Northwest Alaska Summer Chum Salmon

Harvest Rates in the June Fishery from 1993 to 1996

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ABSTRACT

In the most recent study of chum salmon caught in the June "False Pass" fishery, Seeb et al. (1997) provided new estimates on the origins of these fish from 1993 to 1996. This new analysis is based on ten stock groups. The group that consistently made the greatest contribution to this June fishery was the Northwest Alaska Summer chum stock group, which includes spawning populations from Port Heiden and Cinder River on the North Alaska Peninsula, Bristol Bay, the Kuskokwim and Yukon (summer run) Rivers, and Kotzebue and Norton Sound. The Board of Fisheries asked the Alaska Department of Fish and Game to use these genetic estimates to produce harvest rate estimates, to be used by the Board at their 1998 Area M meeting. Calculation of defendable harvest rates for this stock group was not possible; we can not accurately estimate the total size of the runs that make up this stock group. However, using estimates of inshore catch and hypothetical inshore harvest rates, a range of stock sizes for the Northwest Alaska Summer chum stock group was generated for 1993 to 1996. If the inshore harvest rate was at least 25%, the harvest rate in the June "False Pass" fishery was likely at least 1% in these years. However, if the inshore harvest rate on the Northwest Alaska Summer chum stock group was at most 75%, then the June fishery harvest likely did not exceed 12% from 1994 to 1996, but could have been higher in 1993.

Background

Controlling harvest rates to meet some objective forms the basis of rational fisheries management. This term *harvest rate* is defined to be the number of salmon harvested from a stock grouping of interest, divided by the salmon abundance (the number of salmon of that stock grouping that would have returned to their streams of origin in the absence of the fishery). In other words the harvest rate is *the percentage of fish that got caught*. For example if the fleet caught 1,000 fish, and the escapement was accurately measured to be 99,000 fish, then harvest rate is

h_rate = 1,000/(1,000 caught + 99,000 escaped)

= 1,000/(100,000 abundance) = 0.01, or 1%.

If the catch takes place in more than one time or place, the overall harvest rate can be broken up into individual components that show the percent caught in each fishery. These individual harvest rates add to a total, overall harvest rate, which is what should be used to judge whether the catch was appropriate for the run size.

For many years the Alaska Board of Fisheries has been trying to find a way to allow a harvest of migrating sockeye salmon in the June "False Pass" fishery[2] and control the harvest rate of sockeye and chum salmon to levels generally agreed to be "acceptable." Harvesting these migrating salmon in this June fishery – or in any fishery along the migratory path – reduces the harvest potential of these same fish at other locations further along the migration path. Maturing chum salmon from Asia, western Alaska, as well as immature chum salmon originating from various locations in North America could be in the vicinity of the June fishery in the spring and early summer (Salo 1991; Fredin et al. 1977). The chum salmon in this June fishery are harvested before any inseason information on the strength of the run of any particular stock is available. So there is no practical way to adjust harvest rates based on the strength of any particular stock, while the June fishery is taking place. Currently, the Board capped the harvest of chum salmon in this fishery at 700 thousand.

Under this cap strategy, harvest rate and abundance can have an inverse relationship if the cap acts as something of a quota. The harvest rate is a ratio with catch in the numerator and total abundance in the denominator. In the example above, 1,000 fish were caught (the numerator) and abundance was 100,000 (the denominator). If abundance goes up broadly, then the denominator of the ratio gets bigger. With a bigger denominator, the ratio will get smaller (continuing with the same example, if the abundance goes up to 1,000,000, note 1,000/1,000,000 = 0.1%, which is much smaller than 1%). Similarly, if the fleet struggles to catch a cap when the abundance is down, the harvest rate will go up. In other words, when there are *more fish available*, the *percentage* caught in the June

[2] These fisheries actually take place during June in the Shumagin Islands (Southeastern District) and south of Unimak Island (Unimak District), Alaska (Figure 1). For simplicity, these fisheries will be called the June fishery throughout the remainder of this document, unless more specific wording is necessary.

fishery *goes down* if the same number of fish get caught. Similarly, when there are *less* fish available for harvest, the *percentage caught* in the June fishery may increase.

For as long as the Board has been examining these caps, the Alaska Department of Fish and Game has been trying to answer basic fisheries management questions about these chum salmon. These questions include to what extent do western Alaska chum salmon contribute to these fisheries, what are the harvest rates on western Alaska chum salmon stocks, and what can the Department do to control this harvest rate in the June fishery?

At past Board meetings some members of the public seemed to misunderstand information presented by the Department. In particular, some people confused the concepts of harvest rate and contribution rate. *Contribution rate* is the ratio of the number of salmon of a particular stock of interest harvested, to the total number of fish caught in the entire fishery. Modern genetic tools (Utter et al. 1986; Pella and Milner 1986; Gharrett and Smoker 1994) often provide the best hope of producing contribution estimates with small bounds of accuracy and precision, but these techniques often only work for large stock groupings. The *contribution rate* statistic is used to tell *where the harvested fish came from*. In contrast, the *harvest rate* statistic is used to tell *if too many fish were caught* for the size of the run.

Depending on the run size and size of the fishery, a large stock could have a high contribution rate, but low harvest rate, and not be a management problem; a small stock could have a low contribution rate, but high harvest rate, and be a big problem. The size of the stock and the size of the contribution rate alone are not important in themselves. The contribution rate needs to be judged in the context of the run size and magnitude and consistency of the harvest rate. The most recent contribution rates for the June fishery are found in Seeb et al. (1997). Stock size estimates are not available for the Northwest Alaska Summer chum stock group. In their absence, hypothetical values are generated below to illustrate the general principles linking stock size, contribution rates, and harvest rates.

Previous Studies

A few tagging studies were conducted before and near the time of statehood. Gilbert (1923) reported on tagging studies of sockeye salmon in the Alaska Peninsula during 1922, and Gilbert and Rich (1925) reported on subsequent tagging efforts. Thorsteinson and Merrel (1964) reported on a 1961 tagging effort on both sockeye and chum salmon. They stated,

> Of the 996 chum salmon tagged [south and southwest of Unimak Island], 60 (6%) were recovered... The recaptures were reported from 25 locations, the majority being from points along the north side of the Alaska Peninsula, in

> Bristol Bay, and at various rivers on the Bering Sea Coast [the report refers to a Figure 6 and shows recoveries up to the Kuskokwim River].

The Department of Fish and Game conducted pilot studies using scale pattern analysis for stock separation in the June fishery in 1983. No formal reports of this work were ever produced. A lack of samples of fish of Russian origin was one of the main difficulties with this approach.

Eggers et al. (1991) tagged both chum and sockeye salmon in the Unimak and Shumagin Islands areas in 1987. They used probability-based methods to go beyond simply reporting recovery numbers, to estimate stock composition rates. They were able to tag over 6,000 chum salmon, recovering about 13% of the tags for use in their analysis. They concluded,

> The stock composition of the tagged chum salmon differed markedly from that of the sockeye salmon. There was a more diverse mixture of stocks, and no particular stock dominated. Tagged fish of Asian origin were significant and constituted 18% of the Unimak and 44.8% of the Shumagin releases. Tagged fish of Bristol Bay origin were the most abundant stock in the Unimak releases, accounting for 40.0% of the releases. Tagged fish of Japanese origin were the most abundant stock in the (36.5%) Shumagin release. Of the Alaskan stocks, Bristol Bay (59%) and Kuskokwim (49.9%) were the most abundant in the collective Unimak and Shumagin releases.

This study was reworked, several mistakes were corrected, and the analysis was broken into three cases before again presenting the results in 1992 [in a report titled 1987 South Peninsula Tagging Study (Review and Revisions) at the 1992 Area M Board Meeting]. This same material was presented to the Board of Fisheries in 1994.

In the mid 1990s the Department began work to assess the effects on chum salmon stocks of moving fishing effort to the north side of the Alaska Peninsula in June (Geiger et al. 1994). This plan was politically infeasible, and the work did not come to completion.

At the 1995 Area M Board meeting, Seeb et al. (1995) presented a preliminary analysis of 2,000 chum salmon caught in the Unimak District (Figure 1) in 1993 and 1994. This study was a genetic analysis of what are called allozymes. This technique is based on identifying different forms of enzymes – the proteins that control the basic biochemistry of life. The authors were able to group the chum salmon into stock groupings identified as (1) Japan, (2) Russia, (3) Northwest Alaska Summer (including Kotzebue, Norton Sound, Lower Yukon and Kuskokwim, and Bristol Bay, Port Heiden and Cinder River on the Alaska Peninsula, and the Susitna River in Cook Inlet), (4) Yukon Fall, (5) Peninsula/Kodiak, (6) Prince William Sound to SE Alaska, (7) British Columbia, and (8) Washington. They found the Northwest Alaska Summer chum stock group predominated in all estimates. Its contribution ranged from 72% in the second sampling period of 1994 to 52% in the first sampling period of 1994. Yukon River Fall populations appeared to be absent from all samples. Seeb et al. (1995) also presented an analysis of mitochondrial DNA used to check for Japanese chum salmon in 1994. This DNA analysis agreed nearly perfectly with the allozyme analysis – providing confidence in the allozyme approach.

Eggers (1995) provided the Board with a model-based synthesis of the 1987 tagging study and the more current genetic analysis. Combining the tag and genetic data, he provided estimates of harvest rates from 1979 to 1994. This was accomplished by introducing statistics called *vulnerability indices*, generated from the tagging and genetic analyses, and then assuming that harvest rates in the June fishery were controlled by constant vulnerabilities and variable run sizes. Eggers presented a provocative conclusion that the harvest rates on the Northwest Alaska Summer chum stock grouping had been increasing since the mid 1980s.

The Department withdrew the Eggers (1995) report at the March 1996 Area M Board meeting. In a memorandum to the Board of Fisheries, the director of the Commercial Fisheries Management and Development Division wrote that the Department was concerned about, "(1) the way the total returns for most chum salmon stocks are estimated, (2) that the assumptions made setting the "vulnerability coefficients" need to be tested, and (3) that there needs to be more work to measure the precision and accuracy of the estimates." Since that time, the Department formed a committee to examine this model and its assumptions. The committee concluded that the model cannot be validated with existing data, that the data inputs are insufficient to support the model, and that work in this area will require additional resources, which would have to come at the expense of more valuable programs. Currently, the Department's position on the Eggers (1995) harvest rate report is that this work not a priority when ranked against other needs.

Ackley (1996) examined chum bycatch in the Bering Sea trawl fishery. He found chum salmon are attracted to an area Northwest of Unimak Island, and the bycatch was largely confined to the months of August to October. Although the bycatch had previously remained at levels of 10 to 40 thousand chum salmon, the bycatch soared to over 240 thousand in 1993 – a year of very poor chum returns to western Alaska. Subsequently, these fish have been found to be largely immature salmon, not returning to spawn in the year of bycatch (David Ackley, Alaska Department of Fish and Game, personal communication).

Two studies of the origin of chum bycatch in the Bering Sea have been conducted. In one study, Patton (1997) and Patton et al. (*in press*) used scale pattern analysis, and reported on contribution rates of age 0.3 chum salmon caught incidentally in the eastern Bering Sea trawl fishery in 1994. They reported that about 50% of the fish they analyzed were of Asian origin, and about 18% originated from central and western Alaska. In the other study, Wilmot et al. (1996) conducted genetic stock identification on chum salmon incidentally harvested in the Bering Sea trawl fishery in 1994 and 1995. They estimated the origins of these fish to be 39%-55% Asian, 20%-35% western Alaska, 21%-29% southeastern Alaska or more southerly stocks for 1994. The 1995 estimates showed 13%-

51% Asian stocks, 33%-53% western Alaska stocks, and 9%-46% southeastern Alaska or more southerly stocks. These two studies produced estimates that agreed essentially.

The 1997 Genetic Analysis of the June Fishery

Seeb et al. (1997) improved and expanded on the 1995 study of chum salmon origins in the June fishery (Seeb et al. 1995). In their latest study, chum salmon were grouped into ten reporting regions: 1) Japan, 2) China/Southern Russia, 3) Northern Russia, 4) Northwest Alaska Summer, 5) Fall Yukon, 6) Alaska Peninsula/Kodiak Island, 7) Susitna River, 8) Prince William Sound, 9) Southeast Alaska/Northern British Columbia, and 10) Southern British Columbia/Washington. The fisheries in 1994 - 1996 were broken into three periods, and estimates of stock contribution were generated for each area and period separately. The 1993 fishery was broken into two periods, and estimates were generated for the Unimak area. The Northwest Alaska Summer reporting group generally had the highest contribution, although the contribution rate changed between and within years, following no obvious pattern. The contribution of the Northwest Alaska Summer group dropped noticeably in 1996.

Available and Accurate Information on the Northwest Alaska Summer Chum Stock Group

Accurate estimates of the stock size remain the biggest obstacle in the way of a harvest rate analysis. The Department has many escapement monitoring studies throughout the range of the Northwest Alaska Summer chum stock group. But the Department's main goal for these studies is to provide managers with an index measure that is consistent from year to year. The exact number of spawning fish in a particular year is not needed for inseason management. What managers do need is a way to determine how a run is performing relative to previous years. In some cases, managers monitor only selected streams and assume other streams in the area are performing similarly. In other cases, managers monitor streams only near the peak abundance. Biologists use different index methods from area to area. In short, the Department could not find any way to accurately estimate the total number of spawning salmon that make up the Northwest Alaska Summer chum stock group.

Estimates of inshore chum catch, or those salmon caught in or near their river of origin, present some problems as well. A legal document called a fish ticket is required for every salmon sale or delivery from fishermen. In many parts of the state the actual inshore catch of a commercially important species is close to the sum of the fish tickets for that inshore area. However, there is no system for tracking subsistence-caught chum salmon. Surveys are conducted in selected locations, but these do not produce straightforward, accurate estimates of total subsistence chum catch for the entire Northwest Alaska Summer chum stock group.

Another problem is that in Bristol Bay, chum and sockeye salmon are caught and processed together. Bright fish of both species appear very similar. Usually the Department makes a post-season adjustment to fish-ticket data based on information generated from samples of the catch and information provided by processors.

Yet another problem has to do with matching the catch of summer and fall chum salmon to their correct genetic category. The Yukon River has two runs of chum salmon: a summer run and a fall run. These runs are both made up of many different stocks. The Department manages these stocks based on when they occur in time, but genetically the situation is more complex. Chum salmon that are genetically fall-run stocks were probably caught and recorded on fish tickets during the period of time when fish are assumed to be summer chum salmon, and vice versa.

Fishery managers were asked to consider subjectively or objectively the sources of uncertainty, and use fish tickets, subsistence surveys, and other gauges, to estimate total catch as a range. Estimated inshore catch, including commercial, personal use and subsistence, for the entire range of the Northwest Alaska Summer chum stock group is provided in Table 1 for the years 1993-1996. This covers the Port Heiden and Cinder River systems in the North Peninsula area, all of Bristol Bay, and Kotzebue Sound, Norton Sound, the Kuskokwim River, and the Yukon River summer run in the Arctic-Yukon-Kuskokwim Region. Catches not listed in Table 1 were assumed negligible.

Results and Discussion

First, accurate estimates of escapement throughout the range of the Northwest Alaska Summer chum stock group are simply unavailable with the current level of escapement monitoring in this area. A group of reviewers within the Department looked at several options, and concluded that no acceptable method exists to generate estimates of these stock sizes. The committee did recognize that catch statistics are generally reliable.

Hypothetical estimates of the size of the Northwest Alaska Summer chum group were generated by assuming various average inshore exploitation rates, and expanding accordingly. For example, if the inshore catch was 1,000 fish, then assuming the inshore harvest rates were 25%, or 50%, or else 75%, the total stock size could be guessed at as, 4,000 (= 1,000/25%), 2,000 (= 1,000/50%), or else 1,333 (= 1,000/75%). The hypothetical estimates of the size of the Northwest Alaska Summer chum group ran from just under 2 million for the low estimate in 1993 to just over 13 million for the high estimate in 1995 (Table 2).

Overall harvest rates between 40% and 60% have been used by the Department before for planning purposes when dealing with chum salmon. Heard (1991) assumed a hypothetical harvest rate of 65% for pink salmon when discussing published values of harvest rate.

Geiger et al. (1996) speculated that some previous published estimates of pink salmon stock productivity were far too high – suggesting an upward bias in harvest rate estimates, and that actual harvest rates were much lower than reported. Sockeye stocks in Bristol Bay often have exploitation rates that exceed 80% (Linda Brannian, ADF&G, personal communication), although, the harvest rate on these closely monitored runs is probably higher than what most chum salmon stocks could sustain. Examining a range of *inshore* harvest rates from 25% to 75% seems to cover most plausible values for western Alaska chum salmon. However, harvest rates outside this range are entirely possible – especially for years of very low or very high returns.

Combining the genetic estimates of catch in the June fishery and the hypothetical stock sizes resulted in a way to generate hypothetical harvest rate estimates. The Seeb et al. (1997) estimates of the harvest of this Northwest Alaska Summer chum stock group are found in Table 3. When the estimated inshore harvest rate was assumed to be between 25% and 75%, hypothetical estimates of total stock size harvest rate for the Unimak and Shumagin Islands fisheries combined were generally less than 10% (Table 4). A high-range value reached 13% for the Unimak area in 1993 and a high-range value reached 12% for the total June fishery in 1994. During that same time, the estimated harvest rates on Bristol Bay sockeye salmon in the June fishery were 5.4% in 1993, 2.8% in 1994, 3.4% in 1995, and 2.7% in 1996.

The estimates of harvest rates presented here are not a careful accounting of fish, but a collection of best guesses at the possible magnitude of the harvest rates on the total Northwest Alaska Summer chum stock group. These numbers come with a long list of assumptions and qualifications, some of which are more reasonable than others are. The various confidence intervals and subjective ranges are not strictly comparable, but they do provide a rough guide to the uncertainty in the numbers. First, the subjective ranges that managers came up with to express uncertainty in the catch estimates had almost no effect on the hypothetical harvest rate estimates. The majority of the harvest is coming from Bristol Bay, with the Kuskokwim and Yukon Rivers making a substantial contribution in some years. If harvests from these areas are approximately correct, then the total harvest estimate for the Northwest Alaska Summer Chum stock group is probably reasonable, unless there is a large unaccounted harvest somewhere else. Secondly, from Table 3 we see the range of genetic estimates – expressed as a confidence interval – is very small. Seeb et al. (1997) provided extensive testing of the genetic estimates. The confidence in the genetic estimates is quite high, as judged by confidence intervals, and by subjective judgement about the quality of these estimates. Thirdly, from Table 4 you can see that estimates of total stock size based on assumed harvest rates of 25% to 75% cover a range of under 2 million to over 13 million in various years. From this same table, the high-range harvest rate estimate is always at least double the low-range harvest rate estimate for the Northwest Alaska Summer Chum stock group. Uncertainty in the June fishery harvest rates comes from a lack of confidence in the denominator of this ratio – the total stock sizes of the Northwest Alaska Summer chum stock group. The total run size estimates are simply hypothetical guesses made by knowledgeable experts, and these estimates remain the weak link in this analysis.

If we could assume that the inshore harvest rates were constant, these estimates could be compared across years to look for trends. But this assumption is almost surely false and misleading. Inshore harvest rates probably change a great deal from year to year in response to market conditions, and particularly to inshore run strength. In 1993, chum salmon runs were weak throughout western Alaska (Geiger and Simpson 1994), so the inshore harvest rate was presumably far lower than what is common – the inshore harvest rate was perhaps well below 25%. For this reason, 1993 harvest rates should be considered separately.

In summary, accurate estimates of harvest rates on the Northwest Alaska Summer chum stock group could not be provided because the size of this stock group is unknown. Using an arbitrary range of inshore harvest rates leads to the conclusion that the Northwest Alaska Summer chum stock group *as a whole* underwent a harvest rate between 1% and 12% in the years 1994 -1996. Other conclusions follow from different inshore harvest rate assumptions. One might conclude that individual stock groups, such as the Kuskokwim River, the Yukon River, Norton Sound, and so forth, are subjected to harvest rates that fluctuate annually based on random, unobserved conditions in the ocean. However, without specific information on substock groupings, any conclusion about a level of resolution finer than the entire Northwest Alaska Summer chum grouping is speculative.

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Table 1. Estimated inshore chum salmon catches assumed to be from the Northwest Alaska Summer chum stock grouping, by year, and expressed as a range. Ranges were used to express uncertainty in subsistence harvest and misclassification of chum salmon with other species in the commercial harvest. Middle value is just the average of min. and max values. Middle value as percent of total is provided as a index of the contribution to the total, and does not provide relative stock size information. Catches are in units of thousands of fish (0 denotes catch < 500).

	Minimum	Middle	Maximum	Middle value as percent of Total
North Peninsula				
Port Heiden and Cinder River				
1993	0	0	0	0%
1994	0	1	1	0%
1995	0	1	1	0%
1996	0	1	1	0%
Bristol Bay				
1993	838	838	838	56%
1994	895	895	895	44%
1995	979	979	979	30%
1996	842	842	842	39%
Arictic-Yukon-Kuskokwim				
Kuskokwim River				
1993	160	164	167	11%
1994	437	447	457	22%
1995	794	813	832	25%
1996	298	305	311	14%
Yukon River Summer				
1993	235	249	262	17%
1994	378	395	412	19%
1995	933	945	957	29%
1996	781	794	806	37%
Norton Sound				
1993	78	80	82	5%
1994	35	36	36	2%
1995	81	85	88	3%
1996	40	42	44	2%
Kotzebue Sound				
1993	159	167	175	11%
1994	249	257	264	13%
1995	394	398	402	12%
1996	180	188	195	9%
Assumed Total Harvest for Northwest Alaska Summer Chum Stock Group				
1993	1,471	1,498	1,525	100%
1994	1,994	2,030	2,065	100%
1995	3,181	3,220	3,259	100%
1996	2,142	2,171	2,200	100%

Table 2. Hypothetical chum salmon stock sizes for the Northwest Alaska Summer ehum stock group. Inshore catches from Table 1 were expanded with three assumed inshore harvest rates: 25%, 50%, and 75%. The "hypothetical" stock sizes are based on the maximum assumed harvest and the minimum assumed harvest rate, and the minimum assumed harvest and the maximum assumed harvest rates. Values are in thousands of fish.

Stock sizes ranges based on an assumed
25% overall average harvest rate

	Minimum	Middle	Maximum
1993	5,882	5,991	6,099
1994	7,977	8,119	8,260
1995	12,724	12,880	13,036
1996	8,567	8,683	8,798

Stock size ranges based on an assumed
50% overall average harvest rate

	Minimum	Middle	Maximum
1993	2,941	2,995	3,050
1994	3,989	4,059	4,130
1995	6,362	6,440	6,518
1996	4,283	4,341	4,399

Stock size ranges based on an assumed
75% overall average harvest rate

	Minimum	Middle	Maximum
1993	1,961	1,997	2,033
1994	2,659	2,706	2,753
1995	4,241	4,293	4,345
1996	2,856	2,894	2,933

Hypothetical stock size ranges based
on high and low assumptions

	Minimum		Maximum
1993	1,961	--	6,099
1994	2,659	--	8,260
1995	4,241	--	13,036
1996	2,856	--	8,798

Table 3. Catch numbers for the South Unimak and Shumagin Islands June fishery, by year and time period, corresponding to the genetic analysis (from Seeb et al. 1997, Table 2), and from calculation. Also genetic-based estimates of the chum salmon from the Northwest Alaska Summer chum stock group in the June fishery (from calculation). Cateh numbers and estimates are in thousands of fish.

Catch Numbers

Year	Time Period	Unimak	Shumagin	Areas Combined
1993	1	284	N.A	
	2	98	N.A	
	Sum	382		
1994	1	137	44	
	2	110	67	
	3	127	97	
	Sum	374	208	582
1995	1	126	103	
	2	162	48	
	3	54	44	
	Sum	342	195	537
1996	1	61	68	
	2	37	116	
	3	32	45	
	Sum	130	229	359

Genetic-based estimates of the Northwest Alaska Summer chum catch in the June fishery

	- - South Unimak - -		- - Shumagin Islands - -	
	Lower CI	Upper CI	Lower CI	Upper CI
1993	199	248		
1994	187	225	81	102
1995	199	233	90	107
1996	44	57	73	94

Table 4. Hypothetical estimates of harvest rates of the Northwest Alaska Summer chum stock group in the Unimak Island and Shumagin Islands June fishery from 1993 to 1996 expressed as a range. Low range for the harvest rate estimate are developed using the lower confidence internal from genetic data and the maximum "hypothetical" stock size from Table 2. Similarly, the high range was based on the upper confidence interval and the minimum "hypothetical" stock size. Estimated stock size levels are in thousands of fish. Numbers do not add exactly because of rounding.

Hypothetical stock size range based on high and low harvest rate assumptions

	Minimum	Maximum
1993	1,961	6,099
1994	2,659	8,260
1995	4,241	13,036
1996	2,856	8,798

Unimak Harvest Rate

	Low range	High range
1993	3%	13%
1994	2%	8%
1995	2%	5%
1996	1%	2%

Shumagin Harvest Rate

	Low range	High range
1993	NA	NA
1994	1%	4%
1995	1%	3%
1996	1%	3%

June Fishery Overall Harvest Rate

	Low range	High range
1993	NA	NA
1994	4%	12%
1995	3%	8%
1996	1%	5%

Figure 1. Map of the Alaska Peninsula showing Alaska Department of Fish and Game statistical areas. The June "False Pass" fishery takes place south of Unimak Island (Unimak District) and tin the Shumagin Islands (Southeastern Districts).