Part 5

THE SPORT FISHERY FOR SALMON ON PUGET SOUND

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History and Fishing Methods

The sport of fishing for salmon has a background on Puget Sound at least as long as Washington's statehood. Collins (1892) referred to trolling for salmon as a recreation, saying, "In autumn, when salmon are most numerous in the Sound, Seattle Bay is literally covered with pleasure boats for days in succession."

Gear employed by early-day sport fishermen was simple compared to the elaborate rods, reels, and lures used by modern anglers. A well-equipped sport fisherman in the early 1900's needed only a cotton line attached to a short steel leader with a single-hook brass spoon as a lure. The steel leader was often omitted and the brass spoon and hook were usually home made. Steel leaders were not rust proof and Cobb (1911) reported that unless precaution was taken to carefully dry and oil them after fishing they could not be used more than a couple of days. Pole fishing was not common; the line was held in the hand or spooled on a home-fabricated wooden reel, known as a hand gurdy. A lead sinker was usually attached at the junction of the leader and line. Pioneer plumbing shops on Puget Sound did a brisk business in sinkers molded from lead pipe.

By 1915 many anglers were using the now conventional rod and reel, and the old method of hand-line fishing was being frowned upon as unsportsmanlike. In 1916 the Seattle Rod and Gun Club decided to encourage the use of light tackle, and for this purpose stipulated the kind of gear its members were required to use to win silver and gold award buttons for their catches. The general trend to light tackle has continued, and today many anglers are landing 20- to 40-pound chinook salmon using only 12-pound test line with 6-pound test leaders.

Trolling

Trolling is still the most popular method of sport fishing. Current day trollers have more elaborate gear than did their predecessors, but the basic method of fishing has remained unchanged. In place of oars, fishmen use outboard motors to pull their lures through the water. The standard practice is to throttle the motor to a rather slow speed and trail from 60 to 100 feet of line. A large variety of lures are used. Spoons, both single and multiple,

are still very popular and a wide selection of types are sold by sporting goods dealers. Colored plugs which imitate natural bait have proved to be a very effective lure for large fish and are used extensively. Fast trolling with coho flies is a newly developed technique for the taking of silver salmon.

Probably the most widely-used trolling lure is the herring dodger. Actually, the dodger is not a lure in itself. It is an attractor and also adds action to the bait, which is trailed two or three feet behind the dodger. A similar attractor lure, known as the flasher and rudder, was popular prior to the introduction of the dodger in the early 1930's. The dodger has been used with practically every type of lure dragged behind it.

Sinkers or leads used by troll fishermen range from one-half ounce to one pound, depending upon the fishing area, magnitude of the tide, time of day, type of lure, and the species of salmon being sought. The leads are usually of the slip type and are attached two to six feet in front of the lure. Little or no weight is used when trolling coho flies.

Spinning

Spinning for salmon originated many years ago in Elliott bay, but this technique of fishing did not become popular until recent years. Nearly all spinners use very light tackle which appeals to those anglers desiring the ultimate in sport. A light and limber rod 7½ to 9 feet long and a fast-retrieving type of reel without a star drag generally are used, with 10- to 15-pound test clear nylon line. At the terminus of the line a crescent-shaped sinker is attached, followed by a 6-foot nylon leader and finally a single or double hook. If a double hook is used, the upper hook is tied from two to three inches above the lower. Often a sliding tie is used so the hook can be adjusted to the size of the bait. Swivels are attached to both ends of the sinker to help avoid tangling.

Spinning is usually done from an achored boat in 60 to 125 feet of water; however, in recent years many fishermen have been spinning from boats that are not anchored but are allowed to drift freely with the tide. Whether the boat is stationary or drifting, the fishing method is identical. The lure is a fresh or frozen herring, either cut or whole. Whole candlefish are also widely used. The bait is cast 20 to 50 feet from the boat and is allowed to sink a few feet above the bottom. The current works the bait as it is slowly retrieved by intermittently stripping a few feet of the line through the guides of the pole. Some fishermen prefer to retrieve the bait directly with the reel.

Cutting bait for spinning is in itself an art. There are essentially two types of cut bait, the "cut spinner" and the "plug-cut" herring. The cut-spinner is actually a triangular fillet cut from a large herring (Figure 1). A properly cut-spinner has the leading edge cut forward at a 45° angle. The spinner should also be tapered, thick at the head and thin at the tail. A plug-cut herring is merely a herring with the head cut off at an angle and the viscera removed.

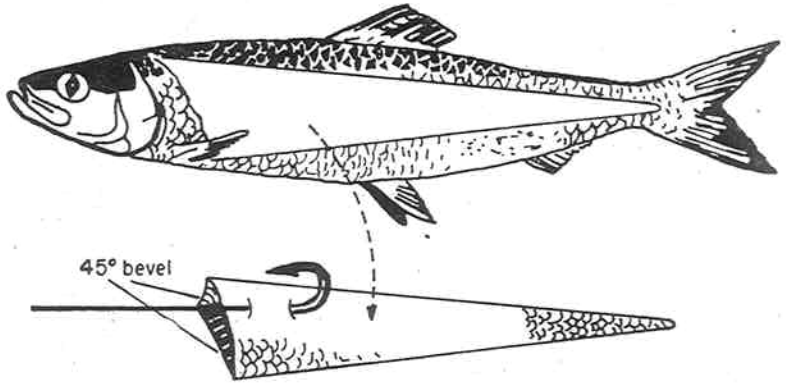
There are numerous ways to hook the bait. Many fishermen use only one hook when fishing for chinooks and two when angling for silvers. The silver generally strikes more readily on a faster rotating bait.

Mooching

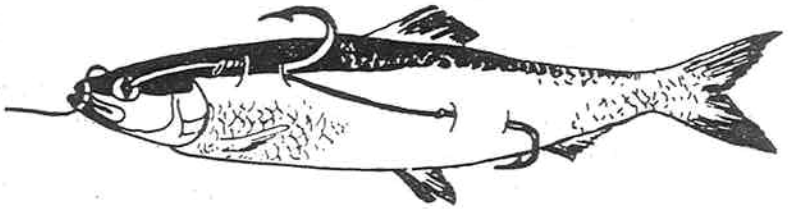
The gear and bait used in mooching are essentially the same as that employed in spinning. Techniques of fishing are also similar, but mooching is always conducted from an unanchored boat. In lieu of stripping the line, bait action is obtained by slowly moving the boat with stops now and then to let

Figures 1, 2, 3

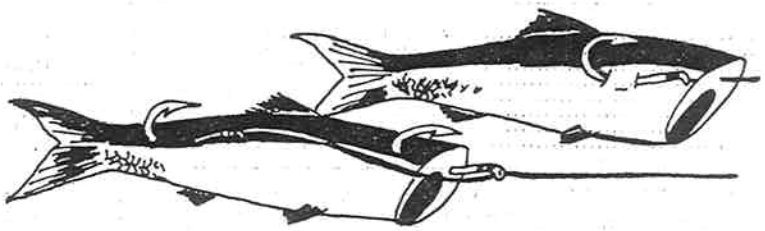
TYPES OF HERRING BAIT USED IN PUGET SOUND SPORT SALMON FISHING



CUT SPINNER



WHOLE HERRING



PLUG CUT

the bait sink deeper. In Puget Sound, most moochers use row boats but in the Strait of Juan de Fuca motor mooching is popular. The weight of the sinkers used varies with the depth of the water, but many successful moochers prefer to fish deep and ocassionally bump the bottom.

Intensity of the Fishery

In the collection and analysis of statistical research data, the fishery is divided into 19 areas. For the sake of clarity the following discussion will refer to only two composite areas, the inside or Puget Sound fishery and the outside or Strait of Juan de Fuca fishery. The inside fishery includes all fishing areas from Olympia north to Bellingham, including the San Juan Islands and Hood Canal. The outside fishery consolidates all areas to the west of Port Discovery: Dungeness, Port Angeles, Sekiu, and Neah Bay. In these two general fishing areas, there are 150 boathouses and fishing resorts having more than 4,000 rental boats. There are also large numbers of residents who own their own boats and fish throughout the year. About 15,000 outboard boats and private cruisers are registered with the Coast Guard and many of them are used for salmon fishing.

Until the late 1930's the saltwater sport fishery was still minor in size. By 1939 it was rapidly becoming one of the major fisheries of the state. At that time the Department of Fisheries initiated a system of monthly boathouse reports which listed a daily record of boat rentals and catches. From these reports, combined with field observations, the first actual statistics of sport fishing intensity and catch were calculated. The program was expanded in 1940 and 1941, but the manpower shortage during the war forced its abandonment. It was established again in 1946 and has been continued to the present day with the exception of 1948, when it was temporarily stopped because of lack of funds. In 1950 and 1951, in addition to catch statistics, special emphasis was directed to the collection of data to determine size and age composition of the catch. Data recorded for this study was taken randomly each month of the year and in all areas.

The sport fishery has experienced a tremendous increase in fishing effort in recent years. In 1939 there were 231,000 fishermen trips (Table 1), while in 1951 there were over 609,000, an increase of more than 375,000 fishermen trips per year in 12 years.

Table 1

PUGET SOUND SPORT CATCH OF SALMON

YEAR	Number of Fishermen Trips	Chinook	Silver	Pink (Humpy)
1939	231,000	87,089	155,374	10,108
1940	260,000	88,801	128,611	39
1941	271,000	81,265	187,782	12,826
1946	316,000	60,988	107,154	.....
1947	343,000	82,374	120,113	19,152
1949	531,344	92,544	214,809	88,090
1950	536,848	98,135	198,480	41
1951	609,489	131,732	208,854	28,627

Prior to World War II the fishery in the Strait of Juan de Fuca was of minor importance. Since 1947 this area has become increasingly popular with sport anglers, and in 1951 nearly 89,000 fisherman days were recorded.

Analysis of the Sport Catch

Chinook Salmon

As the intensity of the sport fishery increased total salmon catches also rose. Sports anglers in 1951 boated approximately 132,000 chinooks, a total unprecedented in the entire history of the fishery. There was an anomaly in this rise: despite the increase in take, the catch per unit of effort fell. The shift is especially apparent over the long range. In a 12-year period the catch per unit of effort for chinooks decreased from .38 fish per fisherman trip in 1939 to .21 fish in 1951.

The anomaly is not inexplicable. Given stable fish populations any appreciable increase in the number of fishermen will change the division of catch towards a smaller percentage for each individual. In this case the increase in fishermen was not matched by a proportionate increase in numbers of fish, and the unit catch turned downward. The data does not, however, indicate an overall population decrease on Puget Sound.

Excluding the good chinook catches made in the Strait of Juan de Fuca, Puget Sound anglers averaged 0.16, 0.15, and 0.18 chinooks per trip in 1949, 1950, and 1951, respectively. Since the incidence of sport angling in the Strait was small prior to 1947, the overall catch per unit of effort from 1939 to 1947 would be comparable to the actual inside fishery of 1949, 1950, and 1951 (Table 2).

Table 2

SPORT CATCH OF SALMON PER FISHERMAN TRIP

YEAR	All Areas Chinook	Inside Puget Sound Chinook	Strait of Juan de Fuca Chinook	All Areas Silver
1939	.38	*	*	.67
1940	.34	*	*	.49
1941	.30	*	*	.69
1946	.19	*	*	.34
1947	.24	.23	.48	.35
1949	.17	.16	.41	.40
1950	.18	.15	.45	.37
1951	.21	.18	.44	.34

* Area catch not segregated.

Thus, the inside Puget Sound catch per trip has actually declined from about 0.38 to 0.18 during the period 1939-1951.

Silver Salmon

The silver catch in the past three years has averaged more than 200,000 fish; again, however the catch per fisherman trip has been decreasing for the reasons cited in connection with the chinooks. Here the downward trend is in an opposite direction to the actual conditions of the stocks. Considering a 10-year period from 1941 to 1951, the catch per unit of effort dropped from 0.69 to 0.34 fish per trip. Silvers caught in the Strait of Juan de Fuca are usually large fish, but the catch per unit of effort closely parallels the inside fishery, so a reliable composite catch per fisherman trip for the two districts is depicted in Table 2.

Pink and Chum Salmon

Pink salmon are caught in numbers only in the odd years. The catch of pinks has risen with the increase of fishing intensity, but the catch per unit of effort, with one exception, remained at approximately 0.05 fish per fisherman trip. In 1949 a phenomenal catch of 88,000 "humpies" was recorded. Nearly one-third of these fish were landed in the Tacoma area.

Each year sport anglers boat from 2,000 to 3,000 chum (dog) salmon. Chums do not bite readily on sport gear; however, in areas with large chum populations, such as Hood Canal, these fish are common in the sport catches.

Length Frequencies

Chinook Salmon

In 1951, 4,009 chinooks were measured to determine the length frequencies of the catches. These measurements were taken randomly in every month and in all areas. The original measurements were recorded in centimeters from the tip of the nose to the fork of the tail. Since fishermen measure to the tip of the tail, it was essential to convert the measurement to total length in inches. This was done for both chinook and silvers, using the formulae for the tail in the normal position calculated by Van Hyning (1951).

Little fishing is conducted in the strait from October through April, so no comparison with the inside fishery could be made during these months. Chinook length frequencies recorded in the strait from May through September showed a definite difference from those taken in the inside fishery. It is apparent that the outside fishery is predominantly catching larger and older chinook than the inside fishery (Figures 4 and 5).

From May through September the inside measurements show a dominant modal group from 16 to 20 inches progressively. A secondary modal group from 25 to 35 inches is present, although it is somewhat masked by the smaller dominant group. Length frequencies of the outside sport catch show nearly a complete absence of small fish with over 90 per cent of the fish exceeding 25 inches in total length.

In analyzing the inside chinook landings, it was noted that 50.8 per cent, or a calculated 46,817 fish, were under 20 inches in length.

Length Distribution of Chinook Salmon in Relation to Age

Age determination by scale analysis of the chinook catch was conducted in 1950 and 1951. The analysis of the 1951 sample is not complete, but the results of the age readings of 1,980 scales taken in 1950 in the inside fishery are depicted in Figure 6.

A random sample of scales was collected each month of the year and in all fishing areas. The number of scales examined represented 2.7 per cent of the total inside catch. Seasonal fluctuations in the fishery and the many ports of landing made it difficult to get a proportionate sample from each area. The samples ranged from 2.4 to 3.2 per cent of the total catch of each individual area and resulted in the unequal weighting of some areas. Since individual samples did not show a wide variation in size distribution, the weighting process should not have introduced any serious bias.

Two scales from each fish were mounted by the acetate impression method. They were examined with a projector, and three separate readings were recorded without reference to length or weight. Of the 2,048 scales examined

Figure 4

1951 LENGTH FREQUENCIES OF SPORT CAUGHT CHINOOK SALMON PUGET SOUND EXCLUSIVE OF STRAIT OF JUAN DE FUCA

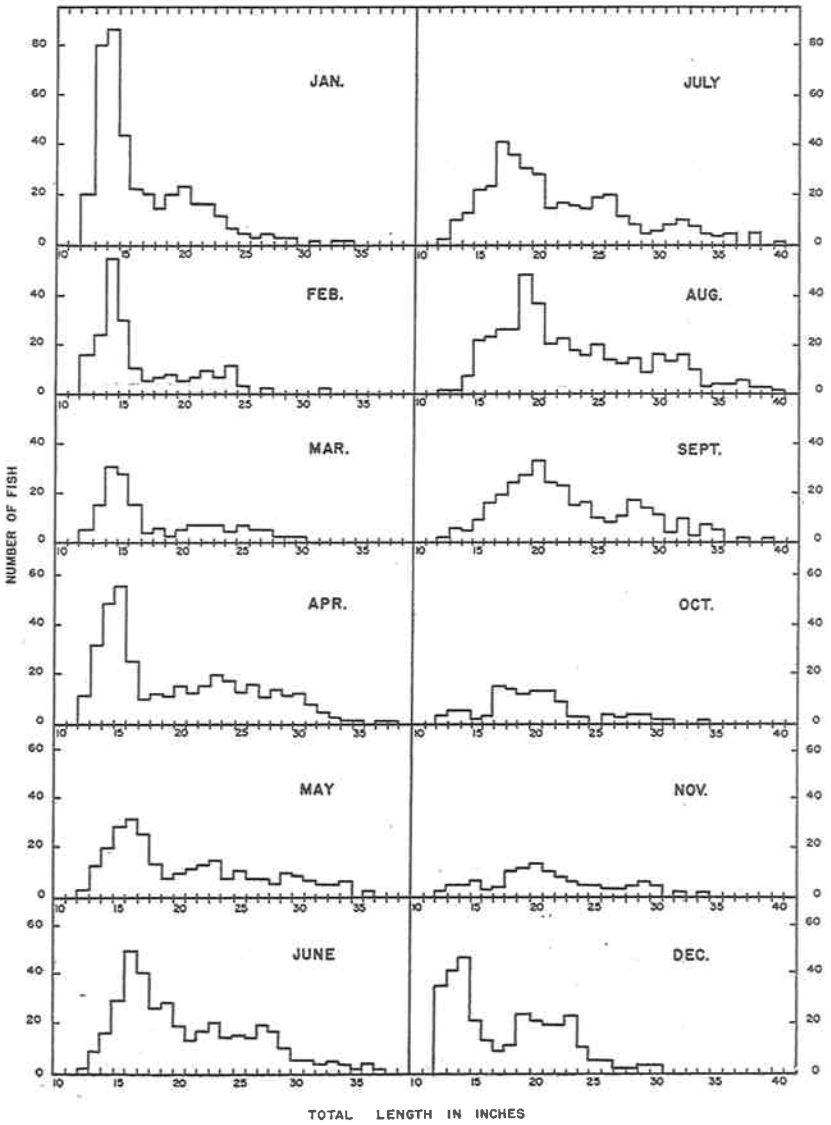


Figure 5

LENGTH FREQUENCIES OF 1951 SPORT CAUGHT CHINOOK SALMON IN STRAIT OF JUAN DE FUCA (NEAH BAY, SEKIU AND PORT ANGELES)

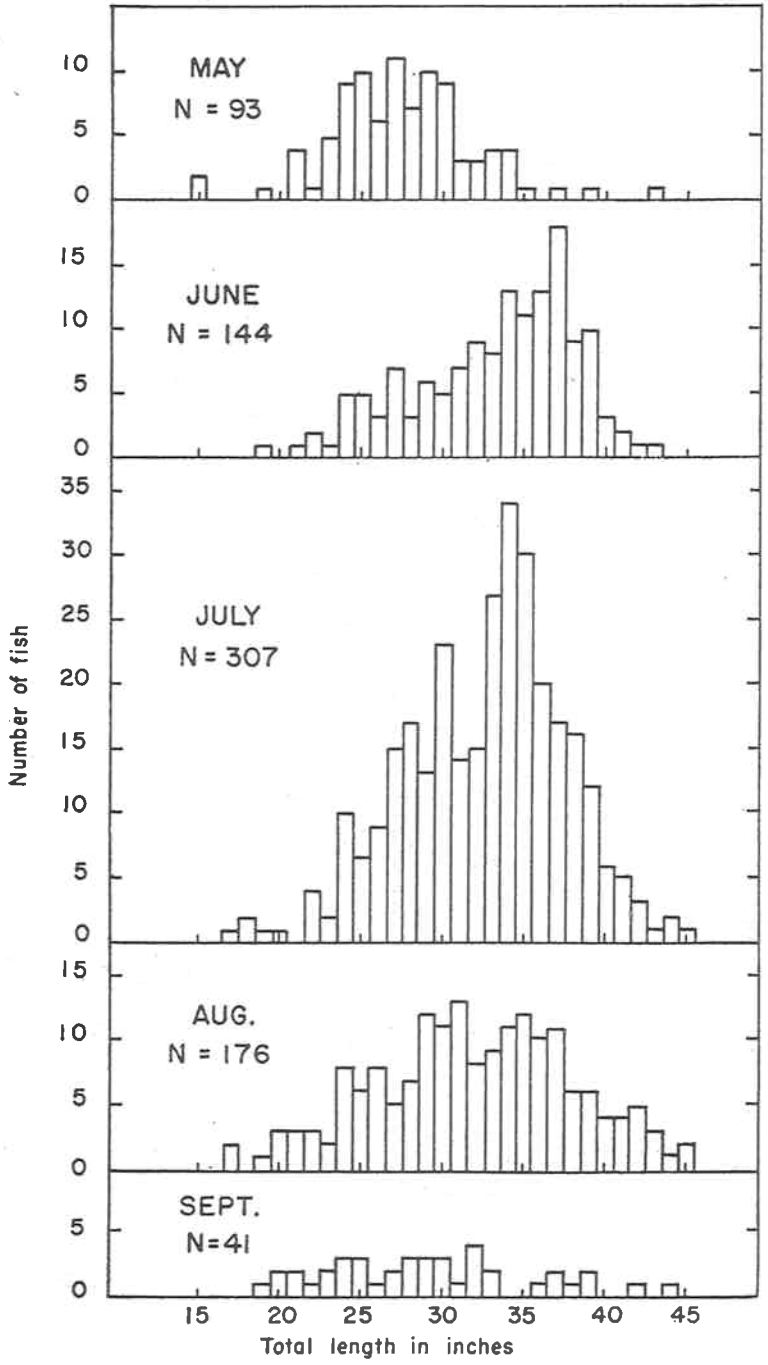
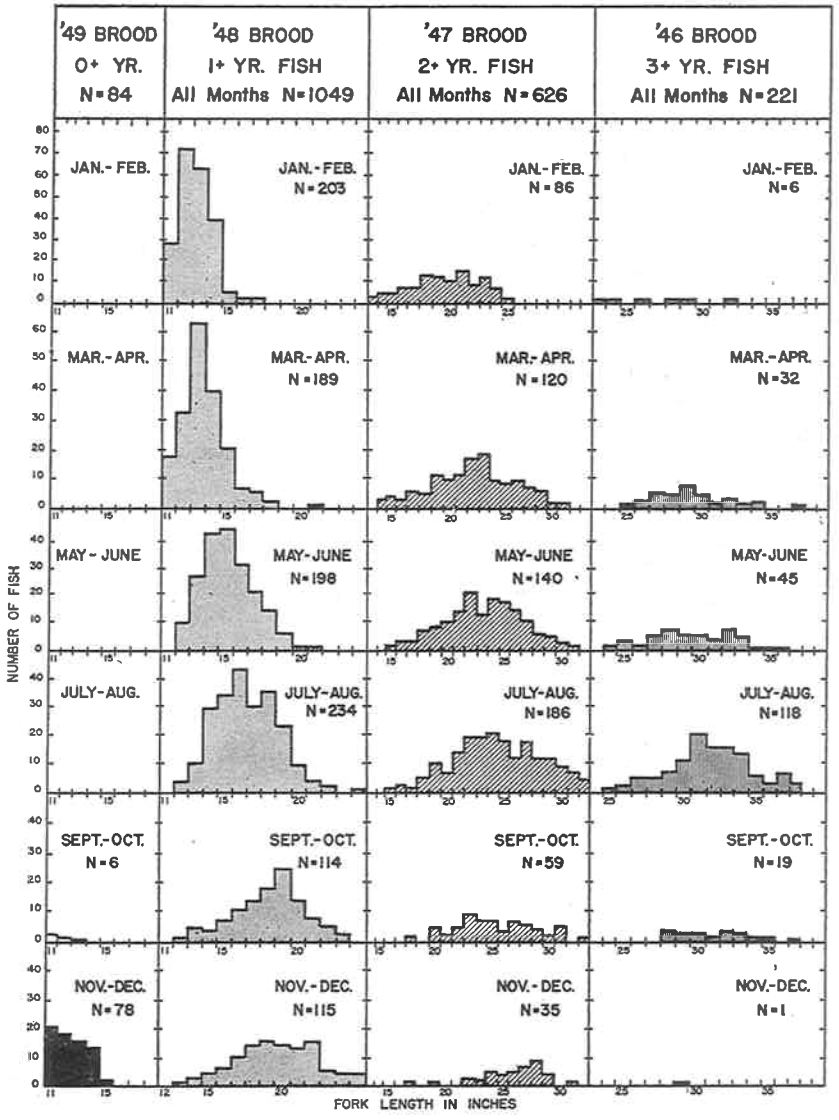


Figure 6

1950 CHINOOK SPORT CATCH

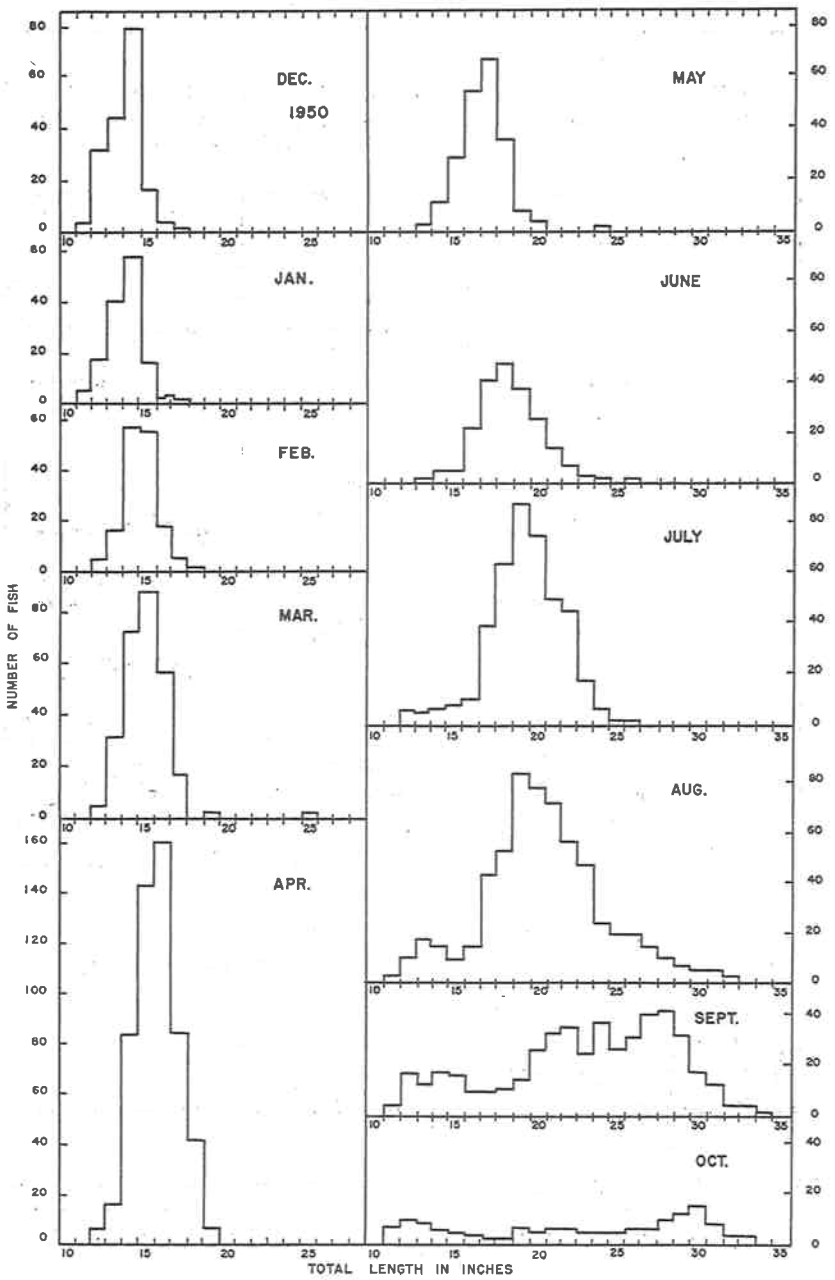
LENGTH DISTRIBUTION IN RELATION TO AGE



1,455 agreed on all three readings, 533 agreed on two readings and the question of age was finalized by further examination; 60 were discarded. In this analysis the ages were determined by the number of annuli counted, i.e., a

Figure 7

1951 LENGTH FREQUENCIES OF SPORT CAUGHT SILVER SALMON PUGET SOUND EXCLUSIVE OF STRAIT OF JUAN DE FUCA



2+ fish would have two annuli and would be in its third year. Fish were assigned to the 0+ year class when no annulus was visible. However, after examining the scales of 38 marked chinooks from the 1948 brood in the months of December 1949, January, February, and March 1950, it was found that on 32 of these scales the annulus was not visible yet. The age of these fish was obviously 1+ years. From additional marked fish recoveries of the 1948 brood, it was noted that the majority of the first annuli could be detected in April and May, but some were not visible until the month of June. All of the marked returns had "ocean nuclei" scales. It was evident that these fish were of the 1948 brood year, so all scales collected from January 1st to June 30, 1950, and not showing an annulus were assigned to the 1948 brood year.

Figure 6 shows that 1+ year chinooks dominate the catch of the inside fishery in every month of the year. The percentages of the various year classes in the sample are as follows: 4 per cent were 0+; 53 per cent were 1+; 32 per cent were 2+; and 11 per cent were 3+. Since only eight fish were found to be 4+ years, they were not considered in the overall analysis.

Only 112 scales were obtained in the outside sport fishery in 1950. Age analysis of this sample showed that only two fish were 1+; 32 were 2+; 77 were 3+; and one fish was 4+. Although this small sample is not directly comparable to the inside sample, it is evident that the outside fishery is fishing on more mature stocks. Length frequencies taken in 1951 (Figure 5) support this assumption, as very few fish under 20 inches in length are landed in the straits.

A rather steady growth is shown by the 1948 brood (Figure 6). The mode progresses from 13 inches in January and February to approximately 20 inches in December.

Silver Salmon

Unlike the chinook landings, the silver salmon catch consists largely of only one year class. Most of the silvers first appear in the sport landings in December as two-year-old fish. They grow rapidly during their third year, and by November they leave the fishery to spawn as mature fish.

From December 1950 through October 1951, 3,436 silver measurements were taken from the inside landings. The growth of the silver is very clearly shown by the length frequency data (Figure 7).

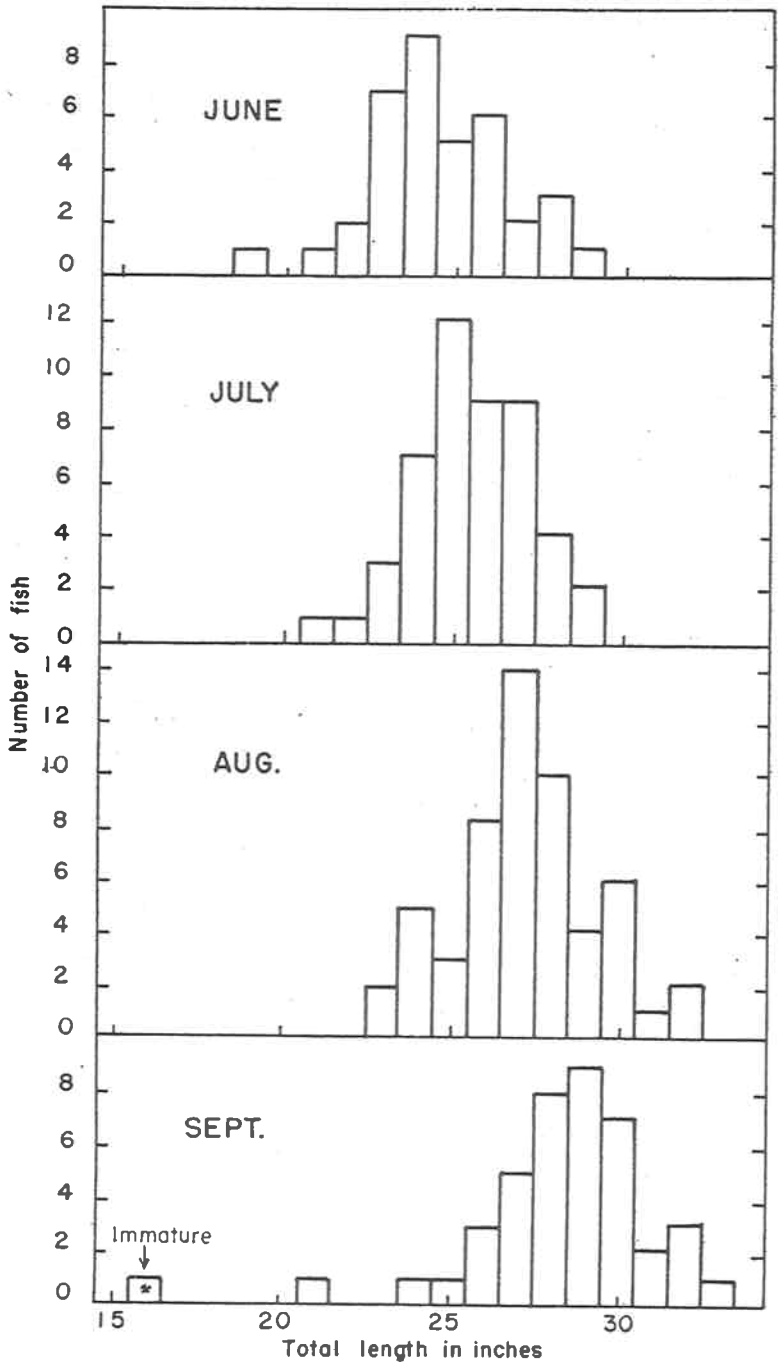
The movement of the mode to the right as the season progresses is plainly evident. The appearance of a larger group of fish in August, which become prominent in September, is not attributed entirely to growth. It is assumed that the presence of these larger fish is due to the influx of ocean-run silvers in the inside fishery. The first segment of the oncoming year class appears in the catch in August. When possible, the gonodal development was checked on the smaller fish to determine in which brood year they belonged. As a general rule, most of the fish over 15 inches in August, September, and October were mature and would be spawning in the near future. It is probable that some of the males were precocious jacks of the oncoming year class.

Length measurements taken in the Strait of Juan de Fuca on the same year class (Figure 8) contrast sharply with the inside sample.

Outside measurements show nearly a complete absence of fish under 20 inches in length. During comparable months, silvers under 20 inches constitute a high percentage of the Puget Sound landings. Modal lengths in the Strait are six to seven inches larger during the months of June, July, and August. By September, however, the inside landings have many large fish comparable

Figure 8

LENGTH FREQUENCIES OF 1951 SPORT CAUGHT SILVER SALMON IN STRAIT OF JUAN DE FUCA (NEAH BAY, SEKIU AND PORT ANGELES)



to the Strait of Juan de Fuca. Puget Sound measurements taken in September do not show clearly a bi-modal distribution, but it is possible that such a distribution does exist and is masked by the overlap of the two size groups. Van Hyning (1951) found that from June to November the modal length of troll-caught silvers increased only 5.2 inches in six months. It is improbable that the dominant 19-inch silver in Puget Sound in July would experience a growth to 28 inches in September.

Milne (1950) found that there was a definite difference in growth of silver salmon on the east and west coasts of Vancouver Island. He reports that "those caught in outside waters are from two to four pounds heavier than those taken in inside waters." Milne also noted an influx of large outside fish in September. In Puget Sound waters this influx of ocean silvers apparently starts in August.

The reason for this difference in growth is open to conjecture. It is plausible that resident Puget Sound silvers find feeding conditions poorer than do their brothers and sisters foraging in the ocean. Past data do not point to the presence of slow-growing stocks from any particular streams. Marked fish recoveries indicate that silvers from many of the streams migrate to both Puget Sound and outside waters.

Immature Salmon Catches

The catch of small salmon by sport anglers has been a point of controversy for many years. It has been the general belief that the majority of small immature salmon are landed during the months of December, January, and February. To the casual observer, it may appear that the catch of these small fish is more critical in the afore-mentioned months than at any other time of the year. However, actual data collected by the department do not confirm this point. Table 3 depicts percentages and numbers of chinook and silver salmon in the sport catch under 16 inches calculated from the measurements of 3,222 chinook and 3,436 silvers taken in 1951.

Table 3

CALCULATED NUMBERS AND MONTHLY PERCENTAGES OF CHINOOK AND SILVER SALMON UNDER 16 INCHES IN THE 1951 SPORT CATCH IN PUGET SOUND①

MONTH	Number of Chinook	Per Cent of Catch	Number of Silvers	Per Cent of Catch
January	4,192	60%	6,168	96%
February	3,377	67%	7,221	85%
March	1,887	54%	13,251	72%
April	5,402	40%	14,700	47%
May	2,431	25%	4,037	20%
June	2,454	14%	699	4%
July	1,705	12%	1,210	5%
August	784	7%	2,515	9%
September	366	5%	3,165	14%
October	290	11%	2,244	25%
November	507	13%	996	25%
December	2,292	47%	5,718	96%
Totals	25,687		61,919	
	25.76% of inside Chinook catch. 19.5% of total Chinook catch.		31.8% of inside Silver catch. 29.% of total Silver catch.	

① Excluding Strait of Juan de Fuca.

Approximately 9,861 chinooks under 16 inches in length were boated by sportsmen during the months of December, January, and February. Comparing this with 10,287 chinooks under 16 inches landed by anglers during the months of April, May, and June, it is apparent that actually the late spring and early summer fishery is harvesting more small chinooks than the winter fishery. Considering six-month periods, from April 1 through September 30, a total of 13,142 chinooks under 16 inches were caught, whereas from October 1 through March 31, 12,545 were landed.

The most critical period for small silvers is March, April, and May. In 1951, 31,988 silvers under 16 inches were landed. Only 19,107 silvers under 16 inches had been caught during the preceding months of December, January, and February.

While it is true that a larger **percentage** of the catch during the late fall and winter months is small chinooks and silvers (Table 3), the intensity of the fishery is greatly decreased during those months (Table 4) and the actual **number** of small fish caught is less than in the spring and summer.

Table 4

CATCH BY MONTHS IN 1951 SPORTS FISHERY

MONTH	Number of Boats	Number of Fishermen	Chinook	Silvers	Pink (Humpy)	Total Salmon	Average Per Fisherman
January	5,448	9,416	6,987	6,382	.....	13,369	1.42
February	6,819	11,872	5,055	8,496	.....	13,551	1.14
March	8,662	16,685	3,494	18,404	42	21,940	1.31
April	19,901	38,429	14,468	31,308	198	45,974	1.19
May	22,993	41,985	12,199	20,218	564	32,981	.79
June	37,311	75,530	23,797	16,642	1,320	41,759	.55
July	55,052	115,923	29,538	25,401	2,467	57,406	.49
August	68,026	145,473	16,664	37,611	12,456	66,731	.46
September	53,313	107,990	8,094	25,032	11,540	44,666	.28
October	14,332	27,223	2,604	9,538	40	12,182	.44
November	6,224	10,722	3,930	3,987	.....	7,917	.73
December	5,075	8,241	4,902	5,835	.....	10,737	1.30
Totals	303,756	609,489	131,732	208,854	28,627	369,213	.61

During the winter only three areas are actually being fished with any intensity. Represented in these areas are only 10 operating boathouses, while during the spring and summer 152 boathouses are operating full time. The incidence of private boats is also higher during the spring and summer than in the fall and winter.

Gear Study

During 1950 and 1951, a limited study of the effectiveness and selectivity of various lures was conducted. Considerable criticism has been directed toward the use of multiple spoon gear, so special attention was given to the numbers and size of the catch of this lure. Multiple spoons are fished by trolling with worms or small pieces of herring attached to a trailing hook. This lure is commonly used during the winter and spring months.

A tally of fish was recorded in December 1951, in one of the winter fishing areas, where 124 fishermen using multiple spoons caught 142 silvers and 6 chinook. All of these fish were under 18 inches. A tally of fish landed by

fishermen using mooching gear showed that 134 fishermen boated 83 chinook and 13 silvers. Seventy-one of the chinook were under 18 inches, and all of the silvers were small. These data indicate that multiple spoons are primarily selective for silver salmon and are not an effective lure for chinook. Mooching gear appears to attract chinook salmon of all sizes.

During the spring of 1949 Mr. Hans Jensen of the Fisheries Department conducted a program of tagging small salmon caught on sport-type gear. During a 3-week period in March, two sets of multiple spoons were fished simultaneously with two single spoon lures. All of the fish landed were under 20 inches in length. Multiple spoons caught 78 silvers and no chinook. Single spoons accounted for 105 silvers and 30 chinook. From these results, it is again apparent that multiple spoons primarily catch silver salmon. Considering only the silver catches, a chi-square test still shows the single spoon a significantly more effective lure than the multiple spoon. It must be remembered that this experiment represented catches from only one area and during only three weeks of the year. Different areas and seasons might change the pattern of catch of the two lures.

Smith and Lindsay (1942) conducted a similar gear experiment in January, February, and March. Their results also showed the multiple spoon selective to silvers and the single spoon satistically a more effective lure.

Summary

1. The salmon sport fishery in Puget Sound is not a recent development. Gear used by early day sportsmen was relatively simple in comparison to the elaborate tackle of the modern-day angler. For the past 30 years, there has been a trend toward the use of progressively lighter gear in the sport fishery. There are three basic fishing methods in the sport fishery, trolling, spinning, and mooching.
2. The sport fishery is conducted in 11 areas of Puget Sound and the Strait of Juan de Fuca. There are over 150 boathouses and 4,000 rental boats in these two areas.
3. The intensity of the sport fishery has increased by more than 375,000 fisherman days annually in 12 years. Along with this increase of gear the average chinook catch per unit of effort has declined from 0.38 in 1938 to 0.21 in 1951. The catch of silvers per fisherman trip has decreased from 0.69 in 1941 to 0.34 in 1951.
4. Chinooks landed in the Strait of Juan de Fuca are larger than the inside catch. Over 50 per cent of the Puget Sound chinook catch is under 20 inches in length.
5. The inside chinook catch showed a dominance of 1 + year fish with 2 + next in abundance. The outside catch was dominated by 3+ year fish with 2+ secondary.
6. The Strait of Juan de Fuca silver catch consists of a much higher percentage of large fish than do the Puget Sound landings. Outside silvers apparently grow larger than do resident Puget Sound silvers of the same age. An influx of "ocean silvers" into the Sound starts in August and becomes quite common in the sport catches by September.
7. Contrary to popular belief, more chinooks under 16 inches are landed by sportsmen during April, May, and June than at any other time of the year. The largest landing of silvers under 16 inches occurs during the months of March, April, and May.

8. Single spoons appear to be a better lure for silver salmon during the month of March. Multiple spoons are very selective to silver salmon.

Acknowledgments

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