PINK SALMON STOCK STATUS AND ESCAPEMENT GOALS

IN SOUTHEAST ALASKA AND YAKUTAT

by

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ABSTRACT

Pink salmon stocks in Southeast Alaska appear to be at their highest abundance level since record keeping began in the late 1800s. At statehood the commercial harvest of pink salmon was near three million fish, but the commercial harvest has since risen to levels sometimes exceeding twenty times that amount. Five of the top 10 harvest levels in the 109-year harvest history have occurred in the last 10 years, including the highest harvest of 78 million fish in 1999, and the second highest harvest of 67 million fish in 2001. Escapements have similarly increased and escapement measures have all tended upwards over the entire history of the series, from 1960 to the present, although the sharpest increase began in the late 1970s.

The escapement goals for pink salmon in Southeast Alaska were previously presented on the basis of twelve management districts. We considered these previous goals to be *sustainable escapement goals*, under the definition of the Alaska Board of Fisheries' Escapement Goal Policy. We recommend new escapement goals, which we consider to be *biological escapement goals*. These new goals are established at the level of three sub-regions of Southeast Alaska, as the commercial harvest of these fish cannot be differentiated in the mixed-stock fisheries of Southeast Alaska to a scale finer than sub-region. We used a "tabular approach" to summarize 42 years of escapement and harvest information, and we examined yield as a function of escapement level, using a range of hypothesized expansions of escapement index to total escapement. This approach then provided a range of highest potential yields, which the revised biological escapement goals are based on. We also divided these goals into management targets for 12 fishing districts and 45 stock groups as an aid to management in reaching the new escapement goals, and also as an aid to the Board of Fisheries and the public in evaluating escapement distribution. Escapement goals for two streams in the Yakutat area have previously been established and we consider these to be *biological escapement goals.*

We did not identify any stock groups with biologically meaningful declines in escapement over the last 21 years. Of the 45 stock groups we examined, 42 showed clear increases in escapement over the last 21 years, and three stocks measured very small declines. The largest decline was less than 0.3% of the escapement level at the beginning of the series, which we interpreted as functionally stable. Similarly, though pink salmon production in the Yakutat area is much lower than in Southeast Alaska and there are few directed pink salmon fisheries in the area, escapement trends in two monitored Yakutat area systems indicate sustainable harvests and returns. There are no stocks of pink salmon in Southeast Alaska or the Yakutat area that can be considered stocks of concern, under the definition of the Board of Fisheries' Sustainable Salmon Fisheries Policy.

INTRODUCTION

Pink salmon (*Oncorhynchus gorbuscha)* spawn in approximately 2,500 short, coastal streams throughout the Southeast Alaska and Yakutat area (Figure 1). Pink salmon are harvested in the region primarily in commercial purse seine fisheries, and to a lesser extent by commercial drift gillnet, troll, and set gillnet (Yakutat area only) fisheries, as well as sport, personal use, and subsistence fisheries. The total annual exvessel value of the commercial pink salmon harvest in recent years has been near $20 – $30 million ($27 million in 2001). Almost all (>97%) of the pink salmon harvest in Southeast Alaska and Yakutat is of wild stock origin.

Commercial Fishery History

Commercial utilization of salmon in Southeast Alaska began in 1878 (Moser 1899). The first recorded commercial harvests of pink salmon were made in the early 1890s (Byerly et al 1999). Annual commercial harvests remained below 10-million pink salmon through 1906 (Appendix Table A.1). Harvests reached a peak of 60 million in 1941, gradually declined to a low of three million in 1960, and then increased to between 10- and 20-million fish through the mid-1960s. Annual harvests declined again to three million fish in 1967 and remained at low levels until the late 1970s. Harvests have risen tremendously since then, reaching nearly 60 million in 1989, and fluctuating between 20 million and a historical high of 78 million fish (1999) since 1990.

Fish traps were the dominant gear used to harvest pink salmon from the early 1900s through statehood in 1959. Use of fish traps was prohibited at statehood, with the exception of several that were operated annually on the Annette Island Fishery Reserve until 1993. Net fisheries had grown in importance by the mid-1900s and became the dominant harvester of pink salmon after statehood.

Federal regulation of commercial fisheries was lax in the early 1900s. Crutchfield and Pontecorvo (1969) describe early regulation as “indicative of congressional intent rather than operational programs.” They note that in 1896 “funds were provided for one inspector and an assistant” to monitor fisheries in the region. Alexandersdottir (1987) notes that concern with falling harvests in the late 1910s and early 1920s led to implementation of the White Act in 1924. The regulation mandated that half of the run be allowed to escape the fishery, and was in force until the state assumed management from the federal government. Under the Act, between 1924 and 1945, fisheries operated prior to around mid-July and then were closed to allow for escapement (Thorsteinson 1950). Alexandersdottir (1987) concludes that this resulted in over-exploitation of early runs, a shift in the temporal run timing pattern, and depressed pink salmon production throughout the region.

Low returns of pink salmon in the early to mid-1970s caused the Alaska Department of Fish and Game (ADF&G) to severely curtail the purse seine fishery for several years to rebuild runs. As a result of chronic weakness of early run stocks to several inside areas of northern Southeast Alaska, the department modified its management strategy in the Icy Strait/northern Chatham Strait area. When improved returns developed in the late 1970s, harvest opportunities were moved from the Cross Sound area to more inside waters of eastern Icy Strait and northern Chatham Strait and fishing opportunities were limited early in the season until managers could assess returns of early run stocks (Ingledue 1989).

Present-day management of pink salmon stocks in Southeast Alaska is accomplished through extensive monitoring of fishing effort, harvests, and developing escapements. Preseason and inseason forecasts of abundance are developed and catch, effort, and sex ratios of commercial and test fishery harvest data are tracked, and aerial surveys are flown extensively throughout the region to monitor escapements (ADF&G 2002).

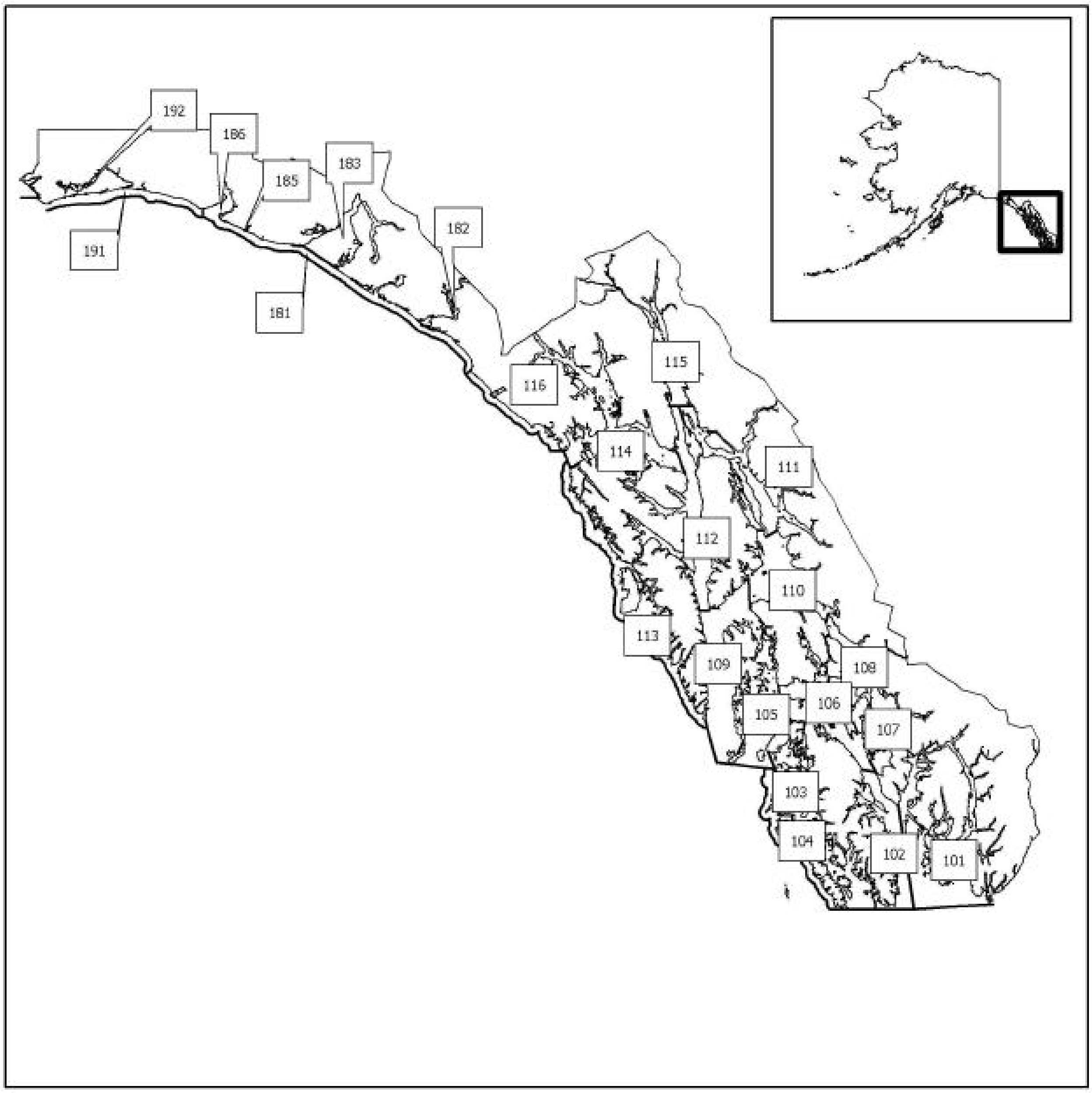

Figure 1. Map of Southeast Alaska and the Yakutat area, showing the management districts.

Escapement Monitoring Program

In Southeast Alaska, ADF&G maintains an annual index of escapement (or size of the spawning populations) that covers the period from 1960 to present. The index is based on a standardized set of 718 streams that are observed at intervals during the salmon migration and spawning period (Van Alen 2000). Observers fly a series of surveys over the course of a season, and their observations are statistically adjusted so the estimates of the number of fish are comparable among observers and comparable with historical observations. The observations, collected throughout the season, are visual counts of fish adjusted to the level of the senior manager in the 1995 base year, and we refer to these as the *adjusted counts*. The largest count for the year is then retained for each stream in the survey and termed the *peak-adjusted count* for each stream. The index for each stock group is made up of the peak-adjusted counts summed over this standard set of index streams for a particular area.

The methods of calculating the escapement index have changed over the years, and, the term "index escapement" has been applied to several different statistical series. Recently ADF&G has applied the term "index escapement," to two different series that differ by a factor of 2.5. The 2.5 multiplier was originally intended to convert peak escapement counts to an estimate of what was actually present at the time of the survey (Hofmeister 1990). Dangle and Jones (1988) showed that aerial observers usually see an average of about 40 to 50% of the actual fish present – although this relationship is highly dependent on the run size (Jones et al. 1998). Jones et al. (1998) state that "Peak aerial counts ... are summed as the total escapement index for individual management districts. A multiplier of 2.5 expands this index to an estimate of the district's total escapement." In reality, there is no simple way to convert the index series to an estimate of total escapement, and escapement indices are less than total escapements (Hofmeister 1990). The streams that are surveyed make up about one-third of the pink salmon producing streams (Jones et al. 1998). Another important factor to consider in relating total run size to index series of escapement is the relationship between the total fish that spawn and die and the number of fish that are present in the creek at the time of the "peak observation" (Bue et al. 1998). This factor has not been well studied for systems in Southeast Alaska. Based on the hypothetical modeling of Quinn and Gates (1997), the peak count might be expected to represent something on the order of one-tenth of the total spawning stock size – and be highly variable. Although this ratio would not be expected to be similar from year to year, it would be highly dependent on the number of fish in the escapement. Unpublished ADF&G data have shown that ratio to be much smaller and quite variable at Traitors Creek, where the average conversion of peak aerial survey estimate to *total* escapement was 1.9 (range 0.7 to 4.9; $n = 7$).

We previously mentioned that there are 718 *index streams* in Southeast Alaska (selected from over 2,500 known pink salmon spawning streams in the region). Each of these was designated as an index stream if it was surveyed a minimum of seven different years during the 1986 through 1997 period. The index streams are not simply the largest streams in the area; all stream sizes are represented (Table 1) based on peak counts, although stream size in the index set does not necessarily match the distribution of stream size within the entire region.

Area management biologists and their assistants estimate pink salmon spawning stock size by visual observation during aerial surveys, at intervals, during the entire migration period. These surveys are predominately done using small, fixed wing aircraft, usually a Piper Supercub[2], as this aircraft can fly at slower speeds and observers have excellent visibility on either side. The air speed during surveys is kept at about 90 to 150 $km \cdot hr^{-1}$ at an altitude of 100 to 200 m.

2 Product names used in this publication are included for scientific completeness but do not constitute product endorsement.

For each survey, and for each stream, fish counts are divided into four categories: mouth, intertidal, stream live, and stream dead. Mouth counts normally consist of fish in saltwater that are in proximity to the stream being surveyed. Intertidal counts include fish in the area from low tide to the approximate high tide mark. Stream counts normally include any fish above the high-tide mark.

Table 1. Pink salmon escapement index stream distribution by group size based on 1960–2001 average of “peak count” by stream.

Escapement Index Group Size	Number of Streams
< 500	21
510 - 2,499	173
2,500 - 4,999	141
5,000 - 9,999	161
10,000 - 24,999	140
25,000 - 100,000	77
> 100,000	5
Total Streams	**718**

Since 1997, each survey has also been qualified based on visibility and timing, and categorized into one of three groups: 1) not useful for indexing or estimating escapement; 2) potentially useful for indexing or estimating escapement; 3) potentially useful as a peak escapement count. This grouping is used later in the estimation process to filter out inadequate surveys from the pool of survey observations.

The individual “raw survey” counts are entered into the ADF&G Southeast Alaska Integrated Fisheries Database (IFDB).

Pink salmon production in the Yakutat area is much lower than in Southeast Alaska. Pink salmon escapements have been recorded in the department’s database for 20 Yakutat area streams since 1961. However, only two systems have been consistently monitored. These streams, the Situk River and Humpy Creek, are two of the more substantial producers in the area and each supports a terminal set gillnet fishery, though the Situk fishery targets other species and the Humpy Creek fishery has not been active in recent years. Escapements in the Situk River have been assessed with aerial and boat surveys and with a weir, although there is some spawning that occurs downstream from the weir. Escapements into Humpy Creek have been assessed by foot, boat, and aerial surveys, although these assessments have been limited in the late 1990s.

“Bias Adjusting” Raw Surveys in Southeast Alaska

Individual observers track absolute abundance within the streams, but each observer tends to count at his or her own rate or bias (Dangel and Jones 1988; Jones 1995; Jones et al. 1998; Bue et al. 1998). Beginning in 1995, raw stream survey counts were standardized to remove as much “observer bias” as possible – not by removing bias, but rather by adjusting all observer counts within a management area to the same bias level. Each observer’s counts are converted to the counting rate of a major observer (typically the current area management biologist). The major observer’s rate is set at 1.0.

1) We identified every instance where one observer and the major observer from the same management area surveyed the same stream within three days of one another. Each paired observation was expressed as a ratio of the count of the one observer to the count for the major observer.
2) The median of the ratios of all such paired observations was used to generate a “bias adjustment” for each observer.
3) Surveys by all observers were then multiplied by their bias adjustment.

These observer calibrations have not been updated for several years, but in the future they will be updated annually, once a statistically stable method has been developed to combine annual estimates with the historical measurements each observer has for his or her entire career.

The actual process of generating the estimates requires some subjective judgment. The principal research biologist in charge of this index retrieves the counts from the IFDB database and chooses which of the different data types and which of the observations over time to use for the peak count, for each stream. “Mouth-only” counts are usually eliminated from consideration as previous studies indicated that pink salmon mill about and frequently spawn in streams in the area but not necessarily closest to the stream mouth where they were first observed (Jones and Thomason 1984). There are a few streams where “mouth-only” counts are accepted, as the stream canopy cover is too dense to allow in-stream counts later in the season. The analyst considers the entire series of counts for each stream through the season. For example, if the analyst sees evidence that a large school entered a stream, but then backed out and moved elsewhere, the count of the fish that moved is excluded from consideration for the peak. Or if the peak in-river count appears to have been missed because of poor weather, the analyst may make some adjustments. Prior to final tabulation, all peak counts by stream are reviewed by the area management biologists for obvious errors in data entry.

The final observer-calibrated peak count (or adjusted peak count) is stored in the regional database, and is used as the primary datum on pink salmon abundance for each index stream. These adjusted peak counts are then assembled into the overall escapement index, as mentioned above, by summing the peak counts for all index streams in the stock group.

Adjustments for Missing Surveys in Southeast Alaska

If a particular index stream is missing escapement counts for any given year, an iterative EM algorithm (McLachlan and Krishnan 1997) is used to interpolate a peak count. Missing counts are interpolated by assuming that the expected count for a given year is equal to the sum of all counts for that stream, divided by the sum of all counts over all years for all the streams in the unit (i.e., row total times column total divided by grand total). This assumes a multiplicative relation between yearly count and unit count, with no interaction.

Definitions of Pink Salmon Stock Groups in Southeast Alaska

In 1997, the Southeast Alaska index streams were divided into 45 management “stock groups” (in the sense of Ricker 1975: “The part of a fish population which is under consideration from the point of view of actual or potential utilization”). Stock groups were created by managers to correspond to spawning aggregations they actively managed. Stock groups are organized into four management areas (Juneau, Petersburg, Sitka, and Ketchikan) that correspond to department area offices in charge of managing commercial fisheries on these stocks. The management areas are shown in Appendix Figure A.1. Stock group boundaries within each management area are shown in Appendix Figures A.2–A.5. There are an additional seven stock group areas in Southeast Alaska that complete the regional division. These areas are Annette and Suemez-Dall (Ketchikan area), SW Baranof, W Kruz, and W Yakobi (Sitka area), and Dundas Bay and Glacier Bay (Juneau area). These seven areas are indicated (diagonal hatching) in Appendix Figures A.2–A.5 but do not have index streams or associated escapement targets. The Annette area is managed exclusively by the Metlakatla Indian Community as a reservation. The state has no jurisdiction in this area. The other six areas each have a few small pink salmon streams with very little production, it would be cost prohibitive to survey these outlying areas on a regular basis, and there are no directed fisheries on stocks from these specific areas. Even so, the streams in these six areas are surveyed occasionally. These escapement observations are available in the IFDB database, although we have not used them in our analysis.

Harvest Estimation

Commercial harvests are recorded on legal documents called *fish tickets*. A fish ticket is made for each salmon landing. The total weight of the harvest is recorded and serves as the basis of payment on the part of the processor to the fishers. The fish ticket also captures both temporal and spatial information about the harvest, as well as information about the vessel making the harvest and sale. Harvests in units of total weight are converted into units of fish numbers by the processors, based on their own individual methods of determining the average weight of individual fish. Fish tickets are required by regulation to be delivered to the ADF&G within seven days of initial record. Information from these tickets are reviewed for obvious errors by a member of the management staff and then entered into the electronic ADF&G Fish Ticket Database System. Harvest data from 1960 to present is contained within the database. This system has automated error checking that flags obvious inconsistencies. The estimated total weight and the estimated total number of commercially harvested salmon are then available to individual biologists in various time and spatial summaries.

ESCAPEMENT GOALS

History of Escapement Goals

Escapement goals for two pink salmon streams in the Yakutat area were established in the last decade. Pink salmon escapement goals for the remainder of the Southeast Alaska area were originally established in the early 1970s and have subsequently been modified several times.

Yakutat Area Escapement Goals

Clark (1995) used Ricker-type stock recruit analyses to establish escapement goals for pink salmon in the Situk River and Humpy Creak in the Yakutat area. He compared weir counts to peak aerial and boat counts in the Situk River, and assumed a three-fold conversion factor to scale peak counts to the total escapement. He used a model-based approach to apportion the harvest in the Yakutat Bay set gillnet fishery to stock of origin, using relative abundance of inshore returns of the two stocks. Based on this analysis, he recommended the biological escapement goal ranges presented in Table 2.

Table 2. Recommended pink salmon biological escapement goal ranges for the Situk River and Humpy Creek in the Yakutat area.

Stock	Goal	(Range)	Survey Type
Situk River (even-year)	22,000	(14,000-35,000)	Peak Aerial or Boat
Situk River (even-year)	66,000	(42,000-105,000)	Weir
Situk River (odd-year)	30,000	(18,000-67,000)	Peak Aerial or Boat
Situk River (odd-year)	90,000	(54,000-200,000)	Weir
Humpy Creek (even-year)	5,700	(3,300-8,000)	Peak Aerial or Foot
Humpy Creek (odd-year)	12,000	(7,000-18,000)	Peak Aerial or Foot

Southeast Alaska Escapement Goals

Although escapement indices were calculated starting in 1960, escapement-index goals were first set in 1970 (Valentine et al. 1970). The harvest originating from each stock group, or from any specific area in Southeast Alaska, could not be estimated because of uncertainties in the number of fish intercepted outside of their home districts or areas. Goals were developed for two sub-regions, Northern (NSE) and Southern (SSE), because tagging studies documented different migration routes for pink salmon stocks destined for the northern and southern areas (Nakatani et al. 1975). This differential migration routing was later verified by further marine tagging studies in the early 1980s by Hoffman et al. (1984). Southern Southeast is made up of Districts 101 through 108 and northern Southeast is made up of Districts 109 through 115. In 1998, the Northern index was further divided into Northern Inside (NSEI) and Northern Outside (NSEO). The Northern Outside area includes all waters of District 113, except Subdistricts 113-51 through 113-59 (Peril Straits and Hoonah Sound).

The first index goals were five million for SSE and three million for NSE. The goals were not the result of a formal statistical analysis, but rather from observations that in southern Southeast escapement indices of less than four million had produced fair to poor returns, and escapements in excess of four million generally produced good returns. In addition, a SSE escapement index that exceeded five million resulted in the largest return in many years. The pattern of returns from NSE was more variable than SSE and the index goal was set at three million. In 1971, the SSE index goal was raised from five to six million and the NSE goal was raised from three to four million (Durley and Seibel 1972).

The SSE and NSE goals were adjusted upward in later years based on an analysis of the harvest and index of escapement. The SSE index goal became a range of six to nine million, and the NSE index goal became a range of 3.9 to 5.7 million.

Goals were most recently expressed in terms of districts. The SSE goal was divided into individual goals for each of Districts 101–107, and the NSE goal was divided into individual goals for each of Districts 109–114 (Table 3).

Table 3. Previous sustainable escapement goals for pink salmon, in units of escapement index (the sum of the peak, bias-adjusted, aerial observations in streams in the index sample, in millions), for Southeast Alaska, by district and sub-region.

District	Lower Goal	Upper Goal
101	2.00	3.00
102	0.60	1.10
103	1.70	2.55
104	No Escapement Goal	
105	0.50	0.65
106	0.60	0.85
107	0.60	0.85
108	No Escapement Goal	
SSE Total	6.00	9.00
109	0.50	0.70
110	0.80	1.20
111	0.40	0.60
112	0.50	0.70
113 Inside	0.49	0.74
114	0.40	0.60
115	No Escapement Goal	
NSE Inside Total	3.09	4.54
113 Outside	0.81	1.16
NSE Outside Total	0.81	1.16
NSE Total	3.90	5.70
SE Total	9.90	14.70

Revision of Escapement Goals

In Alaska, escapement goals are frequently developed using Ricker analysis (Hilborn and Walters 1992; Quinn and Deriso 1999). This approach is based on the premise that an analyst can, on a brood year basis, develop a reliable statistical relationship between the breeding stock size and the subsequent adult production that resulted from that breeding stock. This statistical relationship is then used to forecast the level of harvest associated with each breeding stock size. The stock size with the forecast for the largest average sustainable harvest is then recommended as the biological escapement goal, as it is referred to in the Alaska Board of Fisheries' Escapement Goal Policy. In the case of Southeast Alaskan pink salmon, total escapement cannot be accurately estimated. The index escapement measures that are available represent an unknown and random fraction of the total escapement. For this reason, a Ricker analysis is not possible without making some unproven and possibly ill-advised assumptions. Hilborn and Walters (1992) suggest what they call a rough and ready "tabular method" for setting escapement goals when the form of the stock-recruit relationship is not known, and when there might be errors that would complicate traditional statistical approaches. They do caution that this approach requires large sample sizes, which we have. In essence, their approach is to graphically look at potential yield in several escapement categories. We simply used several “cases” to look at these potential yields under several assumptions about the relationship between the escapement index and actual total escapement.

We implemented this approach in five steps. First, the catch and escapement index values were organized into the three sub-regions: Northern Southeast Outside, Northern Southeast Inside, and Southern Southeast. Next, within each sub-region the data was partitioned into a variable number of escapement intervals that were not mutually exclusive – that is an observation could fall into two different categories. Next, the escapement index values were multiplied by a factor of 1.0, 2.5, 5.0, 7.5, and 10.0 to expand the index to an estimate of total escapement and create the five cases. We added the estimated total escapement to the catch to represent a presumption of what the total return might have been. Finally, potential yield was calculated as the return (catch plus expanded escapement) minus the brood year escapement that produced that return. In each sub-region, the different cases were remarkably similar in the escapement index categories that produced the highest potential yields (Figure 2; Appendix Tables A.2 and A.3).

Based on a visual analysis of Figure 2, we recommend a biological escapement goal of four to nine index spawners (millions of summed peak counts) in the Southern Southeast sub-region, 2.5 to 5.5 in the Northern Inside sub-region, and 0.75 to 1.75 in the Northern Outside sub-region.

The revised goals are intended for analysis and management at the sub-region level only. We calculated the allocation of these sub-region goals to the 12 districts that had previous goals (Table 4). However, the district allocations will be used as “management target ranges” to assist in meeting the sub-region goals.

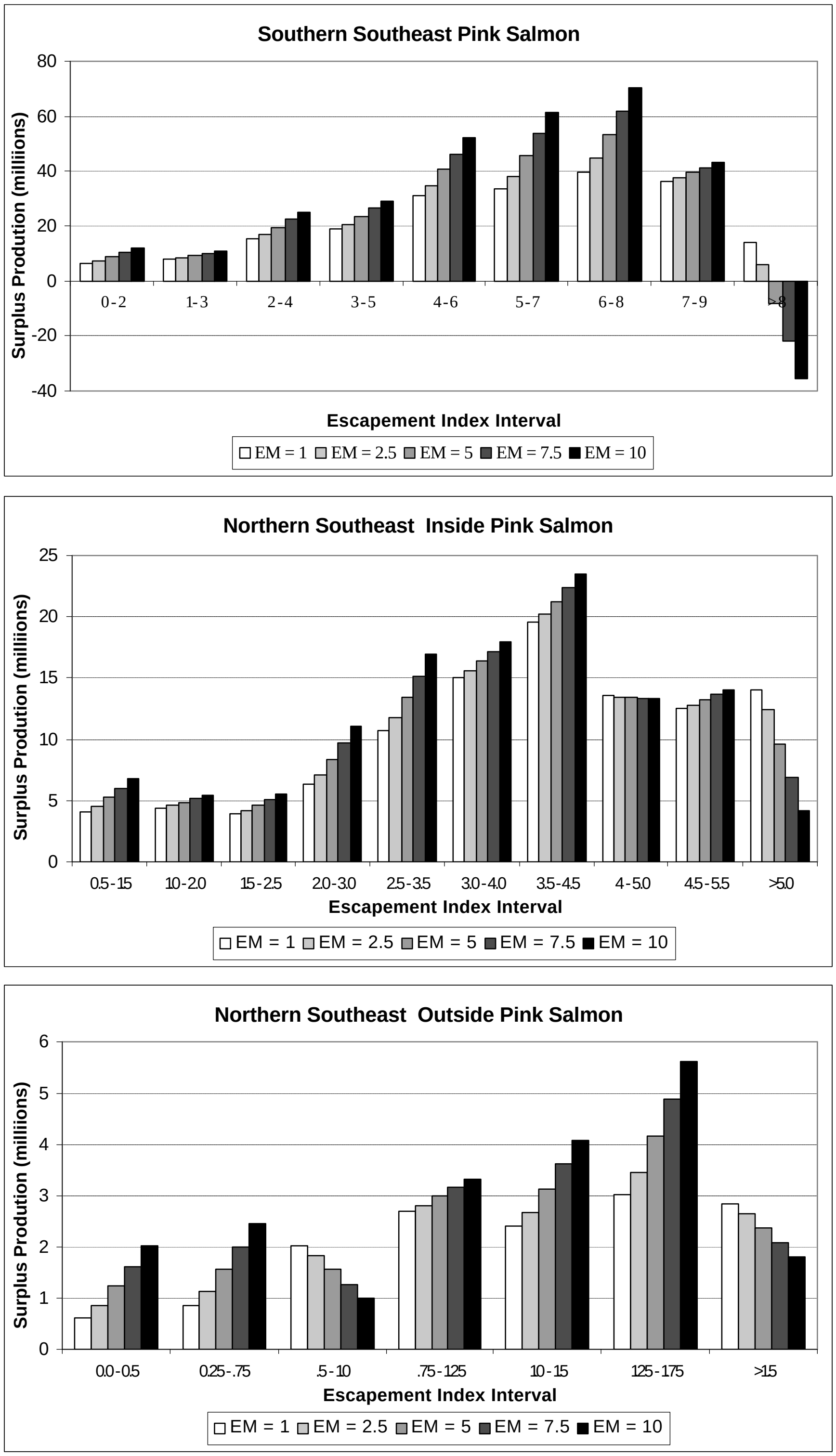

Figure 2. Surplus production (potential harvest) in five cases, as a function of index escapement, for the three sub-regions of Southeast Alaska. The five cases represent the amount the escapement index value was expanded to represent total escapement. The "EM" value is the value between 1 and 10 of the assumed expansion.

Table 4. Management target ranges by district, in units of escapement index (the sum of the peak, bias-adjusted, aerial observations in streams in the index sample, in millions), for Southeast Alaska pink salmon.

District	Lower Target	Upper Target
101	1.33	3.00
102	0.40	1.10
103	1.13	2.55
104	No Escapement Target	
105	0.33	0.65
106	0.40	0.85
107	0.40	0.85
108	No Escapement Target	
SSE Total	4.00	9.00
109	0.40	0.85
110	0.65	1.45
111	0.32	0.73
112	0.40	0.85
113 Inside	0.40	0.90
114	0.32	0.73
115	No Escapement Target	
NSE Inside Total	2.50	5.50
113 Outside	0.75	1.75
NSE Outside Total	0.75	1.75
NSE Total	3.25	7.25
SE Total	7.25	16.25

We then reformatted the revised district-wide escapement targets, and we have now expressed them on the basis of the 45 stock groups (Table 5). These stock-group target ranges are more meaningful because they represent managed units of production. To reformat the district-specific escapement targets to stock group targets we calculated the 40-year median index escapement in each area that corresponds to a specific stock group. We then converted these medians to a percent of the district-total management target. The district's escapement target was then partitioned out to each stock group based on each stock group's percent of the total of the 40-year medians. Although these management targets represent a finer scale resolution of the district targets, when pooled together either on a district-wide basis or on a sub-regionwide basis they do not differ. Again, to be clear, we consider our recommended escapement goals by sub-region (the sub-district totals in Table 4) to be *biological escapement goals*, and we consider our recommended escapement targets, by district and by stock group (Tables 4 and 5), to be an aid to management in achieving these sub-region goals. In other words, we do not consider the district or stock-group management targets to be escapement goals, under the definition of the Statewide Salmon Escapement Goal Policy (5 AAC 39.223) .

Table 5. Recommended pink salmon management targets for Southeast Alaska, by stock group, in relation to district and the sub-region biological escapement goals, with redistribution based on 1960–2001 median count for each group in units of escapement index (the sum of the peak aerial observations in streams in the index sample, in millions).

Sub-region	District	Stockgroup	Median[a] (60-01)	Percent of District[b]	Lower Target	Upper Target
SSE	101	Portland	197,995	12.4%	0.17	0.37
SSE	101	E Behm	1,003,782	62.9%	0.84	1.89
SSE	101	W Behm	394,896	24.7%	0.33	0.74
SSE	102	Moira	78,202	15.4%	0.06	0.17
SSE	102	Kasaan	427,988	84.6%	0.34	0.93
SSE	103	E Dall	190,985	14.3%	0.16	0.36
SSE	103	Hetta	356,054	26.7%	0.30	0.68
SSE	103	Klawock	614,668	46.0%	0.52	1.17
SSE	103	Sea Otter Sound	173,780	13.0%	0.15	0.33
SSE	105	Shipley Bay	72,269	41.2%	0.14	0.27
SSE	105	Affleck Canal	103,293	58.8%	0.20	0.38
SSE	106	Burnett	45,556	24.1%	0.10	0.20
SSE	106	Ratz Harbor	46,501	24.6%	0.10	0.21
SSE	106	Totem Bay	34,418	18.2%	0.07	0.15
SSE	106	Whale Pass	62,514	33.1%	0.13	0.28
SSE	107	Union Bay	61,063	19.7%	0.08	0.17
SSE	107	Anan	248,680	80.3%	0.32	0.68
SSE	108	Stikine	14,639	No Escapement Target		
NSEI	109	SE Baranof	46,050	12.5%	0.05	0.11
NSEI	109	E Baranof	60,995	16.5%	0.07	0.14
NSEI	109	Tebenkof	119,521	32.4%	0.13	0.27
NSEI	109	Saginaw Bay	66,570	18.0%	0.07	0.15
NSEI	109	Eliza Harbor	76,285	20.6%	0.08	0.18
NSEI	110	Portage Bay	16,329	5.6%	0.04	0.08
NSEI	110	Farragut Bay	5,661	2.0%	0.01	0.03
NSEI	110	Houghton	177,603	61.2%	0.40	0.89
NSEI	110	Pybus/Gambier	90,384	31.2%	0.20	0.45
NSEI	111	Seymour Canal	139,528	56.3%	0.18	0.41
NSEI	111	Stephens	108,201	43.7%	0.14	0.32
NSEI	112	SW Admiralty	113,635	19.8%	0.08	0.17
NSEI	112	W Admiralty	55,286	9.7%	0.04	0.08
NSEI	112	Tenakee	250,237	43.7%	0.18	0.37
NSEI	112	Freshwater Bay	87,700	15.3%	0.06	0.13
NSEI	112	Kelp Bay	37,446	6.5%	0.03	0.06
NSEI	112	Lynn Canal[c]	28,393	5.0%	0.02	0.04
NSEI	113	Hoonah Sound	216,374	100.0%	0.40	0.90
NSEO	113	Whale Bay	24,272	7.0%	0.05	0.12
NSEO	113	W Crawfish	6,909	2.0%	0.01	0.03
NSEO	113	Sitka Sound	98,759	28.5%	0.21	0.50
NSEO	113	Salisbury Sound	71,685	20.7%	0.16	0.36
NSEO	113	Slocum Arm	94,743	27.3%	0.21	0.48
NSEO	113	Portlock	15,781	4.6%	0.03	0.08
NSEO	113	Lisianski	34,329	9.9%	0.07	0.17
NSEI	114	Homeshore	22,709	14.2%	0.05	0.10
NSEI	114	N Chichagof	136,691	85.8%	0.28	0.62
NSEI	115	Lynn Canal[b]	28,637	No Escapement Target		

[a] The column labeled "Median (60-01)" provides the median escapement index value for years between 1960 and 2001.

[b] The column labeled "Percent of District" denotes the percent each stock group contributes to the sum of all stock group medians, for each specific district. Except for Hoonah Sound that is the only NSEI stock group in District 113.

[c] Lynn Canal stock group consists of streams in both Districts 112 and 115. This table breaks them out by district but District 115 streams in the Lynn Canal stock group have no escapement goal.

STOCK STATUS

Pink salmon runs in Southeast Alaska appear to be at their highest level since harvest and escapement records of the runs began. Pink salmon production in the Yakutat area is much more limited but pink salmon runs and harvests in this area appear to be sustainable as well.

Stock Status of Pink Salmon in the Yakutat Area

Clark (1995) estimated both odd- and even-year escapement levels that he expected to produce maximum sustainable yield for the two principal pink salmon stocks in the Yakutat area. He concluded that escapements into the Situk River and into Humpy Creek were generally above the level needed for sustained yield. Specifically, he stated, “Review of the past escapement surveys for pink salmon in the Situk River and in Humpy Creek reveal that 52% of annual escapements have exceeded the escapement ranges predicted to provide 90% or more of MSY (29 of 56 cases).” Clark recommended an escapement through the Situk River weir of 66,000 in even-numbered years, and 90,000 in odd-numbered years (Table 2). Since the time of that recommendation the pink salmon escapement during even-numbered years has been measured at 157,000, 97,000, 332,000, and 99,000, and during odd-numbered years measured at 466,000, 27,000, and 121,000 fish (Appendix Table A.4). Clark also made recommendations for Humpy Creek, but because of very low exploitation, Humpy Creek escapement has not been consistently monitored since the mid-1990s. Due to the very low commercial fishing effort and generally non-directed nature of harvests in the Yakutat area, we have not examined trends in the Yakutat commercial fishery harvests. Based on the information we have about pink salmon escapement in the Yakutat area, it appears escapements have been far above levels needed to sustain these runs.

Stock Status of Pink Salmon in Southeast Alaska

Unlike the Yakutat area, large, regionwide fisheries target pink salmon in Southeast Alaska. We therefore provide analyses of harvest trends for this area, as well as trends in escapement.

Analysis of Escapement Trends in Southeast Alaska

For all of Southeast Alaska, eight of the top 10 index escapements have occurred within the last 10 years (Figure 3). In over 100 years of commercial exploitation, the pink salmon harvests in Southeast Alaska are recently at the highest levels observed, yet the number of fish escaping the fishery to breed is also at very high levels — at the highest level since statehood, when records began.

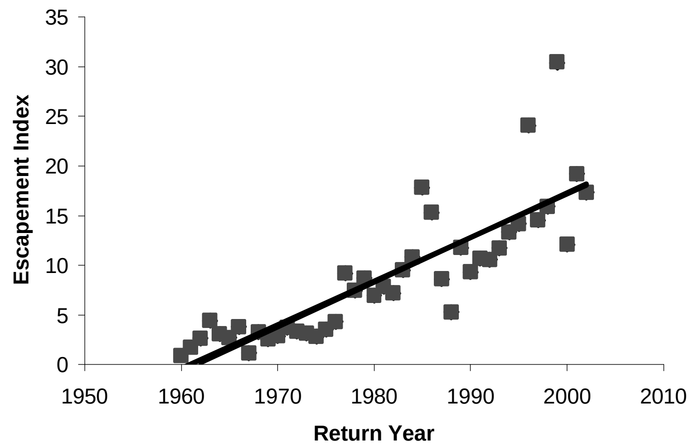

Figure 3. Overall index of pink salmon escapement for all of Southeast Alaska since statehood (*y* axis), plotted by return year (*x* axis). The index is not total spawning stock size; it is the sum of the observed peak abundance (in millions of fish), in a set of index streams that are observed over a series of years.

A 1996 American Fisheries Society sponsored study of salmon stocks at risk found the size of breeding populations of both odd- and even-year lines of pink salmon to be increasing or stable in over 96% of the spawning aggregations they examined in Southeast Alaska (Baker et al. 1996). Van Alen (2000) examined escapement trends on the level of individual streams from 1960 to 1996. He also noted a general upward trend in pink salmon abundance, harvest, and escapement, and noted only one of the 652 streams he examined had a “significant downward trend,” although he was referring to statistical, rather than biological, significance.

Although odd- and even-year lines of pink salmon are genetically isolated (Gharrett and Smoker 1990) and biologically separate populations, data from both lines were pooled for our analysis of escapement trends because they are managed as if they were a single population. Escapement goals in Southeast Alaska are the same for both brood lines, although the goals for the Yakutat area are specific for each line. Looking at the entire 42-year series for the Southeast Alaska systems, the escapement index shows a general upward trend in every case (Figures 4 to 7), when plotted on a stock group basis.

Since 1990, the escapement index has been larger than the lower end of the current escapement goal in approximately 75% of the available cases, when escapements are examined on a district-specific basis. The district escapement indices were greater than the midpoint of the target range approximately 60% of the time. In general, when escapement targets were not reached, they were missed by proportionately small amounts. The years 1991, 1992, and 2000 were the years with the most missed management targets, although all targets were met in 1999 and 2001. In 1999 and 2001, district-specific escapement indices were generally above the upper end of the management target range.

Geiger and Zhang (2002) recommend using 21 years of escapement index values for analysis of escapement trends for pink salmon when both brood lines are pooled. They note that marine environment changes on an inter-decadal scale, and they suggest 15 or 21 years provides some balance between sample size needs and a comparison of escapement under similar conditions. We combined both odd and even years into a 21-year series for this purpose. We then regressed escapement on time using a resistant regression line, based on medians. The back-cast estimate of what the escapement was in year zero of the series (22 years into the past) is a nonparametric escapement benchmark called the *year-zero reference point*. We would conclude that an escapement decline was biologically meaningful when the estimated underlying annual decline was more than 3% of the year-zero escapement, based on the recommendation of Geiger and Zhang. Using this method of reviewing escapement trends, 42 of the 45 stock groups showed an upward trend in annual escapement over the 21-year series, and no stocks showed a meaningful decline (Appendix Tables A.5–A.8). We were unable to estimate this reference point for five stocks because of a very steep, nonlinear, increase in escapement level over the 21-year series. Only three stocks indicated any decline in escapement at all; the largest estimated decline was less that 0.3% of the year-zero escapement. We consider this level of decline to be equivalent to stock stability.

Taken as a whole, the trend in the escapement index was increasing, with an estimated increase of nearly 7% of the underlying escapement level from the reference year (1980), over the entire 21-year series. If this index were accurately tracking total annual escapement, a sustained 7% increase over 21 years would equate to an underlying escapement level in the present of approximately 250% of the level of escapements 21 years ago. However, there is not a linear relationship between total escapement and the escapement index; small changes at low escapements produce relatively larger changes in the escapement index, and small changes at very high escapement levels produce proportionally very small increases in the index (Jones et al. 1998). In other words, current escapement levels, overall, are probably much higher than 250% of the escapement levels 21 years ago.

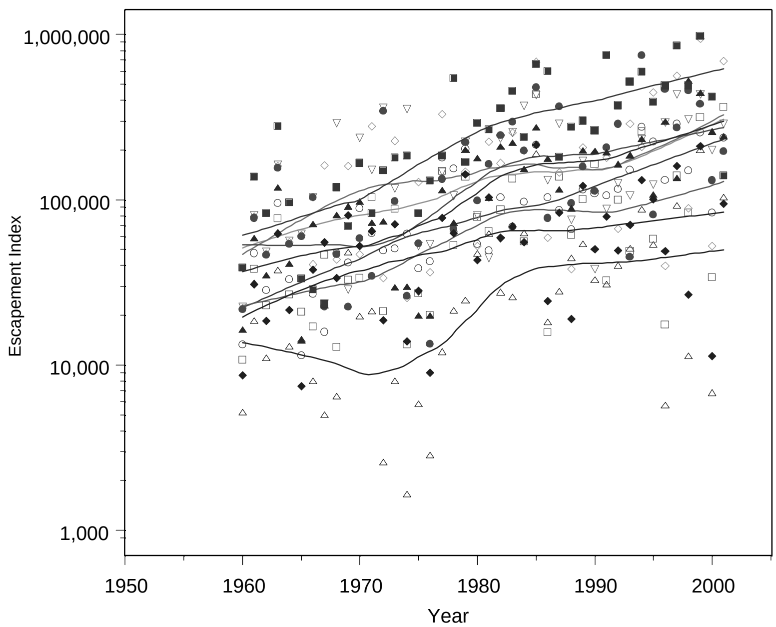

Figure 4. Pink salmon escapement indices for stock groups in the Juneau management area in northern Southeast Alaska. The *y*-axis is an escapement index, expressed on a logarithmic scale, based on first adjusting a series of observers to a standard level, choosing the largest count for the year, and then summing these "peak observations" across a series of standard index streams by stock group. The magnitude of the index is not the total escapement. The index gives the sum of the manager's visual impression of the number of fish present in the index streams, near the peak of spawning activity. The curves are a nonparametric loess smooth through the data. Only the Lynn Canal stock group (open boxes) did not show an upward trend over the most recent 21 years. The Freshwater Bay stock group (open diamonds) showed the largest increase in trend over the most recent 21 years. All stock groups show a general upward trend over the entire series.

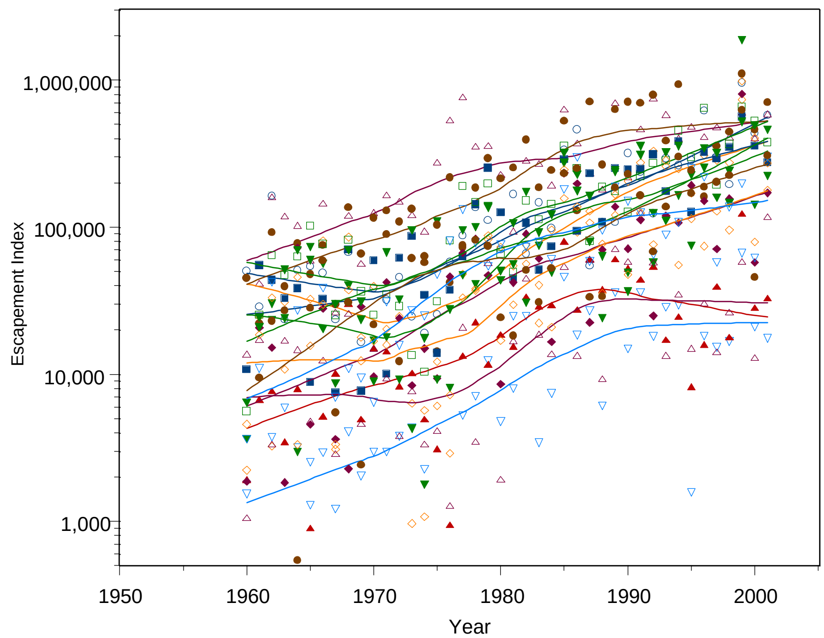

Figure 5. Pink salmon escapement indices for the stock groups in the Petersburg management area in northern and southern Southeast Alaska. The *y*-axis is an escapement index, expressed on a logarithmic scale, based on first adjusting a series of observers to a standard level, choosing the largest count for the year, and then summing these "peak observation," across a series of standard index streams by stock group. The magnitude of the index is not the total escapement. The index gives the sum of the manager's visual impression of the number of fish present in the index streams, near the peak of spawning activity. The curves are a nonparametric loess smooth through the data. Only the Farragut Bay (filled triangles) and Portage Bay (inverted open triangles) stock groups did not show an upward trend during the most recent 21-year period. All stock groups show a general upward trend over the entire series.

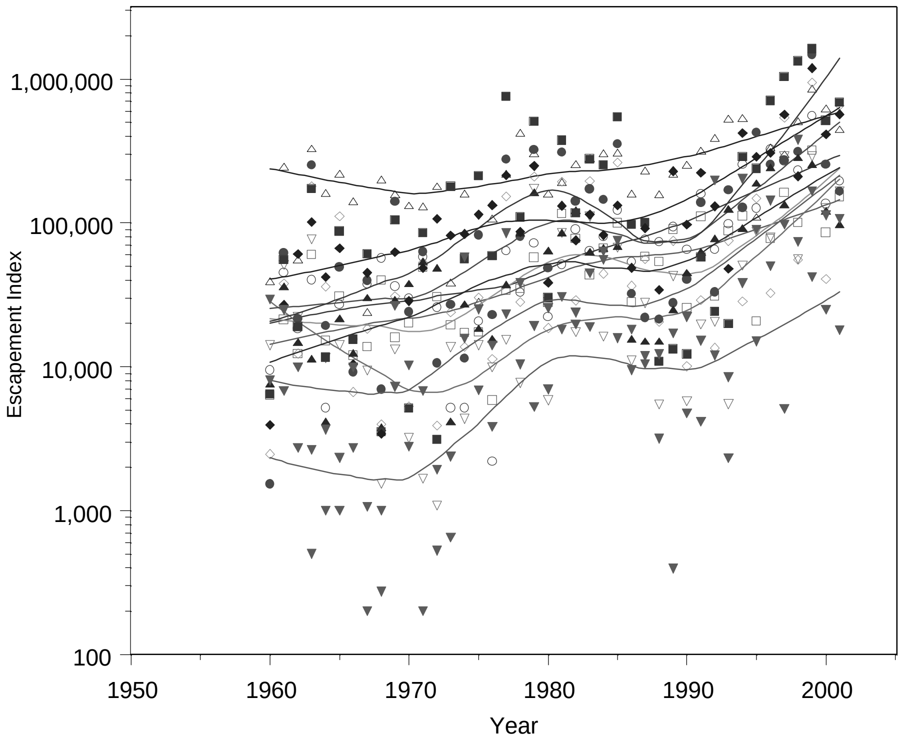

Figure 6. Pink salmon escapement indices for the stock groups in the Sitka management area in northern Southeast Alaska. The *y*-axis is an escapement index, expressed on a logarithmic scale, based on first adjusting a series of observers to a standard level, choosing the largest count for the year, and then summing these "peak observations" across a series of standard index streams by stock group. The magnitude of the index is not the total escapement. The index gives the sum of the manager's visual impression of the number of fish present in the index streams, near the peak of spawning activity. The curves are a nonparametric loess smooth through the data. All stock groups show a general upward trend over the most recent 21-year period and over the entire series.

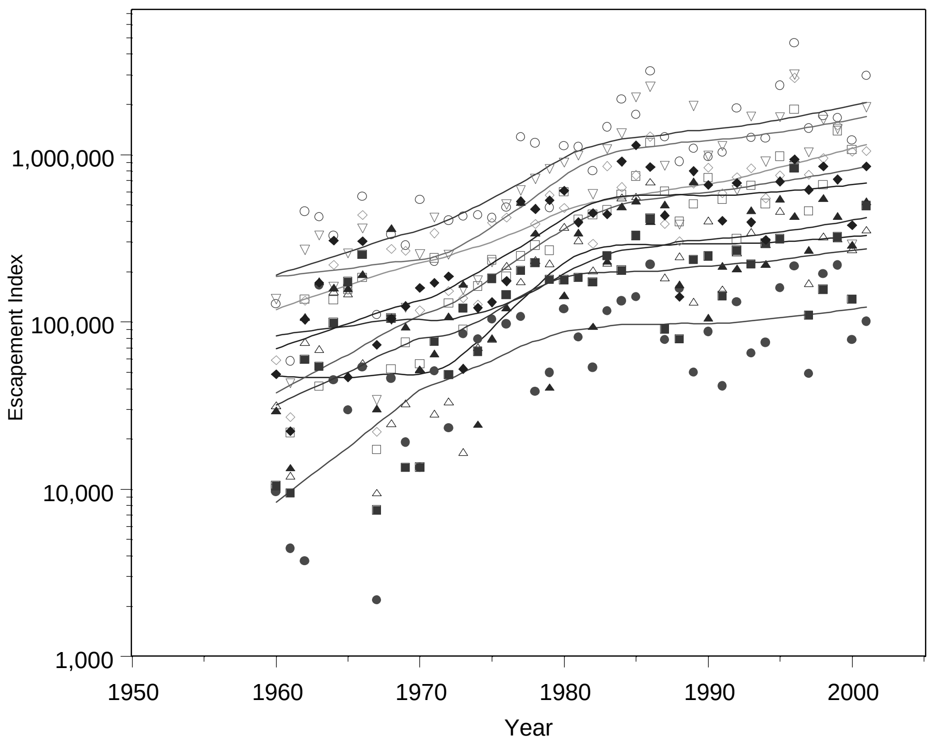

Figure 7. Pink salmon escapement indices for the stock groups in the Ketchikan management area in southern Southeast Alaska. The *y*-axis is an escapement index, expressed on a logarithmic scale, based on first adjusting a series of observers to a standard level, choosing the largest count for the year, and then summing these "peak observations" across a series of standard index streams by stock group. The magnitude of the index is not the total escapement. The index gives the sum of the manager's visual impression of the number of fish present in the index streams, near the peak of spawning activity. The curves are a nonparametric loess smooth through the data. All stock groups show an upward trend in both the most recent 21-year period and over the entire series.

Escapement History in Southeast Alaska Relative to Biological Escapement Goals

The escapement indices since 1990 are generally within or above the new biological escapement goals for each of the three sub-regions (Table 6); as well as management targets for most of the districts (Table 7); and as well as management targets for most pink salmon stock groups in Southeast Alaska (Tables 8–11).

The Portage Bay stock group (Table 9) consists of seven index streams, of which four are small and canopy covered making it difficult to enumerate. Many of the surveys for these systems are mouth only counts. This poor in-stream visibility may be the primary cause of the high incidence of years below the recommended target range. Further analysis and more frequent surveys may bring this stock group back to within the management target range on most years.

During this new analysis we discovered a few stock groups that met the revised management target ranges less than half the time. These stock groups located in the Cross Sound–Icy Straits area (N. Chichagof, and Homeshore) and the District 113 stock groups located north of Kruzof Island (Lisianski, Portlock, Slocum Arm, and Salisbury Sound) have dominant odd-year cycles. The even-year cycle averages less than half the odd-year cycle for the past 23 years. Examination of the odd-year cycle shows that the escapement target ranges for these groups have been met quite often since 1980 (Table 12). A very detailed analysis will be needed to create a management target for the weaker even years for these northern sub-regions that would likely be lower than the existing targets for all years.

Hoonah Sound was the other stock group that met the revised target range less than half the time since 1980. The Hoonah Sound stock group is not dominated by odd-year cycles. However, since 1990 it has met the target range more often.

Table 6. The count and percentage of the 1980 to 2002 pink salmon annual escapement indices, by sub region of Southeast Alaska, that were below, within, or above the recommended biological escapement goal ranges, as well as the number of occurrences since 1990.

Sub-region	Recommended Biological Escapement Goal Index Range (millions)	Years When Escapement Was Below Recommended Target Range	Years When Escapement Was Within Recommended Target Range	Years When Escapement Was Above Recommended Target Range
SSE	4.0 to 9.0	2 of 23 years (9%) 0 since 1990	14 of 23 years (61%) 8 since 1990	7 of 23 years (30%) 5 since 1990
NSEI	2.5 to 5.5	4 of 23 years (17%) 0 since 1990	16 of 23 years (70%) 11 since 1990	3 of 23 years (13%) 2 since 1990
NSEO	0.75 to 1.75	11 of 23 years (48%) 4 since 1990	7 of 23 years (30%) 4 since 1990	5 of 23 years (22%) 5 since 1990

Table 7. The count and percentage of the 1980 to 2002 pink salmon annual escapement indices, by management district in Southeast Alaska, that were below, within, or above the recommended escapement target ranges, as well as the number of occurrences since 1990.

District	Recommended Escapement Target Range (millions)	Years When Escapement Was Below Recommended Target Range	Years When Escapement Was Within Recommended Target Range	Years When Escapement Was Above Recommended Target Range
101	1.34 to 3.00	1 of 23 years (4%) 0 since 1990	14 of 23 years (61%) 8 since 1990	8 of 23 years (35%) 5 since 1990
102	0.40 to 1.10	1 of 23 years (4%) 0 since 1990	15 of 23 years (66%) 7 since 1990	7 of 23 years (30%) 6 since 1990
103	1.13 to 2.55	1 of 23 years (4%) 0 since 1990	11 of 23 years (48%) 6 since 1990	11 of 23 years (48%) 7 since 1990
105	0.33 to 0.65	8 of 23 years (35%) 1 since 1990	10 of 23 years (43%) 8 since 1990	5 of 23 years (22%) 4 since 1990
106	0.40 to 0.85	9 of 23 years (39%) 2 since 1990	12 of 23 years (52%) 9 since 1990	2 of 23 years (9%) 2 since 1990
107	0.40 to 0.85	8 of 23 years (35%) 1 since 1990	13 of 23 years (57%) 11 since 1990	2 of 23 years (9%) 1 since 1990
109	0.40 to 0.85	3 of 23 years (13%) 0 since 1990	7 of 23 years (30%) 1 since 1990	13 of 23 years (57%) 12 since 1990
110	0.65 to 1.45	10 of 23 years (43%) 3 since 1990	12 of 23 years (52%) 9 since 1990	1 of 23 years (4%) 1 since 1990
111	0.32 to 0.73	8 of 23 years (35%) 4 since 1990	10 of 23 years (43%) 5 since 1990	5 of 23 years (22%) 4 since 1990
112	0.40 to 0.85	0 of 23 years (0%) 0 since 1990	8 of 23 years (35%) 2 since 1990	15 of 23 years (65%) 11 since 1990
113	1.15 to 2.65	11 of 23 years (48%) 4 since 1990	7 of 23 years (30%) 4 since 1990	5 of 23 years (22%) 3 since 1990
114 (Even Years)	0.32 to 0.73	12 of 12 years (100%) 7 since 1990	0 of 12 years (0%) 0 since 1990	0 of 12 years (0%) 0 since 1990
114 (Odd Years)	0.32 to 0.73	5 of 11 years (45%) 1 since 1990	3 of 11 years (27%) 3 since 1990	3 of 11 years (27%) 2 since 1990

Table 8. The count and percentage of the 1980 to 2002 pink salmon annual escapement indices, by stock group in the Ketchikan management area of Southeast Alaska that were below, within, or above the recommended escapement target ranges, as well as the number of occurrences since 1990.

Sub-Region	**District**	**Stock Group**	**Recommended Escapement Target Range (millions)**	**Years When Escapement Was Below Recommended Target Range**	**Years When Escapement Was Within Recommended Target Range**	**Years When Escapement Was Above Recommended Target Range**
SSE	101	Portland	0.17 to 0.37	3 of 23 years (13%) 1 since 1990	8 of 23 years (35%) 5 since 1990	12 of 23 years (52%) 7 since 1990
SSE	101	E Behm	0.84 to 1.89	1 of 23 years (4%) 0 since 1990	15 of 23 years (66%) 8 since 1990	7 of 23 years (30%) 5 since 1990
SSE	101	W Behm	0.33 to 0.74	2 of 23 years (9%) 1 since 1990	13 of 23 years (56%) 9 since 1990	8 of 23 years (35%) 3 since 1990
SSE	102	Moira	0.06 to 0.17	4 of 23 years (17%) 1 since 1990	15 of 23 years (66%) 8 since 1990	4 of 23 years (17%) 3 since 1990
SSE	102	Kasaan	0.34 to 0.93	2 of 23 years (9%) 0 since 1990	14 of 23 years (61%) 7 since 1990	7 of 23 years (30%) 6 since 1990
SSE	103	E Dall	0.16 to 0.36	2 of 23 years (9%) 1 since 1990	13 of 23 years (56%) 8 since 1990	8 of 23 years (35%) 4 since 1990
SSE	103	Hetta	0.30 to 0.68	0 of 23 years (0%) 0 since 1990	15 of 23 years (65%) 7 since 1990	8 of 23 years (35%) 6 since 1990
SSE	103	Klawock	0.52 to 1.17	2 of 23 years(9%) 1 since 1990	10 of 23 years (43%) 5 since 1990	11 of 23 years (48%) 7 since 1990
SSE	103	Sea Otter Sound	0.15 to 0.33	5 of 23 years (22%) 3 since 1990	15 of 23 years (65%) 8 since 1990	3 of 23 years (13%) 2 since 1990

Table 9. The count and percentage of the 1980 to 2002 pink salmon annual escapement indices, by stock group in the Petersburg management area of Southeast Alaska that were below, within, or above the recommended escapement target ranges, as well as the number of occurrences since 1990.

Sub-Region	District	Stock Group	Recommended Escapement Target Range (millions)	Years When Escapement Was Below Recommended Target Range	Years When Escapement Was Within Recommended Target Range	Years When Escapement Was Above Recommended Target Range
SSE	105	Shipley Bay	0.14 to 0.27	10 of 23 years (44%) 3 since 1990	7 of 23 years (30%) 5 since 1990	6 of 23 years (26%) 5 since 1990
SSE	105	Affleck Canal	0.20 to 0.38	10 of 23 years (44%) 1 since 1990	7 of 23 years (30%) 7 since 1990	6 of 23 years (26%) 5 since 1990
SSE	106	Burnett	0.10 to 0.20	11 of 23 years (48%) 3 since 1990	8 of 23 years (35%) 6 since 1990	4 of 23 years (17%) 4 since 1990
SSE	106	Ratz Harbor	0.10 to 0.21	11 of 23 years (48%) 4 since 1990	10 of 23 years (43%) 8 since 1990	2 of 23 years (9%) 1 since 1990
SSE	106	Totem Bay	0.07 to 0.15	8 of 23 years (35%) 2 since 1990	11 of 23 years (48%) 8 since 1990	4 of 23 years (17%) 3 since 1990
SSE	106	Whale Pass	0.13 to 0.28	10 of 23 years (43%) 3 since 1990	10 of 23 years (43%) 7 since 1990	3 of 23 years (13%) 3 since 1990
SSE	107	Union Bay	0.08 to 0.17	9 of 23 years (39%) 3 since 1990	7 of 23 years (30%) 6 since 1990	7 of 23 years (30%) 4 since 1990
SSE	107	Anan	0.32 to 0.68	8 of 23 years (35%) 1 since 1990	13 of 23 years (56%) 11 since 1990	2 of 23 years (9%) 1 since 1990
NSEI	109	Tebenkof	0.13 to 0.27	5 of 23 years (22%) 1 since 1990	7 of 23 years (30%) 3 since 1990	11 of 23 years (48%) 9 since 1990
NSEI	109	Saginaw Bay	0.07 to 0.15	4 of 23 years (17%) 1 since 1990	5 of 23 years (22%) 3 since 1990	14 of 23 years (61%) 9 since 1990
NSEI	109	Eliza Harbor	0.08 to 0.18	5 of 23 years (22%) 0 since 1990	8 of 23 years (35%) 3 since 1990	10 of 23 years (43%) 10 since 1990
NSEI	110	Portage Bay	0.04 to 0.08	16 of 23 years (70%) 8 since 1990	6 of 23 years (26%) 4 since 1990	1 of 23 years (4%) 1 since 1990
NSEI	110	Farragut Bay	0.01 to 0.03	6 of 23 years (26%) 1 since 1990	13 of 23 years (57%) 8 since 1990	4 of 23 years (17%) 4 since 1990
NSEI	110	Houghton	0.40 to 0.89	11 of 23 years (48%) 4 since 1990	10 of 23 years (43%) 7 since 1990	2 of 23 years (9%) 2 since 1990
NSEI	110	Pybus/Gambier	0.20 to 0.45	9 of 23 years (39%) 2 since 1990	13 of 23 years (57%) 10 since 1990	1 of 23 years (4%) 1 since 1990

Table 10. The count and percentage of the 1980 to 2002 pink salmon annual escapement indices, by stock group in the Sitka management area of Southeast Alaska that were below, within, or above the recommended escapement target ranges, as well as the number of occurrences since 1990.

Sub-Region	District	Stock Group	Recommended Escapement Target Range (millions)	Years When Escapement Was Below Recommended Target Range	Years When Escapement Was Within Recommended Target Range	Years When Escapement Was Above Recommended Target Range
NSEI	109	SE Baranof	0.05 to 0.11	4 of 23 years (17%) 1 since 1990	11 of 23 year (48%) 5 since 1990	8 of 23 year (35%) 7 since 1990
NSEI	109	E Baranof	0.07 to 0.14	5 of 23 year (22%) 2 since 1990	10 of 23 year (43%) 3 since 1990	8 of 23 year (35%) 8 since 1990
NSEO	113	Whale Bay	0.05 to 0.12	11 of 23 year (48%) 3 since 1990	6 of 23 year (26%) 4 since 1990	6 of 23 year (26%) 6 since 1990
NSEO	113	W Crawfish	0.01 to 0.03	8 of 23 year (35%) 5 since 1990	9 of 23 year (39%) 3 since 1990	6 of 23 year (26%) 5 since 1990
NSEO	113	Sitka Sound	0.21 to 0.50	10 of 23 year (43%) 4 since 1990	5 of 23 year (22%) 2 since 1990	8 of 23 year (35%) 7 since 1990
NSEO	113	Salisbury Sound	0.16 to 0.36	11 of 23 year (48%) 4 since 1990	9 of 23 year (39%) 6 since 1990	3 of 23 year (13%) 3 since 1990
NSEI	113	Hoonah Sound	0.40 to 0.90	16 of 23 year (70%) 6 since 1990	7 of 23 year (30%) 7 since 1990	0 of 23 year (0%) 0 since 1990
NSEO	113	Slocum Arm	0.21 to 0.48	12 of 23 year (52%) 3 since 1990	8 of 23 year (35%) 7 since 1990	3 of 23 year (13%) 3 since 1990
NSEO	113	Portlock	0.03 to 0.08	11 of 23 year (48%) 4 since 1990	5 of 23 year (22%) 3 since 1990	7 of 23 year (30%) 6 since 1990
NSEO	113	Lisianski	0.07 to 0.17	13 of 23 year (92%) 7 since 1990	4 of 23 year (8%) 3 since 1990	6 of 23 year (0%) 3 since 1990

Table 11. The count and percentage of the 1980 to 2002 pink salmon annual escapement indices, by stock group in the Juneau management area of Southeast Alaska that were below, within, or above the recommended escapement target ranges, as well as the number of occurrences since 1990.

Sub-Region	District	Stock Group	Recommended Escapement Target Range (millions)	Years When Escapement Was Below Recommended Target Range	Years When Escapement Was Within Recommended Target Range	Years When Escapement Was Above Recommended Target Range
NSEI	111	Seymour Canal	0.18 to 0.41	10 of 23 years (43%) 5 since 1990	10 of 23 years (43%) 6 since 1990	3 of 23 years (13%) 2 since 1990
NSEI	111	Stephens	0.14 to 0.32	7 of 23 years (30%) 4 since 1990	10 of 23 years (44%) 5 since 1990	6 of 23 years (26%) 4 since 1990
NSEI	112	SW Admiralty	0.08 to 0.17	0 of 23 years (0%) 0 since 1990	7 of 23 years (30%) 3 since 1990	16 of 23 years (70%) 10 since 1990
NSEI	112	W Admiralty	0.04 to 0.08	5 of 23 years (22%) 3 since 1990	9 of 23 years (39%) 5 since 1990	9 of 23 years (39%) 5 since 1990
NSEI	112	Tenakee	0.18 to 0.37	1 of 23 years (4%) 1 since 1990	8 of 23 years (35%) 1 since 1990	14 of 23 years (61%) 11 since 1990
NSEI	112	Freshwater Bay	0.06 to 0.13	2 of 23 years (9%) 0 since 1990	11 of 23 years (48%) 4 since 1990	10 of 23 years (43%) 9 since 1990
NSEI	112	Kelp Bay	0.03 to 0.06	4 of 23 years (17%) 2 since 1990	4 of 23 years (17%) 1 since 1990	15 of 23 years (66%) 10 since 1990
NSEI	112	Lynn Canal	0.02 to 0.04	2 of 23 years (9%) 1 since 1990	2 of 23 years (9%) 2 since 1990	19 of 23 years (82%) 10 since 1990
NSEI	114	Homeshore	0.05 to 0.10	14 of 23 years (61%) 8 since 1990	6 of 23 years (26%) 3 since 1990	3 of 23 years (13%) 2 since 1990
NSEI	114	N Chichagof	0.28 to 0.62	17 of 23 years (74%) 8 since 1990	3 of 23 years (13%) 3 since 1990	3 of 23 years (13%) 2 since 1990

Table 12. The count and percentage of the 1980 to 2002 pink salmon annual escapement indices, for Cross Sound – Icy Strait and the northern District 113 stock groups by distinct even and odd-years that were below, within, or above the recommended escapement target ranges, as well as the number of occurrences since 1990.

Sub-Region	District	Stock Group	Recommended Escapement Target Range (millions)	Years When Escapement Was Below Recommended Target Range	Years When Escapement Was Within Recommended Target Range	Years When Escapement Was Above Recommended Target Range
NSEO	113	Lisianski (Even Years)	0.07 to 0.17	11 of 12 years (92%) 6 since 1990	1 of 12 years (8%) 1 since 1990	0 of 12 years (0%) 0 since 1990
NSEO	113	Lisianski (Odd Years)	0.07 to 0.17	2 of 11 years (18%) 1 since 1990	3 of 11 years (27%) 2 since 1990	6 of 11 years (55%) 3 since 1990
NSEO	113	Portlock (Even Years)	0.03 to 0.08	7 of 12 years (58%) 2 since 1990	3 of 12 years (25%) 3 since 1990	2 of 12 years (17%) 2 since 1990
NSEO	113	Portlock (Odd Years)	0.03 to 0.08	3 of 11 years (27%) 2 since 1990	2 of 11 years (17%) 0 since 1990	6 of 11 years (55%) 4 since 1990
NSEO	113	Slocum Arm (Even Years)	0.21 to 0.48	7 of 12 years (58%) 2 since 1990	5 of 12 years (42%) 5 since 1990	0 of 12 years (0%) 0 since 1990
NSEO	113	Slocum Arm (Odd Years)	0.21 to 0.48	5 of 11 years (45%) 1 since 1990	3 of 11 years (27%) 2 since 1990	3 of 11 years (27%) 3 since 1990
NSEO	113	Salisbury Sound (Even Years)	0.16 to 0.36	8 of 12 years (67%) 3 since 1990	3 of 12 years (25%) 3 since 1990	1 of 12 years (8%) 1 since 1990
NSEI	113	Salisbury Sound (Odd Years)	0.16 to 0.36	3 of 11 years (27%) 1 since 1990	6 of 11 years (55%) 3 since 1990	2 of 11 years (18%) 2 since 1990
NSEI	114	Homeshore (Even Years)	0.05 to 0.10	10 of 12 years (83%) 6 since 1990	2 of 12 years (17%) 1 since 1990	0 of 12 years (0%) 0 since 1990
NSEI	114	Homeshore (Odd Years)	0.05 to 0.11	4 of 11 years (36%) 2 since 1990	4 of 11 years (36%) 2 since 1990	3 of 11 years (28%) 2 since 1990
NSEI	114	N Chichagof (Even Years)	0.28 to 0.62	12 of 12 years (100%) 7 since 1990	0 of 12 years (0%) 0 since 1990	0 of 12 years (0%) 0 since 1990
NSEI	114	N Chichagof (Odd Years)	0.28 to 0.62	5 of 11 years (46%) 1 since 1990	3 of 11 years (27%) 3 since 1990	3 of 11 years (27%) 2 since 1990

Harvest Trends in Southeast Alaska

Harvests in southern Southeast Alaska and northern Southeast Alaska increased dramatically beginning in the 1980s.

Alexandersdottir (1987) describes the pink salmon populations in southern Southeast Alaska as more stable and capable of sustaining higher harvest rates than those in northern Southeast Alaska. The average harvest in both sub-regions has increased since the time of her analysis, although the harvest in southern Southeast Alaska has increased further, and has supported a more stable harvest (Figure 8; Appendix Table A.1). Overall, five of the top 10 harvest levels in the 109-year harvest history have occurred in the last 10 years, including the highest harvest of 78 million fish in 1999, and the second highest harvest of 67 million in 2001. Currently, commercial pink salmon harvests in both SSE and NSE are at their highest levels in the historical series. Many harvests during the past 10 years could have been higher – as indicated by the high escapements. However, processor capacity, not stock abundance, has now become the limit on high harvests.

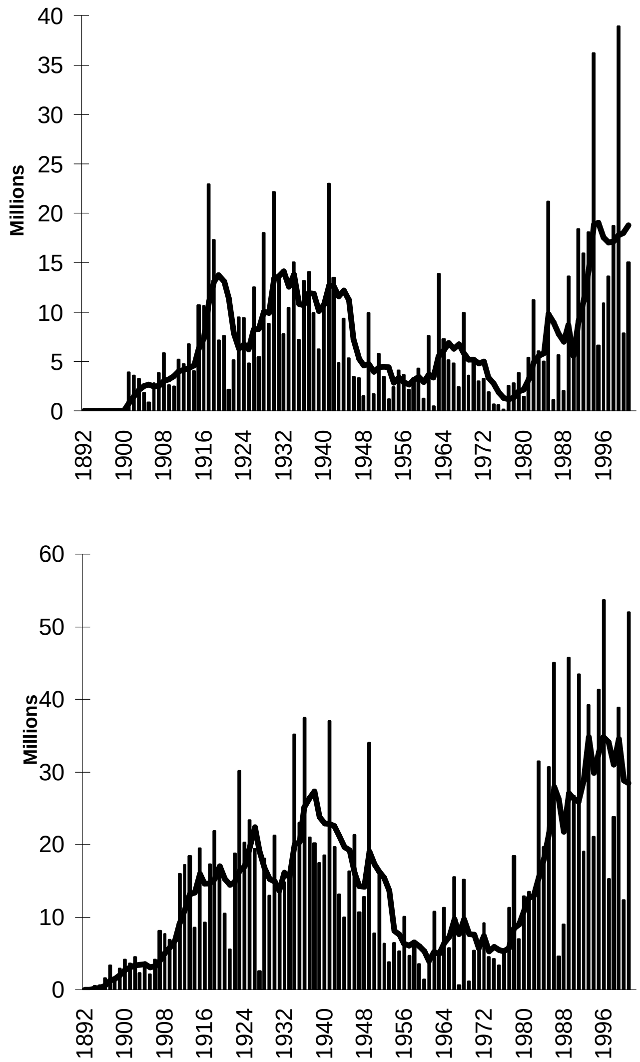

Figure 8. Annual commercial harvest of pink salmon in northern Southeast (top) and southern Southeast (bottom) Alaska from 1892 to 2001 with the 5-year running average (bold line through peaks).

DISCUSSION

The status of pink salmon in Southeast Alaska and Yakutat is biologically very favorable – especially in Southeast Alaska. No pink salmon stocks in either area are considered stocks of concern under the definition of the Sustainable Salmon Policy (5 AAC 39.222). Escapement indices in Southeast Alaska are at their all-time highest levels; recent harvests have usually been among the larger harvests in the historical record, with the all-time record in 1999. Undoubtedly, favorable environmental conditions deserve part of the credit for improved returns (Quinn and Marshall 1989; Beamish and Bouillon 1993; Mantua et al. 1997, and many others). However, it appears that pink salmon managers have made good use of these conditions by allowing improved and well-distributed escapements throughout the region. The recent sustained yields of pink salmon were unimagined in the 1960s and early 1970s.

Our measures of escapement are imperfect, but we believe they are fully adequate to assess the health of this resource. Considering the difficulty measuring such dispersed salmon production, substantial improvements to the monitoring program would only lead to modest improvements in the quality of the stock assessment information — which is not true for other species of salmon in Southeast Alaska. The consistency of all of our indicators gives us confidence in our assessment of pink salmon. This is especially true of the consistency in the increase in harvest.

As we mentioned several times already, the biological escapement goals discussed in this paper are recommended at the sub-region level. We have not found a defendable way to establish escapement goals at the district or stock group level, based on the existing information. Again, the management targets we provided are intended as an aid to managers, and as an aid to the Board of Fisheries and the public in judging whether or not escapements are well distributed within Southeast Alaska. These targets will be carefully reviewed prior to the next Board of Fisheries meeting in 2006. We will continue to evaluate and report on pink salmon escapement at the sub-region, district, and stock group scales, but in evaluating our charges under the Sustainable Salmon Fisheries Policy for the next Board of Fisheries meeting, escapement performance will be formally judged in relation to the index-based escapement goals on the sub-region level.

We will continue to improve the escapement estimation process, and try to better understand the relationship between the current escapement index and total escapement in the region. The department received funding from the Southeast Sustainable Salmon Fund, starting in 2002, to increase the aerial survey coverage of the region. In addition, there are ongoing research programs to assess individual observer counting rates, their relationship to other observers, and the relationship of adjusted peak counts to the total spawning population for individual streams.

We may wish to update the biological escapement goals in the future, although given the limits of the data, the apparent changes and improvements in ocean environment, and the practical constraints on salmon management, we doubt that we can improve yield by further statistical analysis of the stock assessment record for these pink salmon.

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APPENDICES

Appendix Table A.1. Commercial harvests[a] of pink salmon in Southeast Alaska and Yakutat by sub-region, 1892–2002.

Year	SSE Harvest	NSE Harvest	Yakutat Harvest	Total Harvest	Year	SSE Harvest	NSE Inside Harvest	NSE Outside Harvest	Yakutat Harvest	Total Harvest	Year	SSE Harvest	NSE Inside Harvest	NSE Outside Harvest	Yakutat Harvest	Total Harvest	Hatchery[b] Contribution
1892	0.01			0.01	1929	13.00	8.85			21.85	1966	15.56	4.76	0.02		20.35	
1893	0.19			0.19	1930	21.23	22.18		0.07	43.48	1967	0.64	2.32	0.11	0.03	3.11	
1894	0.53			0.53	1931	13.57	13.68			27.24	1968	15.19	9.84	0.04		25.08	
1895	0.61			0.61	1932	14.78	7.82			22.61	1969	1.20	3.49	0.12	0.06	4.87	
1896	1.63			1.63	1933	15.24	10.42		0.12	25.78	1970	5.41	5.18	0.06		10.65	
1897	3.37			3.37	1934	35.20	15.02		0.11	50.33	1971	6.25	2.93	0.09	0.08	9.34	
1898	1.56			1.56	1935	22.98	7.18		0.09	30.25	1972	9.15	3.20	0.04		12.40	
1899	2.91			2.91	1936	37.43	13.15		0.17	50.75	1973	4.56	1.63	0.25	0.02	6.46	
1900	4.18	0.14		4.32	1937	20.99	14.05		0.13	35.17	1974	4.22	0.61	0.05		4.88	
1901	3.64	3.89		7.53	1938	20.21	9.95		0.13	30.29	1975	3.33	0.05	0.56	0.08	4.03	
1902	4.49	3.58	0.04	8.10	1939	17.45	6.23		0.04	23.72	1976	5.16	0.05	0.10	0.03	5.33	
1903	2.28	3.25		5.53	1940	18.49	10.49		0.11	29.09	1977	11.24	0.35	2.18	0.08	13.84	0.09
1904	3.25	1.82	0.11	5.18	1941	37.02	22.98		0.07	60.06	1978	18.42	2.65	0.13	0.04	21.24	
1905	2.13	0.89	0.05	3.06	1942	19.61	13.46		0.06	33.13	1979	6.99	2.12	1.72	0.15	10.98	0.06
1906	4.21	2.77	0.06	7.04	1943	13.17	4.84		0.03	18.04	1980	12.92	1.36	0.07	0.14	14.50	0.01
1907	8.11	3.81	0.05	11.97	1944	9.95	9.33		0.06	19.34	1981	13.53	2.69	2.68	0.14	19.04	0.15
1908	7.66	5.88	0.05	13.59	1945	16.29	5.34		0.02	21.65	1982	12.96	10.77	0.47	0.01	24.21	0.02
1909	6.88	2.60	0.05	9.53	1946	21.32	3.44		0.06	24.82	1983	31.45	3.52	2.54	0.03	37.53	0.17
1910	6.91	2.47	0.04	9.42	1947	10.68	3.34		0.02	14.04	1984	19.68	3.78	1.23	0.02	24.70	0.25
1911	16.01	5.22	0.18	21.41	1948	12.77	1.48		0.10	14.35	1985	30.71	15.60	5.58	0.07	51.95	0.91
1912	17.23	4.75	0.03	22.01	1949	33.98	9.92		0.02	43.92	1986	45.02	0.93	0.21	0.01	46.17	0.45
1913	18.49	6.76	0.05	25.30	1950	7.74	1.69			9.42	1987	4.63	5.21	0.41	0.02	10.28	1.46
1914	8.57	3.99	0.01	12.57	1951	16.39	5.79		0.04	22.22	1988	9.05	1.97	0.06	0.13	11.21	0.23
1915	19.50	10.69	0.16	30.35	1952	6.33	3.43		0.04	9.80	1989	45.76	12.74	0.87	0.09	59.46	1.13
1916	9.30	10.60	0.04	19.94	1953	3.80	1.17		0.01	4.98	1990	26.68	5.44	0.16	0.05	32.34	1.42
1917	17.27	22.97	0.09	40.33	1954	6.46	2.41		0.04	8.91	1991	43.50	18.05	0.37	0.01	61.92	2.20
1918	21.91	17.27	0.12	39.29	1955	5.25	4.06		0.03	9.33	1992	19.01	15.53	0.40	0.03	34.96	3.42
1919	17.16	7.15	0.02	24.33	1956	10.08	3.63		0.02	13.73	1993	39.22	17.02	1.04	0.01	57.30	0.96
1920	10.49	7.58	0.04	18.12	1957	4.68	2.16		0.02	6.86	1994	21.06	35.21	0.99	0.01	57.27	5.49
1921	5.57	2.13	0.03	7.73	1958	6.46	3.32		0.06	9.84	1995	41.32	4.85	1.75	0.06	47.96	2.02
1922	18.79	5.14	0.07	24.00	1959	3.57	4.27		0.01	7.85	1996	53.67	9.01	1.86	0.03	64.57	2.34
1923	30.11	9.48	0.29	39.88	1960	1.44	1.26		0.01	2.71	1997	15.30	10.83	2.75	0.09	28.98	2.48
1924	20.30	9.42	0.31	30.03	1961	3.77	7.62		0.06	11.46	1998	23.75	12.86	5.84	0.09	42.54	2.24
1925	23.34	4.80	0.10	28.25	1962	10.74	0.43	0.06	0.03	11.26	1999	38.86	36.35	2.61	0.03	77.85	4.09
1926	19.45	12.50	0.25	32.19	1963	5.14	12.61	1.29	0.08	19.12	2000	12.38	5.32	2.56	0.06	20.31	0.44
1927	2.58	5.48	0.10	8.16	1964	11.26	7.21	0.07	0.04	18.58	2001	52.01	13.01	1.99	0.03	67.05	2.35
1928	18.06	17.99		36.05	1965	5.71	4.56	0.61		10.87	2002	23.32	18.99	3.01	0.02	45.33	N/A

[a] Unallocated harvests found in Byerly et al. (1999) were proportionally allocated to the two sub-regions based on known harvest each year. NSE Outside harvests were not discernable from NSE Inside harvests until after statehood, starting in 1962. Offshore harvests in Districts 150 and 152 are assigned to SSE, Districts 154–157 are assigned to NSE outside, and Districts 182–192 are assigned to Yakutat.

[b] Hatchery contributions are included in the total harvest; numbers were retrieved from ADF&G, Alaska Fisheries Enhancement Program Annual Reports.

Appendix Table A.2. A summary of the Hilborn and Walters "tabular approach" for pink salmon in three sub-regions of Southeast Alaska. Spawner Intervals are non-exclusive categories of observed escapement. *N* denotes the number of observation in each category; because the categories not exclusive, the sum of *N* is more that the total number of observations. The mean of recruits and harvest is the average over several assumed ratios of the index escapement to total escapement.

Southern Southeast Alaska Pink Salmon Stocks						
Spawner Interval	N	Mean Escapement	Mean Recruits	Mean Yield	Range of Yield	
0 - 2	12	1.32	7.65	6.33	-0.48	12.01
1 - 3	13	1.84	9.70	7.86	-0.48	16.36
2 - 4	7	2.86	18.22	15.36	4.10	29.56
3 - 5	7	4.18	23.08	18.89	7.73	32.56
4 - 6	9	5.25	36.34	31.09	11.71	65.61
5 - 7	10	5.89	39.29	33.40	11.71	65.61
6 - 8	9	6.74	46.30	39.56	19.12	65.61
7 - 9	4	7.97	44.30	36.33	9.97	50.25
> 8	6	12.43	26.44	14.01	-0.77	48.97

Northern Southeast Alaska Inside Pink Salmon Stocks						
Spawner Interval	N	Mean Escapement	Mean Recruits	Mean Yield	Range of Yield	
0 - 2	19	1.05	13.67	5.81	-4.41	20.07
1 - 3	19	1.95	22.56	7.91	-4.41	39.29
2 - 4	14	2.84	34.77	13.44	-5.21	53.52
3 - 5	9	3.90	44.72	15.48	-5.21	53.52
4 - 6	6	4.86	54.34	17.93	-14.89	68.86
5 - 7	3	5.74	60.02	17.00	-14.89	68.86
>6	2	8.03	47.09	-13.14	-23.32	-2.96

Northern Southeast Alaska Inside Pink Salmon Stocks						
Spawner Interval	N	Mean Escapement	Mean Recruits	Mean Yield	Range of Yield	
0.0 - 0.5	27	0.25	0.88	0.62	-0.12	3.21
0.25 - .75	16	0.37	1.25	0.88	-0.20	3.21
.5 - 1.0	3	0.79	2.81	2.02	-0.20	6.10
.75 - 1.25	4	1.00	3.72	2.71	0.15	6.10
1.0 - 1.5	6	1.34	3.73	2.39	-0.72	4.27
1.25 - 1.75	6	1.47	4.49	3.02	-0.72	6.69
>1.5	5	2.81	5.64	2.83	-1.37	6.69

Appendix Table A.3. Calculated potential yield for Southeast Alaska pink salmon, based on the "tabular approach" of Hilborn and Walters. Table entries show yield under five cases, which represent assumed ratios of index escapement to total escapement (the EM levels). The spawner intervals represent non-mutually exclusive categories of observed index escapement. Yield is based on 1960–2000 brood year catch and escapement index observations.

Southern Southeast Alaska Pink Salmon Stocks

Spawner Interval	Mean Yield EM = 1	EM = 2.5	EM = 5	EM = 7.5	EM = 10
0 - 2	6.33	7.31	8.93	10.55	12.17
1 - 3	7.86	8.38	9.25	10.12	10.98
2 - 4	15.36	16.99	19.71	22.43	25.15
3 - 5	18.89	20.61	23.48	26.35	29.22
4 - 6	31.09	34.61	40.49	46.37	52.25
5 - 7	33.40	38.05	45.80	53.55	61.30
6 - 8	39.56	44.73	53.35	61.97	70.59
7 - 9	36.33	37.50	39.44	41.38	43.32
> 8	14.01	5.74	-8.04	-21.82	-35.60

Northern Southeast Alaska Inside Pink Salmon Stocks

Spawner Interval	Mean Yield EM = 1	EM = 2.5	EM = 5	EM = 7.5	EM = 10
0 - 2	4.26	4.62	5.22	5.81	6.41
1 - 3	5.58	6.12	7.02	7.91	8.80
2 - 4	9.79	10.63	12.04	13.44	14.85
3 - 5	14.39	14.64	15.06	15.48	15.90
4 - 6	15.77	16.26	17.10	17.93	18.76
5 - 7	15.99	16.23	16.61	17.00	17.39
>6	7.81	2.97	-5.08	-13.14	-21.20

Northern Southeast Alaska Outside Pink Salmon Stocks

Spawner Interval	Mean Yield EM = 1	EM = 2.5	EM = 5	EM = 7.5	EM = 10
0.0 - 0.5	0.62	0.85	1.24	1.63	2.01
0.25 - .75	0.88	1.14	1.57	2.01	2.45
.5 - 1.0	2.02	1.85	1.57	1.28	1.00
.75 - 1.25	2.71	2.82	2.99	3.16	3.33
1.0 - 1.5	2.40	2.68	3.14	3.61	4.08
1.25 - 1.75	3.02	3.46	4.17	4.89	5.61
>1.5	2.83	2.66	2.38	2.09	1.81

Appendix Table A.4. Pink salmon escapement indices for Yakutat area streams, 1961–2002.

	Situk River			Humpy Creek [d]		
Year [a]	Count	Type	Estimated Total Escapement [b,c]	Count	Type	Estimated Total Escapement
1961	30,000	Aerial	90,000	25,000	Foot	75,000
1962	70,000	Aerial	210,000	23,000	Foot	69,000
1963	192,359	Extrapolated	192,359	63,278	Extrapolated	63,278
1964	70,000	Aerial	210,000	11,000	Foot	33,000
1965	30,000	Aerial	90,000	3,000	Foot	3,000
1966	5,000	Aerial	15,000	n/a	Extrapolated	28,186
1967	80,000	Aerial	240,000	63,278	Extrapolated	63,278
1968	n/a	Extrapolated	156,735	n/a	Extrapolated	28,186
1969	11,500	Aerial	34,500	29,169	Foot	29,169
1970	n/a	Extrapolated	156,735	n/a	Extrapolated	28,186
1971	27,184	Weir	27,184	63,278	Foot	63,278
1972	10,000	Boat	30,000	1,630	Foot	4,890
1973	80,000	Boat	240,000	3,969	Foot	3,969
1974	20,000	Boat	60,000	2,000	Foot	6,000
1975	44,600	Boat	133,800	39,000	Foot	39,000
1976	38,081	Weir	38,081	4,672	Foot	14,016
1977	177,712	Weir	177,712	36,000	Foot	36,000
1978	120,000	Boat	360,000	5,000	Foot	15,000
1979	450,000	Weir	450,000	45,000	Foot	45,000
1980	250,000	Weir	250,000	10,000	Foot	30,000
1981	300,000	Weir	300,000	210,000	Foot	210,000
1982	40,300	Weir	40,300	8,700	Foot	26,100
1983	183,577	Weir	183,577	90,000	Foot	90,000
1984	113,161	Weir	113,161	16,000	Foot	48,000
1985	366,000	Weir	366,000	225,000	Foot	225,000
1986	85,000	Boat	85,000	10,233	Foot	30,699
1987	24,000	Boat	72,000	6,000	Aerial	6,000
1988	78,753	Weir	78,753	10,000	Aerial	30,000
1989	288,246	Weir	288,246	60,600	Foot	60,600
1990	175,000	Boat	175,000	13,800	Foot	41,400
1991	n/a	Extrapolated	192,359	24,150	Foot	24,150
1992	3,000	Boat	9,000	4,500	Foot	13,500
1993	n/a	Extrapolated	192,359	39,000	Aerial	39,000
1994	n/a	Extrapolated	156,735	11,000	Aerial	33,000
1995	66,273	Weir	66,273	n/a	Aerial	3,800
1996	157,012	Weir	157,012	n/a	Aerial	8,500
1997	466,267	Weir	466,267	n/a		
1998	97,392	Weir	97,392	n/a		
1999	27,386	Weir	27,386	n/a		
2000	331,510	Weir	331,510	n/a		
2001	121,267	Weir	121,267	n/a		
2002	98,790	Weir	98,790	n/a		

[a] Data for 1961 through 1994 is from Clark (1995). Data for remaining years is from IFDB.
[b] Aerial and foot surveys were expanded by 3.0 to estimate total escapement, as per Clark (1995).
[c] Years where survey type method is “extrapolated,” total escapements are derived by Clark (1995).
[d] Data not collected for Humpy Creek in systematic manner since 1996 due to low exploitation of run.

Appendix Table A.5. Escapement index series for the pink salmon stock groups in the Juneau management area, together with summary statistics, 1960–2002.

JUNEAU									
Year	Freshwater Bay	Homeshore	Lynn Canal	N Chichagof	Seymour Canal	Stephens	SW Admiralty	Tenakee	W Admiralty
1960	13,274	5,124	10,697	22,117	22,577	21,675	16,201	38,630	8,661
1961	47,321	18,268	38,134	78,846	80,486	77,270	57,757	137,713	30,877
1962	28,376	10,954	22,867	47,280	48,263	46,335	34,634	82,580	18,515
1963	95,645	36,923	77,077	159,366	162,680	156,180	116,739	278,348	62,409
1964	33,124	12,787	26,693	55,191	56,339	54,088	40,429	96,397	21,613
1965	11,425	14,136	21,021	61,014	62,282	59,794	13,945	33,250	7,455
1966	26,861	7,940	17,106	40,730	103,056	103,141	70,259	28,593	37,641
1967	15,800	4,938	46,543	161,358	23,546	22,605	22,726	23,404	55,086
1968	47,650	6,385	12,800	43,458	290,276	46,748	79,707	118,590	33,580
1969	41,599	47,632	32,681	160,004	28,656	22,417	89,962	69,131	80,380
1970	89,087	19,471	33,619	46,789	236,557	58,399	96,042	166,765	52,366
1971	62,970	20,879	103,730	277,949	151,605	34,385	71,953	83,014	64,727
1972	49,291	2,563	21,078	33,653	359,722	345,349	73,367	150,142	18,632
1973	50,779	7,901	88,231	227,641	117,342	97,614	29,064	179,528	70,946
1974	61,999	1,641	13,345	25,371	353,986	26,187	29,499	184,237	13,931
1975	38,601	5,748	27,102	127,684	52,601	54,614	19,745	82,859	27,995
1976	42,433	2,821	20,010	36,451	53,868	13,385	19,711	130,636	8,958
1977	179,982	11,895	148,555	329,424	147,309	133,510	113,237	184,030	78,088
1978	153,918	21,085	52,843	64,354	105,699	66,488	71,672	541,648	62,871
1979	204,161	24,332	137,465	147,849	223,703	223,219	197,653	168,984	142,393
1980	53,922	46,897	78,613	52,353	80,147	99,005	175,895	289,975	43,053
1981	49,174	61,591	64,449	225,158	44,458	164,788	101,385	265,860	103,735
1982	103,393	27,239	86,847	166,508	234,825	246,318	207,450	356,456	58,679
1983	68,390	25,496	133,964	254,743	255,541	296,681	219,209	454,038	68,855
1984	97,298	62,153	56,055	198,047	370,857	198,348	151,240	238,037	55,486
1985	214,818	187,212	434,809	682,013	429,401	480,770	271,062	659,660	214,929
1986	103,391	17,987	15,782	59,083	131,746	77,274	174,341	599,530	24,407
1987	86,313	27,521	138,005	145,698	288,786	367,392	114,033	181,130	83,674
1988	66,344	44,010	61,356	37,958	75,757	95,072	87,574	275,646	19,035
1989	114,950	53,178	100,751	207,797	171,552	158,881	196,504	299,547	121,374
1990	109,044	32,312	164,581	113,035	37,986	113,261	195,206	262,438	50,232
1991	106,630	30,492	32,379	180,368	88,291	208,075	190,596	748,267	78,796
1992	115,937	39,667	99,741	66,719	125,925	287,450	161,931	371,377	49,512
1993	151,038	50,000	48,861	287,904	106,362	45,126	183,442	517,577	70,588
1994	274,943	86,591	258,190	208,517	231,926	747,349	230,997	592,599	131,826
1995	223,980	52,838	58,006	445,207	124,072	81,048	106,391	388,557	100,695
1996	131,628	5,649	17,584	39,796	292,645	464,972	293,319	489,032	48,873
1997	286,958	91,249	139,262	563,072	436,109	273,165	133,680	857,419	160,563
1998	150,125	11,176	83,378	89,084	307,505	458,048	517,969	489,188	26,658
1999	255,711	198,700	314,444	943,212	435,631	380,050	437,769	977,621	210,733
2000	83,492	6,721	33,990	52,711	199,571	130,925	255,551	418,919	11,349
2001	236,222	102,911	364,852	692,144	288,995	196,245	239,345	140,491	94,229
2002	155,887	13,112	88,108	180,504	216,859	258,555	207,205	602,388	22,498
Avg. 1960-1980	64,201	15,729	49,058	104,709	131,462	83,924	68,581	146,117	44,770
Avg. 1981-2001	144,275	57,843	128,918	269,465	222,759	260,535	212,809	456,352	84,963
Upper 80th percentile	153,342	52,271	136,765	249,323	290,020	284,593	205,491	489,157	92,118
Min. 1960-2001	11,425	1,641	10,697	22,117	22,577	13,385	13,945	23,404	7,455
Max. 1960-2001	286,958	198,700	434,809	943,212	436,109	747,349	517,969	977,621	214,929
Estimated Yr-Zero Level	45,874	21,564	92,715	80,344	189,030	205,027	143,021	301,454	57,954
Decline as % of Yr-Zero Level[a]			<0.01%						
Robust Estimate of Annual Decline[b]			248						
Increase as % of Yr-Zero Level	20%	8%		22%	1%	1%	4%	3%	3%
Robust Estimate of Annual Increase	9,049	1,808		17,654	2,650	1,918	5,801	9,470	1,812

[a] The year-zero escapement level and the robust estimate of stock decline (or increase) are based on the most recent 21 years (1981–2001) of data, and not the entire series.

[b] Declines (or increases) as a percent of year-zero level shows the size of a stock decline (or increase) relative to the size of the stock trend at the beginning of the series.

Appendix Table A.6. Escapement index series for the pink salmon stock groups in the Petersburg management area, together with summary statistics, 1960–2002.

	PETERSBURG															
Year	Affleck Canal	Anan	Burnett	Eliza Harbor	Farragut Bay	Houghton	Portage Bay	Pybus/Gambier	Ratz Harbor	Saginaw Bay	Shipley Bay	Stikine	Tebenkof	Totem Bay	Union Bay	Whale Pass
1960	50,276	13,489	1,548	2,232	1,534	44,947	1,894	10,762	1,861	6,416	3,611	1,044	5,597	4,571	3,620	488
1961	28,747	40,905	271	24,752	250	22,095	6,642	54,988	20,753	24,283	20,867	17,030	25,292	18,557	10,978	9,495
1962	162,801	157,755	4,475	3,229	3,713	92,194	7,619	43,705	15,144	23,374	30,111	3,303	64,493	33,137	42,338	23,011
1963	23,506	117,475	5,159	30,886	250	39,474	3,414	32,824	1,839	23,966	51,407	16,840	47,242	10,794	5,911	27,127
1964	50,955	101,414	164,450	45,698	3,182	77,372	7,870	38,349	72,193	69,806	2,966	14,503	63,096	3,324	27,217	543
1965	54,154	58,636	21,398	32,566	1,286	47,885	886	8,859	4,549	73,184	59,722	4,752	102,286	15,642	2,525	28,369
1966	48,815	143,558	16,037	81,158	2,933	75,586	5,116	32,578	27,922	20,309	56,651	12,255	76,636	29,877	38,528	59,294
1967	23,504	26,014	3,547	3,093	1,213	29,880	10,011	7,519	3,611	8,646	29,984	2,846	25,165	3,330	6,982	5,487
1968	67,516	118,318	45,572	85,626	4,058	136,580	29,850	70,375	2,274	40,283	69,738	25,519	81,504	37,375	10,875	30,852
1969	16,509	55,996	2,676	12,355	2,040	65,768	4,887	7,705	28,902	23,480	31,090	4,554	36,527	17,826	9,439	2,415
1970	38,584	123,831	11,094	39,885	2,960	115,446	14,806	59,337	9,669	8,924	16,910	14,789	25,285	16,781	6,443	21,751
1971	32,007	163,365	15,383	20,317	2,960	129,657	14,107	10,106	42,322	17,872	67,247	9,315	34,969	15,855	31,117	89,149
1972	45,893	147,745	25,627	24,720	3,790	108,761	8,185	61,824	24,004	32,257	9,230	3,774	28,916	360	15,733	12,229
1973	24,726	119,884	34,841	6,332	4,310	133,127	10,102	86,746	8,391	4,272	95,023	7,590	13,415	968	26,981	61,486
1974	19,045	92,704	24,000	5,668	2,263	57,524	4,867	34,487	14,960	1,780	17,506	3,303	10,355	1,079	24,977	63,541
1975	25,562	272,283	37,053	6,113	348	14,249	3,068	13,944	9,402	9,172	109,349	4,074	31,264	12,170	47,562	103,724
1976	57,785	527,733	103,809	2,914	459	42,179	936	37,295	46,020	8,074	27,574	1,263	80,833	7,241	80,660	217,645
1977	87,541	759,337	115,530	47,832	5,223	73,069	13,157	62,935	66,965	47,101	94,838	20,581	189,845	33,149	131,754	75,126
1978	135,900	349,458	45,539	38,182	7,067	185,116	22,298	142,521	83,410	40,976	99,865	3,427	147,557	37,173	78,055	81,892
1979	111,756	353,300	60,446	82,517	12,344	293,445	11,526	253,262	46,981	135,706	139,347	56,267	198,090	87,673	54,157	74,286
1980	70,602	225,798	43,009	73,219	4,764	214,542	18,376	125,728	8,601	50,271	43,492	1,909	65,671	17,009	76,137	24,235
1981	167,667	92,626	22,531	54,444	7,977	253,649	15,234	44,847	41,964	55,995	105,993	16,689	49,302	29,706	24,775	18,258
1982	65,860	280,497	14,559	75,318	24,850	392,525	33,192	106,955	89,752	173,180	30,613	44,270	151,786	56,183	73,150	50,860
1983	146,868	267,823	22,038	40,293	3,427	185,506	28,687	51,339	61,126	91,742	74,799	18,467	112,571	22,289	79,344	30,874
1984	98,542	190,981	26,757	95,518	7,420	244,470	29,150	73,854	16,604	121,751	49,215	13,635	143,072	21,006	60,244	52,669
1985	336,711	625,600	123,047	156,813	45,724	528,018	78,951	288,886	233,646	273,861	319,841	53,284	356,800	244,957	180,930	232,364
1986	461,376	368,561	123,800	92,430	18,497	129,492	27,113	94,021	197,500	226,933	175,900	13,264	250,979	137,673	298,610	252,299
1987	54,841	229,537	33,545	128,130	27,000	715,699	59,910	231,729	22,510	162,602	79,306	59,380	80,694	107,392	58,600	33,545
1988	108,126	177,979	45,889	77,251	6,100	265,901	37,198	108,477	70,000	63,333	24,126	9,228	188,687	35,687	95,258	33,823
1989	108,043	690,479	80,861	166,935	35,963	631,212	59,950	251,180	137,480	236,113	244,783	70,481	174,840	120,754	187,599	186,115
1990	318,582	216,770	110,343	204,968	14,890	709,659	51,876	246,290	71,300	48,873	36,551	57,617	126,472	47,538	149,800	228,789
1991	236,130	457,433	101,511	274,216	35,943	697,196	43,395	247,469	112,340	309,005	356,000	123,269	221,357	125,098	126,100	164,233
1992	124,104	743,391	54,278	330,366	18,079	792,748	53,300	312,448	24,920	124,941	57,272	57,103	271,936	76,235	64,858	68,157
1993	293,600	575,780	77,635	259,446	28,600	386,937	16,948	175,573	119,500	110,656	320,800	13,269	283,871	284,850	88,300	138,188
1994	263,418	396,276	163,800	248,100	29,600	934,688	24,367	382,300	107,200	354,292	164,615	34,500	451,796	55,433	107,800	301,890
1995	284,810	476,254	77,062	170,807	1,577	170,090	8,095	126,478	192,700	74,550	225,583	14,775	297,357	114,324	252,257	244,741
1996	617,412	407,131	256,256	308,920	18,208	161,085	15,709	323,335	151,360	342,434	253,108	29,956	643,566	74,259	218,104	188,064
1997	302,139	472,528	105,211	285,884	15,235	357,621	39,030	291,857	71,000	158,397	318,785	14,036	192,917	128,146	57,452	202,601
1998	196,225	404,021	171,833	273,964	16,674	445,229	17,600	349,639	156,012	240,140	145,581	26,050	366,369	95,586	136,909	225,234
1999	960,756	596,483	777,935	736,736	66,660	1,104,046	122,100	562,300	806,472	520,618	1,869,197	57,591	657,582	980,251	197,756	628,094
2000	436,835	398,712	138,865	403,469	20,921	462,123	27,886	357,385	57,596	491,030	141,708	12,775	526,943	79,467	61,882	45,657
2001	579,400	580,405	244,100	177,971	17,550	707,150	32,586	275,399	171,300	222,827	457,500	116,395	377,306	272,209	299,600	307,676
2002	549,105	420,406	210,637	178,211	24,100	743,538	28,560	368,353	159,000	536,221	135,068	8,476	592,215	138,159	136,561	89,244
Avg. 1960-1980	56,009	189,000	37,213	31,871	3,188	95,185	9,505	56,945	25,703	31,912	51,263	10,902	64,478	19,233	34,857	48,197
Avg. 1981-2001	293,402	411,870	131,993	217,237	21,947	489,288	39,156	233,417	138,680	209,680	259,585	40,764	282,200	148,050	134,254	173,054
Upper 80th percentile	291,842	475,509	121,544	239,474	20,436	514,839	36,397	270,972	118,068	226,112	215,646	51,481	281,484	112,938	135,878	214,636
Min. 1960-2001	16,509	13,489	271	2,232	250	14,249	886	7,519	1,839	1,780	2,966	1,044	5,597	360	2,525	488
Max. 1960-2001	960,756	759,337	777,935	736,736	66,660	1,104,046	122,100	562,300	806,472	520,618	1,869,197	123,269	657,582	980,251	299,600	628,094
Est. Year-Zero Level[a]	45,447	238,422	-20,838	56,805	22,293	314,831	34,470	41,433	33,559	114,971	29,118	27,915	63,204	36,565	28,331	9,768
Decline as % of Year-Zero Level[b]					0.3%		0.3%									
Robust Est. of Annual Decline					68		90									
Increase as % of Year –Zero Level	45.6%	6.1%	Not defined	24.3%		4.3%		39.5%	20.2%	4.8%	42.6%	1.9%	26.5%	11.4%	31.4%	127.5%
Robust Est. of Annual Increase	20,712	14,622	10,363	13,818		13,684		16,380	6,778	5,538	12,414	542	16,731	4,153	8,900	12,455

[a] The year-zero escapement level and the robust estimate of stock decline (or increase) are based on the most recent 21 years (1981–2001) of data, and not the entire series.

[b] Declines (or increases) as a percent of year-zero level shows the size of a stock decline (or increase) relative to the size of the stock trend at the beginning of the series.

Appendix Table A.7. Escapement index series for the pink salmon stock groups in the Sitka management area, together with summary statistics, 1960–2002.

						SITKA					
Year	E Baranof	Hoonah Sound	Kelp Bay	Lisianski	Portlock	Salisbury Sound	SE Baranof	Sitka Sound	Slocum Arm	W Crawfish	Whale Bay
1960	9,463	38,606	6,307	2,467	14,099	1,527	7,482	6,458	3,939	8,045	29,428
1961	45,023	241,834	21,251	37,808	51,000	61,746	35,599	55,498	26,859	6,768	24,758
1962	18,399	54,538	12,263	12,355	22,300	21,644	14,548	19,031	60,789	2,718	9,943
1963	40,000	322,862	60,194	179,232	77,000	252,759	11,154	172,512	101,025	500	2,641
1964	5,171	157,959	15,175	36,059	11,500	19,286	4,089	11,630	42,005	1,000	3,658
1965	27,000	215,621	30,939	111,479	14,087	49,190	21,349	87,280	66,726	1,000	2,331
1966	15,513	138,976	11,979	6,653	9,629	9,178	12,266	15,477	10,459	2,714	9,928
1967	37,617	23,611	13,758	18,415	9,377	39,644	29,744	60,451	44,941	200	1,059
1968	56,882	196,608	39,917	3,992	1,537	6,966	3,718	3,519	3,404	273	1,000
1969	36,198	155,947	15,967	30,966	13,191	141,063	28,621	104,398	62,544	7,244	26,498
1970	30,000	129,806	20,138	5,303	3,202	23,941	37,180	5,155	28,629	2,795	10,223
1971	58,000	127,960	49,000	53,262	1,665	62,945	53,000	85,324	48,290	200	6,800
1972	25,855	176,439	30,452	3,902	1,085	10,600	47,861	3,102	106,443	526	1,923
1973	5,171	37,850	19,499	23,862	13,700	27,001	4,089	179,084	81,883	649	2,373
1974	5,171	156,176	17,212	13,811	4,339	11,424	26,802	56,177	83,772	15,772	57,694
1975	20,684	27,708	17,410	30,226	14,087	82,134	18,163	211,588	114,334	6,844	25,036
1976	2,200	105,496	5,829	11,348	9,914	22,929	15,315	58,936	132,903	3,823	13,983
1977	64,121	216,215	33,916	152,719	15,368	276,560	36,642	751,626	213,960	23,188	84,821
1978	33,000	416,054	34,976	28,104	7,684	80,425	84,000	109,466	86,551	10,383	37,981
1979	72,395	300,384	57,233	209,988	172,887	322,500	160,000	506,616	249,000	5,257	19,231
1980	22,278	156,736	27,966	18,600	5,868	48,383	62,805	30,206	38,477	6,974	25,510
1981	51,350	188,968	115,340	192,701	85,320	308,890	83,740	375,311	131,535	18,170	30,503
1982	90,060	251,185	77,420	28,905	17,401	141,568	120,870	117,368	75,445	19,750	23,785
1983	63,990	275,815	43,213	195,026	110,600	172,220	61,620	277,769	114,076	18,960	44,585
1984	79,790	298,159	66,360	44,405	16,195	145,360	65,570	252,929	82,160	63,200	55,300
1985	122,450	301,512	99,540	262,660	67,150	355,105	67,545	545,041	131,930	15,800	75,050
1986	53,799	156,501	28,124	36,512	11,060	32,209	15,378	97,392	48,726	9,480	18,170
1987	76,630	226,967	58,065	56,135	27,650	21,883	14,773	100,126	92,035	11,850	10,430
1988	73,533	155,248	53,720	20,571	5,460	21,315	14,773	10,886	34,276	3,160	12,224
1989	93,958	216,532	90,060	75,050	42,660	27,705	24,648	13,286	228,508	395	17,064
1990	65,362	247,973	25,675	10,063	5,767	40,448	44,240	12,207	97,452	4,740	22,103
1991	159,321	310,075	110,600	29,072	19,750	138,487	62,015	57,623	223,019	4,153	15,193
1992	65,362	383,211	30,800	13,527	20,500	33,101	76,500	24,168	130,375	12,000	197,250
1993	98,580	521,726	87,690	75,000	5,507	168,822	122,500	19,841	47,923	2,310	8,450
1994	254,380	526,083	111,590	28,407	50,450	127,830	90,160	288,788	421,880	38,000	202,400
1995	126,000	108,161	20,668	148,476	87,000	425,168	186,000	237,776	287,500	15,000	90,000
1996	325,778	328,900	77,500	32,600	79,400	255,000	238,000	708,268	307,000	50,000	143,000
1997	270,000	295,125	162,161	540,000	290,000	272,256	132,500	1,038,900	567,000	5,100	97,000
1998	232,000	500,488	100,100	55,148	56,000	313,000	280,000	1,334,879	211,000	74,000	377,000
1999	557,361	840,707	319,094	946,000	290,000	1,480,500	251,000	1,615,142	1,190,500	42,000	165,500
2000	135,666	615,484	85,585	40,845	127,000	254,672	118,842	514,239	413,111	25,000	112,882
2001	195,407	439,720	151,300	652,000	165,000	165,200	96,000	689,227	568,000	18,000	106,976
2002	186,208	529,871	72,630	147,432	120,536	439,114	70,795	972,882	272,686	81,000	323,366
Avg. 1960-1980	30,007	161,780	25,780	47,169	22,549	74,850	34,020	120,644	76,521	5,089	18,896
Avg. 1981-2001	151,942	342,311	91,172	165,862	75,232	233,369	103,175	396,722	257,307	21,479	86,898
Upper 80th Percentile	125,290	327,692	89,586	151,870	78,290	254,934	114,274	480,355	227,410	18,802	88,964
Min. 1960-2001	2,200	23,611	5,829	2,467	1,085	1,527	3,718	3,102	3,404	200	1,000
Max. 1960-2001	557,361	840,707	319,094	946,000	290,000	1,480,500	280,000	1,615,142	1,190,500	74,000	377,000
Est. Year-Zero Level[a]	12,120	185,525	58,207	5,118	-19,927	52,984	9,905	-30,753	-40,434	10,408	-11,244
Decline as % of Year-Zero Level[b]											
Robust Est. of Annual Decline											
Increase As % of Year-Zero Level	91.6%	7.3%	4.1%	128.9%	not defined	17.1%	86.8%	not defined	not defined	4.7%	not defined
Robust Est. of Annual Increase	11,098	13,467	2,410	6,596	7,096	9,064	8,602	32,524	22,934	488	-5,884

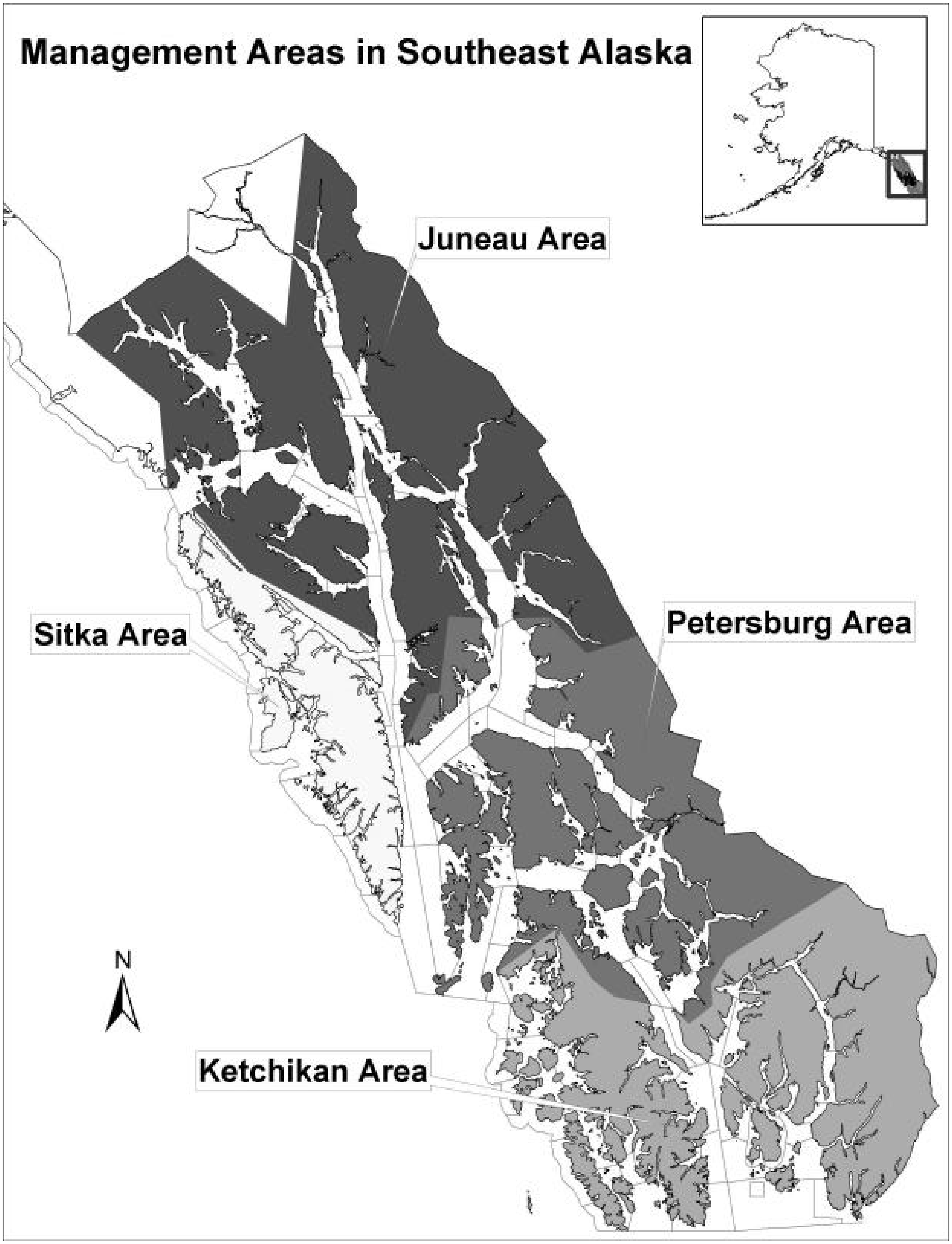
[a] The year-zero escapement level and the robust estimate of stock decline (or increase) are based on the most recent 21 years (1981–2001) of data, and not the entire series.
[b] Declines (or increases) as a percent of year-zero level shows the size of a stock decline (or increase) relative to the size of the stock trend at the beginning of the series.

Appendix Table A.8. Escapement index series for the pink salmon stock groups in the Ketchikan management area, together with summary statistics, 1960–2002.

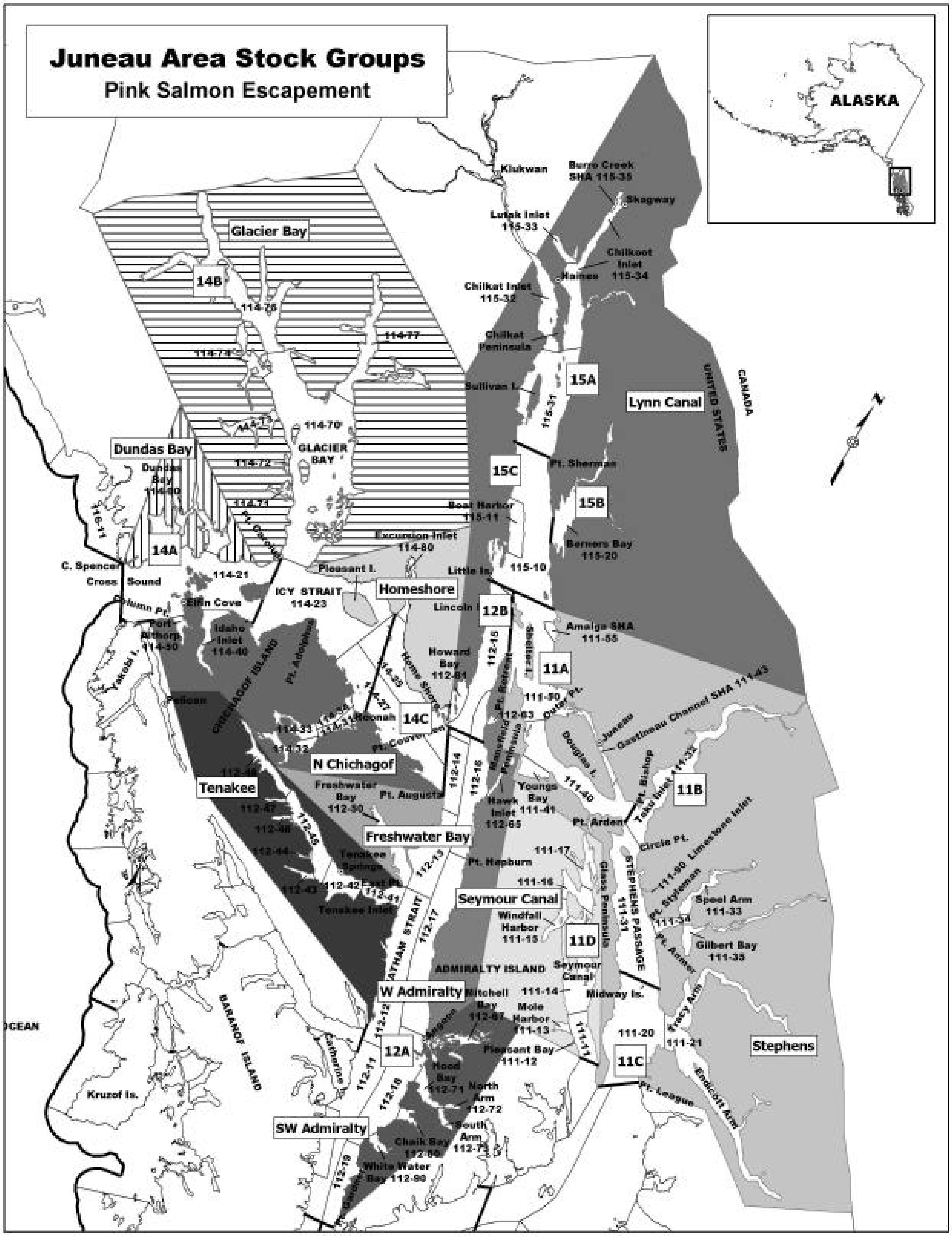
				KETCHIKAN					
Year	E Behm	E Dall	Hetta	Kasaan	Klawock	Moira	Portland	Sea Otter Sound	W Behm
1960	128,231	31,282	10,078	59,019	136,993	9,683	29,074	10,469	48,716
1961	58,490	11,864	21,718	26,920	43,064	4,417	13,262	9,481	22,221
1962	457,998	74,623	136,603	133,638	270,863	3,719	105,574	59,634	103,474
1963	424,743	67,843	41,181	169,986	329,263	166,396	172,470	54,216	172,009
1964	326,624	149,517	134,895	219,935	161,780	45,008	157,672	98,846	306,208
1965	163,799	146,241	156,237	155,604	257,774	29,745	156,797	173,858	46,760
1966	563,257	56,098	184,157	434,740	363,547	53,711	189,751	252,107	303,903
1967	110,331	9,401	17,209	22,073	34,124	2,181	29,806	7,513	73,291
1968	333,839	24,540	52,155	273,581	102,786	46,018	358,131	105,455	104,535
1969	287,197	32,202	75,295	266,765	121,765	19,055	92,345	13,484	124,382
1970	537,660	51,418	56,136	117,231	253,872	13,445	51,365	13,523	160,182
1971	230,772	27,831	240,193	339,882	421,775	51,013	63,952	76,311	171,693
1972	403,976	33,004	129,046	152,586	253,385	23,263	106,574	48,273	187,432
1973	429,521	16,460	89,993	138,957	155,646	84,745	165,965	120,520	52,421
1974	435,141	69,674	163,531	127,083	177,750	79,038	24,093	66,510	121,084
1975	419,241	77,928	234,202	393,354	227,429	103,816	78,806	181,730	131,182
1976	485,290	213,848	186,365	421,236	504,925	97,313	119,887	144,705	175,616
1977	1,276,742	171,756	247,792	511,959	613,438	107,751	512,756	202,383	527,250
1978	1,173,660	230,837	287,591	385,721	717,727	38,345	335,323	225,877	473,888
1979	483,110	221,488	268,150	573,096	823,349	49,638	40,228	179,301	534,174
1980	1,131,383	365,452	598,405	479,966	899,068	119,515	142,100	178,490	609,760
1981	1,113,992	302,281	409,941	393,530	991,121	81,343	337,805	183,939	394,972
1982	802,113	200,472	438,345	293,786	580,478	53,421	92,860	173,702	447,684
1983	1,462,362	223,117	467,702	854,113	1,078,101	116,827	227,980	248,467	439,892
1984	2,151,342	548,992	574,446	638,932	1,340,913	133,470	485,032	203,961	910,715
1985	1,742,320	554,298	743,953	755,813	2,200,923	141,500	525,320	328,200	1,136,482
1986	3,155,245	678,433	1,177,742	1,282,946	2,546,753	220,943	395,677	416,837	843,406
1987	1,275,659	181,498	603,839	385,444	859,679	78,279	494,986	90,453	434,004
1988	907,106	243,157	398,476	303,736	382,349	158,530	165,225	78,976	141,318
1989	1,087,877	129,885	507,056	672,641	1,960,301	50,090	679,689	235,611	798,357
1990	972,996	399,813	724,589	838,051	983,319	87,311	104,411	247,658	661,948
1991	1,034,569	154,760	540,320	588,126	1,127,551	41,320	213,086	143,539	401,725
1992	1,895,361	256,570	313,633	733,334	615,899	131,717	206,240	267,988	676,757
1993	1,265,437	341,228	655,218	829,924	1,697,904	65,192	458,708	221,190	394,820
1994	1,254,007	287,776	508,260	550,855	908,305	75,248	218,720	294,805	308,929
1995	2,593,276	453,205	976,230	750,447	1,673,682	159,784	537,100	314,301	691,781
1996	4,647,575	935,879	1,857,934	2,885,635	3,016,390	215,258	424,199	827,305	940,591
1997	1,439,244	167,811	459,062	759,265	1,030,349	49,024	265,502	109,492	617,649
1998	1,708,862	319,584	660,034	951,587	1,615,746	194,020	542,495	156,096	852,598
1999	1,659,673	310,281	1,389,791	1,497,486	1,426,652	218,996	422,598	322,356	712,248
2000	1,222,724	268,757	1,072,180	1,042,230	291,288	78,124	284,817	136,431	378,030
2001	2,977,408	350,997	496,180	1,052,729	1,918,907	100,894	519,969	492,699	851,675
2002	2,014,774	442,577	1,001,849	1,574,728	1,427,089	107,937	568,299	271,355	662,657
Avg. 1960-1980	469,572	99,205	158,616	257,302	327,158	54,658	140,282	105,842	211,913
Avg. 1981-2001	1,731,864	348,038	713,092	860,029	1,345,077	116,728	362,020	261,619	620,742
Upper 80th Percentile	1,620,211	336,899	644,942	815,792	1,409,504	133,120	451,806	251,379	688,776
Min. 1960-2001	58,490	9,401	10,078	22,073	34,124	2,181	13,262	7,513	22,221
Max. 1960-2001	4,647,575	935,879	1,857,934	2,885,635	3,016,390	220,943	679,689	827,305	1,136,482
Est. Year-Zero Level[a]	1,226,022	279,216	370,625	467,723	803,287	83,534	321,910	164,596	312,681
Decline as Percent of Year-Zero Level[b]									
Robust Est. of Annual Decline									
Increase as % of Year-Zero Level	1.4%	0.4%	7.7%	6.2%	4.8%	3.7%	0.6%	4.8%	6.0%
Robust Est. Of Annual Increase	17,607	1,236	28,699	28,807	38,403	3,068	2,037	7,881	18,897

[a] The year-zero escapement level and the robust estimate of stock decline (or increase) are based on the most recent 21 years (1981–2001) of data, and not the entire series.

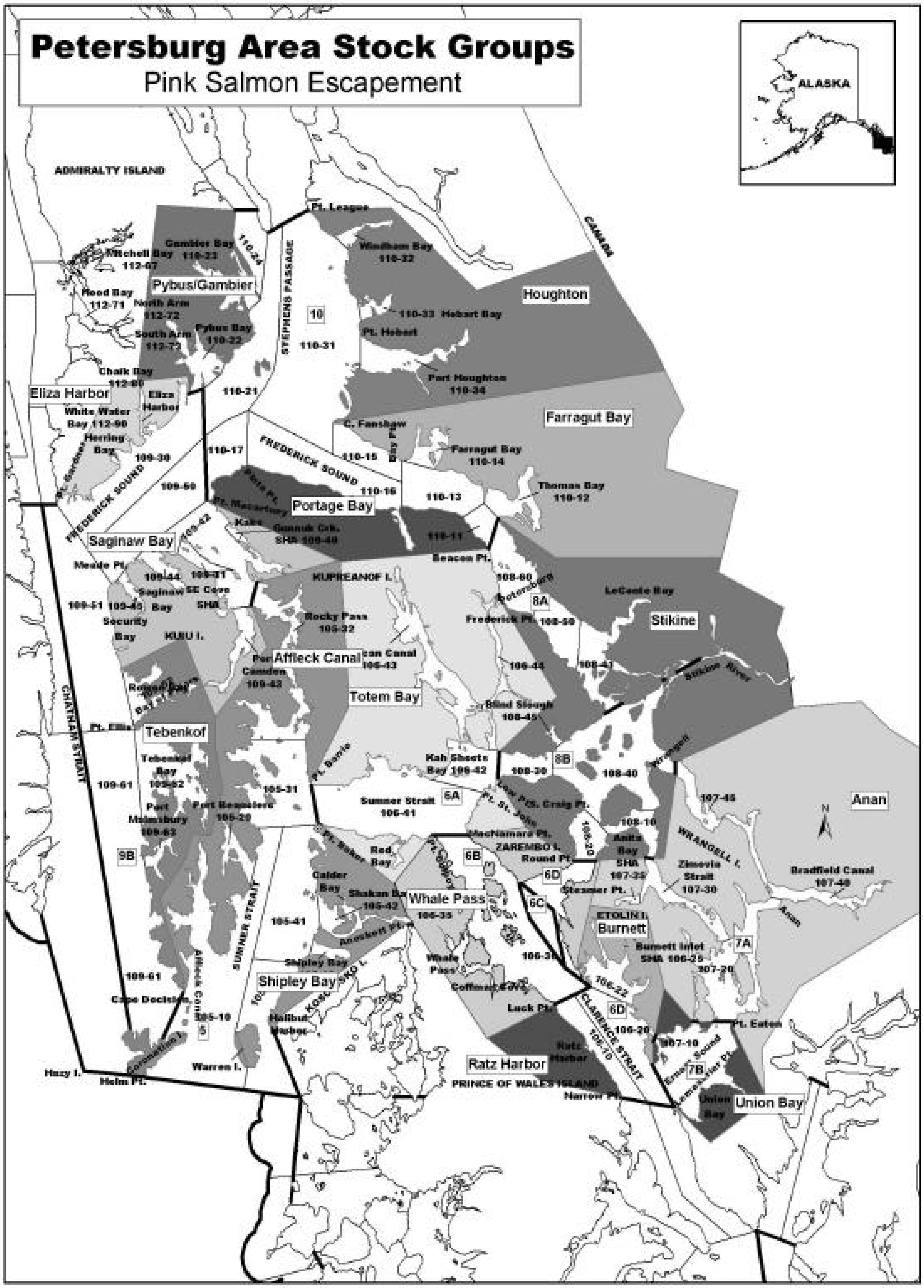
[b] Declines (or increases) as a percent of year-zero level shows the size of a stock decline (or increase) relative to the size of the stock trend at the beginning of the series.



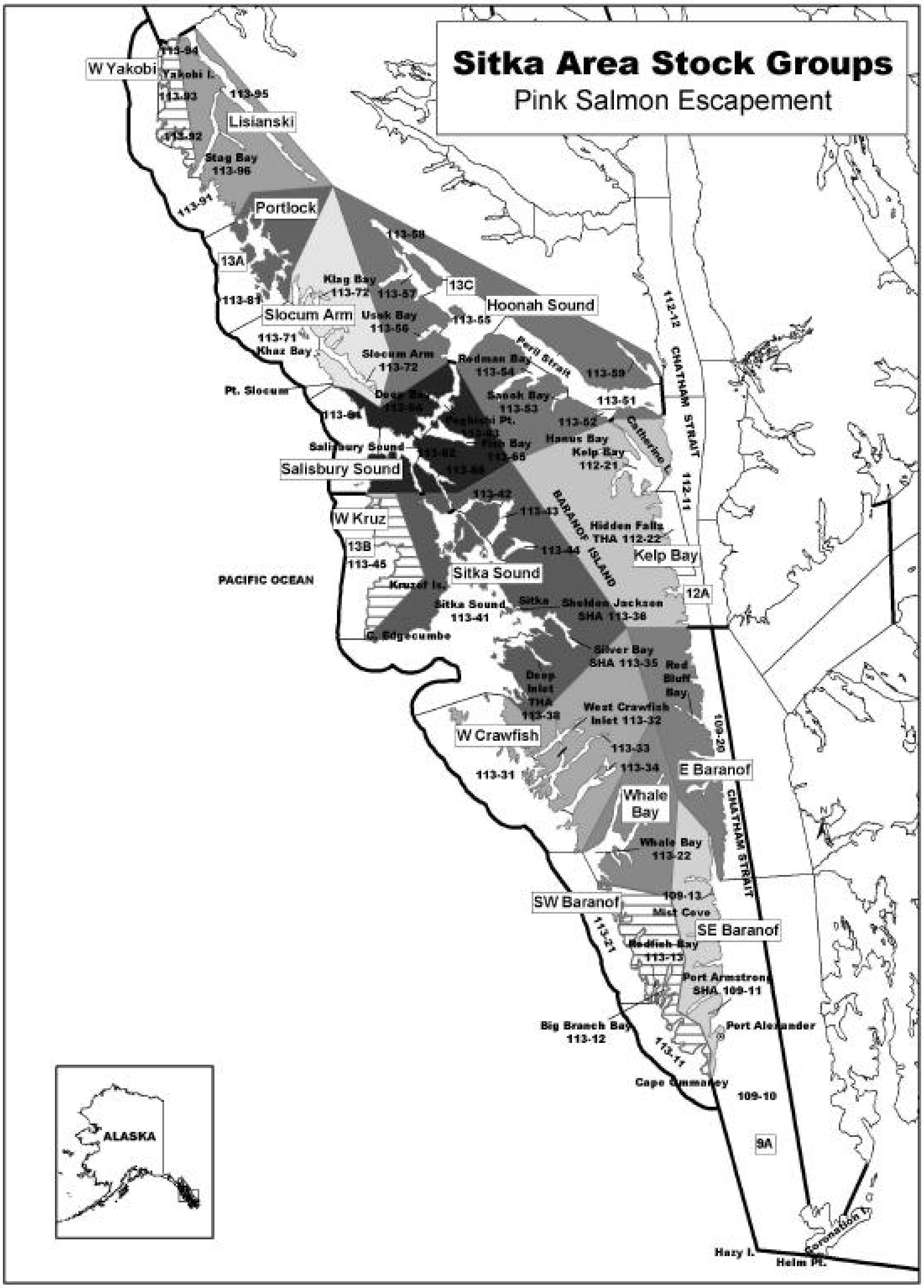
Appendix Figure A.1. Southeast Alaska salmon management areas.



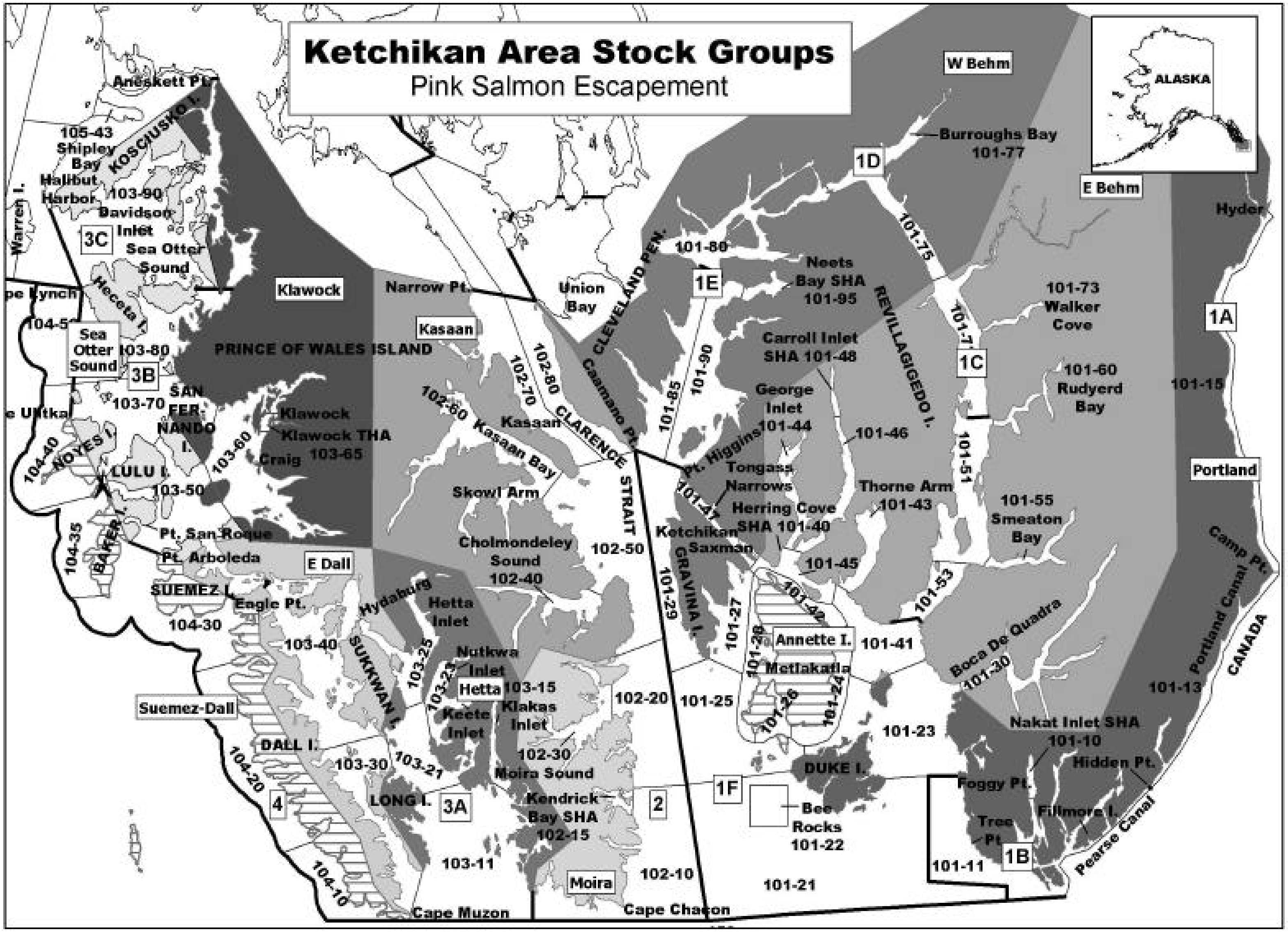
Appendix Figure A.2. Juneau management area pink salmon escapement stock group areas. Diagonal hatched stock groups indicate areas with no index streams or escapement targets.



Appendix Figure A.3. Petersburg management area pink salmon escapement stock group areas.



Appendix Figure A.4. Sitka management area pink salmon escapement stock group areas. Diagonal hatched stock groups indicate areas with no index streams or escapement targets.



Appendix Figure A.5. Ketchikan management area pink salmon escapement stock group areas. Diagonal hatched stock groups indicate areas with no index streams or escapement targets.