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THE PACIFIC SALMON COMMISSION

NORTHERN BOUNDARY TECHNICAL COMMITTEE REPORT

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JOINT U.S./CANADA SALMON RESEARCH

NORTHERN BOUNDARY AREA

ADULT TAGGING REPORT, 1982 TO 1985

A. OBJECTIVES

Emphasis of joint U.S./Canada salmon research has been on the development and application of stock separation techniques for improving the management of Southeast Alaskan and British Columbian salmon resources. As a major component, a large scale pink and sockeye salmon tagging project coupled with incidental tagging of chum salmon was accomplished in southern Southeast Alaska by the Alaska Department of Fish and Game, and in northern British Columbia, by the Canadian Department of Fisheries and Oceans. The main purpose of tagging sockeye and pink salmon was to provide estimates of stock composition in Alaskan and Canadian fisheries of the boundary area, so that assessment could be made of numbers of fish that either country intercepted in fisheries of the other nation. Secondarily, the taggings were conducted to determine migration routes and timing of Alaskan and Canadian stocks of sockeye and pink salmon for improving management of these species. Also, chum salmon were tagged to begin the description of their migrations so interceptive fisheries could be identified for future studies.

B. METHODS

Chartered purse seine, gillnet, and troll vessels were employed to capture adult pink, sockeye, and chum salmon, with the type of vessel utilized usually dictated by the type of commercial fishery present in a given area or the species of fish tagged in a particular year.

Pink, sockeye, and chum salmon were tagged and released at a variety of locations within the Clarence Strait, Tree Point, Cordova Bay, Noyes Island, Dall Island, Dixon Entrance, Hecate Strait, and Portland Inlet areas. Actual tag release locations and the number of tags released varied yearly due primarily to the major species studied in any given year (Table 1).

Highly visible, uniformly labeled, and numerically sequenced international orange Peterson disk tags were utilized during the 1982-83 studies while international orange spaghetti tags were employed during the 1984 and 1985 field seasons. The decision to switch from disk tags to spaghetti tags was based upon studies which indicated equal or better recovery of spaghetti tags over disk tags and user group dislike for disk tags that easily foul up in commercial fishery net gear.

Tag recovery efforts were directed towards the spawning grounds, and commercial, sport, and subsistence fisheries with main emphasis on the escapement and commercial catch.

The purpose of these efforts was to determine numbers and destinations of tagged fish from each fishery which were caught

Table 1. Number of tagged pink, sockeye, and chum salmon released in southern Southeast Alaska and northern British Columbia, 1982-1985.

Location	1982 Pink	1982 Sockeye	1983 Sockeye	1983 Chum	1984 Pink	1984 Chum	1985 Pink	1985 Chum
Noyes Is.	17,200	2,813	3,047	474	5,464	164	17,968	558
Dall Is.	5,757	1,433	1,039	442	9,652	106	10,298	513
Cape Fox	17,477	1,636	883	1,187	9,011	358	5,013	145
Upper Clarence St.	6,942	2,137	4,556	585	0	0	7,152	52
Middle Clarence St.	14,666	136	0	0	0	0	5,970	86
Lower Clarence St.	12,950	382	473	29	6,375	221	7,573	174
Cordova Bay	5,606	29	0	0	0	0	4,012	57
Union B.	1,240	108	0	0	0	0	3,349	25
Alaska Total	81,838	8,720	9,998	2,717	30,502	849	68,811	1,866
Langara Island	3,465	7,909	4,314	672	0	0	5,603	488
Dixon Entrance	12,487	47	0	0	17,293	358	9,250	924
Dundas Island	12,749	10,090	2,958	227	12,195	194	8,439	139
Tracy/Boston Rocks	17,624	5,920	1,308	654	6,490	93	7,241	436
Stephens/Porcher Is.	7,128	5,637	758	253	4,534	149	5,680	74
Portland Inlet	4,924	1,348	2,493	984	7,480	190	7,481	373
Area 5	9,473	490	306	222	5,116	211	7,005	101
Area 6	0	0	0	0	0	0	6,102	617
Canadian Total	67,895	31,405	12,137	3,012	53,108	1,195	56,801	3,152
Grand Total	149,733	40,125	22,135	5,729	83,610	2,044	125,612	5,018

Adult Tagging

or escaped to spawning grounds. Solicitation of tag recoveries from commercial fisheries was achieved through an intense, wide scale, random port sampling program and operation of a lottery drawing for monetary rewards in both countries.

Recovery of tagged fish in escapements was accomplished from spawning ground foot surveys or from weirs across streams. Each year of pink salmon tagging, regular surveys were conducted on between 200 to 400 selected streams in Alaska and 20 to 60 streams in British Columbia. Weirs were established on the Nass (sockeye), Skeena (sockeye and pink), Kwinamass (pink), and Yakoun (pink) Rivers in British Columbia. In Alaska, weirs were placed on eleven sockeye systems in years of tagging this species.

Secondary tagging (as opposed to the primary ocean tagging) of pink or sockeye salmon was conducted on a number of stocks when they had reached their stream of origin. Purpose of these taggings was to estimate the total number of ocean-released tags reaching the spawning grounds. Canada conducted such studies in the Skeena, Nass, Kwinamass, Khutzeymateen, and Yakoun Rivers. In Alaska, secondary taggings were used on several sockeye stocks in 1982 and 1983. International orange Peterson disk or spaghetti tags were used for secondary tagging.

C. ASSUMPTIONS, DATA ANALYSIS, AND LIMITATIONS

Ocean tagging of salmon to determine stock composition in interceptive fisheries involves (1) release of tagged fish in fisheries of concern; and (2) enumeration of these fish, or estimation of their numbers, when their stock origins become evident. Then relative numbers of tagged fish of a release belonging to each of the contributing stocks to the interceptive fishery provide the estimates of stock composition in that fishery. In as much as stock composition varies geographically and over time of season, tagged fish must be released over the season from within fishing areas of concern. Recovery of tagged fish in escapements and some catches provide clear evidence of stock origins; however, origins of many recoveries in other catches are uncertain and require further consideration as we shall see.

Assumptions

Several assumptions are implicit in the use of ocean tagging to determine stock composition and numbers intercepted in fisheries of the boundary area. First, representative samples of stocks comprising the mixtures in fisheries must be tagged. Large numbers of fish were tagged in interceptive fisheries, so chance deviations of stock composition of tagged fish from actual composition in fishing areas and times sampled are probably small.

Second, migratory behavior must not be affected by tagging. If migration routes, rates of movement, or especially, destinations are altered by tagging, results of the experiments could not be extrapolated to the salmon stocks of the region. Fair agreement between independent evaluations of stock composition in mixed sockeye fisheries of the region using ocean tagging or scale analysis shows behavior of this species, at least, may not be seriously affected.

Finally, an implicit assumption underlying ocean tagging is that stock origins of tagged individuals can be determined, at least for a representative sample of those tagged in any fishery. Once tagged fish migrate to their streams and are observed, their origins become known. However, most tagged fish are caught or never seen. Origins of those caught are usually unknown if the fishery is one of those in which mixtures of stocks occur. Stock composition of the survivors of any group released is altered by the interceptive fisheries as they migrate toward their streams. Therefore, the relative numbers belonging to any stock in the release which later occur in the combined escapements of both countries (when their origins become known) is not the same as it was at the time of release in the original fishery. In order to correct stock composition based on relative numbers in escapements, caught tagged fish must be allocated to stocks and combined with tagged fish in escapements.

Data Analysis

An analysis of stock composition is carried out for each time period (eg., two weeks) of the fishing season. Tagging must have occurred in each of the interceptive fishing areas during a time period. The proportion of recoveries from any fishing area destined for any stock (this is the estimate of that stock's unknown actual proportion in the release fishery) is computed as that stock's proportion of total recoveries from the fishing area, either found in the escapement to that stock or allocated to that stock from tags caught. The caught tags of the fishery release are allocated to stocks by the estimates of stock proportions in each of the interceptive fisheries where they are captured. Although the allocation of caught tags involves use of the estimates of stock proportions desired, this allocation and calculation of stock composition can be done in a single mathematical operation (Gazey and Birdsall, 1983).

The allocation is inexact as any procedure for allocation of caught tagged fish to origin must be. Tagged fish caught in any fishery are assigned in the same proportions to the stocks regardless of where (i.e., which fishery) the fish originally were tagged. For example, fish tagged at Noyes Island and caught in Canada's Area 3X could be destined for different stocks (or occur in different proportions to the same stocks) than those caught in the same area, but released from Canada's Area 4. However, tagged fish from the two areas are allocated in the same proportions. Numerical studies have shown the procedure works reasonably well in providing accurate estimates of stock composition if numbers tagged in fisheries are in proportion to abundance. The tagging program was conducted so as to approximate such proportional tagging.

In summary, the essential data for the calculation of stock composition in each of the interceptive fisheries are the numbers of its tagged fish escaping to each contributing stock and numbers of its tagged fish caught in each interceptive fishery. This information must be available for all interceptive fisheries before stock composition can be calculated for any one of them.

Catches in the main interceptive fisheries of either country were sampled intensely for tagged fish. Substantial known proportions of catches of each fishery were examined for tags, and estimates of total tagged fish caught of any release in any fishery were obtained by simple expansion of numbers of tags observed to account for the unexamined catch.

Numbers of tagged fish in escapements of either country cannot be directly observed and enumerated. Instead, these numbers must be estimated both for sockeye and pink salmon. Procedures differ between species in either country, and between countries for either species. Canada concentrated recovery efforts for sockeye on its largest populations of the northern boundary area--the Nass and Skeena sockeye. Weirs allowing accurate enumeration and capture of tagged fish on these two rivers covered much of their escapements; however, many tags disappeared within the rivers in advance of the weirs. Therefore, secondary, riverine tagging experiments were performed to develop expansions of counts at the weirs for losses in the rivers. However, Canada could not examine all escapements potentially and probably containing tagged sockeye, and no means is available to estimate numbers of tagged fish consequently missed.

Alaska has numerous, lesser sockeye-producing systems. Only part (probably about one-third) of the total Alaskan escapement was examined for tags from weirs on some of the largest producers. Tag loss was quite likely negligible within these rivers, so numbers of tagged fish counted in this part of the Alaskan escapement are believed to be quite accurate. However, tagged fish in the remaining sockeye escapements could only be estimated with far less precision. Numbers of tagged sockeye in systems without weirs were estimated from information obtained by secondary tagging and foot surveys in these systems combined with observations at the weirs.

Determination of numbers of tagged pink salmon in escapements of either country proved more difficult than for sockeye. Pink salmon are far more abundant than sockeye, especially in Alaska, and spawn in many more watersheds. Therefore, general use of weirs to enumerate tagged pink salmon is impractical. Instead, both countries attempted to estimate tagged fish in their escapements from numbers of pink salmon escaping and proportions of these fish tagged. Sampling of escapements for proportions tagged was fairly straight forward, but estimating escapements is a less tractable problem. Repeated foot (Canada) and aerial (Alaska) surveys were conducted on a large number of pink salmon systems. However, the basis from which such counts can be expanded to estimate actual escapements is quite limited. Canada supplemented the survey program with secondary riverine tagging on several major producers.

Limitations

The reported values of stock composition and interceptions should be considered along with some reservations. First, all estimates are subject to chance variations. For example, the proportion of fish with tags varies among samples of the catch from a fishery opening or among samples from the escapement from a salmon-producing river. Estimates of stock composition and interceptions are influenced by such sampling variation. However, as greater numbers of fish are tagged, and/or greater portions of the catches and escapements are examined for tags, such influences become less important. Numbers of fish tagged and sample sizes of catches and escapements were chosen to control this variation to acceptable levels. Nonetheless, each estimate is subject to some unknown error of this source; and, in some cases, these errors are potentially substantial. Intervals within which each estimate would probably vary due to this source of error have been computed by both sides and are available in more detailed reports.

Second, a fishery is poorly characterized as having some unique stock composition. Stock composition varies within a season as well as between years. Causes of annual changes include changes in migration routes and timing and fluctuations in stock abundances.

Third, time and area resolution of estimates of stock composition is limited by numbers tagged within fishing areas and time periods (release strata). If too few tagged fish from a release stratum are subsequently recovered in catches and escapements, estimates of stock composition for the stratum become unreliable because of large sampling variation. To assure numbers of recoveries are adequate, stock composition must usually be computed for release time periods of weeks rather than days. Although evaluation of stock composition in fisheries on a daily basis is desirable, such resolution is generally impractical from adult tagging.

Finally, and importantly, estimates should be considered with care because of persistent potential sources of error which cannot be practically controlled by increasing numbers tagged and recovered. Included are lost or discarded tags from the catches, the inexact allocation of caught tags to stocks, and unknown biases in estimates of numbers of tags in escapements. Estimates of numbers of tags in escapements depend on expansions of observed numbers of tags in samples of escapements. These expansions both for sockeye and pink salmon depend on estimates of escapements or estimates of numbers of ocean tags disappearing within rivers in advance of weirs and sampling crews. Methods of estimating escapements include foot and aerial surveys as well as secondary tagging experiments; all have great potential for bias. Also, short term tagging mortality from stress for fish tagged in rivers to determine riverine losses of ocean tags would result in estimates of losses which are too high.

D. RESULTS

Stock composition estimates for pink salmon harvested in fisheries in southern Southeast Alaska and northern British Columbia were determined in 1982, 1984 and 1985 (Tables 2, 3 and 4). The corresponding estimates for sockeye salmon were developed in 1982 and 1983 (Tables 5 and 6). The stock composition estimates for pink salmon in 1984 and 1985 were determined by averaging the Canadian and Alaskan estimates for each fishery. Stock composition estimates for pink salmon in 1982 and sockeye salmon in 1982 and 1983 were based entirely on Canadian analyses.

Several important features have emerged from the analysis of the tagging data. In a general sense the stock composition estimates clearly show the dominance of Canadian origin sockeye salmon in the boundary area. Of particular note is the high proportion of Canadian origin sockeye salmon taken in major Alaskan fisheries at Noyes Island, Cape Muzon and Tree Point. In contrast to the situation with sockeye salmon the proportion of Alaskan catches consisting of Canadian origin pink salmon is relatively small. However, Alaskan origin pink salmon do make a large contribution to Canadian catches in the boundary area especially in the Area 1 and Area 3 fisheries where the percent of the catch consisting of Alaskan origin fish ranges between approximately 40 and 80%.

Another important feature of the tagging analyses is the degree of consistency in the stock composition estimate for each species and fishery between years. Despite annual variations in stock sizes, return migration routes and timing of the return migration, differences in the stock composition estimates of catch were not large. However, a comparison of the estimates for pink (1982, 1984, 1985) and sockeye salmon (1982, 1983) illustrate, with a few notable exceptions, that the stock composition within a fishery exhibit a reasonable degree of similarity between the years.

As described above, the stock composition estimate for pink salmon in 1984 and 1985 are an image of independantly developed Alaskan and Canadian estimates. In 15 of the 20 cases where both Canadian and Alaskan estimates of stock composition are available, the Alaskan and Canadian estimates are within ±5% of each other. We believe the five situations where the difference is greater than 5% can be resolved with further collaboration.

The final aspect of note in Tables 2 through 6 is the conversions of estimate of stock composition into estimates of the actual number of Canadian and Alaskan origin salmon harvested in Canadian and Alaskan fisheries. This operation is important in

Table 2. 1982 total catch, percent composition and catch by country of origin based on Canadian tagging analyses for pink salmon from selected U.S. and Canadian fisheries.

Fishery	Catch	% U.S.	% Can	Number U.S.	Number Can
Area 1 Troll	56,340	84	16	47,326	9,014
Area 1 Seine	18,143	62	38	11,249	6,894
Area 3X	322,930	45	55	145,318	177,612
3Y	469,545	45	55	211,295	258,250
3Z	253,625	35	65	88,769	164,856
Area 4	319,415	21	79	67,077	252,338
Area 5	82,130	21	79	17,247	64,883
District 104 Noyes	3,784,575	92	8	3,481,809	302,766
Muzon	801,840	88	12	705,619	96,221
District 6 Upper Clarence	24,966	97	3	24,217	749
District 2 Middle Clarence	-	99	1	-	-
District 1 & 2 Lower Clarence[1]	5,485,358	96	4	5,265,944	219,414
District 3 Cordova Bay	662,400	97	3	642,528	19,872
District 1-B Cape Fox-Tree Point	347,252	80	20	277,802	69,450
District 7 Union Bay	109,482	92	8	100,723	8,759

[1] Includes the Revilla fishery.

Table 3. 1984 total catch, percent composition and catch by country of origin based on U.S. and Canadian tagging analyses for pink salmon from selected U.S. and Canadian fisheries. The percent composition is an average of the U.S.and Canadian estimates. An asteriks indicates those fisheries were the Canadian and U.S. estimates of % composition differed by more than ± 5%.

Fishery	Catch	% U.S.	% Can	Number U.S.	Number Can
Area 1 Troll	1,177,577	73	27	859,631	317,946
Area 1 Seine	680,993[1]	-	-	-	-
Area 3					
3X	268,796	35	65	94,079	174,717
3Y	785,493	50	50	392,747	392,746
3Z	1,295,428	43	57	557,034	738,394
Area 4	1,001,999	28	72	280,560	721,439
Area 5	576,968	15*[2]	85	86,545	490,423
District 104					
Noyes	2,896,395	94*[3]	6	2,722,611	173,784
Muzon	3,154,798	89	11	2,807,770	347,028
District 6					
Upper Clarence	449,590	-	-	-	-
District 2					
Middle Clarence	216,250	-	-	-	-
District 2 & 1					
Lower Clarence	4,156,218	96	4	3,989,969	166,249
Revilla	3,550,085	93[4]	7	3,301,579	248,506
District 3					
Cordova Bay	875,074	-	-	-	-
District 1-B					
Cape Fox-Tree Point	714,401	63	37	450,073	264,328
District 7					
Union Bay	156,908	-	-	-	-

1 617,453 pinks were caught in the termial fishery occurring in Masset Inlet.
2 U.S. estimate = 10% U.S., 90% Canadian. Canadian estimate = 20% U.S., 80% Canadian.
3 U.S. estimate = 98% U.S., 2% Canadian. Canadian estimate = 90% U.S., 10% Canadian.
4 U.S. estimate only.

Table 4. 1985 total catch, percent composition and catch by country of origin based on U.S. and Canadian tagging analyses for pink salmon from selected U.S. and Canadian fisheries. The percent composition is an average of the U.S. and Canadian estimates. An asteriks indicates those fisheries were the Canadian and U.S. estimates of % composition differed by more than ± 5%.

Fishery	Catch	% U.S.	% Can	Number U.S.	Number Can
Area 1 Troll	726,765	60*[1]	40	436,059	290,706
Area 1 Seine	238,915	35	65	83,620	155,295
Area 3X	172,645	22[2]	78	37,982	134,663
3Y	910,958	62[2]	38	564,794	346,164
Area 3X & 3Y	1,083,603	39[3]	61	422,605	660,998
Area 3Z	1,574,253	47*[4]	53	739,899	834,354
Area 4	1,724,461	6	94	103,750	1,620,711
Area 5	297,021	6	94	17,821	279,200
Area 6	1,510,758	3[2]	97	45,323	1,465,435
District 104 Noyes	6,755,700	93	7	6,282,801	472,899
Muzon	2,414,079	93	7	2,245,093	168,985
District 6 Upper Clarence	991,220	97	3	961,483	29,737
District 2 Middle Clarence	225,220	91[5]	9	204,950	20,270
District 1 & 2 Lower Clarence	4,579,932	97	3	4,442,534	137,398
Revilla	3,831,148	86[3]	14	3,294,787	536,361
District 3 Cordova Bay	2,389,150	100	0	2,389,150	0
District 1-B Cape Fox-Tree Point	691,147	66*[6]	34	456,157	234,990
District 7 Union Bay	820	-	-	-	-

1 U.S. estimate = 70% U.S., 30% Canadian. Canadian estimate = 51% U.S., 49% Canadian.
2 Canadian estimate only.
3 U.S. estimate only.
4 U.S. estimate = 41% U.S., 59% Canadian. Canadian estimate = 54% U.S., 46% Canadian.
5 U.S. estimate only.
6 U.S. estimate = 59% U.S., 41% Canadian. Canadian estimate = 74% U.S., 26% Canadian.

Table 5. 1982 total catch, percent composition and catch by country of origin based on Canadian tagging analyses for sockeye salmon from selected U.S. and Canadian fisheries.

Fishery	Catch	% U.S.	% Can	Number U.S.	Number Can
Area 1 Troll	-	-	-	-	-
Area 1 Seine	59,465	11	89	6,541	52,924
Area 3X	278,724	5	95	13,936	264,788
3Y	97,604	5	95	4,880	92,724
3Z	270,546	5	95	13,527	257,019
Area 4	1,691,797	8	92	135,344	1,556,453
Area 5	71,176	1	99	712	70,464
District 104 Noyes	194,209	21	79	40,784	153,425
Muzon	91,192	20	80	18,238	72,954
District 6 Upper Clarence	192,594	31	69	59,704	132,890
District 2 Middle Clarence	-	57	43	-	-
District 1 & 2 Lower Clarence	94,382	79	21	74,562	19,820
District 3 Cordova Bay	746	65	35	485	261
District 1-B Cape Fox-Tree Point	190,575	29	71	55,267	135,308
District 7 Union Bay	305	-	-	-	-

1 Includes the Revilla fishery.

Table 6. 1983 total catch, percent composition and catch by country of origin based on Canadian tagging analyses for sockeye salmon from selected U.S. and Canadian fisheries.

Fishery	Catch	% U.S.	% Can	Number U.S.	Number Can
Area 1 Troll	3,947	-	-	-	-
Area 1 Seine	32,428	31	96	973	31,131
Area 3					
3X	95,618	1	99	956	94,662
3Y	179,665	1	98	1,797	176,072
3Z	175,600	1	99	1,756	173,844
Area 4 (outside)	285,137	1	99	2,851	282,286
Area 5	14,361	0	100	0	14,361
District 104 Noyes	502,264	8	92	40,181	462,083
Muzon	141,543	4	95	5,662	135,881
District 6 Sumner Strait	27,941	-	-	-	-
District 6 Upper Clarence	22,916	50	50	11,458	11,458
District 2 Middle Clarence	4,477	-	-	-	-
District 2 & 1 Lower Clarence[2]	57,797	6	93	3,468	53,751
District 3 Cordova Bay	1,174	-	-	-	-
District 1-B Cape Fox-Tree Point	136,006	8	92	10,880	125,125
District 7 Union Bay	1,239	-	-	-	-

[1] The combined U.S. and Canada percent composition does not always total 100% as the Canadian analysis included Stikine River sockeye as a separate stock, although it is not shown here. For example the percent composition in the Area 1 seine fishery was: U.S. - 3%, Canada 96% and Stikine River 1% (=100%).

[2] Includes the Revilla fishery.

attempting to evaluate the absolute impact of the various fisheries on particular stocks. However, it should be noted that the estimates of the absolute numbers of salmon are meaningful only in terms of the year in which the catch is taken. When combined over all fisheries, the average Canadian catch of Alaskan origin pink salmon for the years 1982, 1984 and 1985 was approximately 1.6 million. The corresponding figures for the Alaskan harvest of Canadian origin pink salmon was approximately 1.2 million. In 1982 and 1983 the average Canadian harvest of Alaskan origin sockeye salmon was approximately 92,000 while the Alaskan harvest of Canadian sockeye was 651,000.

MIGRATION ROUTES

Sockeye Salmon

Information obtained from adult tagging of sockeye salmon in 1982 and 1983 has provided insight into the general migration routes utilized by sockeye salmon stocks returning to southern Southeast Alaska and northern British Columbia. Analysis of this data indicates that southern Southeast Alaska sockeye salmon return to their natal streams via Dixon Entrance, Sumner Strait, and from directly offshore, with Dixon Entrance and Sumner Strait equally important as primary migration routes for these stocks. Similarly, sockeye salmon returning to northern British Columbia natal streams (primarily Nass and Skeena Rivers) migrated inshore via Dixon Entrance and Sumner Strait, with Dixon Entrance representing the primary route of return for this area's sockeye salmon stocks.

Additional information on individual sockeye salmon stock migration routes is available in reports prepared on 1982 and 1983 adult tagging by the Alaska Department of Fish and Game and the Canadian Department of Fisheries and Oceans (see example in Fig. 1).

Pink Salmon

Data provided by the adult pink salmon tagging projects in 1982, 1983 and 1985 provided information on the general migration routes utilized by pink salmon stocks returning to southern Southeast Alaska and northern British Columbia. Analysis of this information indicates that southern Southeast Alaska pink salmon migrate inshore via Sumner Strait, Dixon Entrance and from directly offshore, with Dixon Entrance representing the primary route of return. Likewise, pink salmon returning to northern British Columbia natal streams migrated inshore via Sumner Strait and Dixon Entrance along with Hecate Strait. Dixon Entrance was noted to be the primary migration route for pink salmon returning to northern British Columbia.

More detailed stock specific migration route data for pink salmon from both countries is available in reports prepared by the Alaska Department of Fish and Game and the Canadian Department of Fisheries and Oceans for reporting years 1982, 1984 and 1985 (see example in Fig. 2).

Chum Salmon

Incidental tagging of chum salmon during operation of the U.S./Canada salmon interception project in 1983, 1984 and 1985 has provided limited information on the migration routes utilized by chum salmon returning to southern Southeast Alaska and northern British Columbia. Analysis of this data indicates that chum salmon returning to southern Southeast Alaska natal streams utilize the same routes noted for pink and sockeye salmon. Dixon Entrance, Sumner Strait and direct movement from offshore areas were identified as the avenues of return for these fish, with Dixon Entrance appearing to represent the primary migration route. Similarly, chum salmon returning to northern British Columbia spawning streams also appear to utilize the same migration routes as pink and sockeye salmon returning to this area. Again, Dixon Entrance appears to be the primary route of return for the chum salmon stocks returning to this area.

Additional details on a limited number of chum salmon stocks returning to both countries are available in reports prepared by the Alaska Department of Fish and Game and the Canadian Department of Fisheries and Oceans for the reporting periods 1983-1985.

Figure 1. Migration Routes, Skeena Sockeye 1982

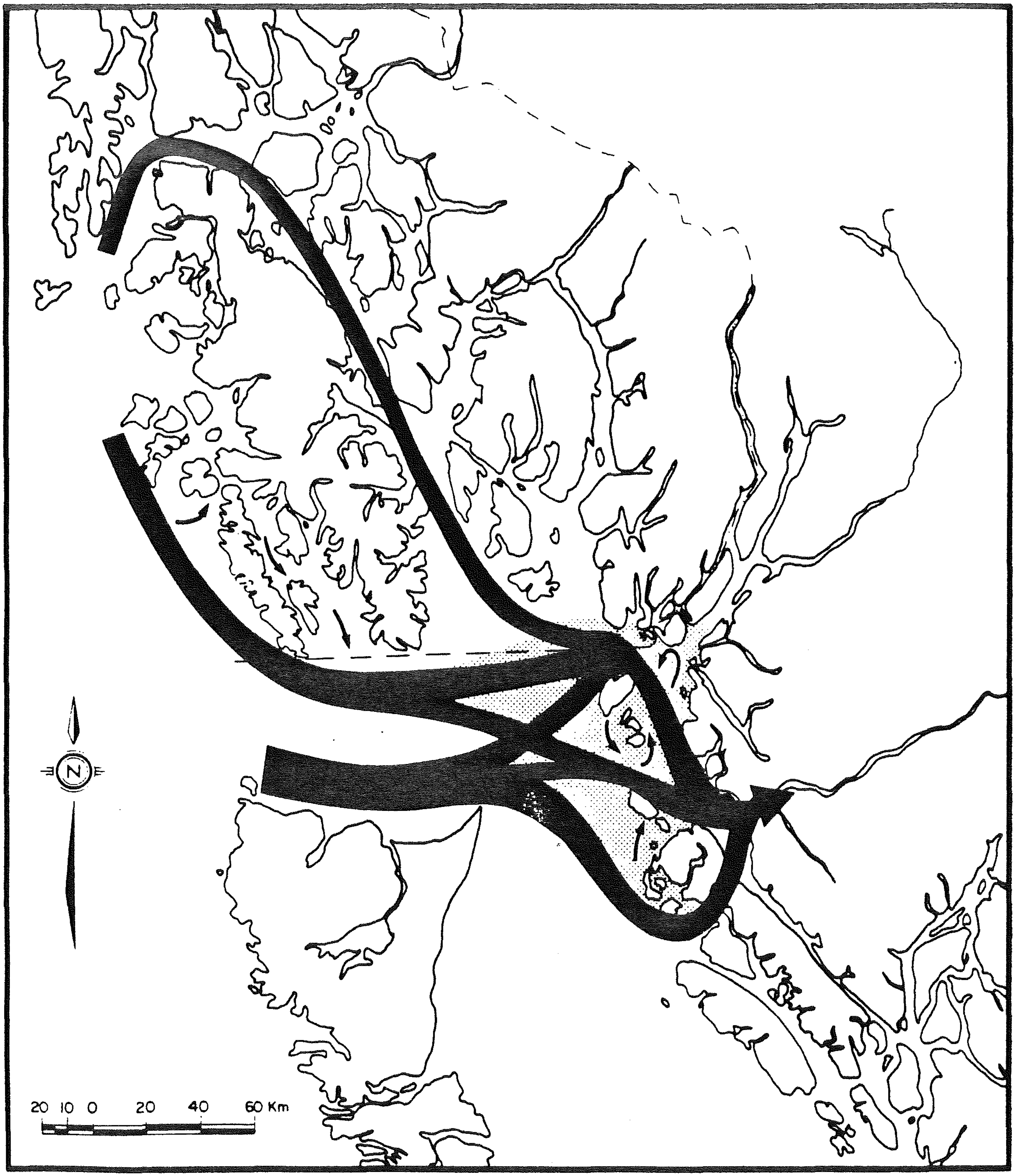
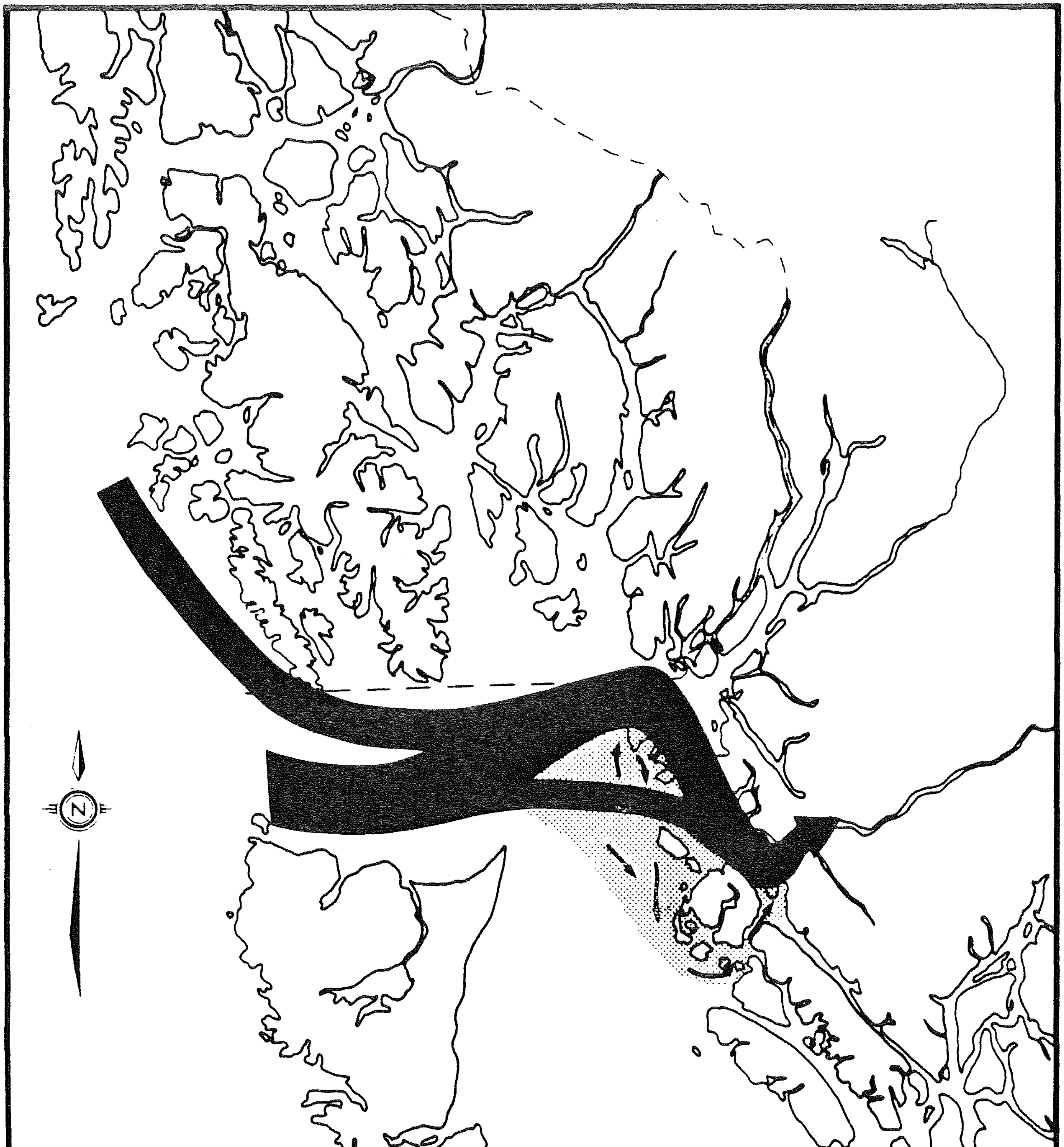


Figure 2. **Migration Routes, Skeena Pink 1982**



RUN TIMING

Sockeye Salmon

A general review of the sockeye salmon run timing data gathered during the 1982 and 1983 adult tagging projects indicates that movement of these stocks through any given area is usually protracted over an extensive time period but peak periods can be identified for individual stocks. Analysis of this data indicates that sockeye salmon returning to southern Southeast Alaska first appeared in most of the study area in late June, intensified in abundance until they peaked out in mid-August, and then declined from that point into early September. On the other hand, sockeye salmon returning to northern British Columbia natal streams (primarily Nass and Skeena Rivers) were fairly abundant in late June, intensified rapidly in July with a peak abundance occurring during late July, and then began a general decline through early August which was followed by a rapid decline in late August and early September (Fig. 3).

Additional and more detailed run timing data is available in 1982 and 1983 reports prepared by the Alaska Department of Fish and Game and the Canadian Department of Fisheries and Oceans (see example in Fig. 4).

Pink Salmon

A general review of the pink salmon run timing data generated during the 1982, 1984 and 1985 adult tagging projects also indicates that timing of these stocks occurs over a prolonged period but that peak periods of movement are identifiable for individual stocks and/or groups of stocks. Analysis of this data indicates that pink salmon returning to southern Southeast Alaska become available in significant numbers in early July, increase rapidly from that point in time, reach their peak in abundance during mid-August, and then decline rapidly past the first week in September. Likewise, pink salmon returning to northern British Columbia appear generally to follow the same pattern in timing derived for southern Southeast Alaska stocks (Fig. 5). This overlap in timing holds true for most stocks but specific pink salmon stocks on either side do appear to have slightly different peaks in run timing.

More precise stock specific and/or area specific run timing data is avaiable in reports prepared for 1982, 1984 and 1985 by the Alaska Department of Fish and Game and the Canadian Department of Fisheries and Oceans (see example in Fig. 6).

Chum Salmon

A review of the incidental chum salmon tagging data from 1983-1985 has provided a limited amount of information on the timing of chum salmon returning to southern Southeast Alaska and northern British Columbia. Analysis of this data appears to indicate a protracted period of run time similar to what was noted for pink and sockeye salmon. Peak periods of abundance have also been identified for a number of stocks in both countries. Based on the incidental tagging data it appears that chum salmon returning to both countries natal streams appear to move inshore in early July, peak out in late July, and then decrease rapidly in August. Additional full scale chum tagging is needed to verify this fact and determine if there are any significant annual variations in run timing (Fig. 7).

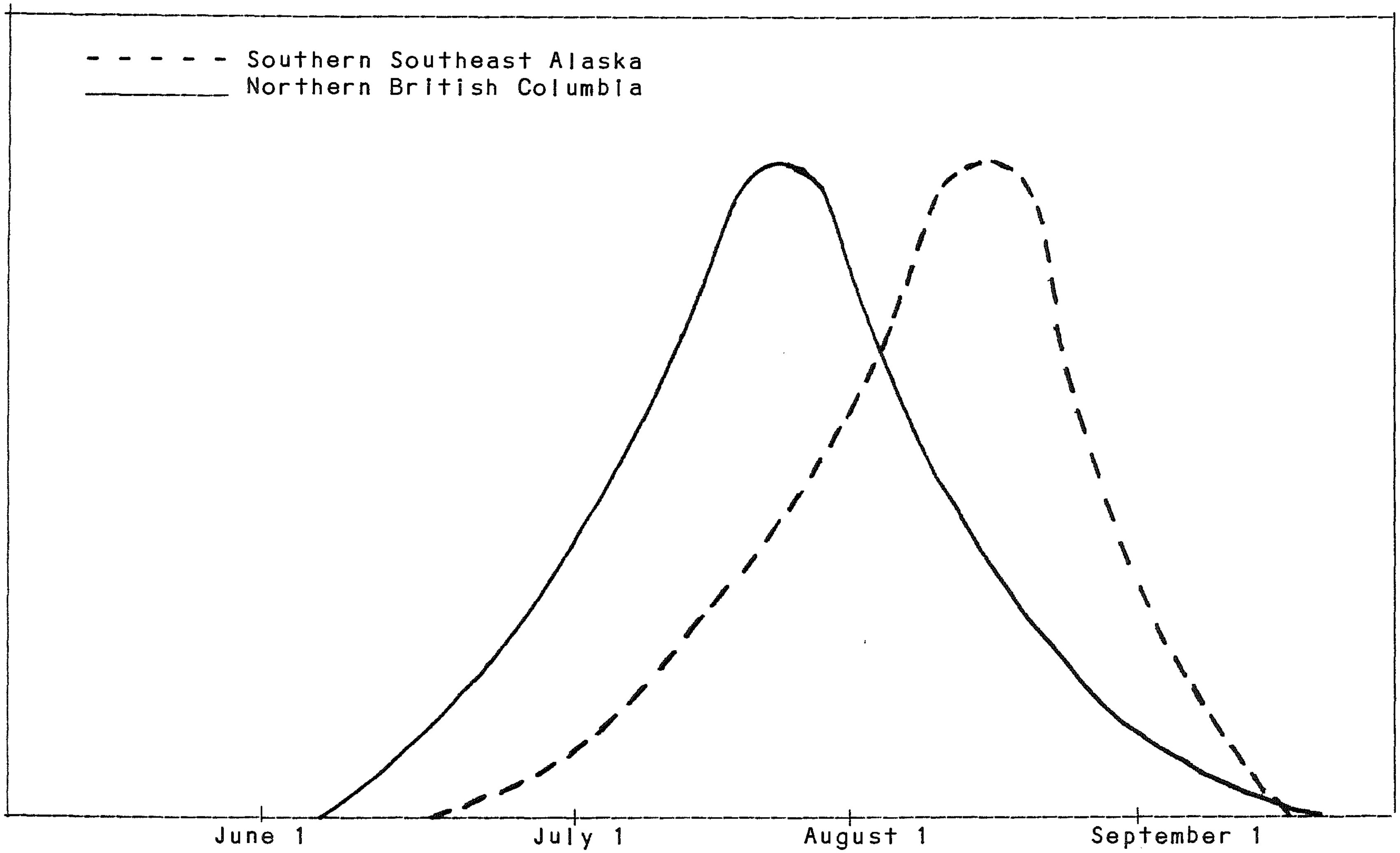
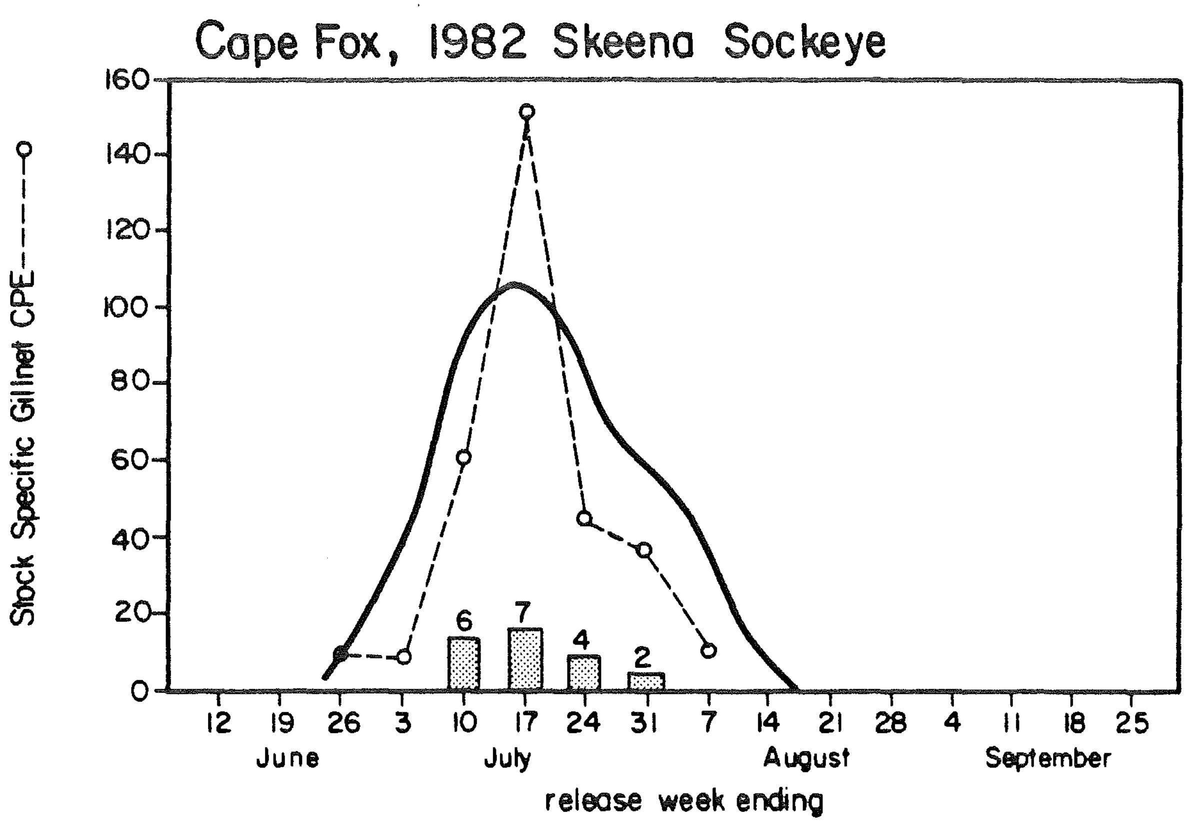
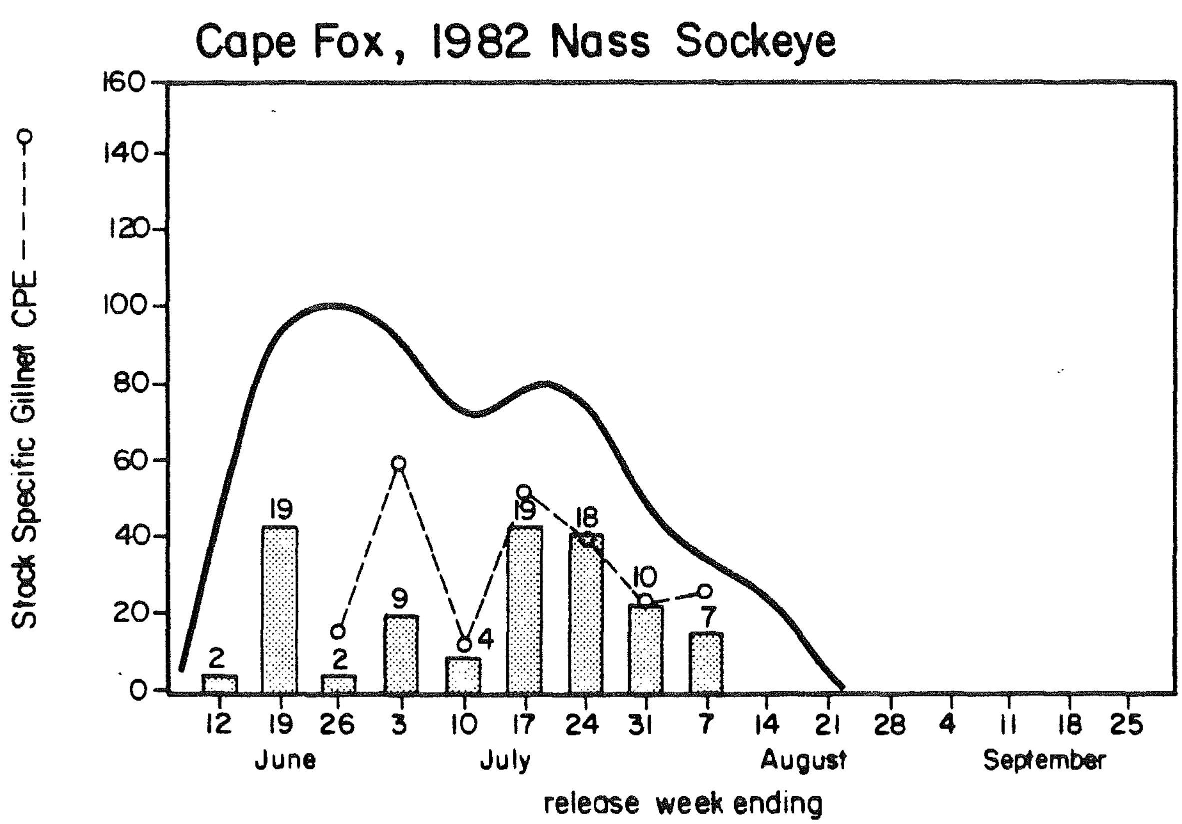


Figure 3. Relative run timing of sockeye salmon returning to southern Southeast Alaska and northern British Columbia, 1982-83.

Detailed Run Timing

Figure 4.





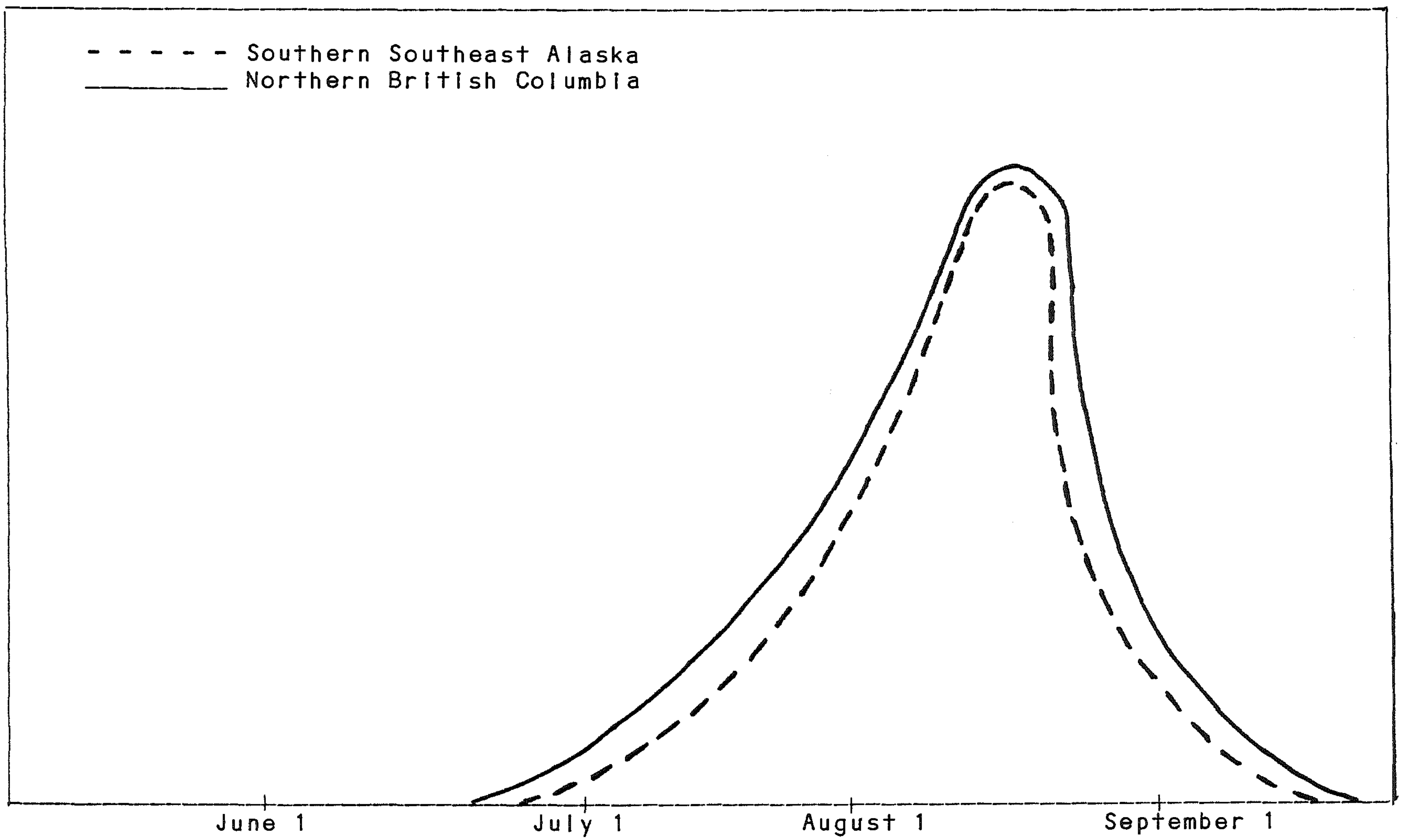
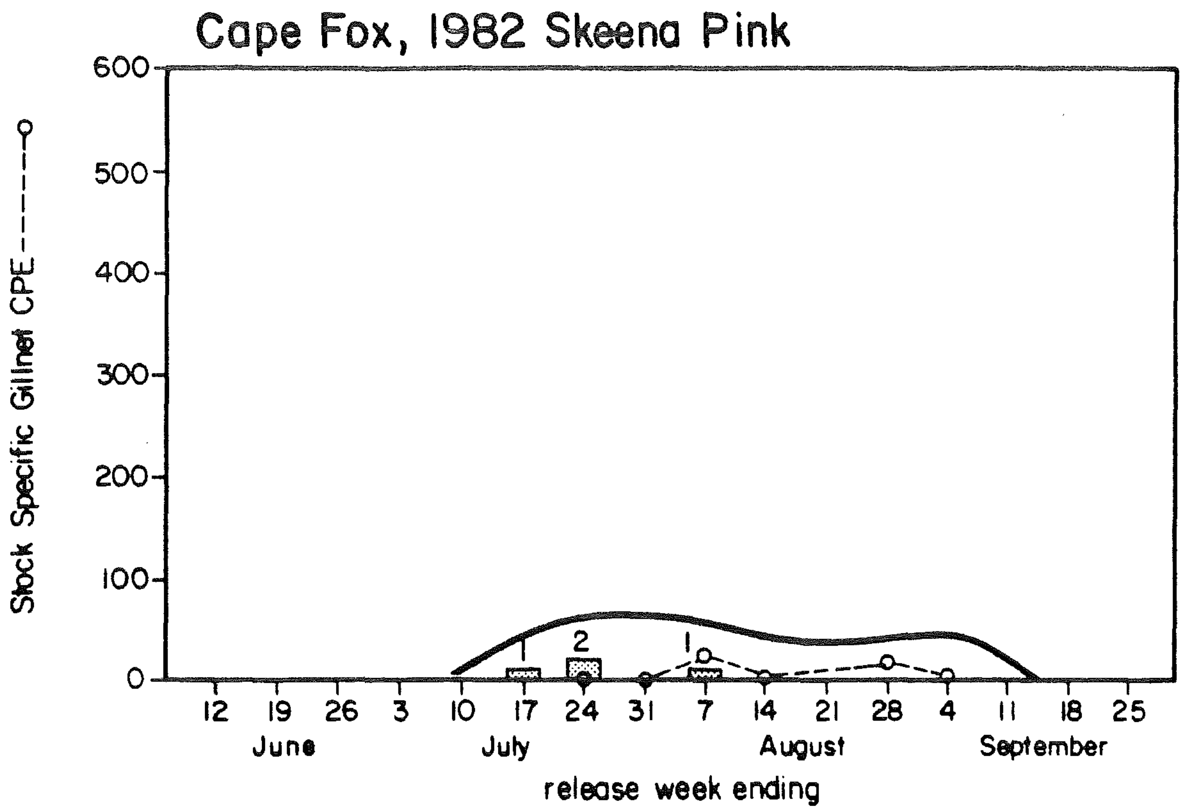
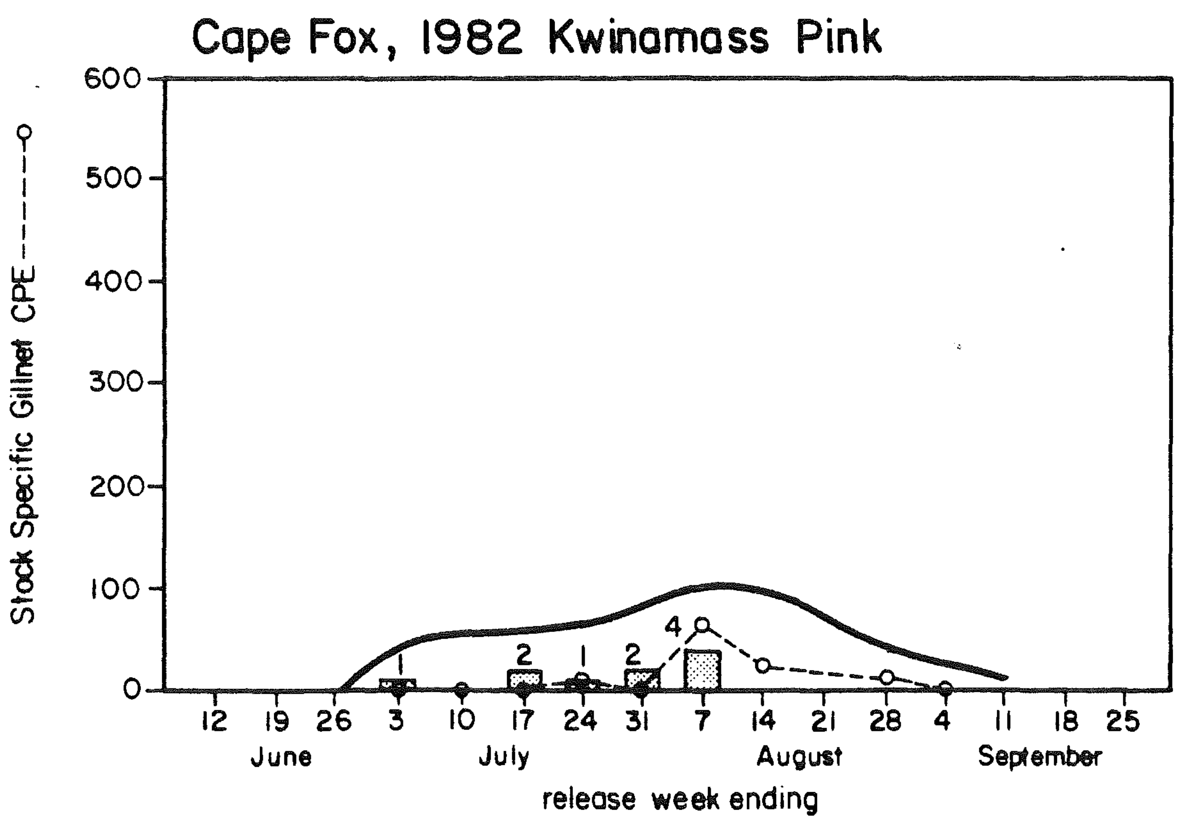


Figure 5. Relative run timing of pink salmon returning to southern Southeast Alaska and northern British Columbia, 1982-83.

Detailed Run Timing

Figure 6.





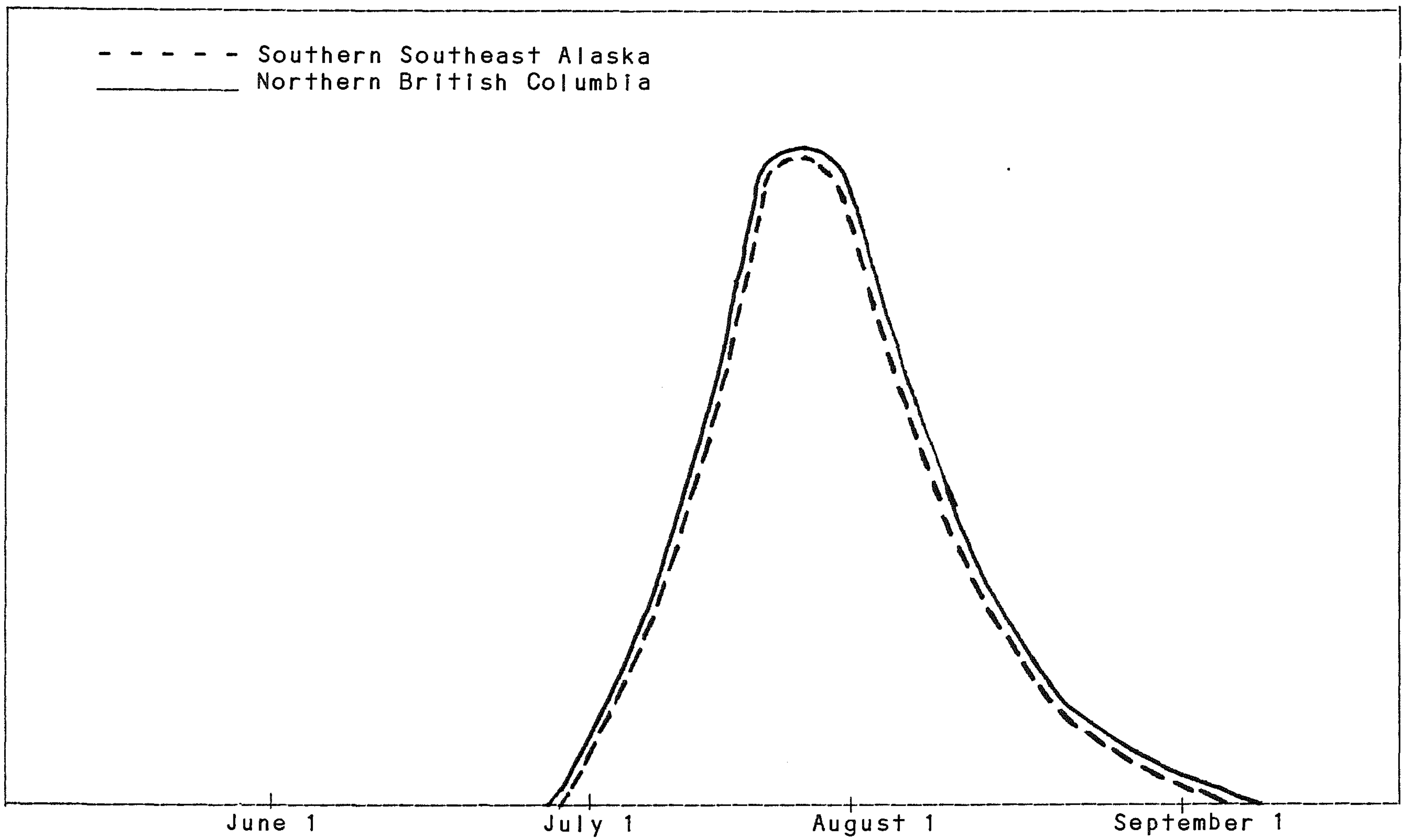


Figure 7. Relative run timing of chum salmon returning to southern Southeast Alaska and northern British Columbia, 1982-83.

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