

TROLL SALMON INVESTIGATION

PROGRESS REPORT

November 1956 to December 1957

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Troll Salmon Investigation Progress Report

November 1956 to December 1957

Introduction and General

At the close of the 1956 trolling season, analysis of the gathered data was begun. Of particular importance was the evaluation of the shortened season for chinook salmon fishing. The season opening had been delayed from March 15 to April 15 in 1956 in Oregon and Washington to help the depleted runs of Columbia River fall chinook salmon and it was necessary to prepare a rather thorough defense of this move as it had met with considerable objection from the fishermen. Various statistics were gathered from the Pacific Coast fisheries agencies and analyzed to show the effects of the regulation on the fishery and the stocks of fish. Meetings were held with the trolling industry at Astoria and Seattle and a report was presented to the Pacific Marine Fisheries Commission in San Francisco in the fall of 1956. A report on this entitled "Results of the 1956 Regulations on Oregon and Washington Chinook Troll Fisheries" has been submitted and mimeographed for distribution. The result of the meeting was to keep the closed season in force. Another major accomplishment of the meeting was to prohibit offshore gill netting.

A meeting of the Oregon Salmon Congress at Coos Bay in November was also attended relative to the sport-commercial problems at the mouths of many bays.

Considerable time was spent in summarizing the 1956 season's sampling and mark recovery data and this was reported on in the April to October 1956 Progress Report, as well as some observations on the 1956 ocean sport fishery. A report was also completed and submitted during this period on the actual and calculated numbers of Oregon marked fish taken by the Pacific Coast troll fisheries in 1955. Other minor reports submitted during the winter of 1956-57

dealt with the contribution of the Umpqua River to the troll fishery, a summary of troll salmon research for the Fish Commission Biennial Report, various statistical data on the fishery for the Library of Congress, the status of the ocean gill-net fishery, and the research program for the 1957 season. Two research papers were completed and drafts submitted to editorial board for editing. They were: "A Preliminary Study of the Salmon Taken by the Troll Fishery in Regard to Size, Hooking Condition, and Gear Selectivity" and "Results of the Offshore Silver Salmon Tagging, 1948-52."

One piece of back data that was analyzed was the length-weight relationship of round ocean-caught chinook salmon and round to dressed conversion factors. Work was continued on a statistical analysis of the maturity of salmon caught at sea from both commercial and sport gonad samples and the chinook tagging experiments of 1948-52.

The usual stream surveys of the Nehalem River were conducted during December 1956 and 1957. Considerable time was spent in searching for new laboratory facilities and satisfactory quarters were finally found. The move into the new lab required a great deal of administrative and other work during January, February, and March 1957.

The Fish Commission and the Pacific Marine Fisheries Commission staff meetings were attended in March 1957.

When the fishing season opened on April 15, sampling began for marks, average weight, abundance, and intensity. This sampling will be the subject of one section in this report. The 1956 catch statistics were tabulated and analyzed when received from the Portland Office in June 1957, and the calculated numbers of marks taken by the Oregon fishery computed and the results sent to the other cooperating agencies. During August a start was made on the hooking mortality program and also samples for length, age, and maturity were taken of the ocean sport and commercial fisheries off the mouth

of the Columbia. Each of these will be discussed in detail in this report. A number of observations on the herring fishery at Winchester Bay were also made in cooperation with trawl investigation personnel.

With the end of the 1957 field season attention again turned to working up the season's data. The sampling was summarized by month and port and the marked fish assigned to their proper experiment, which in the case of chinook necessitated reading the scales. A request was received from the California Department of Fish and Game for a summary of our chinook age composition studies which was complied with. A summary report on the troll salmon fishery was made to the Fisheries Interim Committee of the State Legislature. The spring troll closure again necessitated considerable arguments in its defense and these were presented at the Pacific Marine Fisheries Commission meeting at Portland in November. The coast-wide troll chinook picture was presented with emphasis on the evaluation of the closed season.

Personnel involved in this year's work were:

Ronald C. Naab	resigned May 1957
Gerald Carlson	June - September 1957
Ross MacIntyre	June - September 1957
Fred Vincent	August - September 1957
James Ryan	began September 1957

This report will be in four parts:

1. The 1957 Oregon Troll Salmon Season.
2. Sampling the 1957 Oregon Troll Fishery for Marked Salmon.
3. The 1957 Troll Salmon Hooking Mortality Program.
4. The Size, Age, and Maturity of Chinook Salmon Taken by the Sport and Commercial Fisheries off the Columbia River During August and September 1957.

The 1957 Oregon Troll Salmon Season

The highlights of the 1957 season were the great abundance of silver salmon resulting in a near record catch, a record pink salmon catch, warm water, California white sea bass, and beautiful weather. The large silver

catch in the Coos Bay area was especially outstanding since this area is normally not a heavy silver-producing area.

Tables 1 and 2 and Figure 1 shows the intensity and catch of the troll fishery by area and month in 1957. All these figures and graphs (except Figure 2) combine the landings on the Washington side of the Columbia River (provided by the Washington Department of Fisheries) with the Astoria-Warrenton landings as a biological fishing area. The calculation of the fishing intensity or number of trips is shown in Table 3. The number of trips is computed from the card count as supplied by the IBM section. They record each landing of each species as a separate count as shown in Tables 1 and 2; however, since most trips contain both species (after the silver season opens) it is necessary to adjust them in order to get a true measure of the fishing intensity or number of trips. This has been done by taking each month and area and using the larger number for that month and area since that represents the total number of trips for that month. Since the silver season opens June 15, the total silver intensity must be computed separately from the total chinook intensity. After that date, there are almost always more silver landings than chinook landings. Although significant numbers of landings will contain only silvers and no chinook, the boats generally will be fishing for both species and the total number of trips will more accurately measure the fishing pressure and abundance of fish than using the unadjusted number of landings or card count. The number of fish is computed from the pounds landed and the average weight as found by sampling by month and area.

The troll chinook season opened April 15 with very poor fishing. Due to the inclement weather, very few trollers engaged in any pre-season fishing and those that did were blown back into port with few fish. Fishing picked up a little towards the end of April as the weather and tides improved, however, only 58,000 pounds in 315 trips were landed this April compared with 406,000 pounds in 662 trips in April 1956. Most of the boats went south and

Table 1. Troll Chinook Statistics for 1957 by Month and Area Landed:
Numbers of Landings, Pounds Round, and Numbers of Fish.

	Columbia						Newport	Coos Bay	Total			
	Oregon		Washington		Combined							
	Nos. of Landings	Pounds Round Nos. of Fish										
April	169	45,843 4,196	146	11,808 1,080	315	57,651 5,276	11	2,134 152	41	2,340 180	367	62,1 5,6
May	137	22,890 2,392	98	8,577 896	235	31,467 3,288	185	43,755 3,114	588	132,083 10,163	1,008	207,3 16,3
June	171	13,610 1,266	173	9,014 838	344	22,624 2,104	1,044	350,126 19,077	2,070	435,283 31,465	3,458	808,0 52,6
July	491	60,132 6,377	546	32,497 3,446	1,037	92,629 9,823	892	315,539 23,078	2,978	566,947 47,451	4,905	975,1 80,3
August	443	41,524 3,190	849	46,099 3,541	1,292	87,623 6,731	977	139,627 10,558	2,510	559,633 62,074	4,779	786,3 79,3
September	252	14,202 1,363	255	9,391 902	507	23,593 2,267	1,481	202,701 21,444	473	52,496 6,684	2,461	278,7 30,3
October	12	233 22	22	278 26	34	511 48	34	1,204 85	36	633 49	104	2,3 1
Total	1,675	198,434 18,808	2,089	117,664 10,729	3,764	316,098 29,537	4,644	1,055,086 77,509	8,694	1,749,417 158,068	17,102	3,120,6 265,1

Table 2. Troll Silver Statistics for 1957 by Month and Area Landed:
Number of Landings, Pounds Round, and Numbers of Fish.

	Columbia				Combined	Newport	Coos Bay	Total				
	Oregon		Washington					Nos. of Landings	Pounds Round			
	Nos. of Landings	Pounds Round Nos. of Fish										
June	242	67,555 12,446	203	54,774 10,091	445	122,329 22,537	896	350,348 48,054	1,534	315,709 54,903	2,875	788,312 125,410
July	739	209,239 34,722	840	231,623 38,437	1,573	440,852 73,159	1,230	342,986 50,811	3,763	832,978 127,080	6,566	1,616,858 251,000
August	698	142,847 19,780	1,147	153,976 21,320	1,845	296,823 41,100	1,380	403,772 45,938	4,053	573,846 77,971	7,278	1,274,444 165,000
September	365	40,797 4,997	531	44,503 5,450	896	85,300 10,447	1,671	414,801 51,530	1,095	109,641 15,134	3,663	609,776 77,100
October	74	4,249 614	144	7,342 1,060	218	11,591 1,674	75	6,006 824	300	28,851 4,267	593	46,418 627
Total	2,112	464,677 72,559	2,855	492,218 76,358	4,977	956,895 148,917	5,252	1,517,913 197,177	10,746	1,861,029 279,360	20,975	4,335,868 625,400

Figure 1. Troll Salmon Statistics for 1957 by Month and Area Landed.

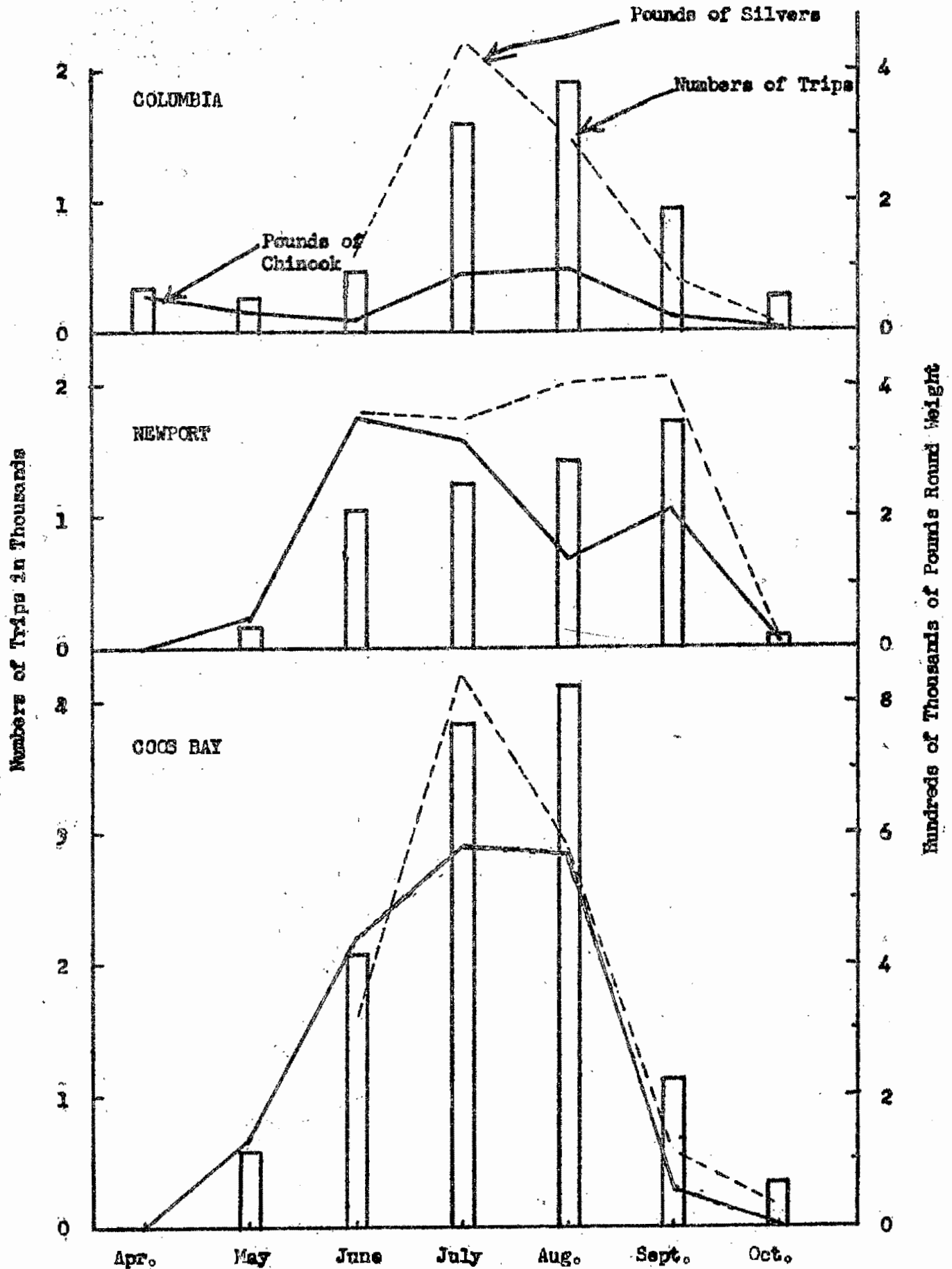


Table 3. Troll Salmon Intensity for 1957, Adjusted
Number of Trips by Month and Area.

	Columbia	Newport	Cocos Bay	Total
April	315	11	41	367
May	235	185	588	1,008
June	Chinook	1,044	2,070	3,458
	Silver	896	1,534	2,875
July	1,573	1,230	3,763	6,566
August	1,845	1,380	4,053	7,278
September	896	1,671	1,096	3,663
October	218	75	300	593
Total	Chinook	5,527	5,596	11,911
	Silver	4,977	5,252	10,746

fished out of Newport and Cocos Bay in May after the disappointing spring season off the Columbia. The silver season opened June 15 with exceptionally good landings. Chinook fishing also was good at Newport during June and July and at Cocos Bay during July and August. As shown in Figure 1, the intensity and catch of silvers remained high through September at Newport but dropped off rapidly in the other areas. July in the Cocos Bay area was outstanding for over 800,000 pounds of silvers landed in one month. The Columbia area never produced any great amount of chinook. Only 316,000 pounds of chinook were landed in the Columbia area in all of 1957 compared with 782,000 pounds in 1956. Newport was down from 1,620,000 pounds of chinook to 1,055,000 pounds and Cocos Bay from 2,276,000 to 1,749,000 pounds. The very high intensity and large catch of salmon in the Cocos Bay area is shown in Figure 1. This area is tending to become more important to the troll fishermen as some of the previously heavily-fished areas are not producing as they have in the

past. It will be assumed even greater importance when the new Fishermen's Cooperative Association plant begins operation in 1958.

Figure 2 shows the trend of production for Oregon troll landings (not including Washington) since 1925. The total 1957 chinook landings were 3,121,000 pounds or 265,000 fish compared with 4,677,000 pounds and 366,000 fish in 1956. However, 1956 was a record year for chinook, so 1957 was still above average. The silver production has steadily risen since 1943 until over 4 million pounds were landed in 1957 making it the best year since the famous 1935. Combining both species gives a total poundage for Oregon ports of 6,847,000 pounds. For total production, this was the second best year in history exceeded only by 1956.

The recorded catch for pink salmon in Oregon in 1957 was 99,718 pounds which is a new high for this species. At times, more pink salmon than chinook were taken off the Columbia River.

Undoubtedly contributing to the fine silver catch, in addition to the abundance of fish, was the excellent summer weather that prevailed. Even the smallest boats were able to fish day after day with little time lost in port.

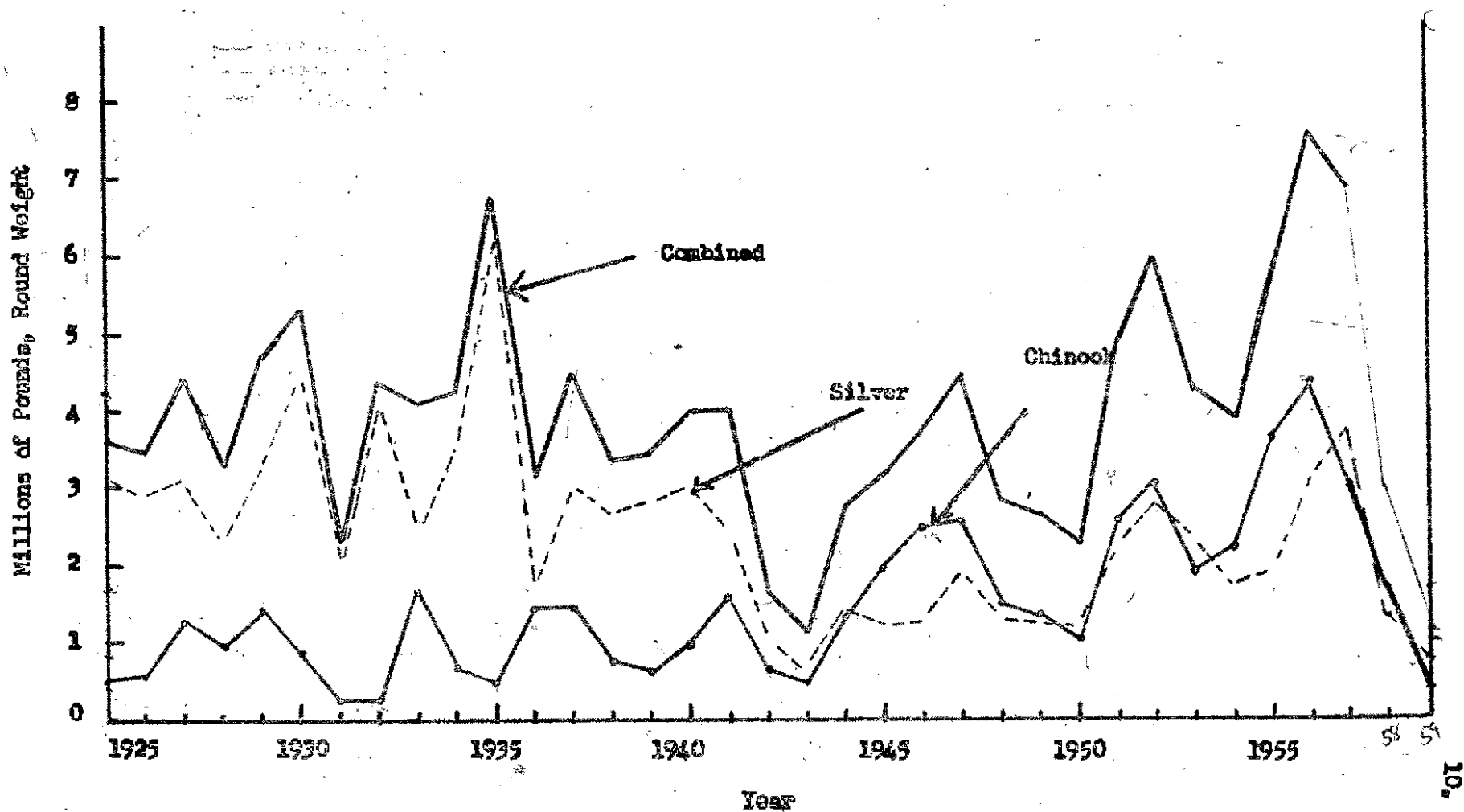
Albacore tuna appeared this year and some of the larger trollers went tuna fishing, but due to the elusiveness of the tuna and the poor price, most returned to salmon fishing after a few trips. An interesting feature of this year's fishery was the catching of a number of California white sea bass during September. At least 3 were caught off the Columbia River, 4 at Winchester Bay, and 2 at Newport and Depoe Bay. Undoubtedly, there were others that were not recorded. These fish were new to the writer and none of the fishermen interviewed had ever seen one before.

Sampling the 1957 Oregon Troll Fishery for Marked Salmon

Introduction

Sampling the troll fishery for marked salmon continued in 1957 as it

Figure 2. Oregon Commercial Troll Salmon Production.



has for a number of years, but on a reduced scale. Two samplers were stationed in Astoria from June through September and they sampled the fish that were trucked from coastal ports to Astoria for processing as well as those landed in Astoria. Occasional trips were made down the coast to sample and get areas of fishing, average weights, etc. By having observers only at Astoria, large numbers of fish were sampled at a moderate cost, but precise data was lacking on the area of catch. Generally, the port of landing was obtainable however, which was precise enough for our purposes. Ross MacIntyre and Gerald Carlson did the sampling during the peak summer fishery, assisted at times by Fred Vincent. Ron Haab sampled the April fishery, Jack Van Hying the May and early June fishery, and James Ryan the late September and October fishery.

From the standpoint of the troll investigation, the main purpose of sampling for marks was to recover the numerous Columbia River fall chinook marks available and learn more about their distribution and fate in the ocean. Since relatively few silver marks were expected and many of them were duplicated, the recovery of silver marks was only incidental to the chinook sampling. Other projects and agencies had various other experiments in progress calling for recoveries from the fishery. The marks from other agencies are being returned to them for further study.

As in previous years the marked to unmarked ratio for each mark by month and area was used with the total numbers of fish landed by month and area (shown in Tables 1 and 2) to arrive at the calculated number of each mark taken by the fishery. The average weight figures used in calculating the numbers of fish are shown in Tables 4 and 5 for silver and chinook salmon, respectively. The average weight of the silvers in 1957 was 5.88 pounds, 0.23 pounds less than the then all-time low of 6.11 pounds recorded in 1956. This is at least partly due to the large landings in June and July when the

Table 4. Average Dressed Weight of Troll-Caught Silver Salmon in 1957.

Port	June	July	Aug.	Sept.	Oct.	Total
Columbia						
Number	1,248	2,062	3,789	746	117	8,162
Weight	5,902	11,867	23,795	5,304	704	47,572
Average	4.72	5.24	6.28	7.10	6.02	5.82
Newport						
Number	0	566	31	339	0	936
Weight	—	3,324	237	2,375	—	5,936
Average	—	5.87	7.64	7.00	—	6.34
Coco Bay						
Number	400	1,540	1,076	149	0	3,165
Weight	1,998	8,786	6,897	939	—	18,620
Average	5.00	5.70	6.40	6.30	—	5.88
Total						
Number	1,648	4,368	4,896	1,234	117	12,263
Weight	7,900	23,977	30,929	8,618	704	72,128
Average	4.79	5.49	6.32	6.98	6.02	5.88

fish are at their smallest. To get the true average weight for the season, one would have to weight the sampling by the monthly landings. The average weights of the chinook did not differ markedly from 1956 to 1957.

Silver Salmon

Table 6 shows the numbers of silver salmon examined in 1957 by month and area of landing. This can be related to Table 2 which shows the numbers of silvers landed and thus the sampling intensity. The total calculated catch in 1957 was 623,454 silvers of which 55,942 or 8.9 per cent were examined for marks.

A summary of the silver salmon double mark recoveries and calculated numbers of marked fish landed by marking experiment, month, and port is presented in Table 7. Only the marks recovered from the random samples of the commercial

Table 5. Average Dressed Weight of Troll-Caught Chinook Salmon in 1957.

Port	Apr.	May	June	July	Aug.	Sept.	Oct.	Total
Columbia								
Number	733	51	157	592	896	203	6	2,638
Weight	6,966	424	1,468	4,858	10,151	1,838	56	25,761
Average	9.50	8.32	9.35	8.20	11.32	9.05	9.33	9.76
Newport								
Number	0	0	110	428	6	66	0	610
Weight	—	—	1,756	5,091	69	543	—	7,459
Average	—	—	15.96	11.89	11.50	8.22	—	12.22
Coos Bay								
Number	0	0	254	600	177	6	0	1,037
Weight	—	—	3,057	7,237	1,389	41	—	11,724
Average	—	—	12.03	10.39	7.84	6.83	—	11.30
Total								
Number	733	51	521	1,620	1,079	275	6	4,285
Weight	6,966	424	6,281	17,186	11,609	2,422	56	44,924
Average	9.50	8.32	12.05	10.60	10.75	8.80	9.33	10.48

Table 6. Numbers of Troll-Caught Silver Salmon Examined for Marks in 1957.

Port	June	July	Aug.	Sept.	Oct.	Total
Columbia	2,118	5,502	4,954 11,793	1,337	342	14,253
Newport	3,522	8,782	3,195	9,987	0	25,486
Coos Bay	460	3,926	9,339	2,478	0	16,203
Total	6,100	18,210	17,488	13,802	342	55,942

Table 7. Summary Of Actual and Calculated Silver Salmon Marks Taken by the Oregon Troll Fishery in 1957 (including Washington Columbia River Ports).

Origin	Mark	Brood Year	June			July			August			September			October	Total Random
			Col. 1/	NP	GP	Col.	NP	GP	Col.	NP	GP	Col.	NP	GP	Col.	
Oregon Coastal Streams	BV	54	2 21.3	7 95.6	5 66.5	16 92.6	16 518.7	4 33.2	9 129.5	22 183.9	5 39.1	27 139.3	18 109.7	1 4.9	132 1,434.3	
Oregon Coastal Streams	BV	55	...	...	1 13.3	...	...	...	...	...	...	1 5.2	...	...	2 18.5
Tillamook River	Ad-RP	54	...	...	...	...	...	...	...	...	...	1 5.2	...	...	1 5.2
Tillamook River	An-LP	53	...	...	...	1 5.8	...	...	...	...	...	...	...	...	1 5.8
Tillamook River	An-RP	54	...	...	...	...	...	1 14.4	...	...	...	...	...	...	1 14.4
Satsop River	LM-RV	54	...	...	...	...	1 32.4	...	...	1 8.3	...	...	...	...	2 40.7
Sandy River	Ad-RV	54	1 10.6	4 54.6	2 26.6	2 11.6	3 97.1	1 8.3	1 14.4	1 8.3	2 15.6	1 5.2	1 6.1	...	19 258.4	
Minter Creek Sandy River or	Ad-LV	54	1 10.6	5 68.3	1 13.3	4 23.1	3 97.1	1 8.3	2 28.8	5 41.7	1 7.8	...	5 30.5	...	28 329.5	
Minter Creek Humptulips River	RM-Ad	54	1 10.6	...	...	...	...	...	...	...	...	1 5.2	...	...	2 15.8
Chehalis River	LM-LV	54	...	...	...	...	...	1 14.4	...	...	...	...	...	...	1 14.4
Chehalis River	RM-LV	54	...	...	...	...	...	...	...	...	...	1 5.2	...	1 4.9	2 10.1
Hoods Canal or	Ad-LV	55	...	...	...	...	...	...	...	...	...	...	...	...	...
Big Creek Unassignable	D-RV	54	...	...	1 13.3	...	...	...	...	...	...	...	...	...	1 13.3
Unassignable	Ad-An	54	...	...	...	1 5.6	...	...	...	...	...	...	...	...	1 5.6
Unassignable	An-LV	54	...	1 13.6	...	...	...	...	...	...	...	...	...	...	1 13.6
Total			5 53.1	17 232.1	10 133.0	24 138.7	23 745.3	6 49.8	14 201.5	29 242.2	8 62.5	32 165.3	24 146.3	2 9.8	194 2,179.6	

1/ Actual number of marks recovered. 2/ Calculated number of marks landed.

catch as shown in the body of the table, were used in the calculation of the theoretical total numbers of marked silvers taken by the entire fishery. This figure was computed by mark on a month and port basis as agreed on by the participants in the Pacific Marine Fisheries Commission marking programs and has been presented similarly for the past several years. It should be considered somewhat tentative, however, as individual experiments may warrant a different approach in final analysis. The non-random or selected marks are those turned in by fishermen, cannery workers, fish receivers, etc.

The 55,942 silvers examined yielded 194 marks; i.e., 0.35 per cent of the sample was marked or one in every 283 fish examined. The calculated total landing of marked silvers was 2,180. Sixty-eight per cent (132) of the marks found were from Oregon Game Commission coastal river plantings, the dominant mark again in 1957 as in 1956 (51 per cent). The next two most frequently found marks were both duplicated from Sandy River (Columbia River) and Minter Creek (Puget Sound) with 19 adipose-right ventral and 28 adipose-left ventral marks.

Chinook Salmon

The same procedure used for silvers was followed for chinook salmon. Table 8 shows the numbers examined and Table 9 contains the summary of double marks found.

The total calculated landing of chinook in 1957 was 265,114 fish (Table 5) of which 24,023 or 10.7 per cent were examined yielding 126 marks or 0.5 per cent marked fish. The calculated total landing of marked chinook was 1,513.

The recoveries of Umpqua River marks of the 1953 brood year totaled 35 which yielded a calculated total of 621 marks landed. The 1953-brood Umpqua chinook dominated the 1956 troll fishery mark recovery also. In 1956, 11.6 per cent of the estimated 832 Umpqua recoveries were from the Columbia River

Table 8. Numbers of Troll-Caught Chinook Salmon Examined for Marks in 1957.

Port	April	May	June	July	Aug.	Sept.	Oct.	Total
Columbia	1,966	750	132	1,348 2,874	1,131	395	7	5,729
Newport	—	328	3,906	2,815	531	4,190	—	11,768
Coos Bay	—	453	1,228	1,606	2,063	1,176	—	6,526
Total	1,966	1,531	5,266	5,769	3,725	5,761	7	24,023

Troll Fishery but in 1957, only 0.5 per cent of 623 estimated marks landed were from this fishery. The Newport and Coos Bay recoveries varied little between the two years with the Coos Bay landings containing about five times as many marks as the Newport landings.

The Rogue River 1953 and 1954 brood years contributed 25 marks to the 1957 recoveries with a calculated total landing of 240 marked fish. All 25 recoveries were from the Newport and Coos Bay areas. These fish were Oregon Game Commission "contribution to catch" marks. The 1956 mark recoveries of 1953-brood Rogue River left maxillary-both ventral and left maxillary-dorsal marked fish were one and two, respectively. These were also from Newport and Coos Bay.

An encouraging number of Columbia River fall chinook marks were found, principally from the Klickitat River. Only a scattering of other marked fish from Spring Creek, Wind River, Little White Salmon River, Willamette River, and Bonneville were found although large numbers were marked in most cases. The Klickitat marks were three-year-old fish giving considerable hope for following these fish through their fourth year and into the river. The most surprising thing about these fish was their presence along the central and southern Oregon coast in apparently good numbers. None of our previous Columbia River chinook marking experiments have revealed any significant migration southwards.

Table 9. Summary of Actual and Calculated Chinook Salmon Marks Taken by the Oregon Troll Fishery in 1957 (including Washington Columbia River Ports).

Origin	Mark	Brood	April		May			June			July			August			September			Total Random	Non-Rand
			Col.	1/2	Col.	NP	CB	Col.	NP	CB	Col.	NP	CB	Col.	NP	CB	Col.	NP	CB		
Willamette or Mad River	Ad-RV	53	3	1/2	...	...	...	...	...	...	1	...	...	...	...	...	...	...	4	...
Spring Creek	An-RV	53	8.0	2/	...	...	...	...	...	...	8.2	...	...	...	...	...	...	...	16.2	...
Klickitat River	Ad-LV	54	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
Klickitat River	Ad-RV	54	2.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2.7	...
Wini River	An-RP	54	5	1	1	1	1	3	2	6	2	...	2	...	1	...	...	...	25	...
Wini River	An-LP	53	13.2	4.4	9.5	22.4	15.9	14.7	51.2	43.7	16.4	...	11.9	...	30.0	...	...	...	233.5	...
Little White Salmon River	D-RV	53	5	3	...	...	2	1	...	...	3	1	1	1	...	...	1	1	18	1
Rogue River	IM-Ad	53	13.2	13.2	...	...	31.9	4.9	...	...	...	82.6	6.0	20.8	...	...	5.1	5.7	183.6	...
Rogue River	IM-BV	53	2	...	...	...	1	...	...	...	1	1	...	...	...	...	...	...	6	...
Rogue River	IM-RV	53	5.3	...	...	...	15.9	...	...	...	8.2	27.5	6.0	...	...	...	...	...	62.9	...
Rogue River	IM-Ad	54	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	1	...
Rogue River	IM-BV	53	1	...	...	...	...	4.9	...	...	...	...	...	...	...	...	...	...	4.9	...
Rogue River	IM-BV	53	2.7	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2.7	...
Rogue River	IM-Ad	54	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	8	...
Rogue River	IM-BV	53	...	...	...	...	...	2	1	...	...	...	...	3	...	...	...	...	2	...
Rogue River	IM-BV	54	...	...	...	...	...	9.8	25.6	...	...	...	...	90.2	...	...	...	...	10.2	...
Rogue River	IM-RV	53	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5	...
Umpqua River	BV	53	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	25.6	...
Umpqua River	RM-BV	53	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
Umpqua River	RM-RV	54	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...
Umpqua River	RM-RV	54	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5.7	...
Umpqua River	RM-BV	53	1	...	...	1	1	5	...	1	3	...	1	2	...	...	...	...	15	4
Umpqua River	RM-BV	53	2.7	...	...	22.4	4.9	127.9	...	8.2	82.6	...	20.8	60.2	...	...	...	...	329.7	...
Umpqua River	RM-RV	54	...	...	...	...	4	2	...	3	4	...	...	2	...	...	...	...	20	...
Umpqua River	RM-RV	54	...	...	...	...	19.4	51.2	...	24.6	110.1	...	...	60.2	...	...	...	...	291.2	...
Umpqua River	RM-RV	54	...	...	...	...	...	...	...	1	2	...	...	...	...	...	...	...	4	...
Umpqua River	RM-RV	54	...	...	...	...	...	...	...	8.2	55.0	...	...	...	...	...	...	...	68.3	...
Umpqua River	RM-RV	54	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
Umpqua River	RM-RV	54	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	20.8	...
Umpqua River	RM-RV	54	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4	...
Umpqua River	RM-RV	54	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	50.0	...
Umpqua River	RM-RV	54	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
Umpqua River	RM-RV	54	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6.0	...
Umpqua River	RM-RV	54	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	6.0	...
Total			18	4	1	2	4	12	10	6	10	13	7	4	9	1	22	3	125	6	
			48.2	17.6	9.5	44.8	63.7	58.7	255.9	43.7	82.0	357.8	41.9	83.2	270.7	5.7	112.5	17.1	1,513.0		

1/ Actual number of marks recovered

2/ Calculated number of marks landed.

The 1957 Hooking Mortality Study

The purpose of this study was to obtain data on the mortality rates suffered by troll-caught chinook (sub-legal lengths) and small silver salmon when released by the commercial fishermen. It was planned that the experience with techniques and materials during this preliminary study would aid in making a more extensive study in 1958 to help evaluate the present minimum size limit on chinook and the effect of the spring closure on silver salmon.

Background

Milne and Ball (1956) reported a loss of about 30 per cent in small (15 to 24 inches) troll-caught coho salmon landed in good condition, tagged, and held in holding tanks or a live pond for 33 days. The total mortality, including those landed dead or in poor condition and those tagged and held, was 42 per cent. The present study was patterned after that of Milne and Ball.

Materials and Methods

The general plan was to capture small salmon at sea using regular commercial gear, record their physical condition and hooking damage when landed, and to hold the fish in live boxes for time intervals sufficient to determine mortalities attributable to being hooked and landed.

Arrangements were made with a commercial fisherman to charter his boat, the "Patricia T" of Winchester Bay. Two live-boxes, one of canvas and one of plywood (both of approximately 100 gallon capacity), were obtained from the Otter Trawl Investigations to hold the small fish. The deck pump on the boat was used to circulate fresh sea-water most of the time while trolling, and a large gasoline pump was also used occasionally to change the water. A floating live-pond, 8 by 16 by 4 feet with tarred mesh bottom, was constructed at Winchester Bay to receive fish at the end of each day's fishing

if it were desired to hold them overnight or longer.

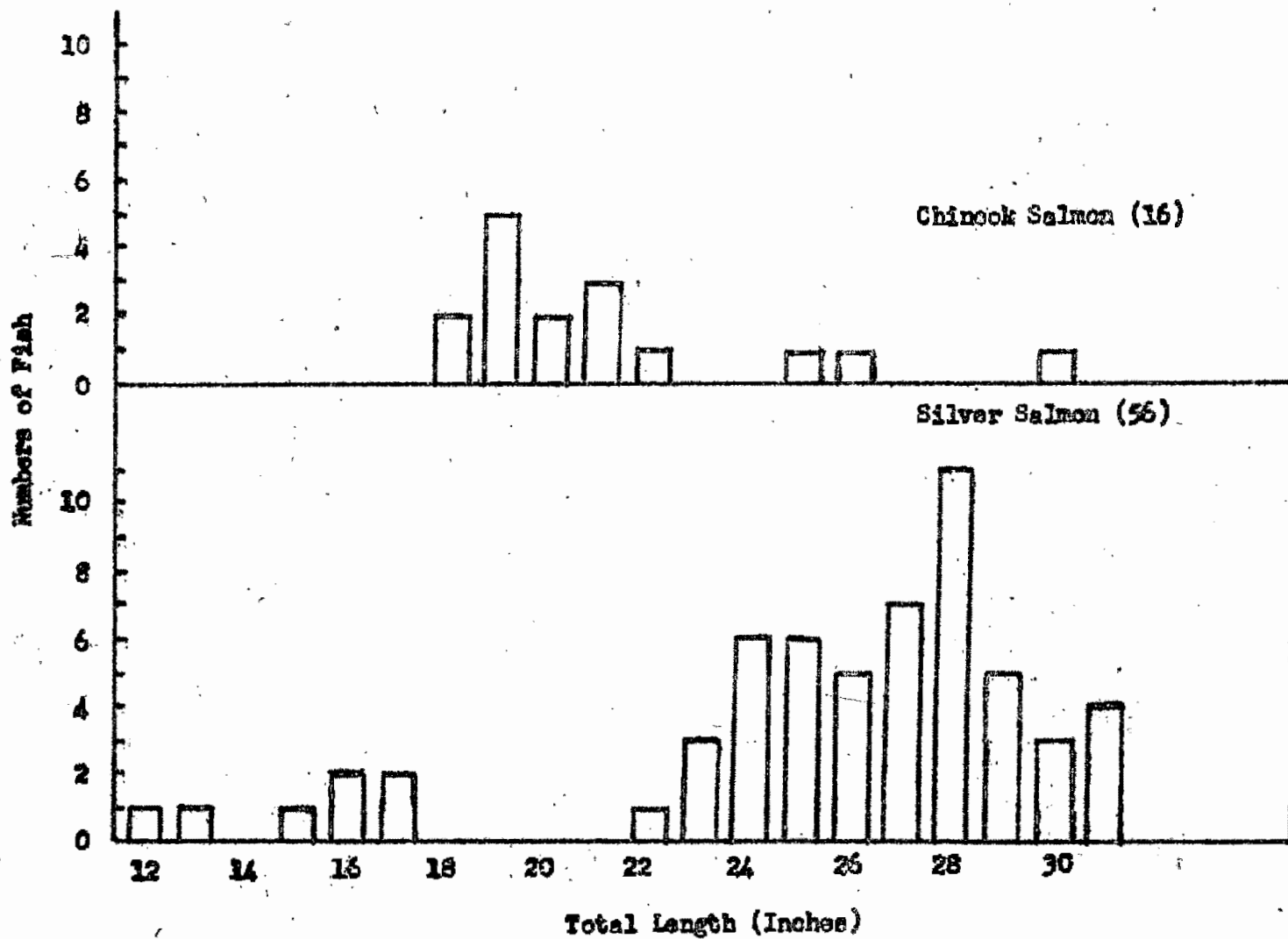
Five one-day trips were made from Winchester Bay in late August and September. During each trip, the fisherman followed his normal routine and fished in any area he wished. Most of the fish landed were caught on bait, either herring or anchovies. Some fish were taken on squid, and a few were taken on artificial lures. The daily catch of commercial-sized fish was probably average for the area fished. It was felt that the fishing methods and gear were representative of commercial boats fishing from Winchester Bay. Figure 3 shows the length-frequency distribution of all the salmon caught during the 4 days of fishing in September. Not all the fish caught were measured on the single trip made in August.

Results

A total of 44 chinook was caught of which 32 fish had a total length of less than 26 inches. Five of these sub-legal fish were either dead when landed or died within one hour in the holding tanks. A total of 67 silvers was landed of which 18 (13 to 23 inches) were held for tagging or observation. None of these silvers were landed dead, but four died within one hour. Thus, 16 per cent of the sub-legal chinook and 22 per cent of the silvers might be called hooking mortalities if one uses the criterion of death within one hour after being hooked.

The type of hook wound and mortality rate could not be correlated and it was observed that the apparent injury and condition of the fish when landed were not reliable indicators of the fish's probability of survival. It was noted that two fish (a 25-inch chinook and a 26-inch silver) recovered after bleeding severely for some time and lived for at least several hours in the holding tank. On another occasion a 21-inch chinook floated belly-up when first put into the tank, but later recovered his equilibrium and survived several hours.

Figure 3. Length-Frequency Distributions of 16 Chinook and 56 Silver Salmon Taken on Commercial Trolling Gear off Winchester Bay During 4 Days of Fishing, September 1957.



Attempts were made to observe fish in the live pound tied to the herring fisherman's float in Winchester Bay. In the first attempt, 6 fish (5 chinook and 1 silver) were maintained in the live pound overnight and only 1 chinook and the silver survived. On another occasion, 3 chinook and 5 silvers either died or disappeared from the live pound over a six-day period. The last attempt to observe overnight mortality was prevented by loss of the pound and contained fish during a severe storm.

It was difficult to ascertain the mortality from longer holding because of the extremely variable conditions under which the fish were held such as rough seas, crowding, tendency for the tanks to become polluted with slime and blood, some fish jumping out of the tanks into the hold, escapement from the pound, etc. In general however, roughly half of the fish died over a period of 6 to 8 hours. This agrees with the findings of Milne and Ball, but at least some of this mortality must be ascribed to holding. There are arguments both ways about what might be the true mortality of fish released to the ocean; perhaps the true value lies somewhere between the two figures of 16 and 42 per cent. At the moment, fish recovering and surviving for an hour would appear to be a better index of survival than the mortality occurring over a longer period in holding tanks or pounds, but the recent work on lactic acid build-up may alter this opinion.

From observing the experiments, the definite impression received was that silvers were hardier than chinook. Apparently healthy specimens of both species would occasionally die for no apparent reason, but chinook seemed more prone to do this than silvers. This may be a reflection of the lactic acid build-up. Silvers also seemed to more often recover from serious injury and severe bleeding. Analysis of the data, however, did not support these observations, although the small number of fish and many variables may have obscured the results. This difference in hardiness, if it exists, may be a function of the advanced maturity of most of the silver salmon caught in the

late summer as compared to the immature condition of most of the chinook under 26 inches.

The use of methyl pentynol (3-methyl-1-pentyn-3-ol) as an anesthetic tranquilizer for fish in the holding tanks was attempted to reduce jumping and nervous strain. Two concentrations were tried. A concentration of approximately 1:29,000 was used on September 24 which obviously killed the fish if they were left in this solution more than an hour. A concentration of approximately 1:58,000 did not produce any observable effect on the fish.

Tagging

A few fish were tagged and released immediately when the holding facilities were full, while others were released or escaped after being held for varying time intervals. Eight chinook and 3 silvers were tagged, and 1 recovery has been made to date. This was a 24-inch chinook tagged with a Petersen-type disc tag and released immediately in good condition. The fish had not increased in length when recovered about 10 months later in the same area where it was released.

Seven of the fish were tagged with Petersen disc tags and stainless steel pins; 4 numbered discs were used on each pin to reduce the high rate of disc loss found in previous experiments. Four salmon were tagged with California tuna dart tags and held for a short period. This type of tag has apparently been used successfully on tuna but our results on salmon were not satisfactory. The main problem appears to be that the interspinous bones (pterygiophores) in which the barb of the tag is supposed to lock are not strong enough and it is mainly the flesh and skin which retains the barb in the small salmon. At least, two of the dart tags were observed to have come off in the live pound after only a short time.

Conclusions

The fish in this study were subjected to treatment not encountered by fish caught and released with reasonable care by commercial fishermen and the results are not directly comparable to "normal" hooking mortalities. However, it is felt that the mortalities observed as the fish were landed and during the first hour in the tank more accurately indicate the true hooking mortality than do mortalities occurring during more lengthy holding which may be due, at least in part, to the holding itself. The landing and first-hour mortalities observed here were 16 per cent of the 32 chinook, and 22 per cent of the 18 silver salmon.

The study of the hooking mortality of small troll-caught chinook and silver salmon is to be continued in 1958. Recent work (Black and Parker) indicates that the concentration of fatigue products, especially lactic acid, in the muscle and blood may be directly correlated with, if not the cause of death. One of the objectives in 1958 will be to evaluate the effects of handling and holding the troll-caught fish in live tanks through the use of another tranquilizer, and to measure the time course of development of lactic acid in fish held in live tanks.

The Size, Age, and Maturity of Chinook Salmon Taken by the Sport and Commercial Fisheries off the Columbia River During August-September 1957

Introduction

The commercial and sport fisheries at the mouth of the Columbia River afford an excellent opportunity to study the age composition, growth, and maturity of the chinook population in this area and to compare the selectivity of the two types of gear. With this in mind, 95 random lengths and scale samples were taken of chinook salmon in the commercial troll landings at Astoria and Warrenton in August and early September 1957. Also, 351 lengths, scales, sex, and maturity determinations from chinook salmon caught in the

ocean sport fishery during the same period were taken. The sport fishery observations are of particular value in helping to define the population structure because very few if any small fish are discarded due to the generous bag limit and absence of a minimum size limit. The limit in effect in 1957 allowed each angler 6 salmon of which not more than 2 could be over 24 inches. Another important factor is that almost all the sport-caught salmon are landed round so that the sex and maturity can be determined as the fish are cleaned at the dock. The commercial trollers on the other hand have a 26-inch minimum size limit and all their fish are landed dressed so that no gonad observations can be made. Thus samples from the commercial fishery are of little or no value in growth rate studies or to determine what ages and sizes might be actually present in the area. Most commercial trollers now use herring, but use large hooks and troll at a fairly good speed, whereas most sport fishermen "nooch" or drift herring on small hooks or occasionally troll slowly. The sport gear seems to take all sizes of fish. Our sampling was largely from charter boats and large cruisers which tend to fish more in the ocean than do the small-boat fleets out of Ilwaco and Chinook. For information on the 1956 sport fishery see Troll Salmon Investigations Progress Report April-October 1956.

Fred Vincent took most of the sport fishery samples and Gerald Carlson and Ross MacIntyre the commercial samples in the course of their mark recovery efforts.

Length Frequency and Age

Figure 4 shows the length-frequency distributions for the sport sample broken down into the age groups present, and Figure 5 the same for the commercial sample. The shaded areas represent fish with the stream type of first year growth (generally thought of as spring chinook; also called sub-2's) as distinguished from the ocean type (fall chinook; sub-1's).

Figure 4. Size and Age of Sport-Caught Chinook Salmon, August-September 1957.
(Shaded areas indicate fish with the stream type of nucleus).

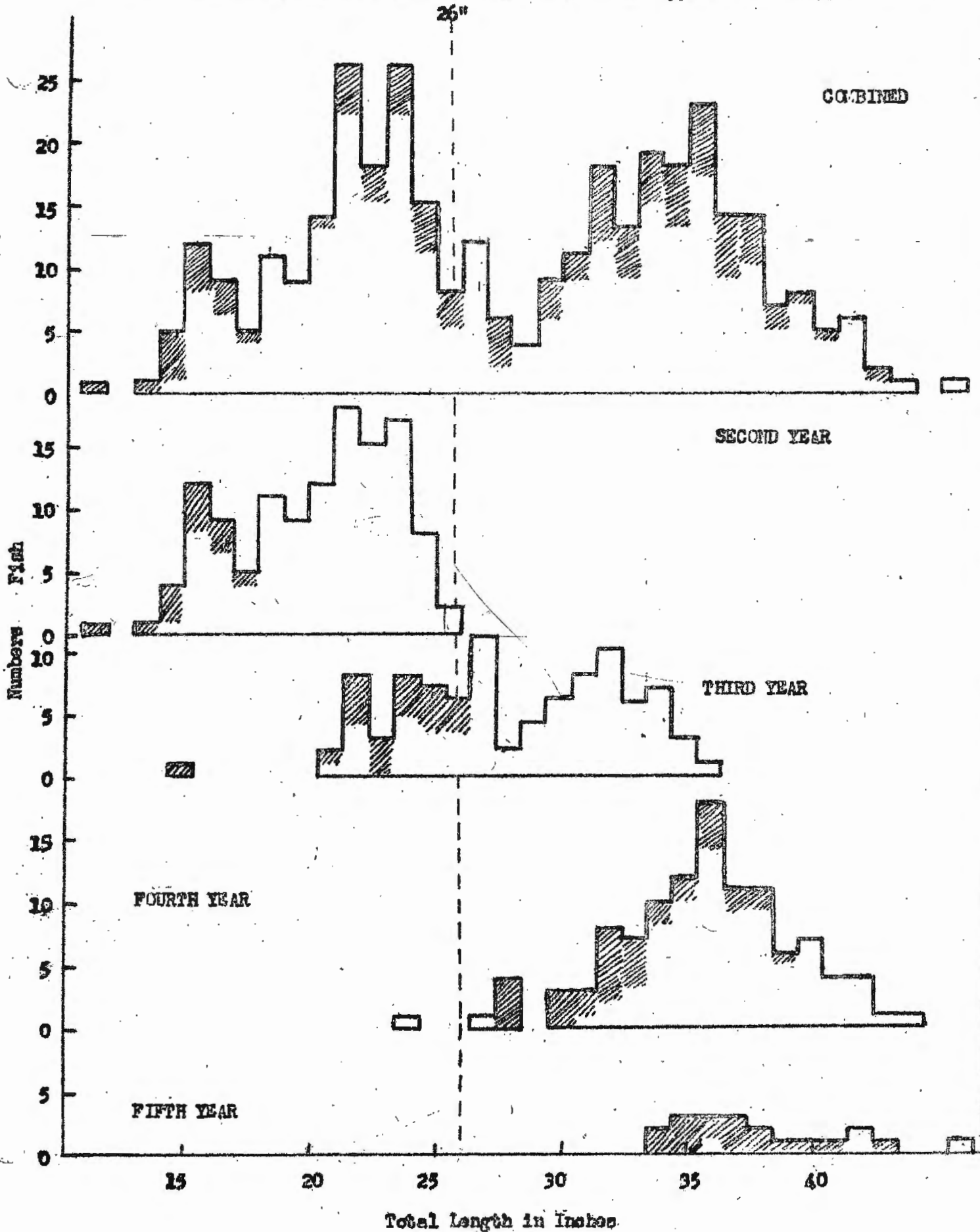
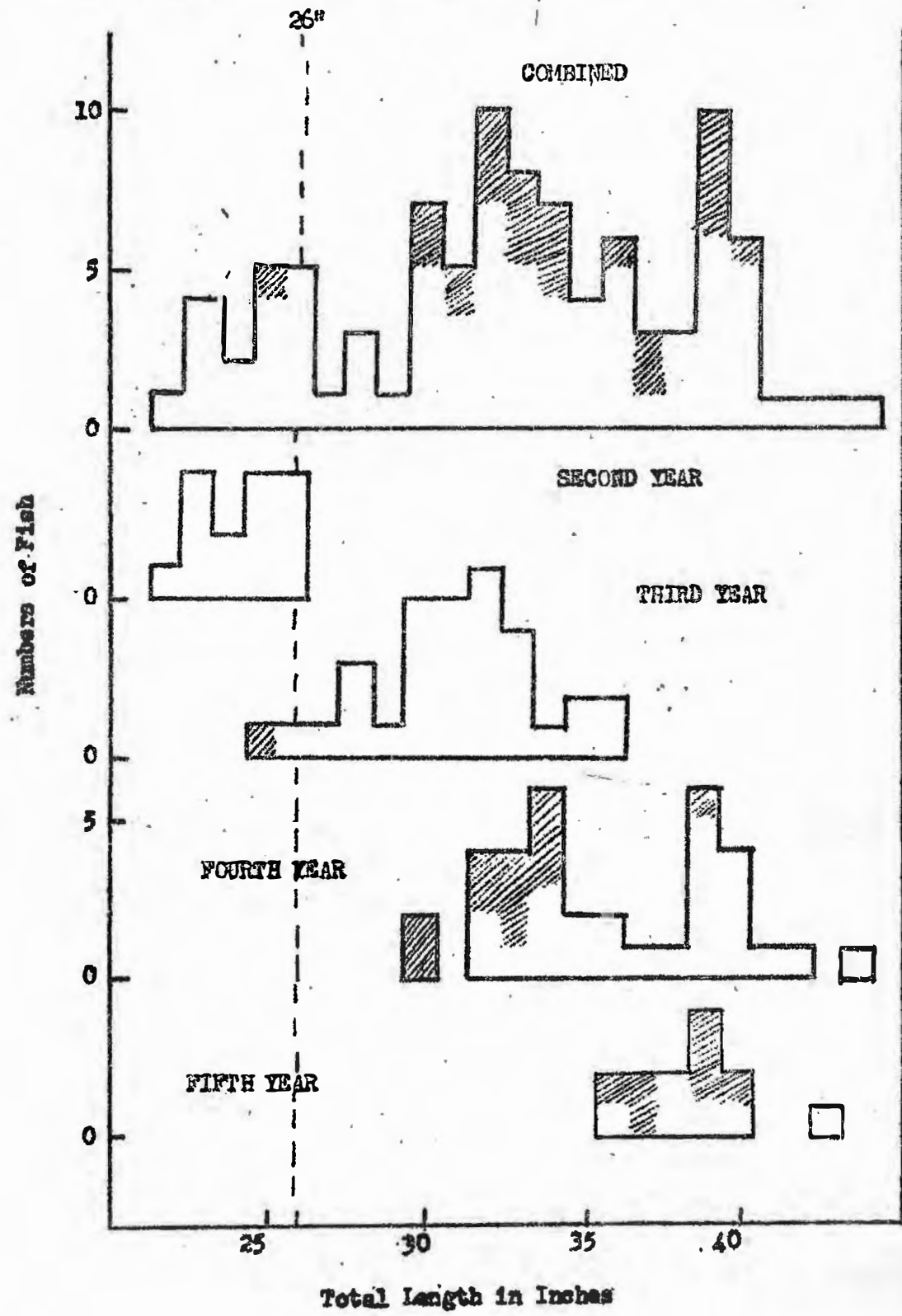


Figure 5. Size and Age of Commercially-Caught Chinook Salmon, August-September, 1957. (Shaded areas indicate fish with the stream type of nucleus).



The 26-inch line is shown as a point of reference. The scales have been read only once and should be checked before the final analysis is made.

Obviously, sportsmen land many fish under 26 inches which are largely protected from the commercial fishery. The number of fish landed commercially under 26 inches is surprisingly high, however, but the situation is not as serious as it may seem because most of these undersized fish were jacks with the secondary sexual characteristics beginning to develop. Ordinarily fishermen will not keep, nor dealers accept, any numbers of sub-legal fish. As would be expected, only the largest of the two-year-old fish were landed by the trollers. In order to learn if there is any selectivity exercised by the troll fishery other than the size limit, we might consider only the fish over 26 inches. The average lengths of the fish over 26 inches are almost identical for both fisheries (34.7 inches for the commercial and 34.6 for the sport), but there does seem to be differences in the shape of the distributions. The large fish (over 29 inches) in the sport fishery approximate a normal curve while the commercial sample is bimodal. This difference appears to be caused primarily by the bimodality of the four-year-old commercially-caught fish. For the four-year-old chinook, the troll fishery seems to take the larger and smaller sizes but relatively few of the middle-sized fish which make up the mode of the sport-caught fish of this age group. In contrast, the curve for the third-year sport-caught chinook is distinctly bimodal in part caused by the number of fish with the stream-type of nuclei present. There appears to be a group of small three-year-old chinook from 21 to 27 inches long which are taken in greater proportions by the sport fishery than by the commercial fishery even though many of them would be of "landable" size.

Although the fall chinook salmon are considered to show predominantly the ocean-type of first year growth, significant numbers apparently do spend their first year in fresh water. For example, in 1957, for mature fish

only, 10 per cent of the 2-year, 22 per cent of the 3-year, and 37 per cent of the 4- and 5-year fish had the stream type of nuclear area. It is noteworthy that the percentage of stream nuclei increases with age. This is probably due to the added protection that they receive from the fisheries in their earlier years due to their smaller size, or the fact that they may mature later than the ocean type. Fish with the stream type of nuclear area were rare in the 1956 sample although this may be due to the small sample (52 age determinations in 1956). Only 1 fish (a 4-year-old) with the sub-2 type of scale was found in this sample.

A comparison of the age composition of the chinook over 26 inches in the sport and commercial samples (mature and immature combined) is as follows:

	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
Sport	31 per cent	59 per cent	10 per cent	
Commercial	37 per cent	46 per cent	17 per cent	

This indicates that the commercial fishery took relatively more 3- and 5-year-olds and fewer 4's than the sport fishery and also helps to explain the 2 peaks in the length-frequency distribution of the commercial sample.

Assuming that the sport catch of mature fish at the mouth of the Columbia River represents a random sample of the population entering the river we can calculate the age composition of the run as it enters the stream and before being fished on by the gill net fishery. Two possible objections to this are: (1) the larger fish tend to break away more readily from the sport tackle and thus the sample may be biased towards the smaller fish, and (2) there may be numbers of fish from other rivers present in the area. In spite of this unproven assumption, the method and results are at least worth recording here, and possibly afford an estimate of the age composition of the runs in the vicinity of the Columbia River. Following is the percentage age composition for the mature chinook in the sport sample:

2 ₁	21 per cent	3 ₁	23 per cent	4 ₁	30 per cent	5 ₁	2 per cent
2 ₂	2 per cent	3 ₂	6 per cent	4 ₂	10 per cent	5 ₂	6 per cent
Total	23 per cent	Total	29 per cent	Total	40 per cent	Total	8 per cent

This is very different from 1956 where the 2's were the most important (38 per cent), followed by the combined 4's and 5's (34 per cent), and the 3's (28 per cent).

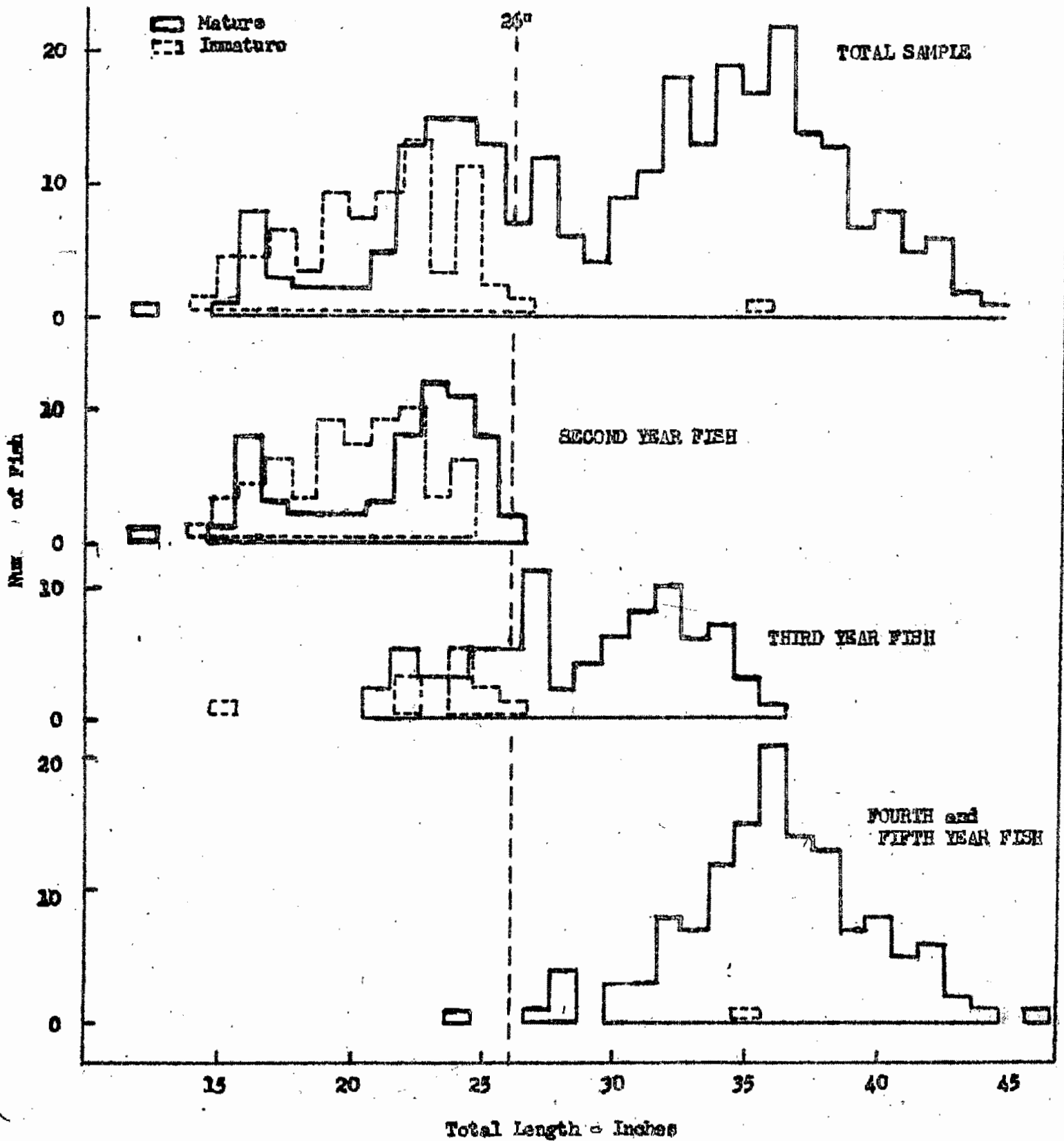
Maturity

Figure 6 shows the size and age of the mature and immature fish found in the sport sample. The solid-lined histograms represent the mature individuals and the dash-lined the immatures. Relatively few immature chinook were found in 1957 compared with 1956. Only 21 per cent of the total sample were immature in 1957 compared with 52 per cent in 1956. In 1956, 64 per cent of the 2-year-olds and 56 per cent of the 3-year-olds were immature compared with 49 and 13 per cent in 1957. The cause of the bimodality of the 2- and 3-year-old mature fish is not readily explainable. There are not enough of the stream-type fish present to account for the two modes. For the 2-year-old fish, at least, it appears that the larger and smaller members of the age group are maturing leaving the immature fish in the middle. This may also be the case with the 3-year fish had the immatures been better represented in the sample. This could account for the single mode of the 4- and 5-year fish since they are virtually all mature. It seems obvious that the immature 3-year-olds were not available to the sport fishery in any numbers this year.

Growth

One of the principal objectives of this study was to determine the growth rate of the chinook salmon in the ocean taking into account both the immature and mature groups. Computing a growth rate from only mature fish, as

Figure 6. Maturity of Sport-Caught Chinook Salmon, Columbia River Area August-September 1957.



is commonly done, does not give a true picture since the two groups differ in size. Ideally one should take the immature fish of one year class and determine the growth of this group into the next year. Unfortunately this would require considerable data over a series of years to rule out year class variation between years. However, we might examine the 1956 and 1957 sport fishery observations to see the results and merits of this method even though the 1956 sample was very small. The immature 2_1 age group sampled in August 1956 averaged 20.8 inches total length and 3.5 pounds round weight. By August 1957 this group had grown to 29.5 inches and 10.0 pounds as both mature and immature 3's. The immature 3_1 's grew from 25.5 inches and 6.4 pounds in 1956 to 37.0 inches and 20.0 pounds in 1957. Using only the 1957 data and taking maturity into account gives very similar results. Thus it is possible that the immature 3-year-olds of around 26 inches may actually triple their weight in a year. This has an important bearing on the value of the minimum size limit. The more conventional method of showing the growth rate as the average size at each age, without regard to maturity, gives a less rapid rate of growth, but this is not the true rate for salmon since the maturing fish are leaving the ocean and are not contributing to the future growth.

Catch Statistics

The census of the sport fishery at the mouth of the Columbia River by the Washington Department of Fisheries and the Oregon Game Commission showed that 19,000 chinook salmon were taken from July 3 to September 2, 1957. However, only 7,000 were taken from August 24 through Labor Day (the usual census period), the second lowest on record (since 1946) for this period. The catch during the same period in 1956 was 17,000, but many more of them were small immature fish. This year (1957) was the first year that the entire season's

fishery had been inventoried.

The summer commercial troll fishery at the mouth of the Columbia River has been seriously reduced in recent years by the decline of the fall chinook run, by competition with sportsmen, and by the closing of the river itself to commercial trolling. The landings of troll-caught chinook salmon at Columbia River ports during July, August, and September 1957 amounted to 177,000 pounds or 18,800 fish, of which 14,600 were caught in the Columbia River area and the remainder in the Newport and Grays Harbor areas. By way of contrast the same three months in 1947 produced 319,000 pounds. The trollers caught over half their fish during July while the sportsmen caught very few chinook until August.

Summary and Conclusions

Size, age, and maturity studies of the ocean sport fishery off the mouth of the Columbia River by the Oregon Fish Commission indicated that the chinook averaged larger in 1957 than in 1956 and fewer immatures were present. In 1957, the group of large fish (separated by a dip in the length-frequency distribution at 29 inches) was practically equal in numbers to the small group, while in 1956 the large fish furnished less than 1/4 of the catch. In addition, fewer immatures were taken in 1957 (21 per cent) than in 1956 (52 per cent). In both years a 22-inch minimum size limit would have been effective in reducing the landings of immature fish, but much less so in 1957 than in 1956. However, after observing the handling of undersized salmon caught on mooching gear in 1958 the writer is somewhat skeptical about the value of a minimum size limit in the sport fishery.

The commercial boats landed larger fish than the sports boats due to the 26-inch minimum size limit, but for the fish over 26 inches there was no difference in average length for the two types of gear. There were differences in the shape of the length-frequency distributions, however. The sport

fishery landed numbers of small 3-year-olds and medium-sized 4-year-olds which were apparently not as available to the commercial fishery. The commercial sample of 4-year-olds was bimodal compared to the unimodal distribution of the sport-caught fish of the same age.

Growth rate calculations based on the sport-caught chinook salmon, taking into consideration their maturity, suggests that small immature fall chinook at least double, and may triple, their weight in a year.

During July, August, and September 1957, sportsmen fishing at the mouth of the Columbia River landed over 19,000 chinook salmon and commercial trollers in the same area landed less than 15,000.

Jack Van Hyning
Robert Ellis

January 1959