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Reconstruction of the Total Return of Sockeye Salmon *(Oncorhynchus nerka)* to the Skeena River for Brood Years 1965 to 1982

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B21

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RECONSTRUCTION OF THE TOTAL RETURN OF SOCKEYE SALMON (*Oncorhynchus nerka*) TO THE SKEENA RIVER FOR BROOD YEARS 1965 TO 1982

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ABSTRACT

Henderson, M. A. and R. E. Diewert. 1989. Reconstruction of the total return of sockeye salmon (Oncorhynchus nerka) to the Skeena River for brood years 1965 to 1982. Can. MS Rep. Fish. Aquat. Sci. 2038: 73 p.

An assessment of the total return of sockeye salmon to the Skeena River is presented for brood years from 1965 to 1982. Annual reconstructions required catch and spawning escapement data. Age structure information was used to apportion the catch and escapement to the appropriate brood year. The proportion of the catch in each of the major interception fisheries consisting of Skeena River origin sockeye salmon for years 1982 to 1987 was based on a series of studies using tagging, genetic, scale pattern and parasite markers. Three different procedures were used to estimate stock composition of the catch for years prior to 1982 and for 1988. The total run size estimates from each of the three procedures are compared.

RÉSUMÉ

Henderson, M. A. and R. E. Diewert. 1989. Reconstruction of the total return of sockeye salmon (Oncorhynchus nerka) to the Skeena River for brood years 1965 to 1982. Can. MS Rep. Fish. Aquat. Sci. 2038: 73 p.

Cet article présente une évaluation de la remonte totale du saumon rouge de la rivière Skeena pour les années de génération 1965 à 1982. Des informations sur la structure d'âge ont été utilisées pour rapporter les données de capture et d'échappée aux années de génération correspondantes. La proportion des prises dans chacune des principales pêches d'interception du saumon rouge provenant de la rivière Skeena pour les années 1982 à 1987 a été établie par différents moyens: marquage, analyse génétique, caractéristiques des écailles et marqueurs parasitaires. Trois méthodes différentes ont été utilisées pour évaluer la composition des captures par années de génération pour les années antérieures à 1982 et pour 1988. Les résultats des évaluations numériques des remontes totales obtenus par chacune de ces trois méthodes sont comparés.

INTRODUCTION

It has been known for some time that sockeye salmon (Oncorhynchus nerka) returning to the Skeena River as maturing adults are harvested in numerous fisheries both in British Columbia and Alaska. However, only recently have estimates been made of the proportion of the catch consisting of Skeena River sockeye salmon in these fisheries. As a result, past attempts to generate reliable estimates of the size of a run to the Skeena River in any given year or the number of individuals arising from a known spawning escapement (brood year) have been difficult.

Recently, two studies have described methodologies that were used in an attempt to determine the total number of sockeye salmon returning to the Skeena River or to a specific group of stocks within the Skeena River in a given year. In the first study (Starr et al. 1984), estimates were made of the proportion of the total catch in various fisheries that was of northern British Columbia origin. These estimates were not based on any particular investigation of stock specific interception rates but rather reflected the best estimate of biologists and fishery officers in the area. Having determined the total catch of northern British Columbia origin sockeye salmon in the various fisheries (for each fishery: proportion of the total catch consisting of northern British Columbia fish * the total catch in the fishery), the number of Skeena origin sockeye was estimated based on the relative size of the spawning escapements of stocks in northern British Columbia. The estimates of catch of Skeena River origin sockeye salmon in the escapement for the same year to estimate the total size of the return. The period covered in this report was from 1970 to 1982. Estimates of the size of the total return of sockeye salmon to the Skeena River in the second study (West and Mason 1987) covered the period from 1955 to 1985 and were based on estimates of the proportion of the sockeye catch in various fisheries that was considered to be of Skeena River origin. As in the preceding study, these estimates were based on the best estimates of biologists and fishery officers. In neither case were the estimates based on studies designed to provide information on the proportion of sockeye caught in a fishery that were of northern British Columbia or Skeena River origin.

Since 1982, several investigations have been carried out that were designed to provide estimates of the proportion of the catch of sockeye salmon taken in major net fisheries in northern British Columbia and southern southeast Alaska that was of Skeena River origin. The objective of this study is to use these estimates of stock composition to reconstruct the total size of the return of sockeye salmon to the Skeena River for brood years from 1965 to 1982.

METHODS

Annual reconstruction of the total size of the run of sockeye salmon to the Skeena River requires data on catch, spawning escapement and age structure of the returns so that catch and escapement can be apportioned to the appropriate brood years. Developing estimates of catch requires data on the total catch in fisheries where Skeena River sockeye salmon are known to be harvested and information on the proportion of the catch in these fisheries that is of Skeena River origin.

DATA AND INFORMATION SOURCES

Information on what fisheries harvest Skeena River origin sockeye salmon is available from several sources. The most complete and recent study that identifies these fisheries is described in English et al. 1985a and 1985b. Maturing Skeena River sockeye salmon are caught in all net fisheries in northern British Columbia and southern southeast Alaska. However, in terms of the absolute catch of Skeena River sockeye salmon (i.e. total catch * proportion of the catch that is of Skeena River origin) only a subset of these fisheries are important. In northern British Columbia, the fisheries of concern are the seine fishery in statistical area 1 and the seine and gillnet fisheries in statistical areas 3 and 4. For purposes of this study, the statistical area 3 fishery was divided into three subareas. These subareas, 3X, 3Y and 3Z, correspond to the most westerly, the mid-point and the most easterly portions of statistical area 3 respectively. In southern southeast Alaska, the Noyes Island seine fishery (district 104) and the Cape Fox seine (district 101) and gillnet (district 101-11) fisheries account for most of the catch of Skeena River origin sockeye salmon.

Sockeye salmon catch data for the Canadian fisheries described above were obtained from the Salmon Catch Data Base of the Canadian Department of Fisheries and Oceans, Pacific Region. Catch data for the U.S. fisheries at Noyes Island and Cape Fox were obtained from reports of the Northern Boundary Technical Committee of the Pacific Salmon Commission and from personnel of the Alaska Department of Fish and Game, Douglas, Alaska.

Spawning escapement data, information on the age structure of the spawning escapement and the catch in statistical area 4 were obtained from personnel of the Canadian Department of Fisheries and Oceans, Prince Rupert, British Columbia. Estimates of escapement to the Babine system were based on counts made at the permanent fence located below Babine Lake. Escapements to

all other portions of the Skeena River were based on visual surveys by local fishery officers.

Only fish aged 4_z and 5_z were considered in this analysis. These two age groups account for a large majority of all returns to the Skeena system and practically all the returns to the Babine Lake sub-system. The proportion of the total catch of Skeena River origin sockeye salmon consisting of these two age groups in all fisheries was based on their contribution to the statistical area 4 fishery. The contribution of 4_z's and 5_z's to the escapement was determined from the age structure at the Skeena River test fishery, located immediately upstream of the commercial fishing boundary. Annual estimates of age structure for both catch and escapement were obtained from CDFO, Prince Rupert, British Columbia.

Estimates of the proportion of the catch consisting of Skeena River origin sockeye salmon were obtained from a variety of sources. Estimates for all fisheries in 1982 and 1983 were obtained from tagging studies described in English et al. (1985a and 1985b). Estimates for the statistical area 1 fishery and the statistical subarea 3X fishery in 1984, 1985 and 1986, the statistical area 4 fishery in 1984 and the Noyes Island fishery in 1986 were provided by C. C. Wood of the Pacific Biological Station, Nanaimo (unpublished data). These estimates were generated from a maximum-likelihood mixture model (Wood et al. 1987) using a combination of two or more characters. The characters available were genetic (i.e. electrophoretic patterns), parasite (i.e. presence/absence) and scale patterns. Estimates for the Cape Fox drift gillnet fishery and the Noyes Island seine fishery in 1984, 1986 and 1987 and the Cape Fox seine fishery in 1986 and 1987 were generated using scale pattern analysis provided by personnel from the Alaska Department of Fish and Game, Douglas, Alaska. The procedure used to generate stock composition estimates from the scale patterns was similar to that described by Marshall et al. 1987.

DATA ANALYSIS

Three different procedures were used to estimate the size of the total return of Skeena River origin sockeye salmon by brood year. All three procedures used the same estimates of spawning escapement and native food fishery catch but different estimates of commercial catch of Skeena River origin sockeye salmon. The three procedures, the modified interception method, the standard interception method and the terminal method, are described below.

MODIFIED INTERCEPTION METHOD

The procedure used to estimate the number of Skeena River sockeye salmon caught in a fishery for any given time period involved taking the product of the interception or stock composition estimate and the total catch (in numbers) for that period. For this analysis, time periods within each year were stratified by week. The major difficulty with this approach is in determining the appropriate interception estimate. From 1982 to 1987, interception estimates were available for many area - week - year combinations as described above. In these instances, the estimate calculated for each area - week - year combination was used to apportion the total catch into Skeena River and non-Skeena River components. In 1986 there were 2 stock composition estimates for the Noyes Island fishery. In this case, the average of the two estimates was used. Estimates were not available for all area - week combinations when the fisheries operated between 1982 and 1987. The method of estimating the interception estimate for these area - week combinations as well as for years when no estimates were available for any part of the fishing season (1969 - 1981 and 1988) is described below. In a few cases the fishing season began before the earliest week or extended beyond the last week for which interception estimates existed. In these instances, the estimate for the nearest adjacent area - week combination was used.

Two major sockeye salmon stock complexes, one originating from the Skeena River and the other from the Nass River, dominate in terms of the total abundance of the species in northern British Columbia and southern southeast Alaska. As a result, one would expect that the proportion of the catch from any fishery in the area would depend, in part, on the relative abundance of the Skeena and Nass river stock complexes for the year under consideration. For example, as the size of the run to the Skeena River increases relative to that of the Nass River one would expect that the proportion of the catch consisting of Skeena River origin fish would also increase. This argument was used in an attempt to generate interception estimates for years other than from 1982 to 1987. More specifically, the proportion of the catch estimated to consist of Skeena River origin sockeye salmon was described as a function of the ratio of the total run size of Skeena River sockeye to Nass River sockeye. In this case total run size was defined as the total statistical area 3 catch plus area 3 escapement for Nass River sockeye and total statistical area 4 catch plus area 4 escapement for Skeena River sockeye. The Skeena to Nass ratios were calculated on an annual basis while estimates of the proportion of the catch consisting of Skeena origin sockeye salmon were stratified by week and fishery for the period from 1982 to 1987 when the interception estimates were available. Where a strong positive relationship existed, the regression was calculated and used to estimate the

appropriate interception estimate for other years. When no clear relationship was apparent between estimates of the proportion of the catch consisting of Skeena River origin fish and the Skeena River to Nass River ratio it was necessary to use other means to estimate the contribution of Skeena River fish. In some instances, particularly when the estimates of the proportion Skeena River were similar across all Skeena River to Nass River ratios, this involved applying the average estimate of the proportion Skeena for the years from 1982 to 1987 to all other years. In a few cases, the estimates of the proportion of the catch consisting of Skeena River origin fish and the Skeena River to Nass River ratio varied widely between years. In these instances, it was necessary to apply other, more subjective, criteria to obtain estimates that could be used for the years 1969 through 1981 and 1988.

STANDARD INTERCEPTION METHOD

The standard interception method for estimating the total catch of Skeena River origin sockeye salmon was the same as the modified interception method except in terms of the derivation of estimates of the proportion of the catch that was of Skeena River origin. For the standard interception method, the estimate of the proportion of the catch of Skeena River sockeye for any fishery and week in the years 1969 to 1981 and 1988 was simply the average of all estimate available over the period from 1982 to 1987. No attempt was made to adjust estimates obtained in the years from 1982 to 1987 using the Skeena River to Nass River ratio before applying them to the other years (i.e. 1969 to 1981 and 1988).

TERMINAL METHOD

The terminal method for estimating the catch of Skeena River origin sockeye salmon was very different from either the standard or modified interception methods. The catch estimate using the terminal method was simply the total statistical area 4 catch. The size of the total run was estimated as the statistical area 4 catch plus the Skeena River sockeye spawning escapement. No allowance was made for the proportion of the statistical area 4 catch consisting of Skeena River origin sockeye salmon or for the catch of Skeena River origin sockeye salmon in other fisheries in northern British Columbia and southern southeast Alaska. The terminal method has obvious limitations with regard to estimating the total catch of Skeena River origin sockeye salmon. However, it is included here for

the purpose of comparison as this is the approach that has been used most commonly in other studies.

RESULTS

STOCK COMPOSITION OF CATCHES

The relative pattern of change over the fishing season within a fishing area in the proportion of the catch consisting of Skeena River origin sockeye salmon was generally similar for most years and independent of the technique (i.e. tagging; scale pattern analysis; combination of parasite, genetic and scale markers) (Figs. 1 to 8 and Tables 1 to 8). In most fisheries there were two maxima in the estimates of the proportion of Skeena River origin fish corresponding to the early (non-Babine) and late components (Babine) of the run (Starr et al. 1984). The first maximum was not evident in sub-areas 3Y and 3Z and in the Cape Fox seine fishery.

Although the general pattern of change in the estimates of the proportion of the catch consisting of Skeena River origin sockeye salmon over the fishing season within an area were generally the same there were some important quantitative differences. Of particular note is the observation that estimates of the proportion of Skeena origin fish were often higher in 1982 and 1983 when tagging estimates were available than in the other years. If we examine terminal run sizes it becomes clear that 1982 and 1983 do not represent years in which the Skeena stock was larger than the other years for which interception estimates exist. This indicates that there may be some source of bias in the tagging estimates, the non-tagging estimates or both.

The relationship between the proportion of the catch consisting of Skeena River origin sockeye salmon and the Skeena River to Nass River ratio are shown in Figures 9 to 16. Estimates of the proportion of the catch consisting of Skeena River origin sockeye salmon that were used in the figures are shown in Tables 1 to 8 while the annual Skeena River to Nass River ratios appear in Table 12. On feature of note is that the anticipated positive relationship between the proportion of the catch consisting of Skeena origin sockeye and the Skeena to Nass ratio was evident but generally only during the early part of the fishing season. For most British Columbia fisheries this early part of the fishing season appears to terminate by approximately the week ending July 5. The presence of a positive relationship

only in the early part of the fishing season is likely the result of the difference in timing of the migration of maturing sockeye salmon to the Nass and Skeena rivers. Nass sockeye peak in abundance in Canadian fisheries in mid to late June while Skeena sockeye peak in early to mid July (English et al. 1985a, 1985b). As a result, after early July the size of the run of sockeye salmon to the Nass River would have little effect on the proportion of the fish in the catch that are of Skeena River origin.

The same relationship between the proportion of the catch consisting of Skeena River origin sockeye salmon and the Skeena to Nass ratio was evident in the Alaskan fisheries. However, on average, the positive relationship did not persist as long as in the British Columbia fisheries. This is most likely explained by the earlier time of passage of both Nass and Skeena river stocks through the Alaskan fisheries.

Estimates of the proportion of the catch consisting of Skeena River sockeye salmon obtained from the 1983 tagging program presented some difficulties. Water conditions in 1983 in the coastal areas of North America were much warmer than normal as the result of an El Niño - Southern Oscillation event (Tabata 1985, Mysak 1986). As a consequence, there may have been change in the migratory pattern of maturing Skeena River sockeye salmon resulting in a corresponding change in the proportion of the catch in a fishery that consisted of Skeena River sockeye. This is supported by the fact that although the 1983 terminal run size was low in comparison with other years, interception rates in some fishery-week combinations were up to ten times higher than for other years in the same strata. As a result in situations where the 1983 estimates were markedly different from estimates from other years, they were excluded from the analysis. However, 1983 estimates were used to apportion the 1983 catch in all fisheries.

A summary of the procedures used to estimate the proportion of the catch consisting of Skeena River origin sockeye salmon for the modified interception method for years others than 1982 to 1987 is shown in Table 9 while the actual values or functions appear in Table 10. Estimates of the proportion of the catch of Skeena River origin used in the standard method appear in Table 11.

RECONSTRUCTING THE TOTAL SIZE OF THE SKEENA RIVER SOCKEYE SALMON RUN BY BROOD YEAR

The three different approaches employed to reconstruct the total run size of Skeena River sockeye salmon used the same

age structure information to apportion the catch and escapement by brood year (Table 13).

All three methods showed very similar trends in total run size of Skeena River origin sockeye salmon by brood year (Fig. 17; Tables 14-16). In fact the estimates for the modified and standard interception methods were so close that it was necessary to show them on separate figures. Estimates of total run size generated from the terminal method were, as expected, always less than those from the other two methods. The difference was usually attributable to the lack of an Alaskan catch component in the estimates derived from the terminal method and was most obvious in the years 1972, 1973, 1977, 1978 and 1979.

DISCUSSION

Several assumptions are made in the approaches taken in this study to estimate the total number of maturing sockeye salmon returning to the Skeena River each year.

With regard to the modified and standard interception methods, we assume that all fisheries harvesting significant numbers of Skeena River sockeye salmon have been identified and incorporated into the analysis leading to estimates of total run size. Based on previous tagging studies (English 1985a, 1985b), we believe this assumption has been met at least with regard to coastal and river fisheries. Fisheries in statistical area 5 in British Columbia and districts 102, 103 and 106 in Alaska are also known to harvest Skeena River sockeye salmon. However, the catch of sockeye in these fisheries is generally small and estimates of the proportion of the catch that is of Skeena River origin are low. Consequently, these four fisheries contribute little to the overall catch of Skeena River origin sockeye salmon.

Although all important coastal fisheries appear to have been accounted for in the analysis, this is not the case for fisheries taking place further off shore in the North Pacific ocean. A Japanese drift gillnet fishery has operated in the North Pacific ocean since 1952 (Harris 1987). Prior to 1978 the fishery operated as far east as 175°W and overlapped with the western most distribution of Skeena River sockeye salmon. However, it does not appear that large numbers of Skeena River origin sockeye salmon were taken in this fishery. The western most boundary of the fishery has been restricted to waters west

of 175°E since 1978; outside the known ocean distribution of Skeena River sockeye salmon.

We have also assumed that the return migratory route and the timing of the Skeena River stock complex through the area of the various fisheries referred to above from 1965 to 1981 are adequately described by the available information on these features for the years 1982-1987. If there were major differences in either the routing or timing of the return migration between the earlier and latter periods, there would be corresponding errors in the allocation of the catch between Skeena and non-Skeena components.

Although the timing of the return migration of the Skeena River sockeye salmon run in coastal areas is known to vary between years, the range of the variation is generally within seven days of the average timing. Consequently, with regard to timing of the return migration, extrapolating the average proportion of the run consisting of Skeena River sockeye salmon for the period from 1982 to 1987 to the period prior to 1982 is not thought to be a major source of error. However, it is more difficult to determine if there were significant interannual differences in the route taken by Skeena River sockeye salmon during their return migration. More specifically, the question arises as to whether the routing, inferred from the estimates of stock composition in the fisheries for the period from 1982 to 1987, can reasonably be extrapolated to the period prior to 1982. A comparison of the stock composition estimates by fishery for 1982 (English 1985a) and 1983 (English 1985b) does provide evidence for differences in the route of the return migration between years. However, the difference was likely the result of the warm water intrusion into the coastal areas of North America in 1983 (Mysak 1986). There were no major warm water events from 1965 to 1981 or in 1988. Consequently, the best description of return migration route for the period prior to 1982 is that for the period from 1982 to 1987, excluding as necessary information from 1983 (Table 9).

The final major concern with regard to the analyses reported here involves possible changes in the size of the Skeena sockeye stock relative to other stocks in the area when comparing the periods 1965 to 1981 and 1982 to 1987. It is necessary to assume that the size of the Skeena River sockeye stock relative to other large stocks in the area for the period from 1965 to 1981 and in 1988 is the same as in the period from 1982 to 1987. As described above, the Nass River supports the only other large sockeye stock complex in northern British Columbia. Although there have been changes in the relative size of these two stocks since 1965, we have attempted to correct for the effect of these changes on the estimates of stock composition of the catch for the period from 1965 to 1981 and in 1988 using the Skeena River to Nass River total run size ratio method described earlier.

There are numerous sockeye salmon stocks in southern southeast Alaska, however, all are small in comparison to the Skeena and Nass river sockeye stock complexes. Further, spawning escapement has only been monitored on a routine basis in seven of these systems (Klawock, Hugh Smith, Karta, Naha, Salmon Bay, Speel and Crescent). Total spawning escapement to these seven systems has averaged approximately 80,000 annually since 1982. Consequently, changes in the size of the Alaskan stocks will have little effect on the contribution of Skeena River original sockeye salmon to fisheries in northern British Columbia and southern southeast Alaska.

Two of the approaches adopted in this study to determine the total sockeye production by brood year involved using estimates of stock composition of the catch from the various interception fisheries. Another approach for estimating production by brood year, not attempted here, permits the reconstruction of runs based on combining information on migration routes and travel speeds with catch and escapement data (Starr and Hilborn 1988). Although this reconstruction approach is conceptually simple, the uncertainty associated with annual estimates of migration routes and travel speeds is such that it offers no advantage over the approach used in this study.

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Table 1. Estimates of the proportion of the sockeye salmon caught in the statistical area 1 fishery that were of Skeena River origin. Estimates for 1982 and 1983 were based on tagging studies. Estimates for 1984 were based on a genetic-parasite study. Estimates for 1985 and 1986 were based on genetic-parasite-scale studies. See text for details.

		1982	1983	1984	1985	1986
JUNE	1					
	2					
	3					
	4					
	5					
	6	0.62				
	7	0.62				
	AVE	0.62				
	8	0.62				
	9	0.62				
	10	0.62				
	11	0.62				
	12	0.62	0.33			
	13	0.84	0.33			
	14	0.84	0.33			
	AVE	0.68	0.33			
	15	0.84	0.33			
	16	0.84	0.33			
	17	0.84	0.33			
	18	0.84	0.33			
	19	0.84	0.24			
	20	0.60	0.24			
	21	0.60	0.24			
	AVE	0.77	0.29			
	22	0.60	0.24			
	23	0.60	0.24			
	24	0.60	0.24			
	25	0.60	0.24			
	26	0.60	0.11		0.52	
	27	0.34	0.11		0.52	
	28	0.34	0.11		0.52	
	AVE	0.52	0.18		0.52	
	29	0.34	0.11		0.52	
	30	0.34	0.11		0.52	
JULY	1	0.34	0.11		0.52	
	2	0.34	0.11		0.52	
	3	0.34	0.58		0.65	
	4	0.86	0.58		0.65	
	5	0.86	0.58		0.65	
	AVE	0.49	0.31		0.58	
	6	0.86	0.58		0.65	
	7	0.86	0.58		0.65	
	8	0.86	0.58	0.52	0.65	
	9	0.86	0.58	0.52	0.65	
	10	0.86	0.64	0.52	0.68	
	11	0.85	0.64	0.52	0.68	
	12	0.85	0.64	0.52	0.68	
	AVE	0.86	0.61	0.52	0.66	

		1982	1983	1984	1985	1986
JULY	13	0.85	0.64	0.52	0.68	0.52
	14	0.85	0.64	0.52	0.68	0.52
	15	0.85	0.64	0.52	0.68	0.52
	16	0.85	0.64	0.52	0.68	0.52
	17	0.85	0.92	0.52	0.64	0.52
	18	0.83	0.92	0.52	0.64	0.52
	19	0.83	0.92	0.52	0.64	0.52
	AVE	0.84	0.76	0.52	0.66	0.52
	20	0.83	0.92	0.52	0.64	0.53
	21	0.83	0.92	0.52	0.64	0.53
	22	0.83	0.92		0.64	0.53
	23	0.83	0.92		0.64	0.53
	24	0.83	0.79		0.62	0.53
	25		0.79		0.62	0.53
	26		0.79		0.62	0.53
	AVE	0.83	0.86	0.52	0.63	0.53
	27		0.79			0.33
	28		0.79			0.33
	29		0.79	0.28		0.33
	30		0.79	0.28		0.33
	31		0.13	0.28		0.33
AUGUST	1		0.13	0.28		0.33
	2		0.13	0.28		0.33
	AVE		0.51	0.28		0.33
	3		0.13	0.28		0.25
	4		0.13	0.28		0.25
	5		0.13			0.25
	6		0.13			0.25
	7					0.25
	8					0.25
	9					0.25
	AVE		0.13	0.28		0.25
	10					0.13
	11					0.13
	12					0.13
	13					0.13
	14					0.13
	15					0.13
	16					0.13
	AVE					0.13
	17					0.38
	18					0.38
	19					0.38
	20					0.38
	21					0.38
	22					0.38
	23					0.38
	AVE					0.38
	24					0.29
	25					0.29
	26					0.29
	27					0.29
	28					0.29
	29					0.29
	30					0.29
	AVE					0.29

Table 2. Estimates of the proportion of the sockeye salmon caught in the statistical subarea 3X fishery that were of Skeena River origin. Estimates for 1982 and 1983 were based on tagging studies. Estimates for 1984 and 1985 were based on a genetic-parasite study. Estimates for 1986 were based on a genetic-parasite-scale study. See text for details.

		1982	1983	1984	1985	1986
JUNE	8					
	9					
	10					
	11					
	12		0.94			
	13	0.36	0.94			
	14	0.36	0.94			
	AVE	0.36	0.94			
	15	0.36	0.94			
	16	0.36	0.94			
	17	0.36	0.94			
	18	0.36	0.94			
	19	0.36	0.85			
	20	0.43	0.85	0.20		
	21	0.43	0.85	0.20		
	AVE	0.38	0.90	0.20		
	22	0.43	0.85	0.20		
	23	0.43	0.85	0.20		
	24	0.43	0.85	0.20		
	25	0.43	0.85	0.20	0.55	
	26	0.43	0.73		0.55	
	27	0.46	0.73		0.55	
	28	0.46	0.73		0.55	
	AVE	0.44	0.80	0.20	0.55	
	29	0.46	0.73	0	0.55	
	30	0.46	0.73	0	0.55	
JULY	1	0.46	0.73	0.58	0.55	
	2	0.46	0.73	0.58	0.55	
	3	0.46	0.73	0.58	0.55	
	4	0.91	0.73	0.58	0.87	
	5	0.91	0.73	0.58	0.87	
	AVE	0.59	0.73	0.41	0.64	
	6	0.91	0.73	0.58	0.87	
	7	0.91	0.73	0.58	0.87	
	8	0.91	0.73	0.58	0.87	0.73
	9	0.91	0.73	0.58	0.87	0.73
	10	0.91	0.82	0.58	0.87	0.73
	11	0.89	0.82	0.58	0.81	0.73
	12	0.89	0.82	0.58	0.81	
	AVE	0.90	0.77	0.58	0.85	0.73
	13	0.89	0.82	0.58	0.81	
	14	0.89	0.82	0.58	0.81	
	15	0.89	0.82	0.78	0.81	0.79
	16	0.89	0.82	0.78	0.81	0.79
	17	0.89	0.83	0.78	0.81	0.79
	18	0.82	0.83	0.78	0.81	0.79
	19	0.82	0.83	0.78		
	AVE	0.87	0.82	0.72	0.81	0.79

		1982	1983	1984	1985	1986
JULY	20	0.82	0.83	0.78		
	21	0.82	0.83	0.78		
	22	0.82	0.83	0.77		
	23	0.82	0.83	0.77		
	24	0.82	1.00	0.77		0.8
	25	0.93	1.00	0.77	0.86	0.8
	26	0.93	1.00	0.77	0.86	0.8
	AVE	0.85	0.90	0.77	0.86	0.80
	27	0.93	1.00	0.77	0.86	
	28	0.93	1.00	0.77	0.86	
	29	0.93	1.00	0.72	0.86	
	30	0.93	1.00	0.72	0.86	
	31	0.93	0.98	0.72	0.86	0.85
AUGUST	1	0.98	0.98	0.72		0.85
	2	0.98	0.98	0.72		0.85
	AVE	0.94	0.99	0.73	0.86	0.85
	3	0.98	0.98	0.72		
	4	0.98	0.98	0.72		
	5	0.98	0.98	0.81		
	6	0.98	0.98	0.81		
	7	0.98	0.85	0.81		0.86
	8		0.85	0.81	0.42	0.86
	9		0.85	0.81	0.42	0.86
	AVE	0.98	0.92	0.78	0.42	0.86
	10		0.85	0.81	0.42	
	11		0.85	0.81	0.42	
	12		0.85		0.42	
	13		0.85		0.42	
	14				0.42	
	15					0.82
	16					0.82
	AVE		0.85	0.81	0.42	0.82
	17				0.71	
	18				0.71	
	19				0.71	
	20				0.71	
	21				0.71	0.70
	22				0.71	0.70
	23				0.71	0.70
	AVE				0.71	0.70
	24					0.70
	25					0.70
	26					0.70
	27					0.70
	28					0.70
	29					0.70
	30					0.70
	AVE					0.70

Table 3. Estimates of the proportion of the sockeye salmon caught in the statistical subarea 3Y fishery that were of Skeena River origin. Estimates were based on tagging studies. See text for details.

		1982	1983
JUNE	1		
	2		
	3		
	4		
	5		
	6	0.01	
	7	0.01	
	AVE	0.01	
	8	0.01	
	9	0.01	
	10	0.01	
	11	0.01	
	12	0.01	
	13	0.05	
	14	0.05	
	AVE	0.02	
	15	0.05	
	16	0.05	
	17	0.05	
	18	0.05	
	19	0.05	0.03
	20	0.05	0.03
	21	0.05	0.03
	AVE	0.05	0.03
	22	0.05	0.03
	23	0.05	0.03
	24	0.05	0.03
	25	0.05	0.03
	26	0.05	0.05
	27	0.04	0.05
	28	0.04	0.05
	AVE	0.05	0.04
	29	0.04	0.05
	30	0.04	0.05
JULY	1	0.04	0.05
	2	0.04	0.05
	3	0.04	0.02
	4	0.61	0.02
	5	0.61	0.02
	AVE	0.20	0.04

		1982	1983
JULY	6	0.61	0.02
	7	0.61	0.02
	8	0.61	0.02
	9	0.61	0.02
	10	0.61	0.17
	11	0.62	0.17
	12	0.62	0.17
	AVE	0.61	0.08
	13	0.62	0.17
	14	0.62	0.17
	15	0.62	0.17
	16	0.62	0.17
	17	0.62	0.73
	18	0.21	0.73
	19	0.21	0.73
	AVE	0.50	0.41
	20	0.21	0.73
	21	0.21	0.73
	22	0.21	0.73
	23	0.21	0.73
	24	0.21	1.00
	25	0.83	1.00
	26	0.83	1.00
	AVE	0.39	0.85
	27	0.83	1.00
	28	0.83	1.00
	29	0.83	1.00
	30	0.83	1.00
	31	0.83	0.93
AUGUST	1	0.87	0.93
	2	0.87	0.93
	AVE	0.84	0.97
	3	0.87	0.93
	4	0.87	0.93
	5	0.87	0.93
	6	0.87	0.93
	7	0.87	0.85
	8		0.85
	9		0.85
	AVE	0.87	0.90
	10		0.85
	11		0.85
	12		0.85
	13		0.85
	14		
	15		
	16		
	AVE		0.85

Table 4. Estimates of the proportion of the sockeye salmon caught in the statistical subarea 3Z fishery that were of Skeena River origin. Estimates were based on tagging studies. See text for for details.

		1982	1983			1982	1983
JUNE	8			JULY	13		0.47
	9				14		0.47
	10				15		0.47
	11				16		0.47
	12		0.11		17		0.33
	13		0.11		18	0.50	0.33
	14		0.11		19	0.50	0.33
	AVE		0.11		AVE	0.50	0.41
	15		0.11		20	0.50	0.33
	16		0.11		21	0.50	0.33
	17		0.11		22	0.50	0.33
	18		0.11		23	0.50	0.33
	19		0.06		24	0.50	0.96
	20		0.06		25		0.96
	21		0.06		26		0.96
	AVE		0.09		AVE	0.50	0.60
	22		0.06		27		0.96
	23		0.06		28		0.96
	24		0.06		29		0.96
	25		0.06		30		0.96
	26		0.16		31		0.92
	27		0.16	AUGUST	1		0.92
	28		0.16		2		0.92
	AVE		0.10		AVE		0.94
	29		0.16		3		0.92
	30		0.16		4		0.92
JULY	1		0.16		5		0.92
	2		0.16		6		0.92
	3		0.12		7		0.87
	4	0.17	0.12		8		0.87
	5	0.17	0.12		9		0.87
	AVE	0.17	0.14		AVE		0.90
	6	0.17	0.12		10		0.87
	7	0.17	0.12		11		0.87
	8	0.17	0.12		12		0.87
	9	0.17	0.12		13		0.87
	10	0.17	0.47		14		
	11	0.17	0.47		15		
	12	0.17	0.47		16		
	AVE	0.17	0.27		AVE		0.87

Table 5. Estimates of the proportion of the sockeye salmon caught in the statistical area 4 fishery that were of Skeena River origin. Estimates for 1982 and 1983 were based on tagging studies. Estimates for 1984 were based on a genetic-parasite study. See text for details.

		1982	1983	1984			1982	1983	1984
JUNE	8				JULY	13	0.93	0.63	0.70
	9					14	0.93	0.63	0.70
	10					15	0.93	0.63	0.89
	11					16	0.93	0.63	0.89
	12		0.47			17	0.93	0.86	0.89
	13	0.88	0.47			18	0.79	0.86	0.89
	14	0.88	0.47			19	0.79	0.86	0.89
AVE		0.88	0.47		AVE		0.89	0.73	0.84
	15	0.88	0.47			20	0.79	0.86	0.89
	16	0.88	0.47			21	0.79	0.86	0.89
	17	0.88	0.47			22	0.79	0.86	0.89
	18	0.88	0.47			23	0.79	0.86	0.89
	19	0.88	0.19			24	0.79	0.89	0.89
	20	0.61	0.19			25	0.99	0.89	0.89
	21	0.61	0.19			26	0.99	0.89	0.89
AVE		0.80	0.35		AVE		0.85	0.87	0.89
	22	0.61	0.19			27	0.99	0.89	0.89
	23	0.61	0.19			28	0.99	0.89	0.89
	24	0.61	0.19			29	0.99	0.89	0.87
	25	0.61	0.19			30	0.99	0.89	0.87
	26	0.61	0.63			31	0.99	0.97	0.87
	27	0.28	0.63		AUGUST	1	1.00	0.97	0.87
	28	0.28	0.63			2	1.00	0.97	0.87
AVE		0.52	0.38		AVE		0.99	0.92	0.87
	29	0.28	0.63			3	1.00	0.97	0.87
	30	0.28	0.63			4	1.00	0.97	0.87
JULY	1	0.28	0.63	0.70		5	1.00	0.97	0.87
	2	0.28	0.63	0.70		6	1.00	0.97	0.87
	3	0.28	1.00	0.70		7	1.00	0.85	0.87
	4	0.93	1.00	0.70		8		0.85	0.87
	5	0.93	1.00	0.70		9		0.85	0.87
AVE		0.47	0.79	0.70	AVE		1.00	0.92	0.87
	6	0.93	1.00	0.70		10		0.85	0.87
	7	0.93	1.00	0.70		11		0.85	0.87
	8	0.93	1.00	0.70		12		0.85	
	9	0.93	1.00	0.70		13		0.85	
	10	0.93	0.63	0.70		14			
	11	0.93	0.63	0.70		15			
	12	0.93	0.63	0.70		16			
AVE		0.93	0.84	0.70	AVE			0.85	0.87

Table 6. Estimates of the proportion of the sockeye salmon caught in the Cape Fox drift gillnet fishery that were of Skeena River origin. Estimates for 1984, 1986 and 1987 were based on scale pattern analysis. See text for details.

		1984	1986	1987			1984	1986	1987
JUNE	8				JULY	20	0.03	0.10	0.13
	9					21	0.03	0.10	0.13
	10					22	0.02	0.10	0.13
	11					23	0.02	0.10	0.13
	12					24	0.02	0.10	0.13
	13					25	0.02	0.10	0.13
	14					26	0.02	0.10	0.21
	AVE					AVE	0.02	0.10	0.14
	15		0.13			27	0.02	0.22	0.21
	16		0.13			28	0.02	0.22	0.21
	17	0.16	0.13			29	0.04	0.22	0.21
	18	0.16	0.13			30	0.04	0.22	0.21
	19	0.16	0.13			31	0.04	0.22	0.21
	20	0.16	0.13		AUGUST	1	0.04	0.22	0.21
	21	0.16	0.13	0.13		2	0.04	0.22	0.22
	AVE	0.16	0.13	0.13		AVE	0.03	0.22	0.21
	22	0.16	0.37	0.13		3	0.04	0.20	0.22
	23	0.16	0.37	0.13		4	0.04	0.20	0.22
	24	0.06	0.37	0.13		5	0.05	0.20	0.22
	25	0.06	0.37	0.13		6	0.05	0.20	0.22
	26	0.06	0.37	0.13		7	0.05	0.20	0.22
	27	0.06	0.37	0.13		8	0.05	0.20	0.22
	28	0.06	0.37	0.08		9	0.05	0.20	0.25
	AVE	0.09	0.37	0.12		AVE	0.05	0.20	0.22
	29	0.06	0.17	0.08		10	0.05	0.16	0.25
	30	0.06	0.17	0.08		11	0.05	0.16	0.25
JULY	1	0.12	0.17	0.08		12	0.27	0.16	0.25
	2	0.12	0.17	0.08		13	0.27	0.16	0.25
	3	0.12	0.17	0.08		14	0.27	0.16	0.25
	4	0.12	0.17	0.08		15	0.27	0.16	0.25
	5	0.12	0.17	0.02		16	0.27	0.16	
	AVE	0.10	0.17	0.07		AVE	0.21	0.16	0.25
	6	0.12	0.10	0.02		17	0.27	0.18	
	7	0.12	0.10	0.02		18	0.27	0.18	
	8	0.08	0.10	0.02		19	0.10	0.18	
	9	0.08	0.10	0.02		20	0.10	0.18	
	10	0.08	0.10	0.02		21	0.10	0.18	
	11	0.08	0.10	0.02		22	0.10	0.18	
	12	0.08	0.10	0.11		23	0.10	0.18	0.11
	AVE	0.09	0.10	0.03		AVE	0.15	0.18	0.11
	13	0.08	0.16	0.11		24	0.10	0.25	0.11
	14	0.08	0.16	0.11		25	0.10	0.25	0.11
	15	0.03	0.16	0.11		26	0.10	0.25	0.11
	16	0.03	0.16	0.11		27	0.10	0.25	0.11
	17	0.03	0.16	0.11		28	0.10	0.25	0.11
	18	0.03	0.16	0.11		29	0.10	0.25	0.11
	19	0.03	0.16	0.13		30	0.10	0.25	0.17
	AVE	0.04	0.16	0.11		AVE	0.10	0.25	0.12

Table 7. Estimates of the proportion of the sockeye salmon caught in the Cape Fox seine fishery that were of Skeena River origin. Estimates for 1982 and 1983 were based on tagging studies. Estimates for 1986 and 1987 were based on scale pattern analysis. See text for details.

		1982	1983	1986	1987			1982	1983	1986	1987
JUNE	8					JULY	20	0.45	0.52	0.06	0.04
	9						21	0.45	0.52	0.06	0.04
	10						22	0.45	0.52	0.06	0.04
	11						23	0.45	0.52	0.06	0.04
	12						24	0.45	0.49	0.06	0.04
	13	0.06					25	0.37	0.49	0.06	0.04
	14	0.06					26	0.37	0.49	0.06	0.11
AVE		0.06				AVE		0.43	0.51	0.06	0.05
	15	0.06					27	0.37	0.49	0.12	0.11
	16	0.06					28	0.37	0.49	0.12	0.11
	17	0.06					29	0.37	0.49	0.12	0.11
	18	0.06					30	0.37	0.49	0.12	0.11
	19	0.06					31	0.37	0.80	0.12	0.11
	20	0.08				AUGUST	1	0.17	0.80	0.12	0.11
	21	0.08					2	0.17	0.80	0.12	0.04
AVE		0.07				AVE		0.31	0.62	0.12	0.10
	22	0.08					3	0.17	0.8	0.06	0.04
	23	0.08					4	0.17	0.8	0.06	0.04
	24	0.08					5	0.17	0.8	0.06	0.04
	25	0.08					6	0.17	0.8	0.06	0.04
	26	0.08	0.02				7	0.17	0.73	0.06	0.04
	27	0.06	0.02				8		0.73	0.06	0.04
	28	0.06	0.02				9		0.73	0.06	0.06
AVE		0.07	0.02			AVE		0.17	0.77	0.06	0.04
	29	0.06	0.02				10		0.73	0.16	0.06
	30	0.06	0.02				11		0.73	0.16	0.06
JULY	1	0.06	0.02				12		0.73	0.16	0.06
	2	0.06	0.02				13		0.73	0.16	0.06
	3	0.06	0.04				14			0.16	0.06
	4	0.44	0.04				15			0.16	0.06
	5	0.44	0.04		0.09		16			0.16	
AVE		0.17	0.03		0.09	AVE			0.73	0.16	0.06
	6	0.44	0.04	0.02	0.09		17			0.32	
	7	0.44	0.04	0.02	0.09		18			0.32	
	8	0.44	0.04	0.02	0.09		19			0.32	
	9	0.44	0.04	0.02	0.09		20			0.32	
	10	0.44	0.42	0.02	0.09		21			0.32	
	11	0.67	0.42	0.02	0.09		22			0.32	
	12	0.67	0.42	0.02	0.09		23			0.32	
AVE		0.51	0.20	0.02	0.09	AVE				0.32	
	13	0.67	0.42	0.12	0.09		24			0.19	
	14	0.67	0.42	0.12	0.09		25			0.19	
	15	0.67	0.42	0.12	0.09		26			0.19	
	16	0.67	0.42	0.12	0.09		27			0.19	
	17	0.67	0.52	0.12	0.09		28			0.19	
	18	0.45	0.52	0.12	0.09		29			0.19	
	19	0.45	0.52	0.12	0.04		30			0.19	
AVE		0.61	0.46	0.12	0.08	AVE				0.19	

Table 8. Estimates of the proportion of the sockeye salmon caught in the Noyes Island fishery that were of Skeena River origin. Estimates for 1982 and 1983 were based on tagging studies. Estimates for 1984 and 1987 were based on scale pattern analysis. Two estimates exist for 1986. These were based on scale pattern analysis (1986a) and on a genetic-parasite-scale study (1986b).

		1982	1983	1984	1986a	1986b	1987
JUNE	8						
	9						
	10						
	11						
	12						
	13	0.51					
	14	0.51					
	AVE	0.51					
	15	0.51					
	16	0.51					
	17	0.51					
	18	0.51					
	19	0.51	0.34				
	20	0.35	0.34				
	21	0.35	0.34				
	AVE	0.46	0.34				
	22	0.35	0.34				
	23	0.35	0.34				
	24	0.35	0.34				
	25	0.35	0.34				
	26	0.35	0.66				
	27	0.21	0.66				
	28	0.21	0.66				
	AVE	0.31	0.48				
	29	0.21	0.66				
	30	0.21	0.66				
JULY	1	0.21	0.66	0.43			
	2	0.21	0.66	0.43			
	3	0.21	0.53	0.43			
	4	0.33	0.53	0.43			
	5	0.33	0.53	0.43			0.18
	AVE	0.24	0.60	0.43			0.18
	6	0.33	0.53	0.43	0.24	0.35	0.18
	7	0.33	0.53	0.43	0.24	0.35	0.18
	8	0.33	0.53	0.43	0.24	0.35	0.18
	9	0.33	0.53	0.43	0.24	0.35	0.18
	10	0.33	0.40	0.43	0.24	0.35	0.18
	11	0.80	0.40	0.43	0.24	0.35	0.18
	12	0.80	0.40	0.43	0.24	0.35	0.27
	AVE	0.46	0.47	0.43	0.24	0.35	0.19
	13	0.80	0.40	0.43	0.28	0.35	0.27
	14	0.80	0.40	0.43	0.28	0.35	0.27
	15	0.80	0.40	0.50	0.28	0.35	0.27
	16	0.80	0.40	0.50	0.28	0.35	0.27
	17	0.80	0.84	0.50	0.28	0.35	0.27
	18	0.84	0.84	0.50	0.28	0.35	0.27
	19	0.84	0.84	0.50	0.28	0.35	0.35
	AVE	0.81	0.59	0.48	0.28	0.35	0.28

		1982	1983	1984	1986a	1986b	1987
JULY	20	0.84	0.84	0.50	0.55	0.35	0.35
	21	0.84	0.84	0.50	0.55	0.35	0.35
	22	0.84	0.84	0.51	0.55	0.35	0.35
	23	0.84	0.84	0.51	0.55	0.35	0.35
	24	0.84	0.64	0.51	0.55	0.35	0.35
	25	0.92	0.64	0.51	0.55	0.35	0.35
	26	0.92	0.64	0.51	0.55	0.35	0.56
	AVE	0.86	0.75	0.51	0.55	0.35	0.38
	27	0.92	0.64	0.51	0.47	0.64	0.56
	28	0.92	0.64	0.51	0.47	0.64	0.56
	29	0.92	0.64	0.60	0.47	0.64	0.56
	30	0.92	0.64	0.60	0.47	0.64	0.56
	31	0.92	0.39	0.60	0.47	0.64	0.56
AUGUST	1	0.91	0.39	0.60	0.47	0.64	0.56
	2	0.91	0.39	0.60	0.47	0.64	0.40
	AVE	0.92	0.53	0.57	0.47	0.64	0.54
	3	0.91	0.39	0.60	0.61	0.48	0.40
	4	0.91	0.39	0.60	0.61	0.48	0.40
	5	0.91	0.39	0.59	0.61	0.48	0.40
	6	0.91	0.39	0.59	0.61	0.48	0.40
	7	0.91	0.43	0.59	0.61	0.48	0.40
	8		0.43	0.59	0.61	0.48	0.40
	9		0.43	0.59	0.61	0.48	0.21
	AVE	0.91	0.41	0.59	0.61	0.48	0.37
	10		0.43	0.59	0.47	0.48	0.21
	11		0.43	0.59	0.47	0.48	0.21
	12		0.43	0.34	0.47	0.48	0.21
	13		0.43	0.34	0.47	0.48	0.21
	14			0.34	0.47	0.48	0.21
	15			0.34	0.47	0.48	0.21
	16			0.34	0.47	0.48	0.36
	AVE		0.43	0.41	0.47	0.48	0.23
	17			0.34	0.38	0.37	0.36
	18			0.34	0.38	0.37	0.36
	19			0.34	0.38	0.37	0.36
	20			0.34	0.38	0.37	0.36
	21			0.34	0.38	0.37	0.36
	22			0.34	0.38	0.37	0.36
	23			0.34	0.38	0.37	
	AVE			0.34	0.38	0.37	0.36
	24			0.34	0.36	0.37	
	25			0.34	0.36	0.37	
	26			0.34	0.36	0.37	
	27			0.34	0.36	0.37	
	28			0.34	0.36	0.37	
	29			0.34	0.36	0.37	
	30			0.34	0.36	0.37	
	AVE			0.34	0.36	0.37	

Table 9. Techniques for estimating the proportion of the catch consisting of Skeena River origin sockeye salmon for the modified interception method in the major interception fisheries in southern southeast Alaska and northern British Columbia for years other than 1982 to 1987. For each fishing area and time period A indicates estimates derived from regression alalysis, B indicates estimates derived from regression analysis excluding 1983, C indicates estimates derived by taking the average of all stock composition estimates and D indicates estimates derived by taking the average of all stock composition estimates excluding those from 1983. See text for details.

		FISHING AREA							
WEEK ENDING		AREA 1	AREA 3X	AREA 3Y	AREA 3Z	AREA 4	FOX DG	FOX SE	NOYES
JUNE	7								
	14	A	C			A			
	21	A	B	A		A	C		A
	28	A	B	A		A	C	A	C
JULY	5	A	B	A	C	A	C	A	C
	12	C	C	C	C	C	C	C	C
	19	C	C	C	C	C	C	C	C
	26	C	C	C	C	C	C	C	C
AUGUST	2	C	C	C		C	C	D	C
	9	C	C	C		C	C	D	C
	16		C			C	C	D	C
	23		C				C		C
	30						C		C

Table 10. Estimated proportion of the catch consisting of Skeena River origin sockeye salmon for the modified interception method in the major interception fisheries in southern southeast Alaska and northern British Columbia for years other than 1982 to 1987. Estimates are based on the techniques outlined in table 9. The X value in the regression equasion is the annual ratio of Skeena River sockeye run size to Nass River sockeye run size. See text for details.

		FISHING AREA							
WEEK ENDING		AREA 1	AREA 3X	AREA 3Y	AREA 3Z	AREA 4	FOX DG	FOX SE	NOYES
JUNE	7								
	14	.205 * X	0.65			.272 * X			
	21	.218 * X	.065 * X	.016 * X		.235 * X	0.14		.157 * X
	28	.086 * X	.073 * X	.018 * X		.177 * X	0.19	.019 * X	0.40
JULY	5	.095 * X	.098 * X	.051 * X	0.16	.176 * X	0.11	.029 * X	0.36
	12	0.66	0.77	0.34	0.22	0.82	0.07	0.20	0.36
	19	0.66	0.80	0.45	0.45	0.82	0.10	0.32	0.47
	26	0.67	0.84	0.62	0.55	0.87	0.09	0.26	0.57
AUGUST	2	0.37	0.87	0.91		0.93	0.15	0.18	0.61
	9	0.22	0.79	0.89		0.93	0.16	0.09	0.56
	16		0.72			0.86	0.21	0.11	0.40
	23		0.70				0.15		0.36
	30						0.16		0.36

Table 11. Estimated proportion of the catch consisting of Skeena River origin sockeye salmon for the standard interception method in the major interception fisheries in southern southeast Alaska and northern British Columbia for years other than 1982 to 1987. See text for details.

WEEK ENDING		FISHING AREA							
		AREA 1	AREA 3X	AREA 3Y	AREA 3Z	AREA 4	FOX DG	FOX SE	NOYES
JUNE	7								
	14	0.51	0.65			0.68			
	21	0.53	0.49	0.04		0.58	0.14		0.40
	28	0.41	0.50	0.05		0.45	0.19	0.05	0.40
JULY	5	0.46	0.59	0.12	0.16	0.65	0.11	0.10	0.36
	12	0.66	0.77	0.34	0.22	0.82	0.07	0.20	0.36
	19	0.66	0.80	0.45	0.45	0.82	0.10	0.32	0.47
	26	0.67	0.84	0.62	0.55	0.87	0.09	0.26	0.57
AUGUST	2	0.37	0.87	0.91		0.93	0.15	0.29	0.61
	9	0.22	0.79	0.89		0.93	0.16	0.26	0.56
	16		0.72			0.86	0.21	0.32	0.40
	23		0.70				0.15		0.36
	30						0.16		0.36

Table 12. Annual ratios of Skeena River sockeye run size to Nass River sockeye run size. Run size for Nass River sockeye is defined as area 3 catch plus area 3 escapement. Run size for Skeena River sockeye is defined as area 4 catch plus area 4 escapement. See text for details.

YEAR	S/N RATIO	YEAR	S/N RATIO
65	3.46	77	1.60
66	3.57	78	2.00
67	3.23	79	5.56
68	3.85	80	2.69
69	3.13	81	4.50
70	5.10	82	2.96
71	3.81	83	2.12
72	3.42	84	4.84
73	2.43	85	7.32
74	2.95	86	3.03
75	6.53	87	4.54
76	3.39		

Table 13. Proportion of age 4-2 and age 5-2 sockeye salmon in the area 4 catch and escapement by year.

	CATCH		ESCAPEMENT	
YEAR	AGE 4-2	AGE 5-2	AGE 4-2	AGE 5-2
69	0.5058	0.4275	0.6252	0.3496
70	0.6127	0.3090	0.6338	0.3011
71	0.5734	0.3883	0.5609	0.3791
72	0.2028	0.7366	0.2945	0.6745
73	0.5442	0.3668	0.4444	0.5020
74	0.3246	0.6374	0.4074	0.5779
75	0.7020	0.2713	0.7596	0.2261
76	0.3867	0.6022	0.4170	0.5550
77	0.4410	0.5300	0.4700	0.5030
78	0.2020	0.7600	0.2480	0.6950
79	0.8340	0.1240	0.8740	0.0900
80	0.1720	0.7680	0.2320	0.7170
81	0.8444	0.1265	0.8802	0.0964
82	0.1560	0.8100	0.1796	0.7901
83	0.2550	0.7020	0.4551	0.5097
84	0.5330	0.4109	0.6721	0.2861
85	0.2244	0.7280	0.3868	0.5949
86	0.3070	0.6524	0.3645	0.5877
87	0.3045	0.6602	0.4578	0.5072

Table 14. Estimated catch, escapement and total run size of age 4 and 5 Skeena River origin sockeye salmon by brood year based on the modified interception method. See text for details.

	FISHING AREA									
	AREA 1		AREA 3X		AREA 3Y		AREA 3Z		AREA 4	
BROOD YEAR	AGE 4	AGE 5	AGE 4	AGE 5	AGE 4	AGE 5	AGE 4	AGE 5	AGE 4	AGE 5
65	11382	10403	22417	4227	16343	7506	15447	4957	232059	147067
66	20628	11612	8382	10573	14883	21667	9829	13706	291611	296429
67	17148	22091	15613	27663	31996	40469	20240	25906	437735	437398
68	6082	4430	7616	12710	11142	10916	7132	46068	120424	416870
69	6573	5887	18857	64514	16196	68382	68348	39060	618485	773614
70	2998	4513	32854	13086	34824	5280	19892	2140	393968	120303
71	11676	4365	33860	22492	13663	18180	5536	16368	311290	351597
72	2803	7729	14443	75980	11674	47629	10511	67142	225777	403588
73	6431	1363	63221	35665	39631	25631	55867	30519	335815	237503
74	362	3823	9479	13258	6812	4996	8112	616	63126	133204
75	25710	23078	89173	61778	33600	22161	4143	8568	895907	225487
76	5169	12381	13836	17545	4963	7799	1919	5148	50500	166693
77	82646	37860	117115	202714	52057	33333	34364	66881	1112695	1236642
78	7292	10946	39041	208886	6420	41147	12881	30923	238168	174786
79	3976	6870	75878	59636	14946	5415	11233	7701	63491	269892
80	8911	49361	77357	77460	7024	0	9989	104745	350091	1301911
81	15215	12574	23876	77014	0	0	32287	16205	401303	265553
82	5917	23247	36240	133989	0	0	7626	17625	124961	301766

Table 14. (cont'd).

	FISHING AREA												
	CAPE FOX GILLNET		CAPE FOX SEINE		NOYES ISLAND		NATIVE FOOD		ESCAPEMENT		TOTAL		
BROOD YEAR	AGE 4	AGE 5	AGE 4	AGE 5	AGE 4	AGE 5	AGE 4	AGE 5	AGE 4	AGE 5	AGE 4	AGE 5	AGE 4+5
65	5514	1906	115	2137	16056	2572	18915	15488	405445	204342	743693	400604	1144361
66	3779	4811	4237	314	5099	1695	30710	30692	430130	313099	819287	704598	1523951
67	7104	12661	464	6286	2503	30400	45322	38224	463247	470286	1041372	1111384	2152823
68	3486	7427	1731	994	8370	21507	10524	24843	205336	377433	381843	923198	1305108
69	11019	9614	1475	2844	31909	41591	36858	52777	334126	419724	1143846	1478007	2621921
70	4896	954	1448	17	21180	3276	26877	23320	295891	185997	834828	358886	1193784
71	2468	8522	45	10	8478	32954	60340	48896	624872	323191	1072229	826576	1898875
72	5472	12991	7	3605	21161	56463	31398	55196	242830	478708	566076	1209030	1775178
73	10810	14933	3000	11787	46982	36382	45927	88099	447301	323035	1054985	804918	1859976
74	3969	1389	3133	74	9670	17629	23416	18786	119918	105254	247998	299029	547101
75	9341	10526	500	4244	118572	154060	126351	106007	1022131	389305	2325427	1005213	3330715
76	2357	1785	951	362	34503	17109	23741	14717	125968	137274	263905	380814	644795
77	11915	18440	2417	20331	114201	161183	98237	171442	1253413	900063	2879061	2848888	5728026
78	3551	13727	3916	24574	31043	227551	33018	96817	204596	455531	579925	1284888	1864891
79	4986	3312	8926	6088	82657	62641	35169	73411	406733	301897	707996	796862	1504936
80	4296	17503	7897	13559	81254	167890	95226	151482	709210	1293792	1351255	3177703	4529038
81	5395	15987	4180	5719	51751	143089	46693	97814	841215	418914	1421915	1052869	2474865
82	7523	10028	2691	1693	67333	41153	46029	92428	259816	673373	558137	1295303	1853522

Table 15. Estimated catch, escapement and total run size of age 4 and 5 Skeena River sockeye salmon by brood year based on the standard interception method. See text for details.

	FISHING AREA									
	AREA 1		AREA 3X		AREA 3Y		AREA 3Z		AREA 4	
BROOD YEAR	AGE 4	AGE 5	AGE 4	AGE 5	AGE 4	AGE 5	AGE 4	AGE 5	AGE 4	AGE 5
65	11963	9276	23691	4368	16202	7064	15447	4957	232731	141846
66	18393	10929	8661	10648	14006	21644	9829	13706	281258	296394
67	16139	24277	15724	29049	31961	40019	20240	25906	437683	438313
68	6684	5136	7998	13748	11018	10906	7132	46068	120676	419509
69	7620	6639	20397	67992	16180	68123	68348	39060	622402	776127
70	3381	4101	34625	13055	34692	5099	19892	2140	395248	114570
71	10612	4507	33780	22576	13193	18175	5536	16368	296455	351399
72	2894	7915	14497	75949	11671	47632	10511	67142	225649	403698
73	6586	2008	63195	40642	39633	25778	55867	30519	335907	249754
74	534	3676	10802	13278	6852	4966	8112	616	66382	133014
75	24725	25558	89305	61844	33400	22161	4143	8568	894630	225490
76	5724	12312	13850	17548	4963	7719	1919	5148	50500	166688
77	82186	37860	117133	202714	51526	33333	34364	66881	1112658	1236641
78	7292	10946	39041	208886	6420	41147	12881	30923	238168	174786
79	3976	6869	75878	59636	14946	5226	11233	7701	63491	269892
80	8910	49361	77357	77460	6778	0	9989	104745	350091	1274168
81	15215	12593	23876	77047	0	0	32287	16205	392752	265553
82	5926	23247	36256	133992	0	0	7626	17625	124961	301738

Table 15. (cont'd).

	FISHING AREA												
	CAPE FOX GILLNET		CAPE FOX SEINE		NOYES ISLAND		NATIVE FOOD		ESCAPEMENT		TOTAL		
BROOD YEAR	AGE 4	AGE 5	AGE 4	AGE 5	AGE 4	AGE 5	AGE 4	AGE 5	AGE 4	AGE 5	AGE 4	AGE 5	AGE 4+5
65	5514	1906	237	2696	16056	2572	18915	15488	405445	204342	746200	394514	1140779
66	3779	4811	5346	904	5099	1695	30710	30692	430130	313099	807211	704521	1511799
67	7104	12661	1335	9353	2503	30400	45322	38224	463247	470286	1041259	1118490	2159815
68	3486	7427	2575	1322	8370	21507	10524	24843	205336	377433	383799	927898	1311765
69	11019	9614	1961	4004	31909	41591	36858	52777	334126	419724	1150820	1485650	2636539
70	4896	954	2039	50	21180	3276	26877	23320	295891	185997	838721	352562	1191353
71	2468	8522	130	29	8478	32954	60340	48896	624872	323191	1055865	826619	1882555
72	5472	12991	19	6997	21161	56463	31398	55196	242830	478708	566104	1212690	1778866
73	10810	14933	5822	15218	46982	36382	45927	88099	447301	323035	1058030	826368	1884470
74	3969	1389	4045	215	9670	17629	23416	18786	119918	105254	253699	298823	552596
75	9341	10526	1443	9160	118572	154060	126351	106007	1022131	389305	2324041	1012678	3336793
76	2357	1785	2052	879	34503	17109	23741	14717	125968	137274	265577	381179	646832
77	11915	18440	5867	24737	114201	161183	98237	171442	1253413	900063	2881501	2853293	5734871
78	3551	13727	4764	24574	31043	227551	33018	96817	204596	455531	580774	1284888	1865739
79	4986	3312	8926	10805	82657	62641	35169	73411	406733	301897	707996	801389	1509463
80	4296	17503	14016	26563	81254	167890	95226	151482	709210	1293792	1357127	3162964	4520171
81	5395	15987	8188	5719	51751	143089	46693	97814	841215	418914	1417372	1052922	2470374
82	7523	10028	2691	1693	67333	41153	46029	92428	259816	673373	558162	1295277	1853521

Table 16. Estimated catch, escapement and total run size of age 4 and 5 Skeena River origin sockeye salmon by brood year based on the terminal method. See text for details.

	AREA 4		NATIVE FOOD		ESCAPEMENT		TOTAL		
BROOD YEAR	AGE 4	AGE 5	AGE 4	AGE 5	AGE 4	AGE 5	AGE 4	AGE 5	AGE 4+5
65	272927	168789	18915	15488	405445	204342	697286	388619	1085905
66	334684	333253	30710	30692	430130	313099	795523	677043	1472566
67	492113	496906	45322	38224	463247	470286	1000682	1005416	2006098
68	136808	476995	10524	24843	205336	377433	352668	879271	1231939
69	707690	880707	36858	52777	334126	419724	1078674	1353207	2431882
70	448506	132533	26877	23320	295891	185997	771273	341850	1113123
71	342934	392551	60340	48896	624872	323191	1028146	764639	1792785
72	252075	454597	31398	55196	242830	478708	526304	988500	1514804
73	378259	308558	45927	88099	447301	323035	871487	719693	1591180
74	82012	152139	23416	18786	119918	105254	225346	276178	501524
75	1023255	264881	126351	106007	1022131	389305	2171737	760193	2931930
76	59322	196097	23741	14717	125968	137274	209031	348088	557119
77	1308964	1375148	98237	171442	1253413	900063	2660614	2446653	5107266
78	264843	200485	33018	96817	204596	455531	502458	752833	1255290
79	72826	312154	35169	73411	406733	301897	514728	687463	1202190
80	404912	1481555	95226	151482	709210	1293792	1209347	2926829	4136177
81	456677	302108	46693	97814	841215	418914	1344585	818836	2163421
82	142163	343231	46029	92428	259816	673373	448008	1109032	1557039

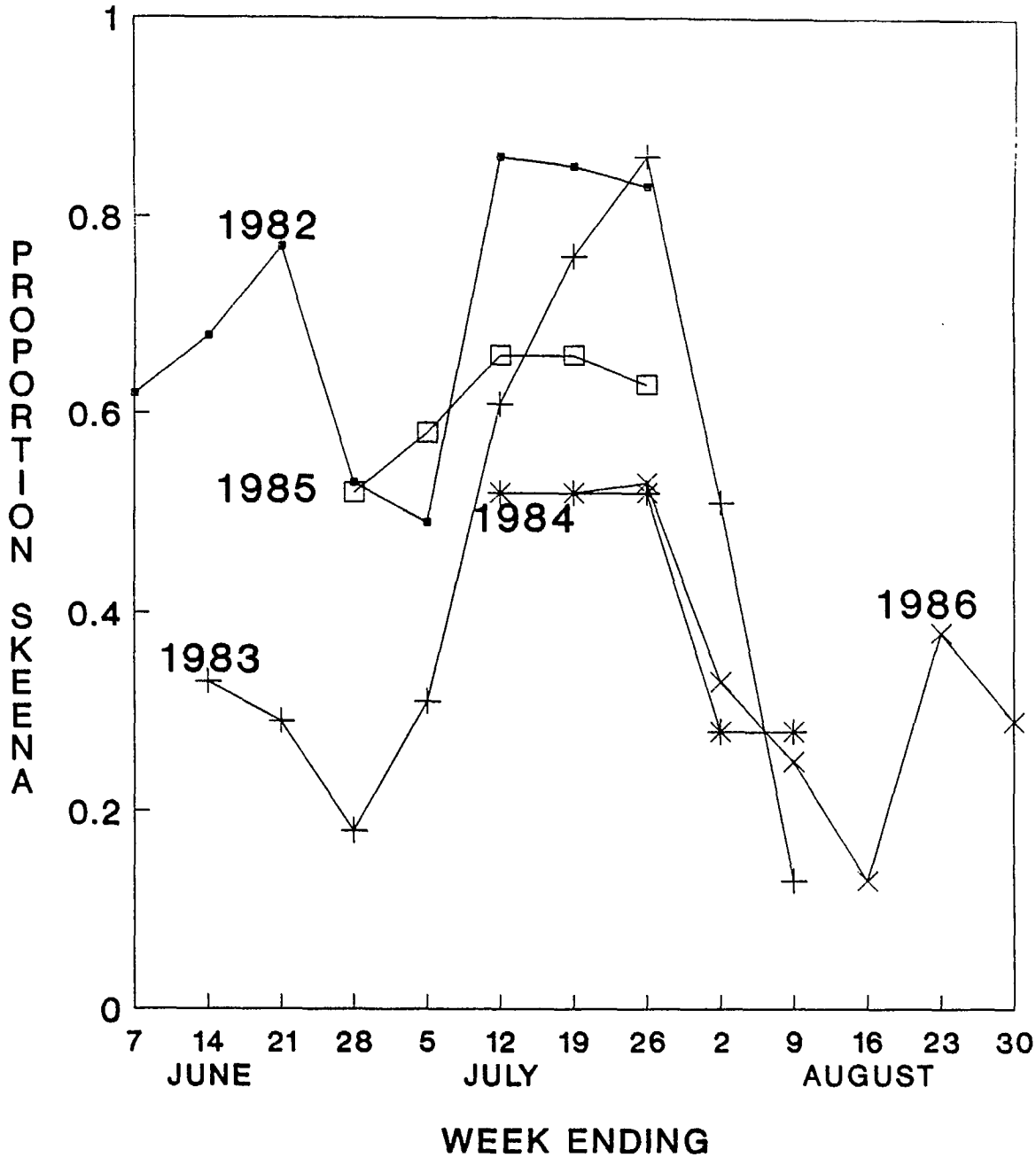


Fig. 1. Estimates of proportion of the catch in the area 1 fishery consisting of Skeena River origin sockeye salmon from 1982 to 1986. The estimation technique for each year is described in the text.

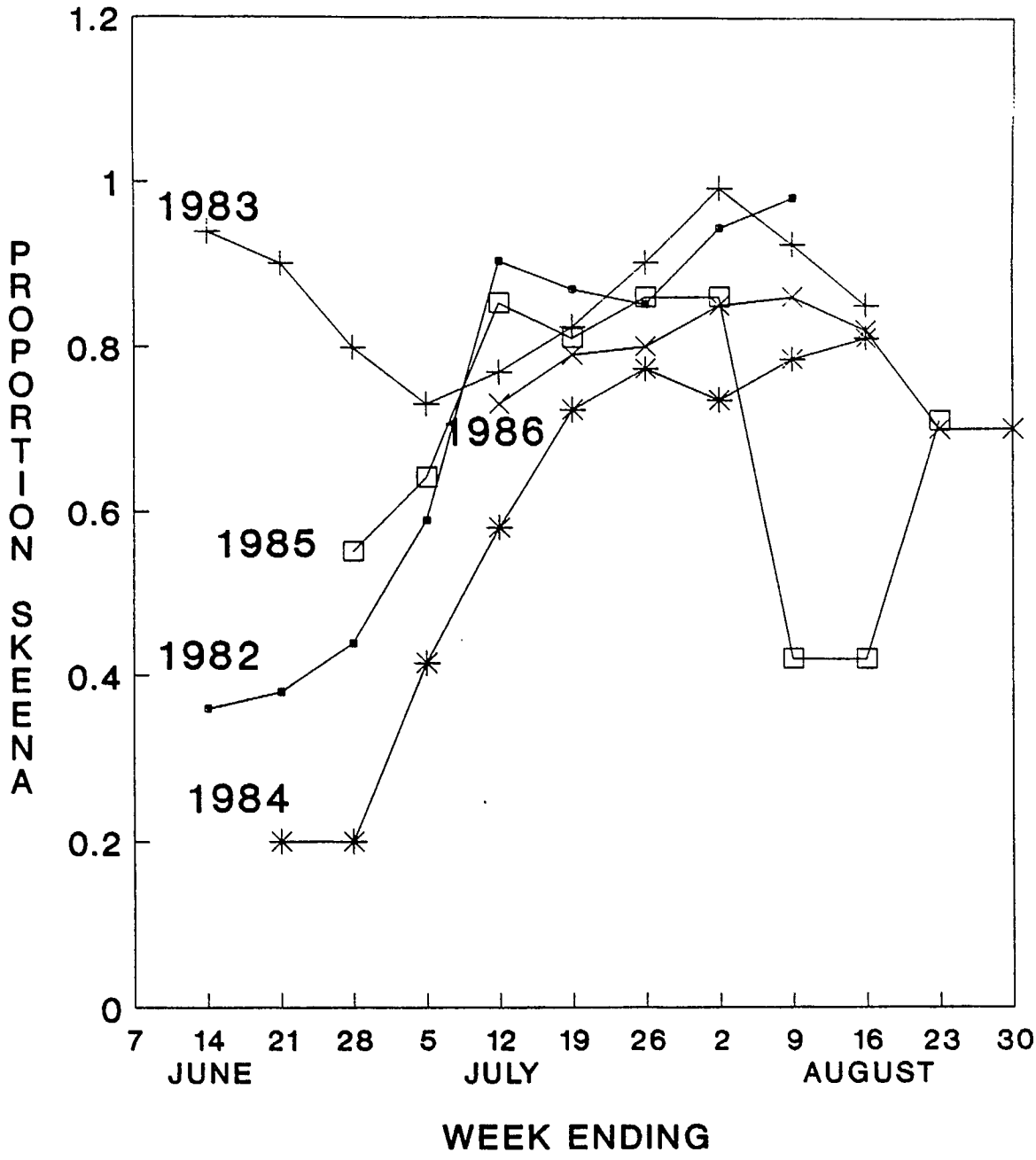


Fig. 2. Estimates of proportion of the catch in the area 3X fishery consisting of Skeena River origin sockeye salmon from 1982 to 1986. The estimation technique for each year is described in the text.

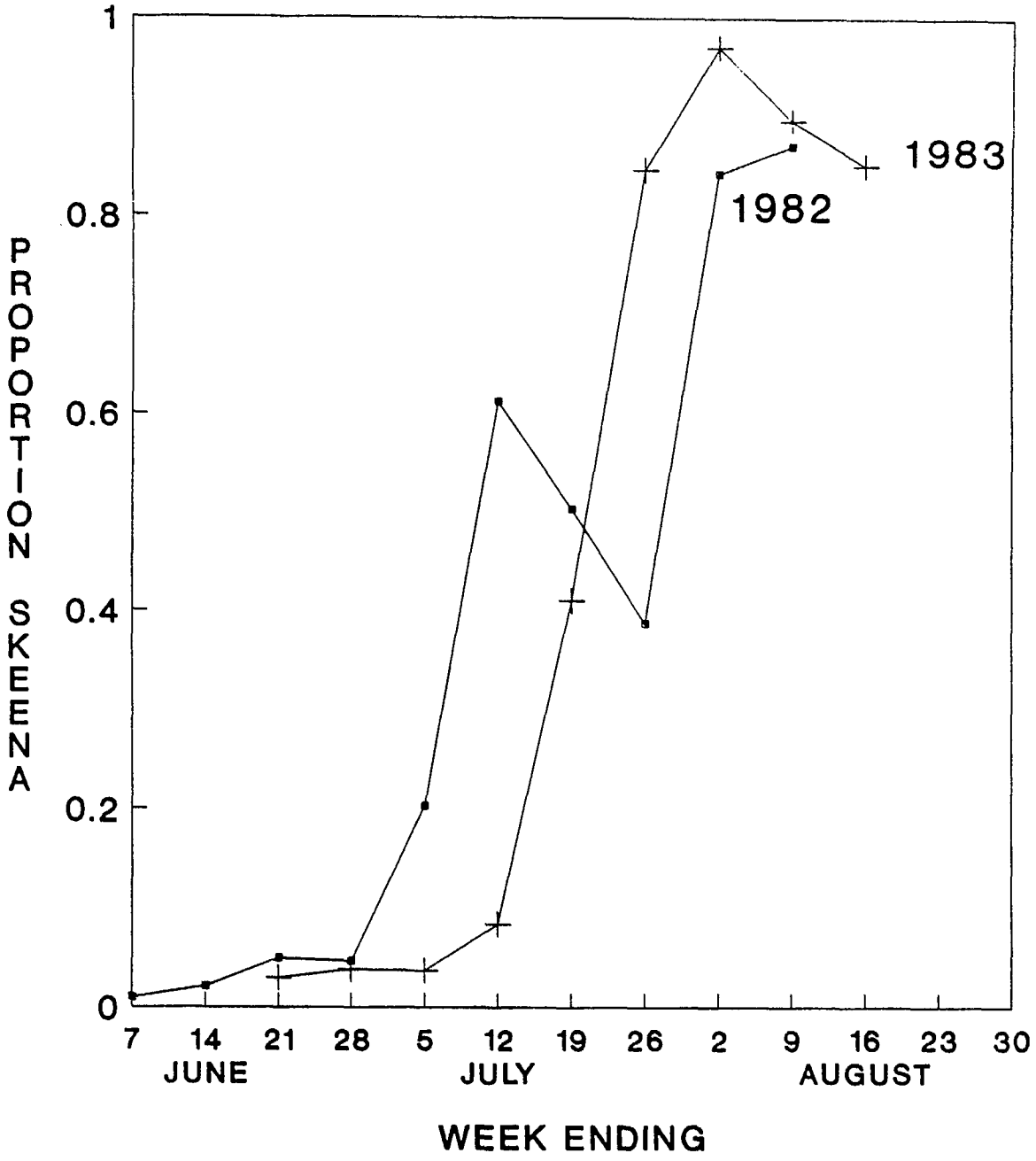


Fig. 3. Estimates of proportion of the catch in the area 3Y fishery consisting of Skeena River origin sockeye salmon from 1982 to 1983. The estimation technique for each year is described in the text.

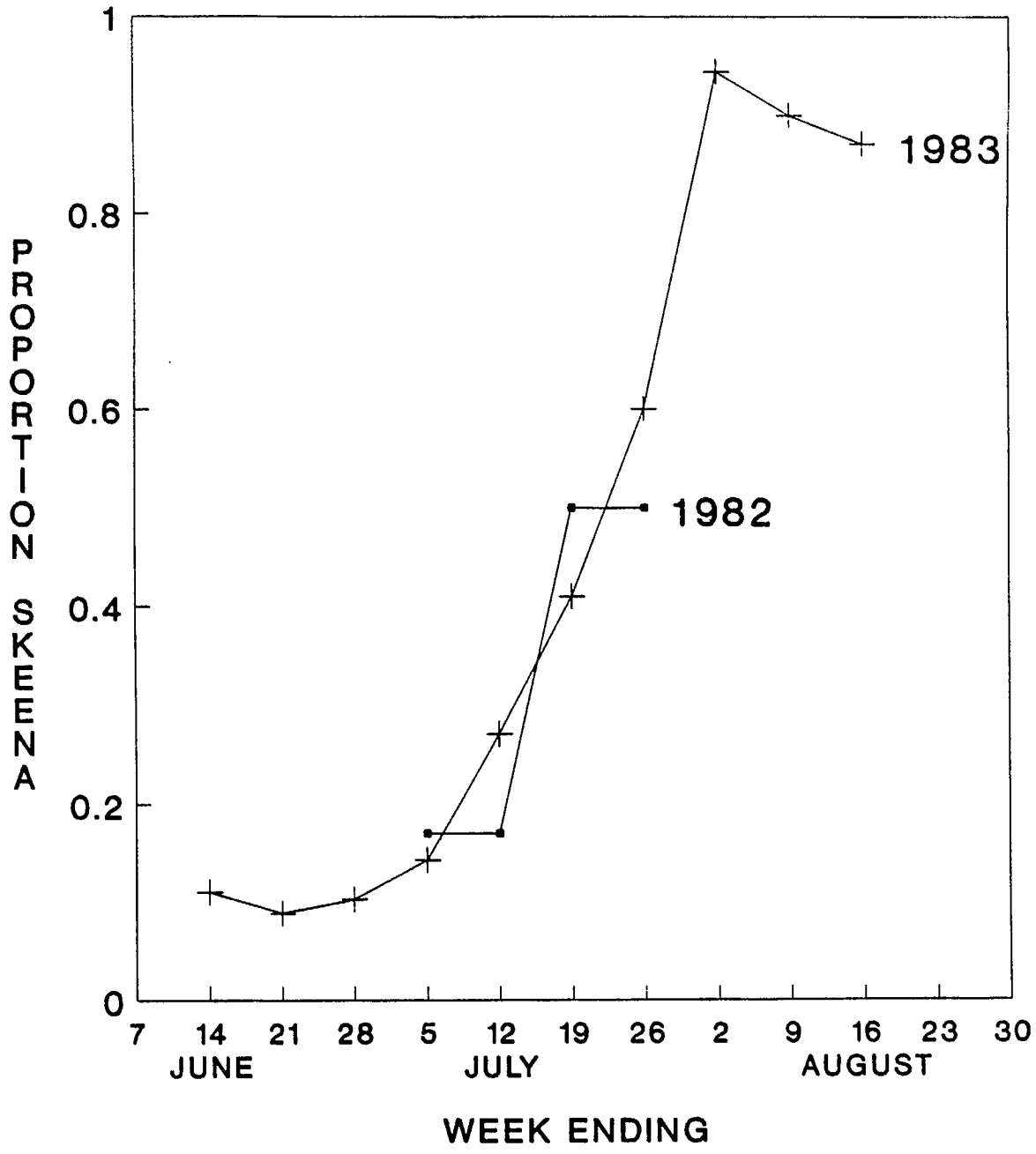


Fig. 4. Estimates of proportion of the catch in the area 3Z fishery consisting of Skeena River origin sockeye salmon from 1982 to 1986. The estimation technique for each year is described in the text.

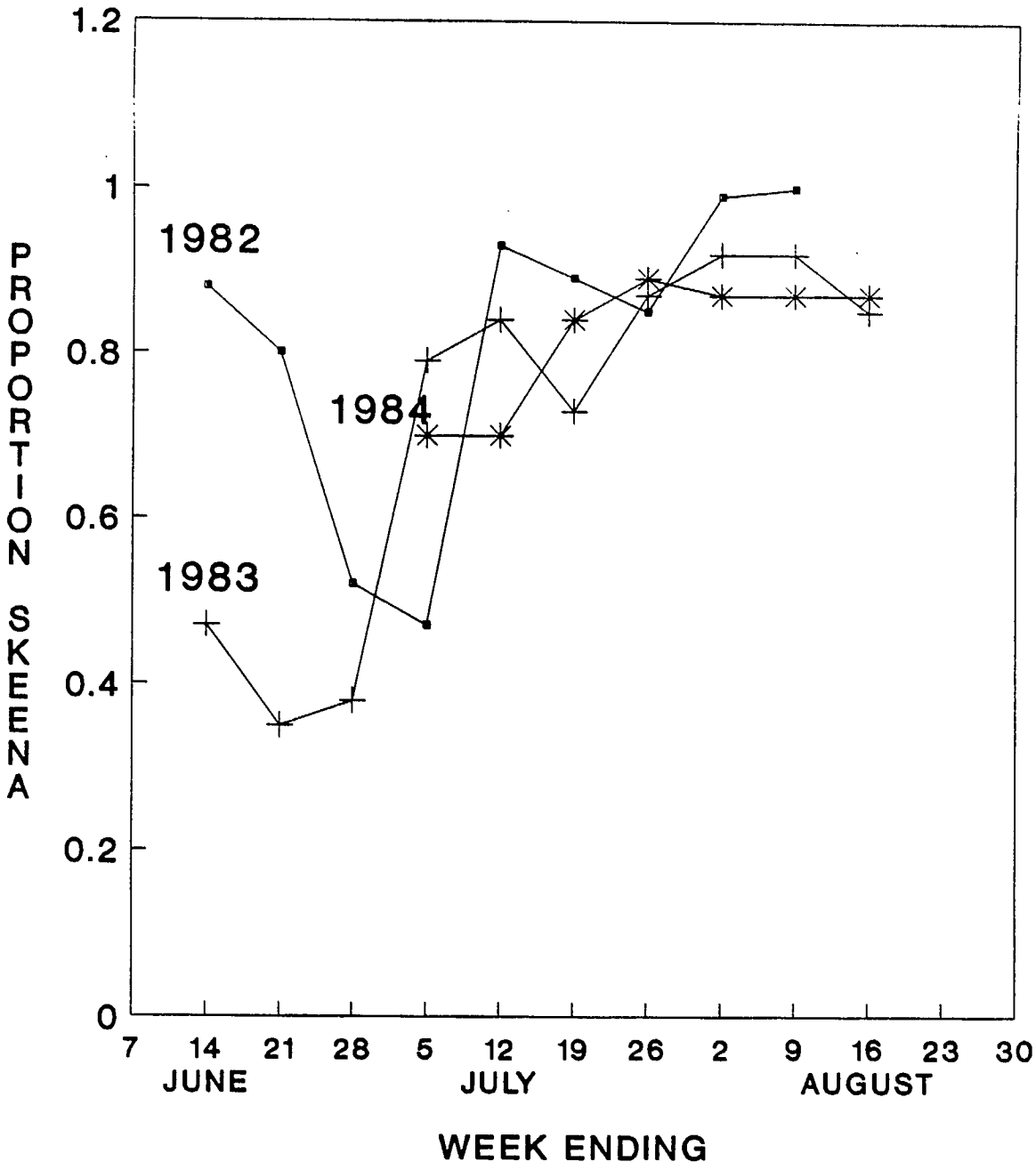


Fig. 5. Estimates of proportion of the catch in the area 4 fishery consisting of Skeena River origin sockeye salmon from 1982 to 1984. The estimation technique for each year is described in the text.

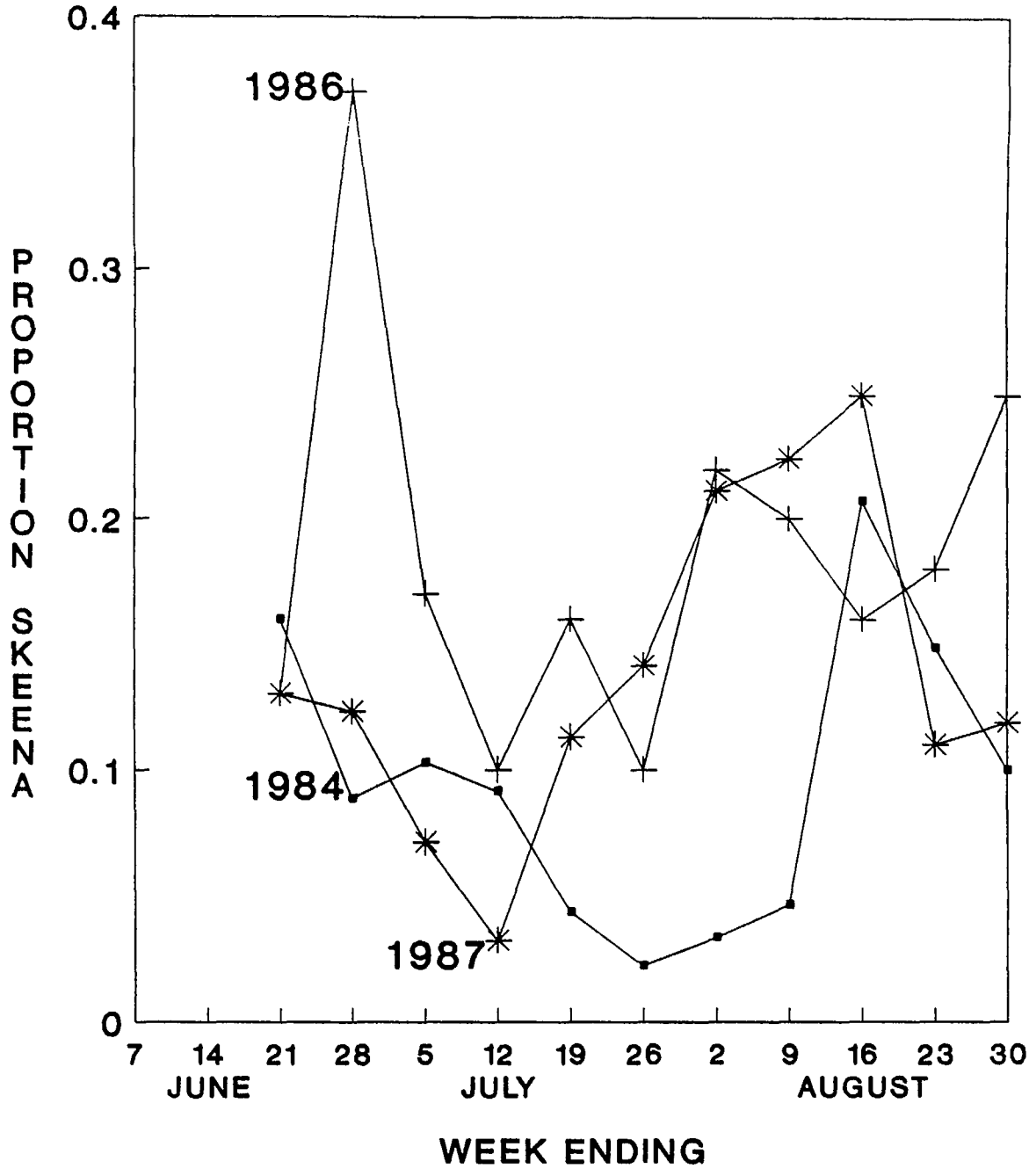


Fig. 6. Estimates of proportion of the catch in the Cape Fox drift gillnet fishery consisting of Skeena River origin sockeye salmon for 1984, 1986, and 1987. The estimation technique for each year is described in the text.

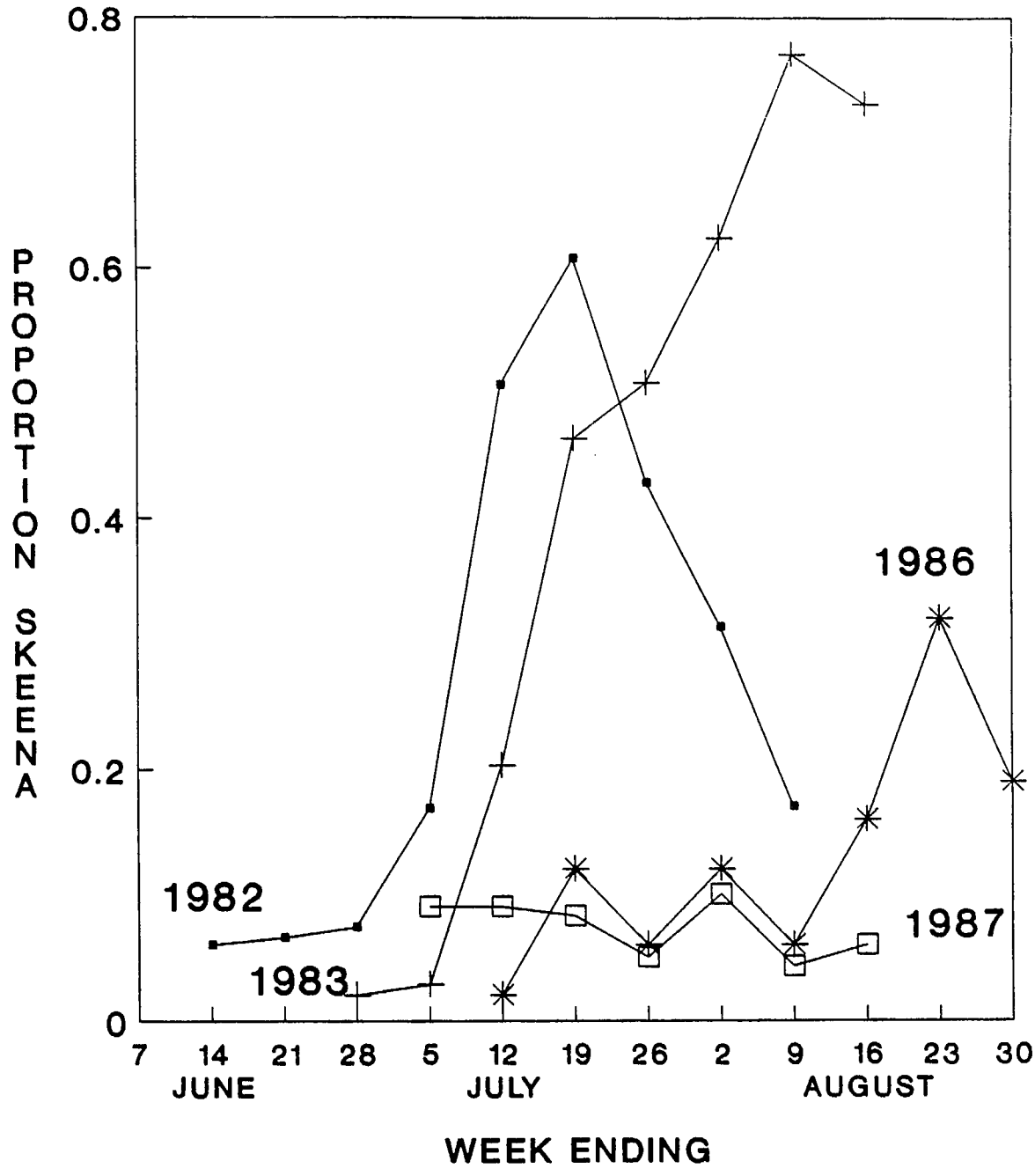


Fig. 7. Estimates of proportion of the catch in the Cape Fox seine fishery consisting of Skeena River origin sockeye salmon for 1982, 1983, 1986 and 1987. The estimation technique for each year is described in the text.

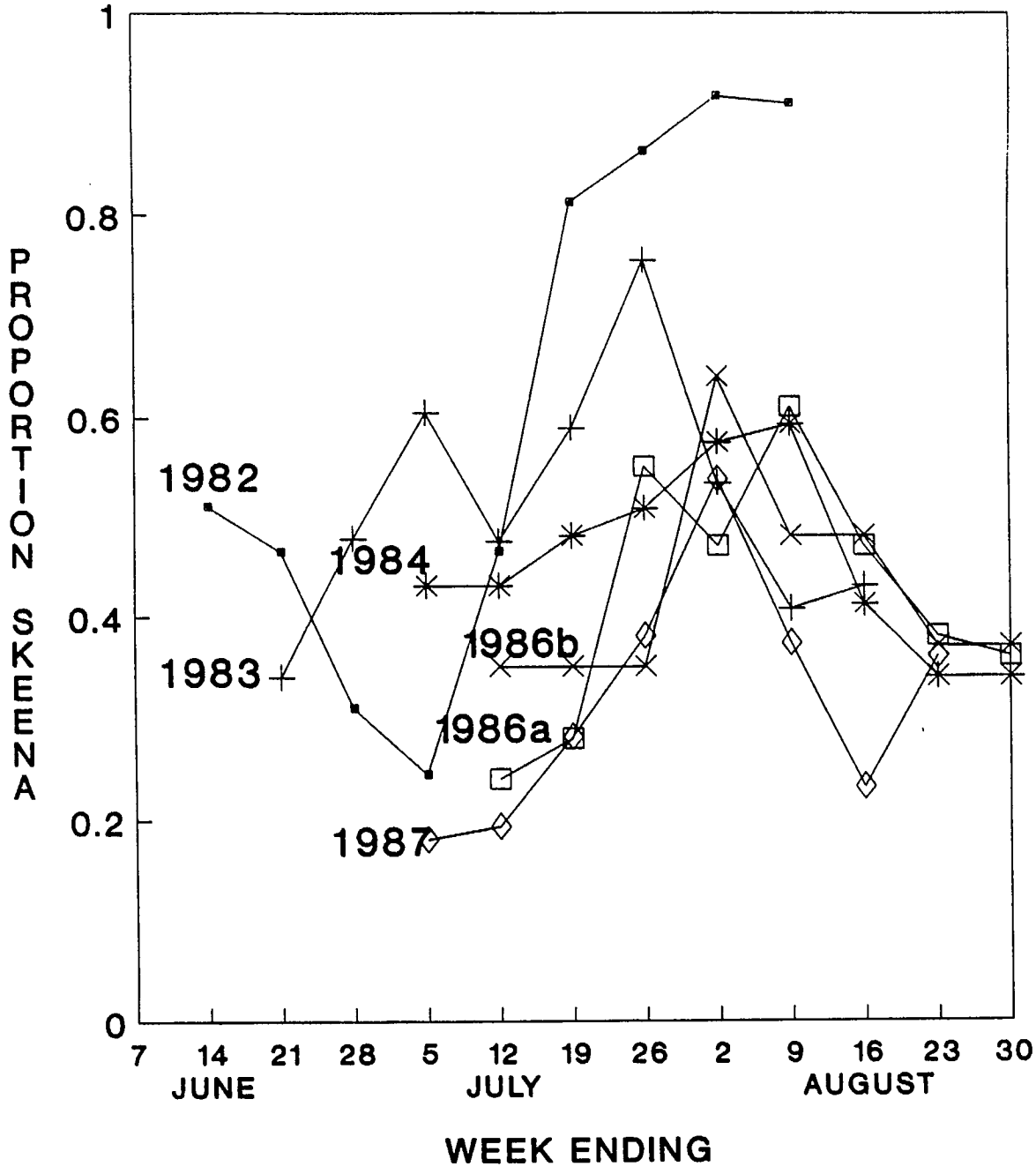


Fig. 8. Estimates of proportion of the catch in the Noyes Island seine fishery consisting of Skeena River origin sockeye salmon for 1982, 1983, 1984, 1986 and 1987. The estimation technique for each year is described in the text.

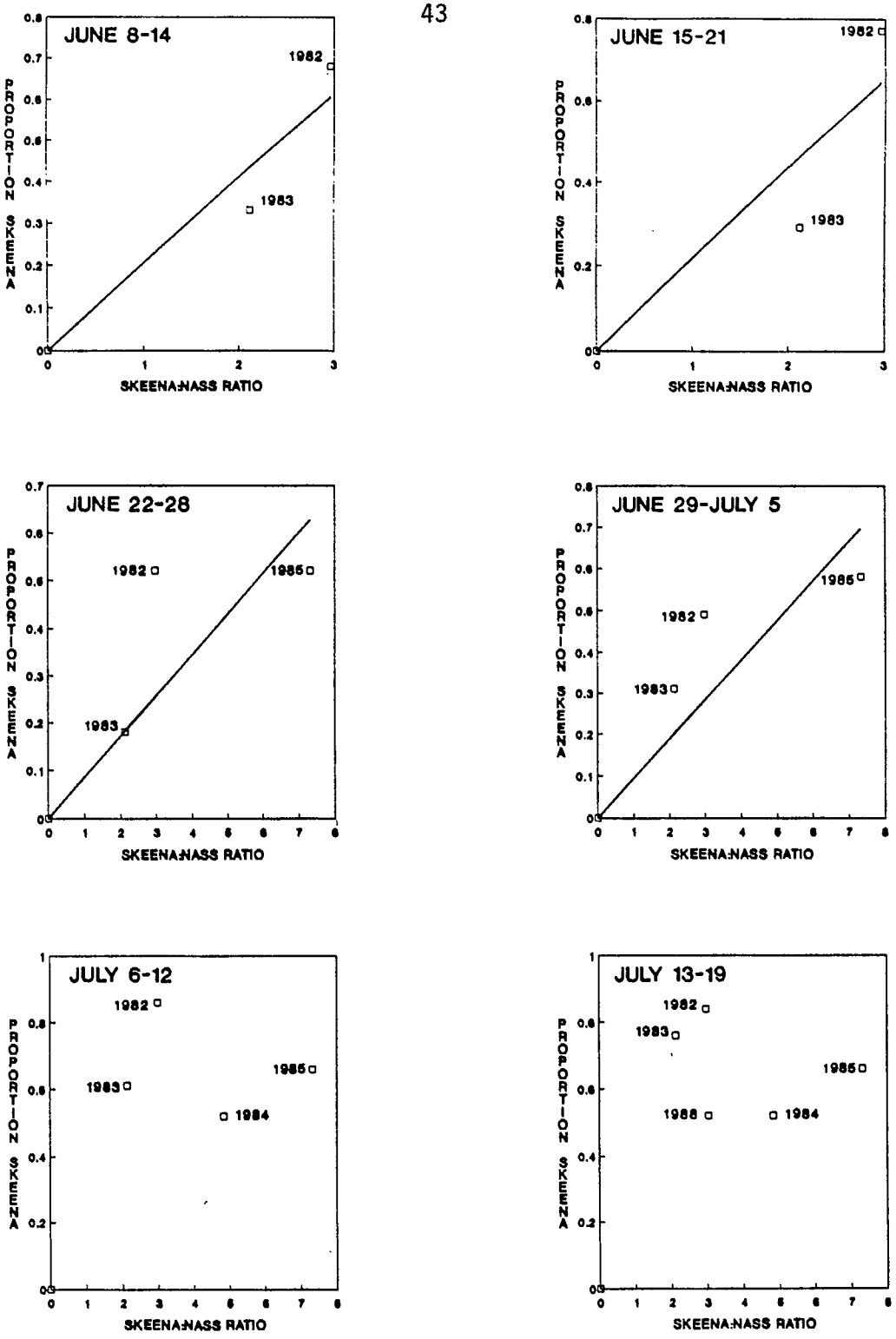
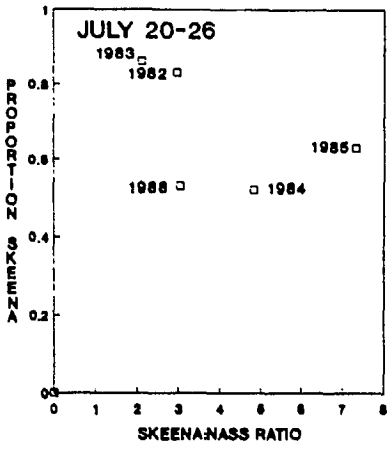
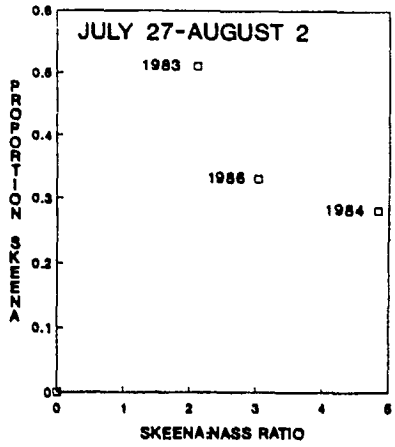


Fig. 9. Relationship between weekly estimates of the proportion of the sockeye catch of Skeena River origin and the annual ratio of Skeena River sockeye run size to Nass River sockeye run size for statistical area 1. Run size for Nass River sockeye is defined as area 3 catch plus area 3 escapement. Run size for Skeena River sockeye is defines as area 4 catch plus area 4 escapement. The techniques for estimating the proportion Skeena origin are described in the text. (note: y axes to different scale).


JULY 20-26
1983
1982
1985
1986
1984
PROPORTION SKEENA
SKEENA:NASS RATIO


JULY 27-AUGUST 2
1983
1986
1984
PROPORTION SKEENA
SKEENA:NASS RATIO

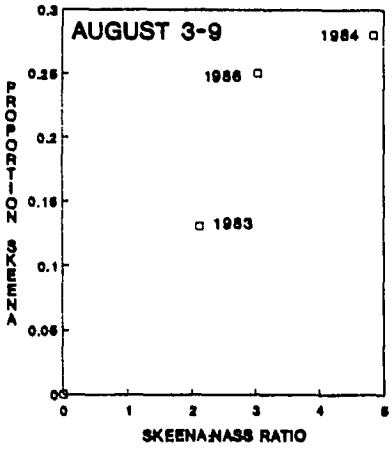

AUGUST 3-9
1984
1986
1983
PROPORTION SKEENA
SKEENA:NASS RATIO

Fig. 9. (cont'd).

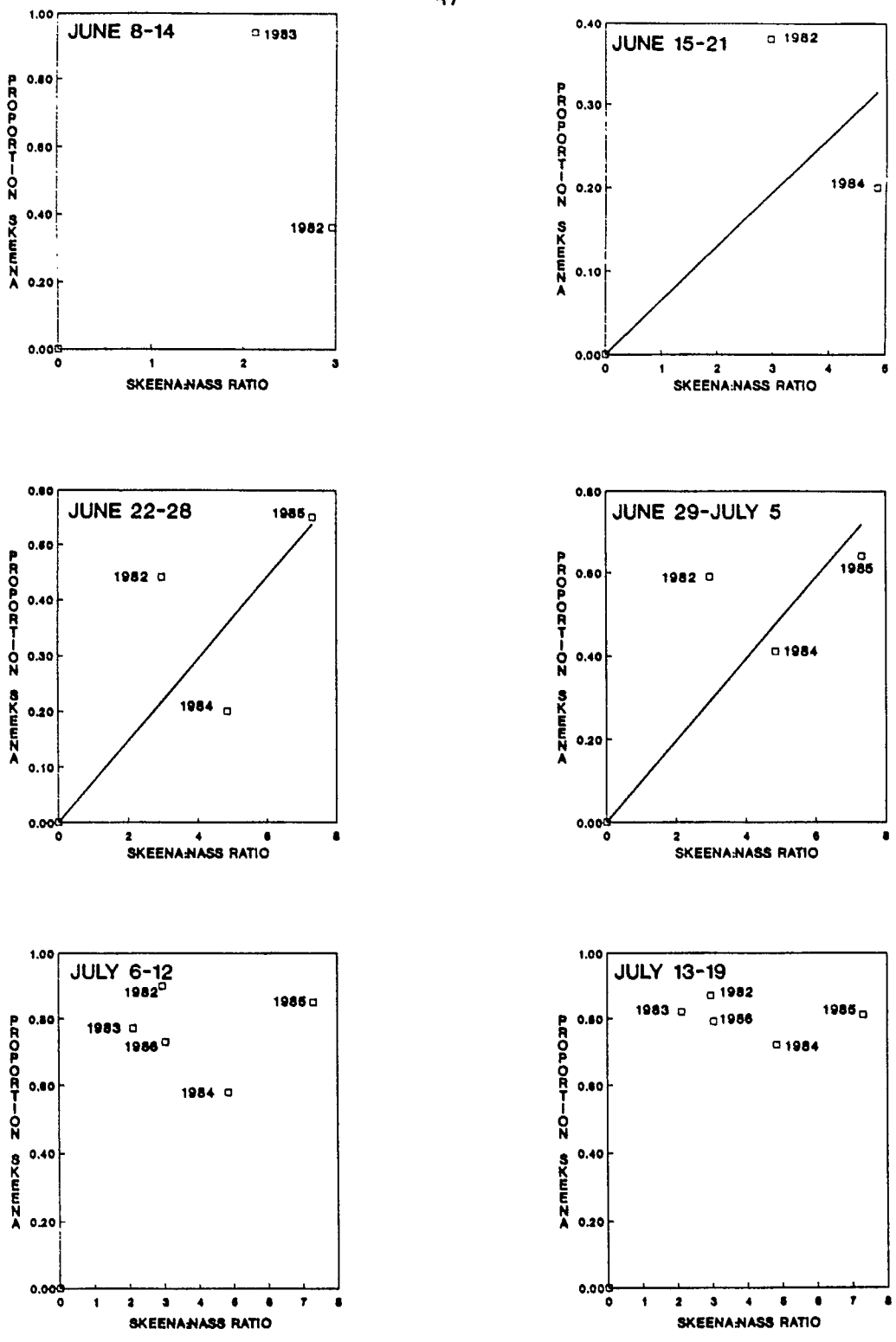
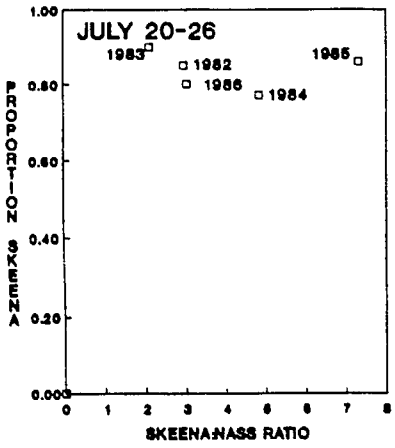
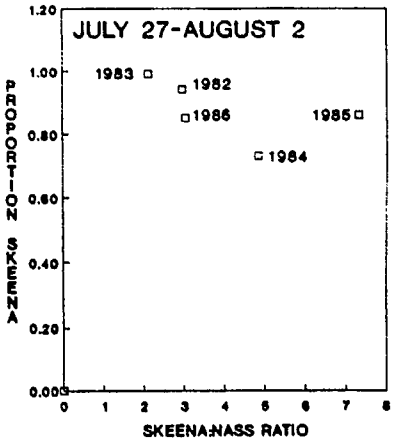
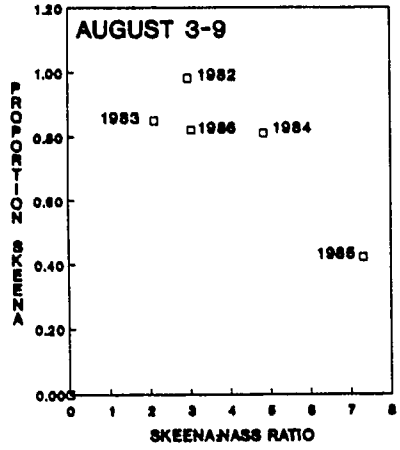
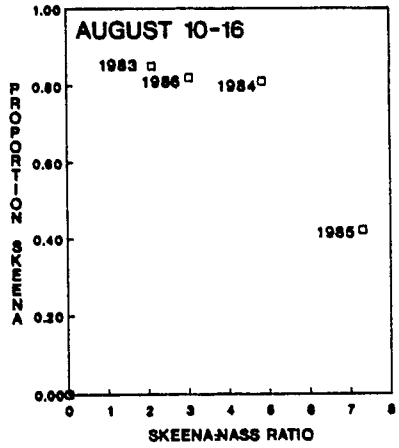


Fig. 10. Relationship between weekly estimates of the proportion of the sockeye catch of Skeena River origin and the annual ratio of Skeena River sockeye run size to Nass River sockeye run size for statistical subarea 3X. Run size for Nass River sockeye is defined as area 3 catch plus area 3 escapement. Run size for Skeena River sockeye is defined as area 4 catch plus area 4 escapement. The techniques for estimating the proportion Skeena origin are described in the text. (note: y axes to different scale).


JULY 20-26
1983
1982
1985
1986
1984
PROPORTION SKEENA
SKEENA:NASS RATIO


JULY 27-AUGUST 2
1983
1982
1986
1985
1984
PROPORTION SKEENA
SKEENA:NASS RATIO


AUGUST 3-9
1982
1983
1986
1984
1985
PROPORTION SKEENA
SKEENA:NASS RATIO


AUGUST 10-16
1983
1986
1984
1985
PROPORTION SKEENA
SKEENA:NASS RATIO

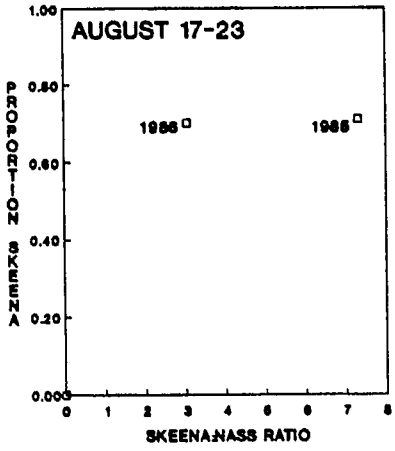

AUGUST 17-23
1986
1985
PROPORTION SKEENA
SKEENA:NASS RATIO

Fig. 10. (cont'd).

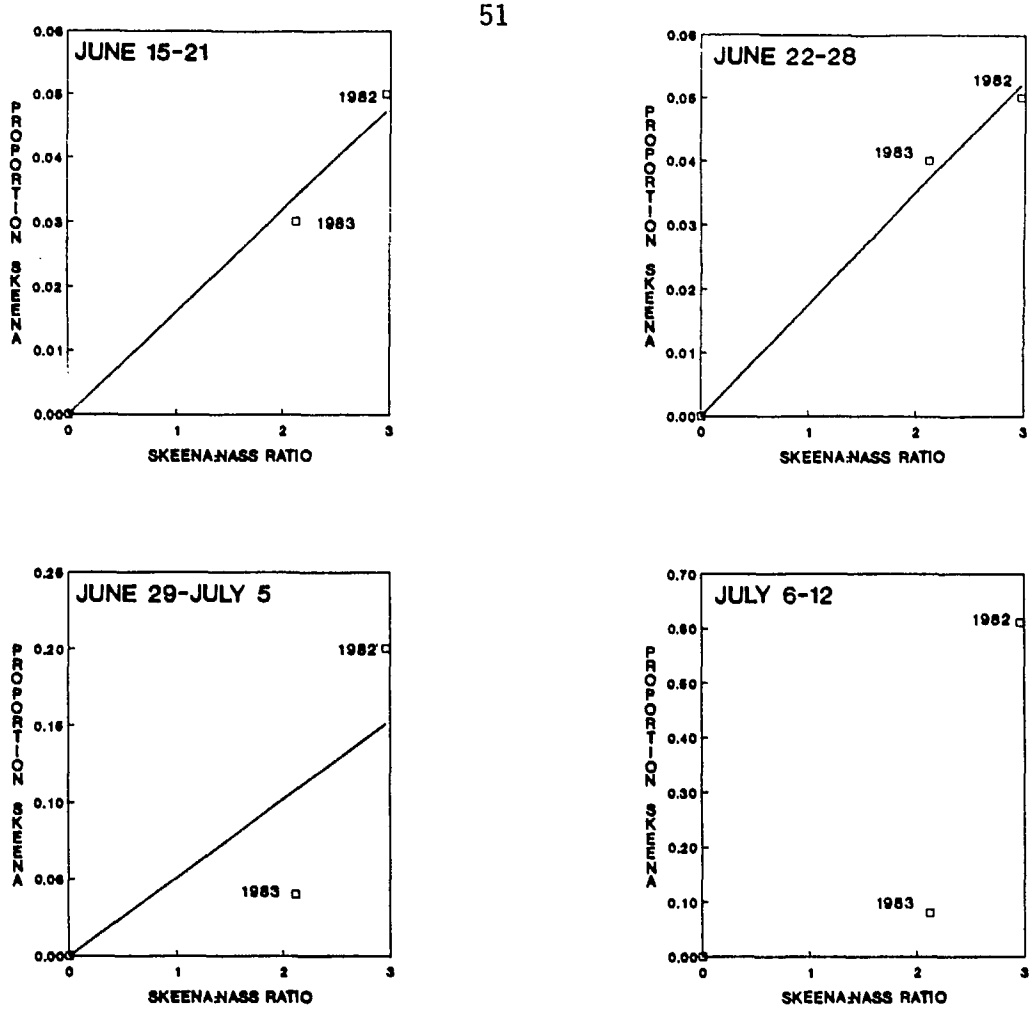
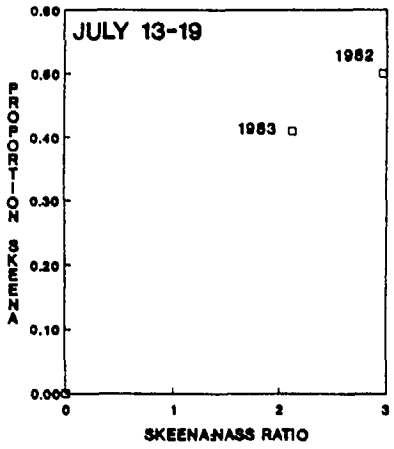
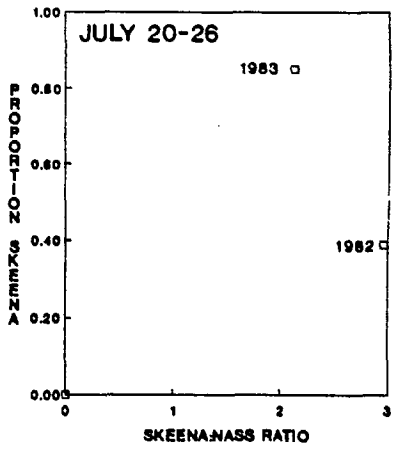
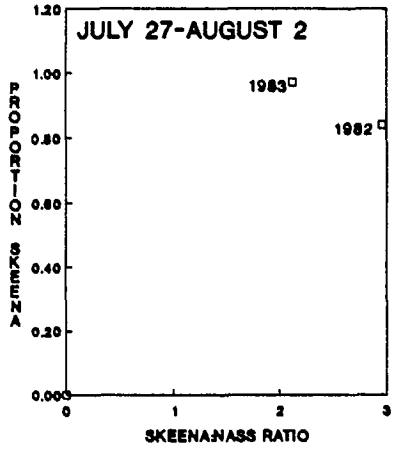


Fig. 11. Relationship between weekly estimates of the proportion of the sockeye catch of Skeena River origin and the annual ratio of Skeena River sockeye run size to Nass River sockeye run size for statistical subarea 3Y. Run size for Nass River sockeye is defined as area 3 catch plus area 3 escapement. Run size for Skeena River sockeye is defined as area 4 catch plus area 4 escapement. The techniques for estimating the proportion Skeena origin are described in the text. (note: y axes to different scale).


JULY 13-19
1982
1983
PROPORTION SKEENA
0.60
0.50
0.40
0.30
0.20
0.10
0.000
0
1
2
3
SKEENA:NASS RATIO


JULY 20-26
1983
1982
PROPORTION SKEENA
1.00
0.80
0.60
0.40
0.20
0.000
0
1
2
3
SKEENA:NASS RATIO


JULY 27-AUGUST 2
1983
1982
PROPORTION SKEENA
1.20
1.00
0.80
0.60
0.40
0.20
0.000
0
1
2
3
SKEENA:NASS RATIO

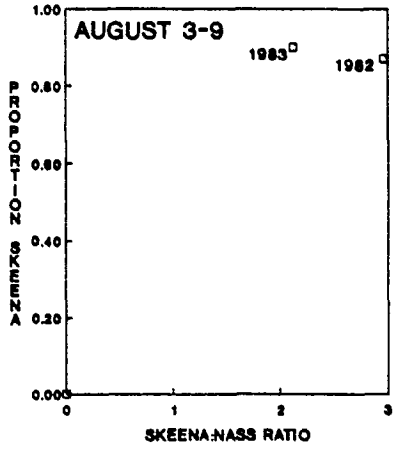

AUGUST 3-9
1983
1982
PROPORTION SKEENA
1.00
0.80
0.60
0.40
0.20
0.000
0
1
2
3
SKEENA:NASS RATIO

Fig. 11. (cont'd).

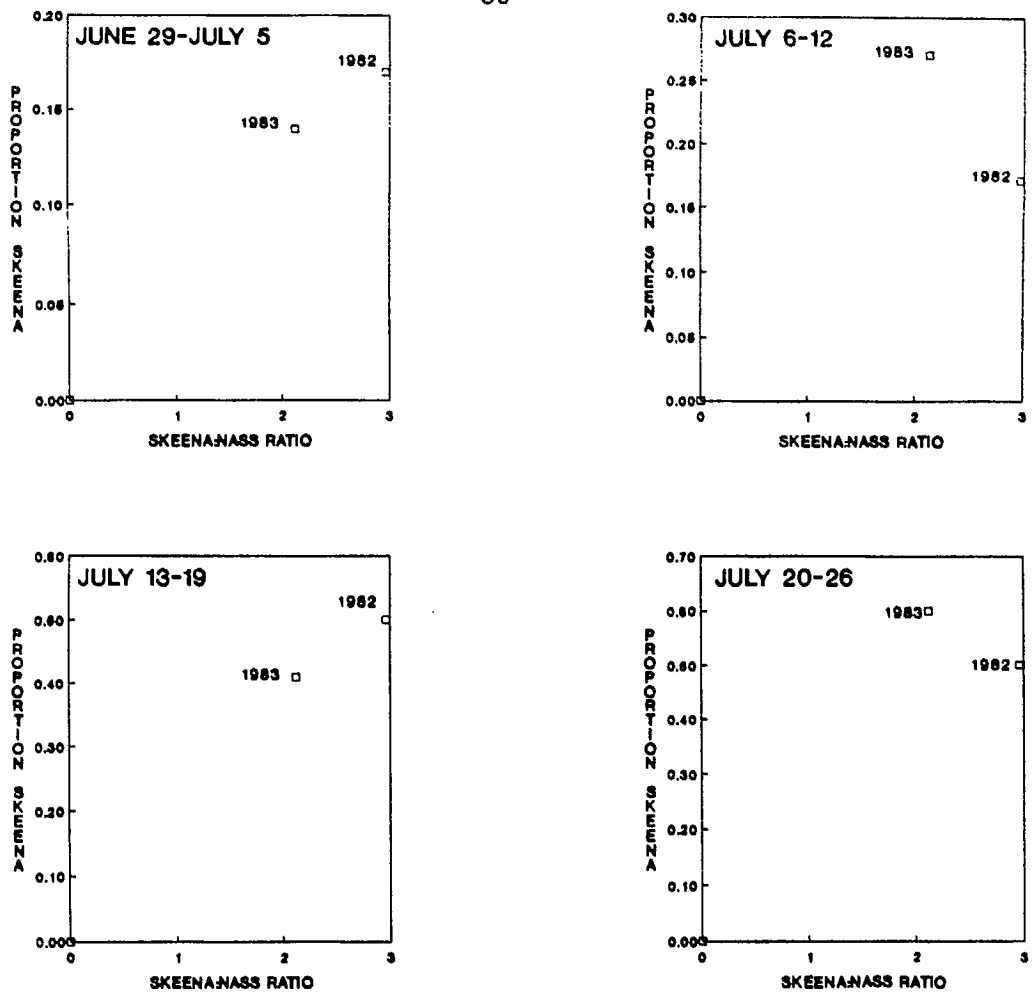


Fig. 12. Relationship between weekly estimates of the proportion of the sockeye catch of Skeena River origin and the annual ratio of Skeena River sockeye run size to Nass River sockeye run size for statistical subarea 3Z. Run size for Nass River sockeye is defined as area 3 catch plus area 3 escapement. Run size for Skeena River sockeye is defines as area 4 catch plus area 4 escapement. The techniques for estimating the proportion Skeena origin are described in the text. (note: y axes to different scale).

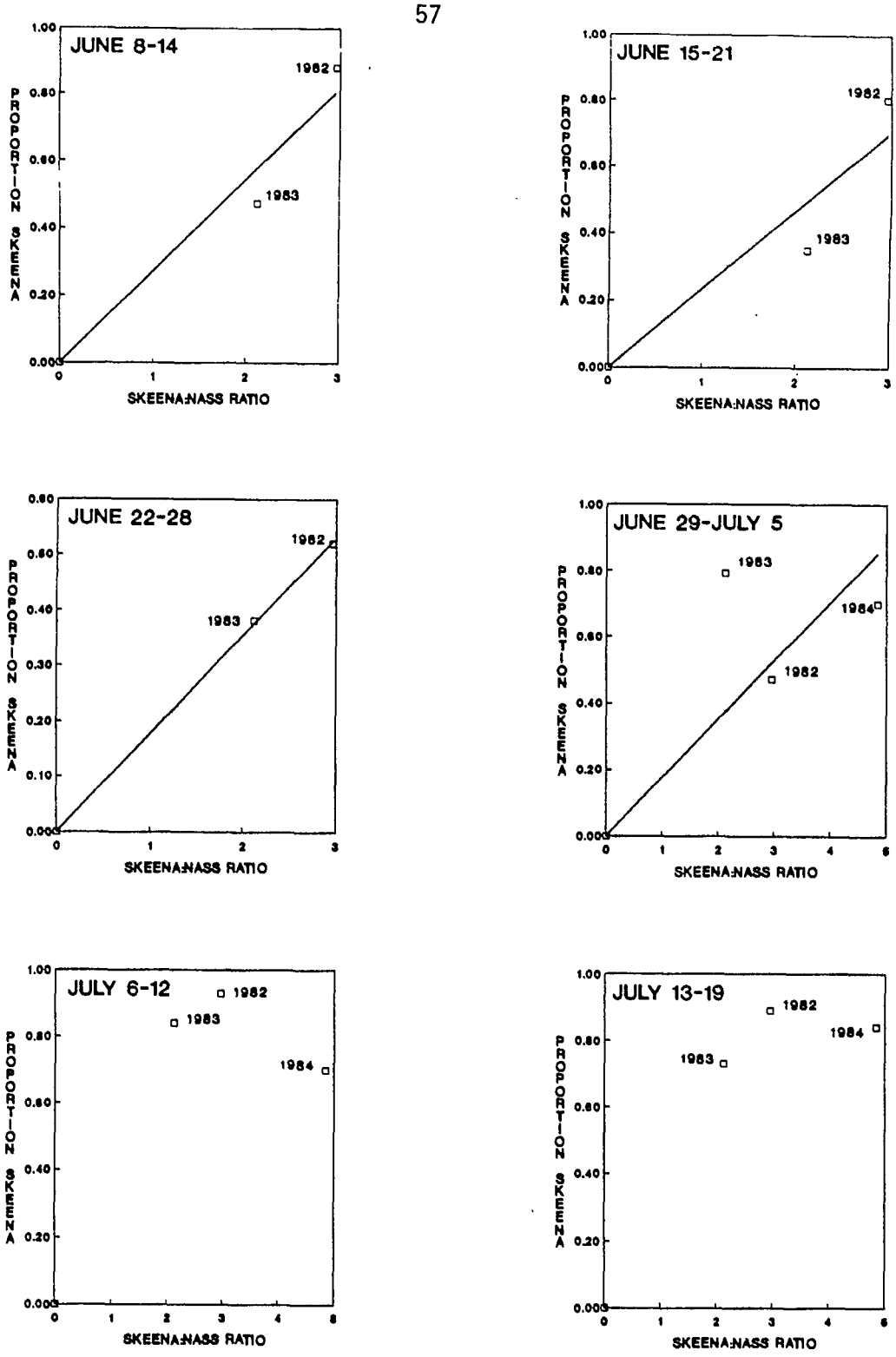
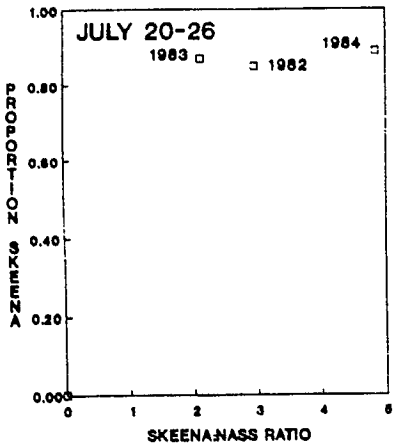
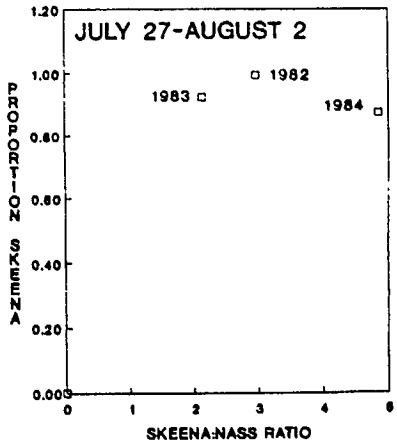
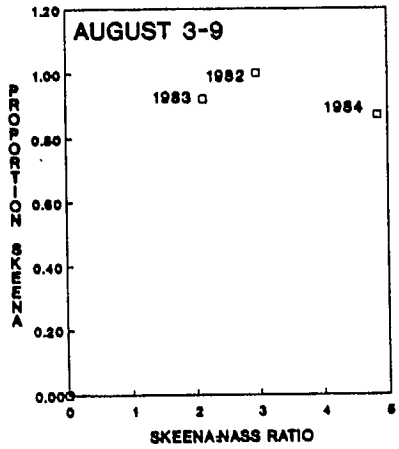


Fig. 13. Relationship between weekly estimates of the proportion of the sockeye catch of Skeena River origin and the annual ratio of Skeena River sockeye run size to Nass River sockeye run size for statistical area 4. Run size for Nass River sockeye is defined as area 3 catch plus area 3 escapement. Run size for Skeena River sockeye is defined as area 4 catch plus area 4 escapement. The techniques for estimating the proportion Skeena origin are described in the text. (note: y axes to different scale).


JULY 20-26
1983
1982
1984
PROPORTION SKEENA
1.00
0.80
0.60
0.40
0.20
0.000
0
1
2
3
4
5
SKEENA:NASS RATIO


JULY 27-AUGUST 2
1982
1983
1984
PROPORTION SKEENA
1.20
1.00
0.80
0.60
0.40
0.20
0.000
0
1
2
3
4
5
SKEENA:NASS RATIO


AUGUST 3-9
1982
1983
1984
PROPORTION SKEENA
1.20
1.00
0.80
0.60
0.40
0.20
0.000
0
1
2
3
4
5
SKEENA:NASS RATIO

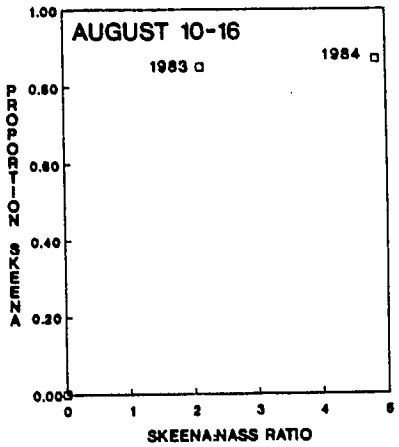

AUGUST 10-16
1983
1984
PROPORTION SKEENA
1.00
0.80
0.60
0.40
0.20
0.000
0
1
2
3
4
5
SKEENA:NASS RATIO

Fig. 13. (cont'd).

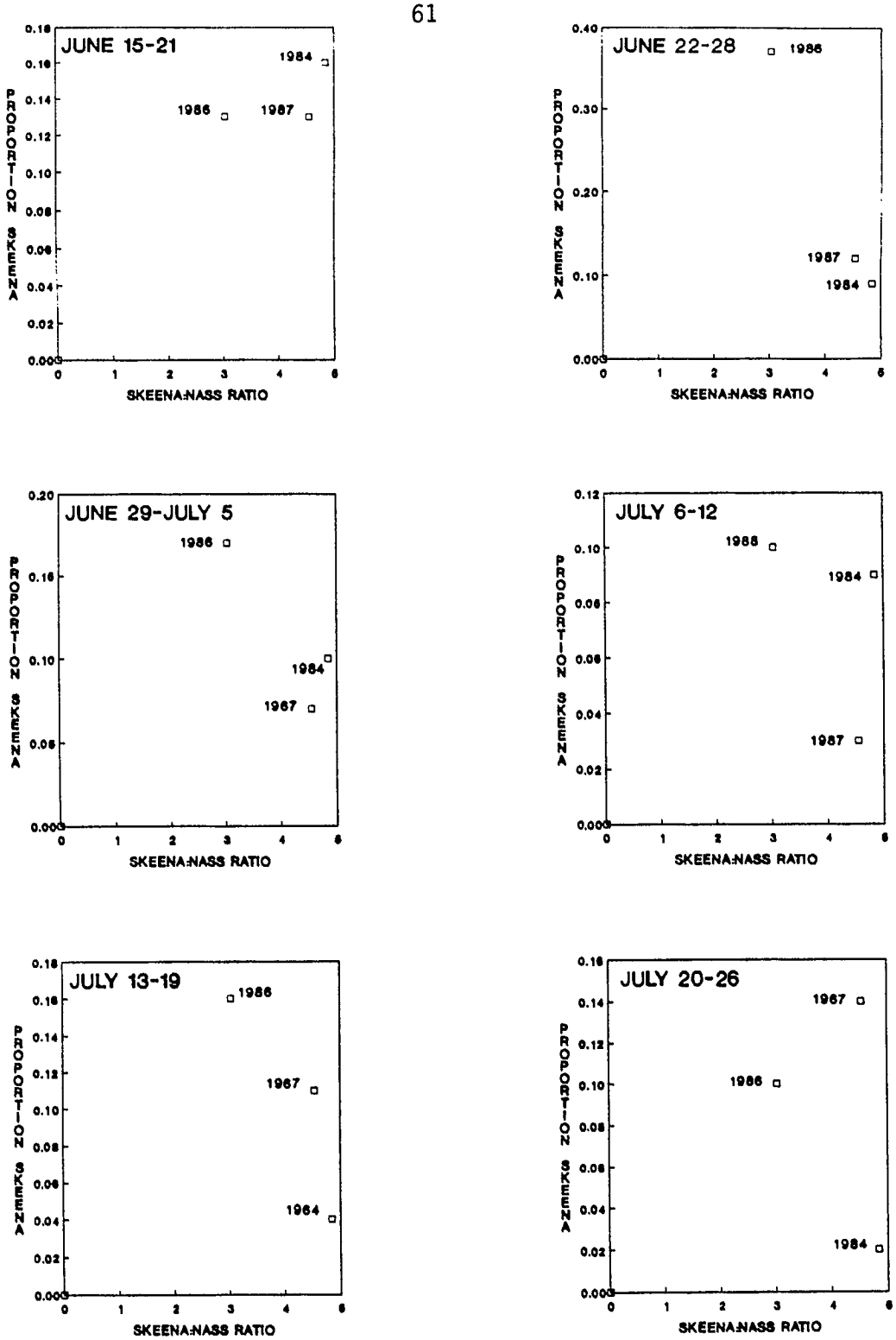
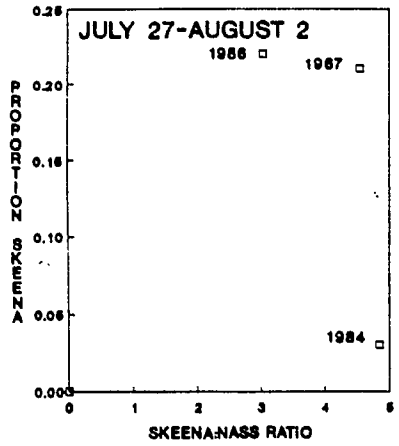
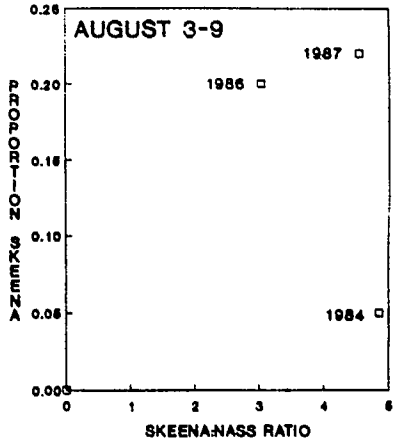
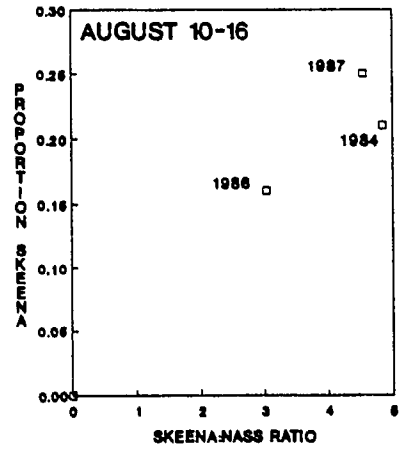
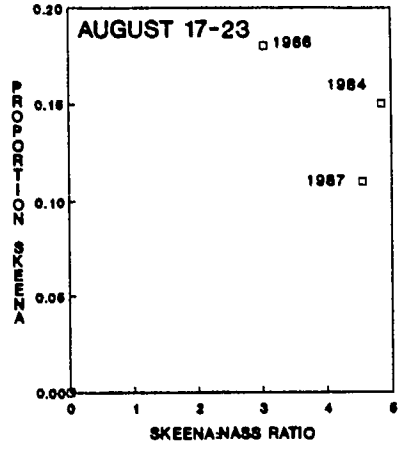


Fig. 14. Relationship between weekly estimates of the proportion of the sockeye catch of Skeena River origin and the annual ratio of Skeena River sockeye run size to Nass River sockeye run size for the Cape Fox drift gillnet fishery. Run size for Nass River sockeye is defined as area 3 catch plus area 3 escapement. Run size for Skeena River sockeye is defined as area 4 catch plus area 4 escapement. The techniques for estimating the proportion Skeena origin are described in the text. (note: y axes to different scale).


JULY 27-AUGUST 2
1986
1987
1984
PROPORTION SKEENA
SKEENA:NASS RATIO


AUGUST 3-9
1987
1986
1984
PROPORTION SKEENA
SKEENA:NASS RATIO


AUGUST 10-16
1987
1984
1986
PROPORTION SKEENA
SKEENA:NASS RATIO


AUGUST 17-23
1986
1984
1987
PROPORTION SKEENA
SKEENA:NASS RATIO

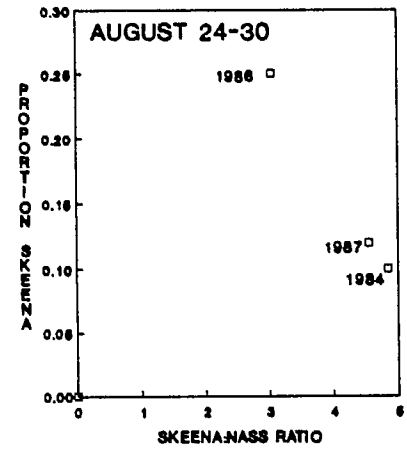

AUGUST 24-30
1986
1987
1984
PROPORTION SKEENA
SKEENA:NASS RATIO

Fig. 14. (cont'd).

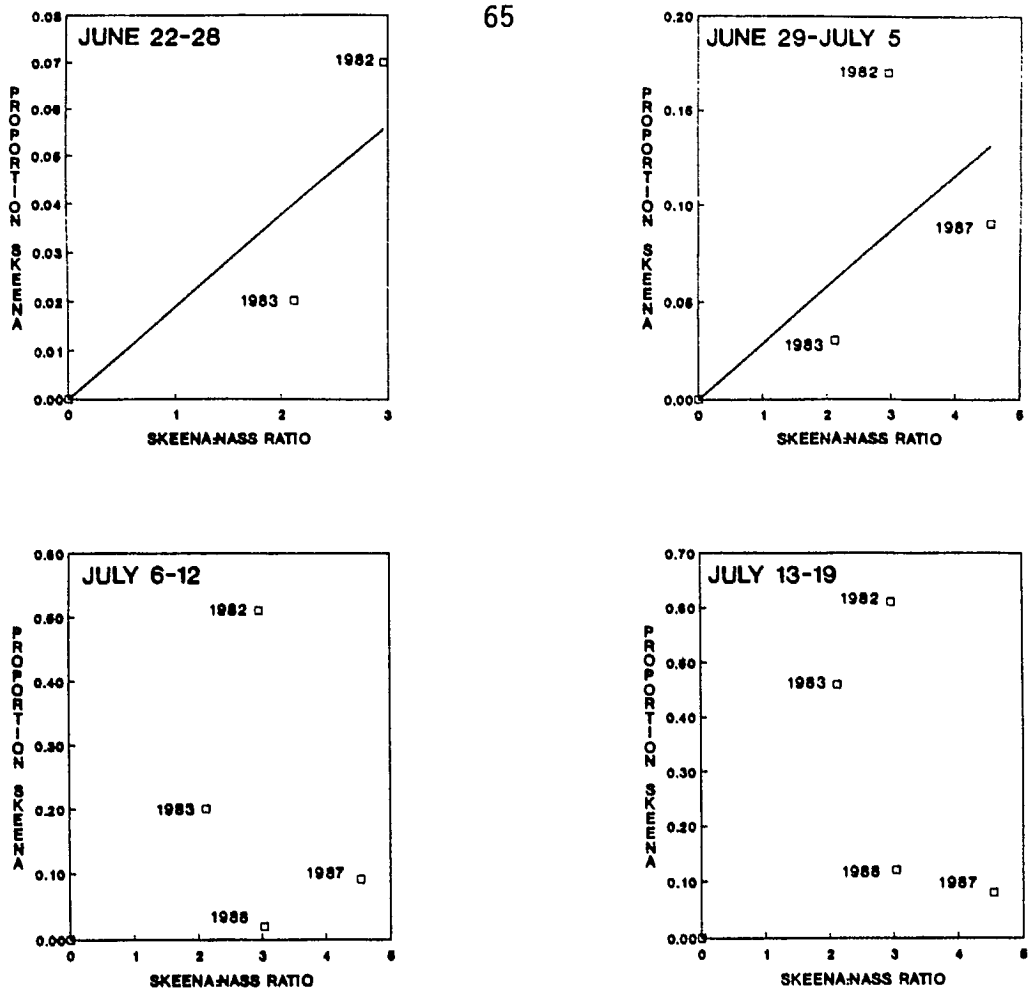
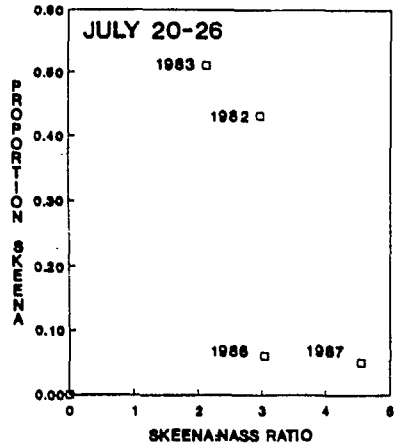
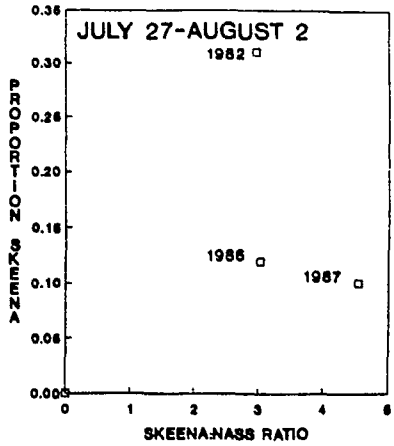
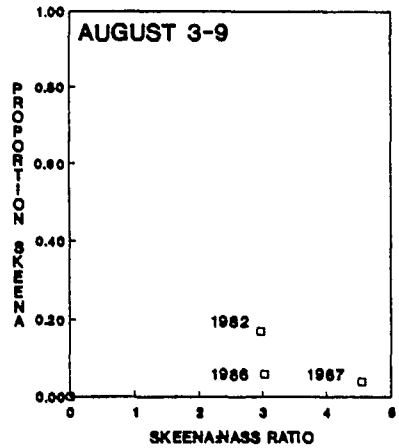


Fig. 15. Relationship between weekly estimates of the proportion of the sockeye catch of Skeena River origin and the annual ratio of Skeena River sockeye run size to Nass River sockeye run size for the Cape Fox seine fishery. Run size for Nass River sockeye is defined as area 3 catch plus area 3 escapement. Run size for Skeena River sockeye is defined as area 4 catch plus area 4 escapement. The techniques for estimating the proportion Skeena origin are described in the text. (note: y axes to different scale).


JULY 20-26
1983
1982
1986
1987
PROPORTION SKEENA
SKEENA:NASS RATIO


JULY 27-AUGUST 2
1982
1986
1987
PROPORTION SKEENA
SKEENA:NASS RATIO


AUGUST 3-9
1982
1986
1987
PROPORTION SKEENA
SKEENA:NASS RATIO

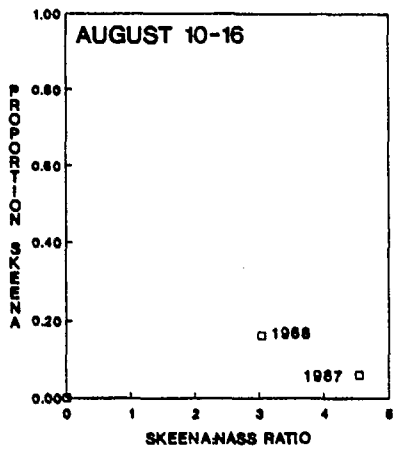

AUGUST 10-16
1986
1987
PROPORTION SKEENA
SKEENA:NASS RATIO

Fig. 15. (cont'd).

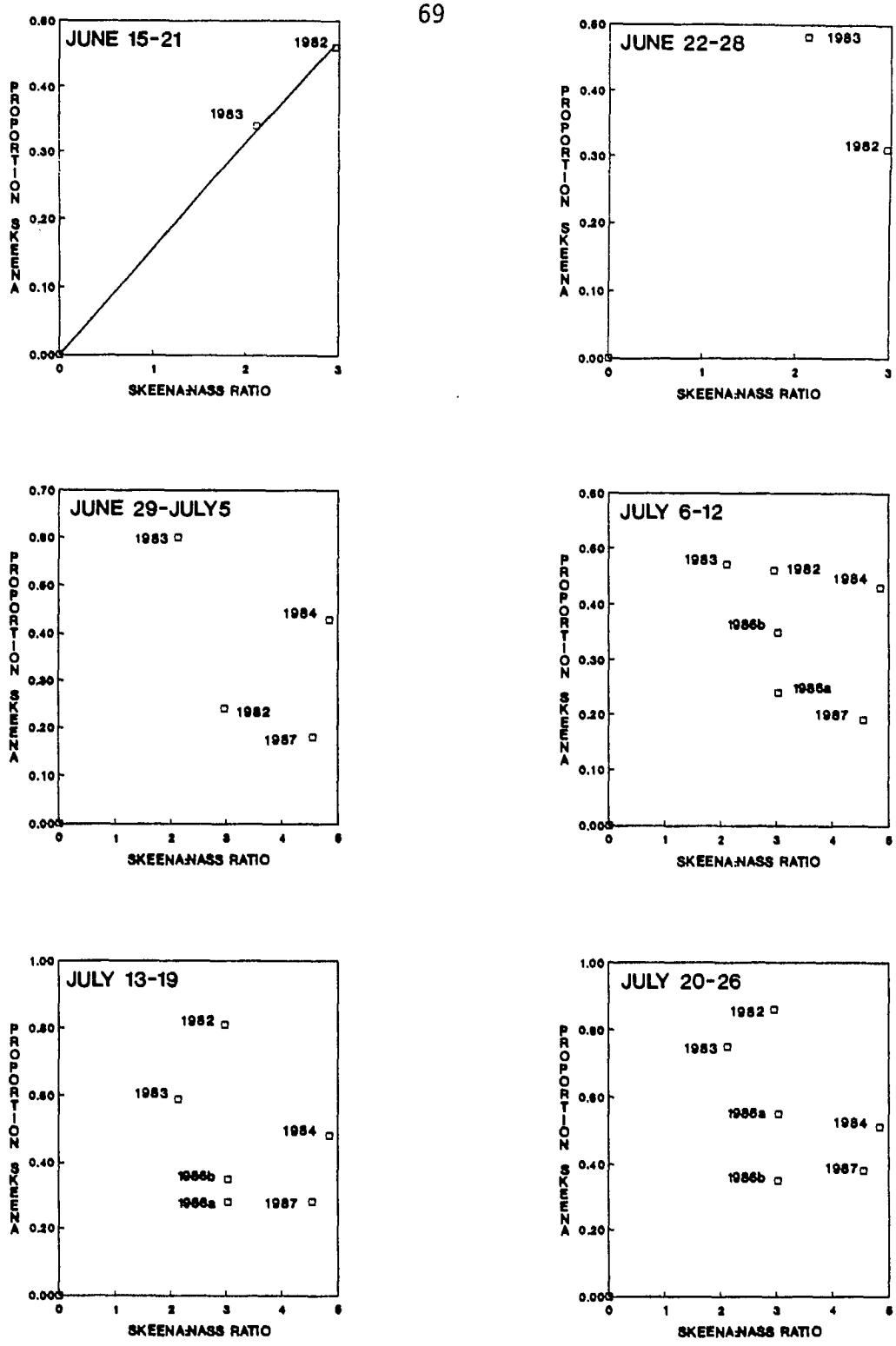
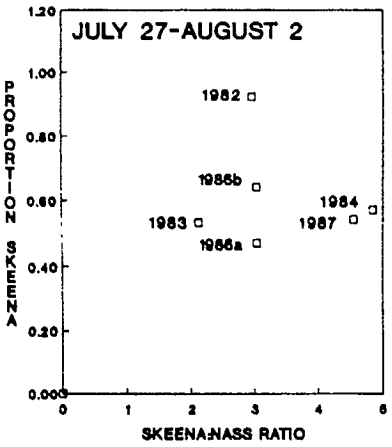
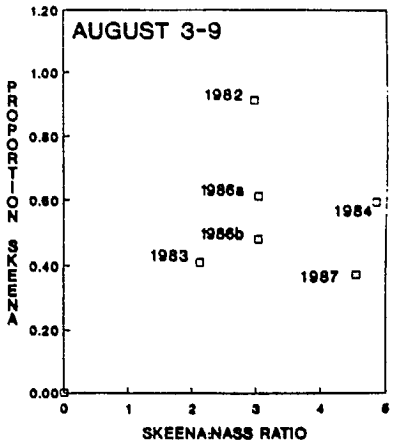
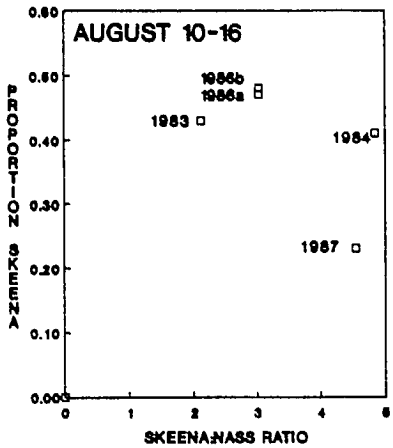
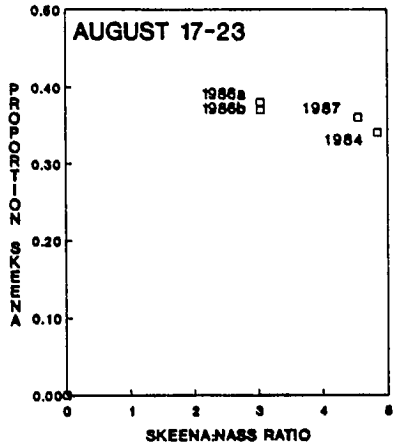


Fig. 16. Relationship between weekly estimates of the proportion of the sockeye catch of Skeena River origin and the annual ratio of Skeena River sockeye run size to Nass River sockeye run size for the Noyes Island seine fishery. Run size for Nass River sockeye is defined as area 3 catch plus area 3 escapement. Run size for Skeena River sockeye is defined as area 4 catch plus area 4 escapement. The techniques for estimating the proportion Skeena origin are described in the text. (note: y axes to different scale).


JULY 27-AUGUST 2
PROPORTION SKEENA
SKEENA:NASS RATIO
1982
1986b
1984
1983
1987
1986a


AUGUST 3-9
PROPORTION SKEENA
SKEENA:NASS RATIO
1982
1986a
1984
1986b
1983
1987


AUGUST 10-16
PROPORTION SKEENA
SKEENA:NASS RATIO
1986b
1986a
1983
1984
1987


AUGUST 17-23
PROPORTION SKEENA
SKEENA:NASS RATIO
1986a
1986b
1987
1984

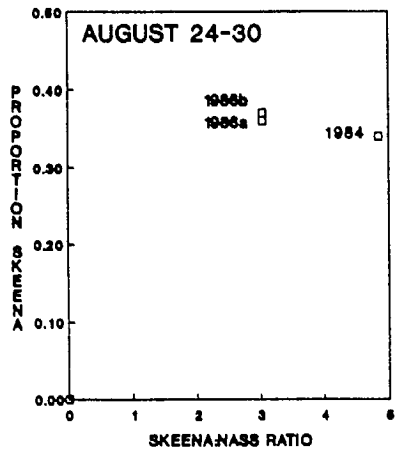
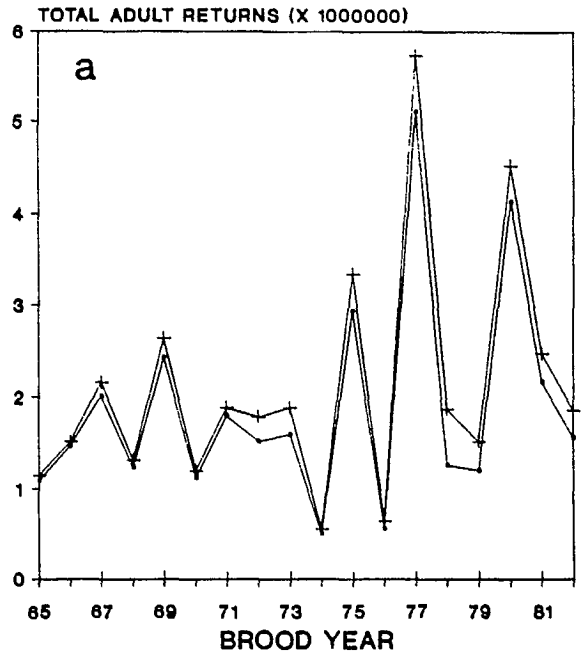

AUGUST 24-30
PROPORTION SKEENA
SKEENA:NASS RATIO
1986b
1986a
1984

Fig. 16. (cont'd).



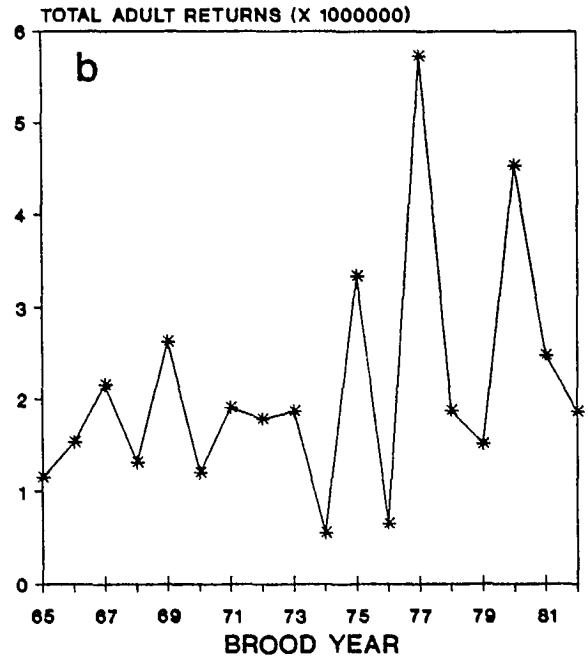


Fig. 17. Estimated total run size of Skeena River origin sockeye salmon by brood year. Figure 17a shows estimates based on the terminal (—●—) and standard (—+—) interception methods. Figure 17b shows estimates based on the modified interception method. See text for details.