petersburg	Petersburg	Petersburg	Petersburg	Petersburg	Petersburg	Petersburg
Survey Type	Foot	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial
Run-timing	Summer	Summer	Fall	Fall	Summer	Summer	Fall	Summer	Summer	Summer	Summer	Summer
Stream No.	108-41-010	109-30-016	109-43-006	109-43-008	109-44-037	109-44-039	109-45-013	109-45-017	109-52-007	109-62-014	110-13-004	110-22-004
Stream Name	North Arm Creek	Tyee Head East	Port Camden S Head	Port Camden W Head	Saginaw Bay S Head	Saginaw Creek	Salt Chuck - Security	Lookout Point Cr Sec B	Rowan Creek	Sample Creek	Dry Bay Creek	Amber Creek - N Arm Pybus
1982	840	700	3,800	1,550	350	650	12,000	30	50	200		40
1983	812		771	680		150	4,830			150	50	50
1984	3470		6,800	3,200	2,590	400	19,000	500	500	1,600	1,000	300
1985	1826	400	8,700	3,500	2,600		21,000	350	500	700	1,700	160
1986	1068	7,000	8,200	6,070	1,300	350	12,000	1,150	1,300	4,500	700	500
1987	1040	6,100	7,400	1,550	1,600	600	11,200	600	150	500	500	250
1988	1280	13,500	4,100	3,250	500	500	15,500	350	700	1,200	500	300
1989	404	4,000	4,700	2,350	300	50	8,410	1,000	1,300	800	350	
1990	4095	10,000	3,000	960		50	20,040	800	100		2,400	850
1991	265	600	3,100	1,800			6,000	200			90	200
1992	708	8,500	2,900		600	1,000	19,300			600	300	
1993	926	7,500	5,100	1,700	1,100	300	7,400	800	900	500	1,400	500
1994	740	4,500	3,800	1,150	600	300	4,900	400	300	300		
1995	570	23,300	2,000	1,200	1,540	50	14,000	950	1,200	1,100	250	600
1996	2530	18,000	3,400	1,350	3,200	3,300	19,000	2,000	650	2,000	1,800	1,200
1997	1420	1,950	2,000	1,500	300		5,400	300	2,000		800	50
1998		1,050	3,600	2,200	1,100	1,000	31,500	900	2,000	300	250	500
1999		6,300	920	600	3,000		20,000		1,400	400		800
2000	2280	34,000	1,400	1,100	3,000	800	12,500		3,200	300	1,000	2,100
2001	820	400			400	1,000	3,500		2,100			450
2002	881	100	300	150			6,000	400			125	
2003	606	2,500	131	545			8,700	300			300	
2004	800	4,100	1,700	1,600	500	1,400	13,100		4,700	2,200	1,200	600
Robust Estimate of Annual[a]												
Decline as percent of Year-Zero Level	2.8%	2.4%	4.6%	4.5%	1.9%		1.7%	2.1%		4.3%	3.1%	
Increase as percent of Year-Zero Level						8.9%			220.0%			13.0%

a Decline as a percent of year-zero level shows the annual size of a stock decline (or increase) relative to the size of the stock trend at the beginning of the series. (Blank cells denote lack of sufficient survey data.)

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Appendix 5A.1–(Page 3 of 7)

District	110	110	110	110	110	110	110	110	110	110	111	111
Area	Petersburg	Petersburg	Petersburg	Petersburg	Petersburg	Petersburg	Petersburg	Petersburg	Petersburg	Petersburg	Juneau	Juneau
Survey Type	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial
Run-timing	Summer	Summer	Summer	Summer	Summer	Summer	Summer	Summer	Summer	Summer	Summer	Summer
Stream No.	110-22-012	110-22-014	110-23-008	110-23-010	110-23-019	110-23-040	110-32-009	110-33-013	110-34-006	110-34-008	111-13-010	111-15-024
Stream Name	Donkey Creek	Cannery Cove - Pybus Bay	Johnston Creek	Bowman Creek	Snug Cove - Gambier Bay	East of Snug Cove	Chuck River -Windham B	Lauras Creek	Glen Creek	Sanborn Creek	Mole River	Windfall Harbor W
1982	1,600	220	10	20	150	30		2,000	50	1,200	400	300
1983	1,300	150	600	80			25	200		350	150	
1984	2,600	1,000	2,500	400	750	1,200	700	3,500	1,200	1,900	400	1,500
1985	1,455	150	400			600		900	700	400	500	
1986	450	350	600	500	700	1,500	300	1,500	500	900	300	300
1987	3,300	1,515	800	400	300			700	405	2,000		200
1988	6,300	3,350	8,000	3,460	2,300	4,300	2,600	3,520	900	3,400	700	350
1989	600		400	100		150		500	600	500		
1990	2,800	700	2,000	400	950	1,650	600	1,500		2,400	500	200
1991	1,200	100	700		450	1,150	30	1,050	900	1,000	200	100
1992	1,500	1,500	500		700	150	1,000	1,800	800	900	300	700
1993	6,000	2,700	1,200	500	800	800	1,000	1,400	1,600	2,900	200	250
1994	3,900	2,400		250			500	1,500	850	950	4,000	200
1995	7,900	1,600	550	300	180	320	400	800	500	1,600	340	20
1996	13,000	4,800	7,200	2,000	800	1,200	7,100	2,320	500	14,300		3,000
1997	11,000	1,800	500	300	600		2,000	180	3,000	1,000		
1998	12,000	2,900	600			400		500	725	1,000		3,000
1999	10,500	3,400	600	400	450	800	300	900	100	700	6,000	1,100
2000	15,000	6,200	2,700	1,100	900	1,100	3,050	4,800	4,000	8,200	2,010	600
2001	4,500	2,800	1,050	500	1,000	400	1,100	1,300	500	2,500	875	2,500
2002	2,100	1,525			400	900	200		1,800	1,200	3,100	1,950
2003	2,500	1,300						350	700	1,095	500	4,000
2004	8,100	5,200	2,100	900	1,300	400	3,000	2,800	3,000	7,300	8,000	
Robust Estimate of Annual[a]												
Decline as percent of Year-Zero Level						3.7%		1.9%		1.2%		
Increase as percent of Year-Zero Level	9.4%	39.1%	0.8%	21.3%	3.1%		3.9%		2.3%	0%	12.4%	14.4%

[a] Decline as a percent of year-zero level shows the annual size of a stock decline (or increase) relative to the size of the stock trend at the beginning of the series. (Blank cells denote lack of sufficient survey data.)

-continued-

Appendix 5A.1–(Page 4 of 7)

District	111	111	111	111	111	111	111	112	112	112	112	112
Area	Juneau	Juneau	Juneau	Juneau	Juneau	Juneau	Juneau	Lynn Canal	Juneau	Sitka	Sitka	Juneau
Survey Type	Aerial	Aerial	Aerial	Aerial	Aerial	Foot	Foot	Aerial	Aerial	Aerial	Aerial	Aerial
Run-timing	Summer	Summer	Summer	Summer	Summer	Summer	Summer	Summer	Summer	Summer	Summer	Summer
Stream No.	111-15-030	111-16-040	111-17-010	111-33-010	111-41-005	111-50-010	111-50-069	112-15-062	112-19-010	112-21-005	112-21-006	112-42-025
Stream Name	Pack Creek	Swan Cove Creek	King Salmon River	Prospect Creek - Speel	Admiralty Creek	Peterson Ck Favor C	Fish Creek-Douglas I	Robinson Creek	Wilson River	Clear River - Kelp Bay	Ralphs Creek	Kadashan Creek
1982	950	350	500	500	450		1219	500	200	5,000	3,000	
1983	100		300	75	520		1466	3,200		8,000	6,000	
1984	1,000	2,100	4,150	800	5,100		3380	550	3,800	4,000	1,000	
1985	2,400	300	3,200		1,500	2675	6683	500	160	2,000	5,000	3,000
1986	700	1,000	4,750	500	1,000		2047	1,200	500	12,000	4,200	1,800
1987	1,000	200	2,000	200	500	1901	281	500	400	23,000		
1988	300	600	1,300	1,750	250	3366	609	350	350	25,000	100	7,600
1989			300	50	200	874	1187	400	500	1,000	3,000	1,000
1990	600	550	1,050	300	800	1980	1486	1,200	500	8,000	2,000	2,100
1991	200	100	1,300	200	200		2194	1,000		2,000		1,000
1992	600		1,300	400	200	760	1839	1,000	1,900	4,000	1,100	2,000
1993	800		1,000	400	500	32	639	1,800	6,000	3,500	4,000	3,500
1994	3,500	1,200	5,800	500	500	6766	3943	1,500	2,000	5,000	2,000	6,200
1995	800		2,200	600	200	3862	2941	400	2,200	8,000	10,800	3,600
1996	8,000	900	9,000		900	13050	6595	2,750	5,600	5,000	6,000	43,000
1997	6,500	200	3,400	321	50	1325	1890	4,000	500	12,000	7,000	3,500
1998	8,000	2,000	7,100	5,000	700	3675	849	1,000	3,100	3,000	6,000	3,000
1999	4,000	500	3,500	500		1700	1570	2,000	4,000	15,000	18,600	2,500
2000	2,600	625	4,110	2,250	300	9630	7915	1,350	5,700	3,600	7,400	10,800
2001	1,500	100	1,150	1,000	5,500	5940	815		2,000	5,500	6,500	700
2002	5,000	1,000	2,800	3,000	3,500	3230	146	4,750	3,100	3,000	9,000	19,000
2003	17,000	500	4,000	400	600	6400	1150	3,200	10,000			5,700
2004	12,500	1,000	5,000	1,100		2,528		1,000	3,000	3,000	5,600	10,000
Robust Estimate of Annual[a]												
Decline as percent of Year-Zero					0.7%		1.5%			3.4%		
Increase as percent of Year-Zero												
Level	24.4%	1.5%	7.6%	24.4%		6.8%		29.0%	33.3%		28.4%	12.0%

[a] Decline as a percent of year-zero level shows the annual size of a stock decline (or increase) relative to the size of the stock trend at the beginning of the series. (Blank cells denote lack of sufficient survey data.)

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Appendix 5A.1–(Page 5 of 7)

District	112	112	112	112	112	112	112	112	112	112	112	112
Area	Juneau	Juneau	Juneau	Juneau	Juneau	Juneau	Juneau	Juneau	Juneau	Juneau	Juneau	Juneau
Survey Type	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial
Run-timing	Summer	Summer	Summer	Summer	Summer	Summer	Summer	Summer	Summer	Summer	Summer	Summer
Stream No.	112-44-010	112-46-009	112-47-010	112-48-015	112-48-019	112-48-023	112-48-035	112-50-020	112-50-030	112-65-024	112-72-011	112-73-024
Stream Name	Saltery Bay Head	Seal Bay Head	Long Bay Head	Big Goose Creek	Little Goose Creek	West Bay Head Creek	Tenakee Inlet Head	Kennel Creek	Freshwater Creek	Greens Creek	Weir Creek N Arm Hood	Weir Creek S Arm Hood
1982		2,800	5,000	3,000	10	1,000	300	140	250		450	500
1983	12,300	7,700	12,000	14,100		2,000	4,000	500	600	500	700	500
1984	250	6,200	8,430	7,600		1,600	1,000	1,400	600	1,800	1,800	1,600
1985	400	5,000	7,000	10,050	100	15,300	1,900	2,000	2,000	4,000	5,000	2,500
1986	1,000	4,500	10,000	10,000	50	2,000	1,050	2,200	750	6,500	1,300	3,000
1987	300	1,000	1,000	1,300		1,000	1,100	450		1,750	630	1,800
1988	200	6,200	6,000	5,400	130	4,300	1,925	1,100	300	800	1,600	500
1989	500	1,000	1,200	2,100		1,800	1,300	500	300	500	700	400
1990	200	2,700	2,200	3,050	100	500	1,500	4,050	300	4,150	1,000	500
1991	1,000	5,500	3,200	5,000		2,000	2,000	2,050	100	200	1,000	200
1992	1,100	9,300	10,100	8,300	200	8,400	6,100	3,150	1,000	600	8,300	4,300
1993	1,050	7,000	7,100	19,700	1,000	10,500	9,200	8,900	1,650	1,000	7,700	2,200
1994	2,800	19,000	42,500	39,200	1,500	29,510	18,000	1,300	1,300	1,100	2,300	500
1995	2,000	7,000	10,000	22,000	500	7,900	13,000	4,200	6,000	900	650	1,500
1996	32,700	89,000	105,000	84,000	2,000	57,000	103,000	39,300	2,600	11,500	22,000	13,000
1997	3,500	5,700	19,900	9,400	1,400	15,000	11,000	7,000	500	2,000		4,900
1998	400	11,000	15,000	10,000	7,700	23,000	6,700	2,700		500	500	550
1999	1,100	20,000	28,000	21,000	2,150	32,000	15,000	3,300		1,200	13,000	6,000
2000	10,500	22,500	28,500	25,000	4,800	42,000	15,000	3,000		2,300	3,000	16,500
2001	4,150	5,000	2,275	2,935	1,000	5,200	10,000	5,000	1,000	1,500	3,900	3,600
2002	21,000	55,000	42,000	23,000	7,500	23,500	28,500	2,950	4,750	1,450	8,000	4,050
2003	700	7,600	4,000	1,100	5,000	5,000	12,000	1,000	500	3,000	500	500
2004	4,100	12,000	10,700	4,500	800	20,000	5,500	2,000	2,400	2,150	2,300	2,500
Robust Estimate of Annual[a]												
Decline as percent of Year-Zero Level										1.2%		
Increase as percent of Year-Zero Level	63.9%	94.7%	10.6%	3.4%	78.3%	69.2%	33.3%	6.2%	14.3%		4.7%	6.2%

[a] Decline as a percent of year-zero level shows the annual size of a stock decline (or increase) relative to the size of the stock trend at the beginning of the series. (Blank cells denote lack of sufficient survey data.)

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District	112	112	113	113	113	113	113	113	114	114	114	114
Area	Juneau	Juneau	Sitka	Sitka	Sitka	Sitka	Sitka	Sitka	Juneau	Juneau	Juneau	Juneau
Survey Type	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Foot	Aerial	Aerial	Aerial	Aerial	Aerial
Run-timing	Summer	Summer	Summer	Summer	Summer	Summer	Summer	Summer	Summer	Summer	Summer	Summer
Stream No.	112-80-028	112-90-014	113-22-015	113-32-005	113-53-003	113-72-005	113-73-003	113-81-011	114-23-070	114-25-010	114-27-030	114-31-013
Stream Name	Chaik Bay Creek	Whitewater Creek	Whale Bay Gr Arm Hd	W Crawfish NE Arm Hd	Saook Bay West Head	Sister Lake SE Head	Lake Stream Ford Arm	Black River	Mud Bay River	Homeshore Creek	Spasski Creek	Game Creek
1982	1,600	300	3,900	400	400	3,000		500	500		800	2,500
1983	2,000	2,550	2,500	500			2000	10,000	400	550	500	8,000
1984	6,900	3,000	1,500	30,000	1,500	41,500		17,000	220	600	3,250	12,200
1985	2,500	2,000	2,000	2,500	5,000	11,000	450	15,000			3,500	4,300
1986	8,300	2,000	5,500	18,000	1,000	3,500	400	3,000		515	2,300	3,900
1987	2,000	700	4,000	4,100	500	3,000	651	5,000	150		500	8,000
1988	6,500	1,800	6,500	3,500	3,500	5,000	1033	3,000	100	150	950	5,600
1989	2,000	2,000	1,300	500		4,000	1610	8,000		100	910	1,500
1990	1,500	1,700	4,000	3,000	3,500	11,000	959	2,500		300	2,500	2,000
1991	500		200	50	2,000	15,000	1456	1,000	200	600	1,500	2,300
1992	11,200	5,000	4,000	1,000	2,000	10,000	1140	500	50	700	3,000	3,000
1993	23,600	9,900	500	2,000		5,000	1559		2,000	1,100	3,700	11,900
1994	6,500	2,500	3,400	3,000	500	4,000	3000	1,000	300	2,200	4,600	3,400
1995	6,300	4,100	7,550	5,000	100	4,000	1416	300	300	4,000	3,200	4,800
1996	21,000	4,500	4,200	10,500	6,600	9,000	1271	1,000	1,100	1,050	9,700	35,100
1997	8,100	3,000	11,000	6,000	1,700	10,000	2955	20,000	1,000	200	4,500	9,000
1998	5,000	2,000	1,300	7,000	4,000	1,000	2631	2,400	200	400	4,200	4,000
1999	10,000	8,950	5,000	8,000		8,000	1697	9,000	3,500	500	2,000	7,000
2000	21,700	5,300	27,000	33,000	6,700	30,000	844	31,000	350	500	900	4,100
2001	12,000	1,700	18,300	8,900	9,500	1,000	5900	23,000	4,500	1,300	9,500	12,100
2002	10,750	1,500	1,000	3,500	5,500	5,000	1927	6,000	2,250	1,100	9,400	2,000
2003	3,800	3,700	5,000	2,300		2,000	6700	6,000		800	3,500	15,000
2004	13,000	4,200	10,100	13,000	3,500	5,000	1,560	30,000	3,100	2,200	4,000	5,000
Robust Estimate of Annual[a]												
Decline as percent of Year-Zero Level												
Increase as percent of Year-Zero Level	25.4%	8.6%	4.0%	7.6%	13.6%	0.0%	76.7%	4.9%	180.0%	16.9%	10.0%	1.5%

[a] Decline as a percent of year-zero level shows the annual size of a stock decline (or increase) relative to the size of the stock trend at the beginning of the series. (Blank cells denote lack of sufficient survey data.)

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Appendix 5A.1–(Page 7 of 7)

District	114	114	114	114	114	115	115	115	115	115
Area	Juneau	Juneau	Juneau	Juneau	Juneau	Juneau	Juneau	Juneau	Juneau	Juneau
Survey Type	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial	Aerial
Run-timing	Summer	Summer	Summer	Summer	Fall	Summer	Summer	Summer	Summer	Summer
Stream No.	114-32-004	114-33-023	114-34-010	114-40-035	114-80-020	115-10-042	115-10-046	115-10-080	115-20-010	115-20-052
Stream Name	Seagull Creek	Neka River	Humpback Creek	Trail River	Excursion River	St James Bay NW Side	St. James River	Endicott River	Berners River	Sawmill Crk - Berners R.
1982	220	2,500	2,300	370	1,640	400				4,580
1983	1,550	24,500	2,250	3,000	3,300	825	5,000			250
1984	2,400	10,550	4,000	1,650	7,750	800	60	500	800	2,500
1985	5,300	7,000	3,700	500	4,025	2,910	100		5,400	400
1986	500	12,500	4,500	400	9,150	700	360	210	1,070	600
1987	2,300	8,000	2,500	500	2,000	1,000		400	600	1,500
1988	600	4,000	550	2,500	3,700	1,900	492	2,563	406	800
1989	200	2,800	800	500	2,050	350		5,000	100	100
1990	110	11,000	1,500	200	5,100	750	150	4,600	500	1,150
1991	1,200	4,400	2,800	7,400	900	1,100		900		430
1992	1,200	9,700	4,400	400	2,700	600	200	2,550	220	450
1993	4,100	12,500	5,500	800	8,200	700	250	1,500	800	1,150
1994	1,700	9,300	6,300	300	4,300	600		800	4,000	3,050
1995	1,700	9,700	4,600		6,140	105			125	
1996	7,000	24,800	27,000	500	9,200	850	2,400	10,000	5,900	5,700
1997	7,800	9,500	5,600	1,400	34,400	300	200		770	1,000
1998	300	8,600	4,000	500	8,000	100		2,000	1,025	1,100
1999	3,000	20,000	6,500	8,000	10,000	50	510	1,900	780	
2000	1,250	29,000	7,400	4,000	17,000	550	72	200	250	2,979
2001	3,000	23,000	6,050	200	17,750		6,000	1,100	10,000	
2002	4,500	11,500	4,350	6,500	4,680	2,800	1,200	3,000	3,400	
2003	600	16,000	2,500	1,000	6,300		5,000	16,100		550
2004	800	7,400	2,500	1,300	5,200	1,800		2,400	1,950	1,000
Robust Estimate of Annual[a]										
Decline as percent of Year-Zero Level						3.3%				
Increase as percent of Year-Zero Level	7.5%	33.3%	11.1%	13.6%	14.1%		33.3%	1.4%	8.7%	2.1%

[a] Decline as a percent of year-zero level shows the annual size of a stock decline (or increase) relative to the size of the stock trend at the beginning of the series. (Blank cells denote lack of sufficient survey data.)