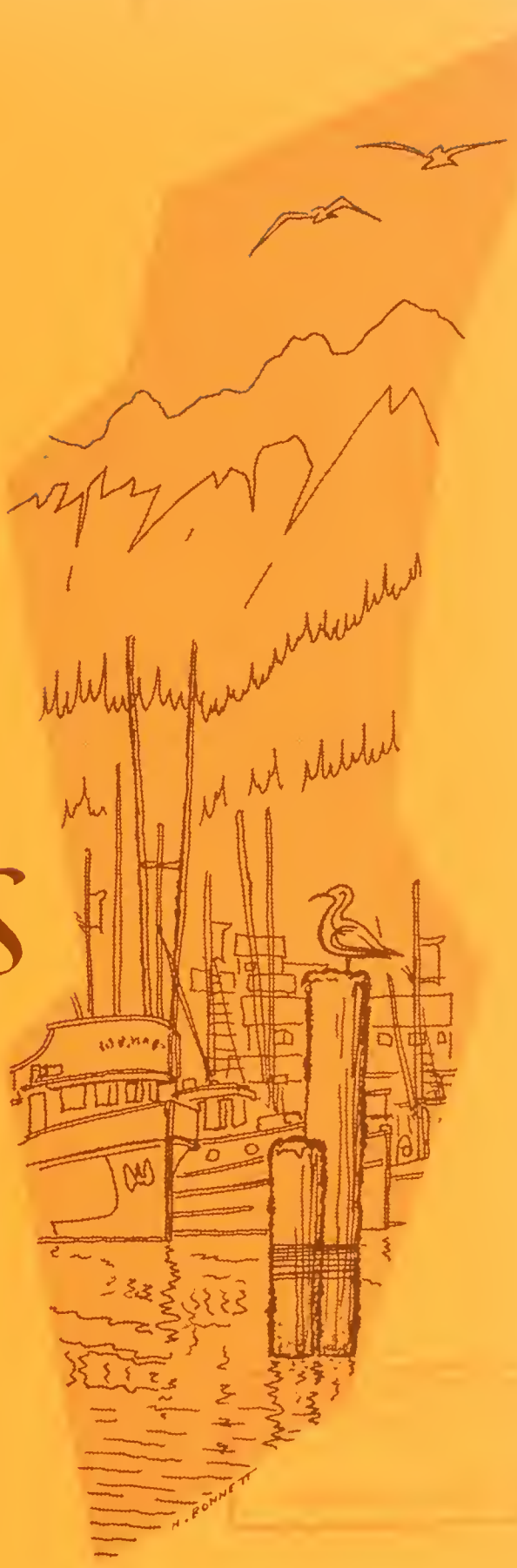
Alaska Fisheries briefs



FISH AND WILDLIFE CIRCULAR 59

FISH AND WILDLIFE CIRCULAR 59
ISSUED AT JUNEAU · SEPTEMBER 1959

The collection of papers included in this Circular are intended to acquaint the fishing industry of Alaska and neighboring regions with some aspects and preliminary results of investigations which are being undertaken by the Bureau of Commercial Fisheries and its contractors in Alaska.

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contents

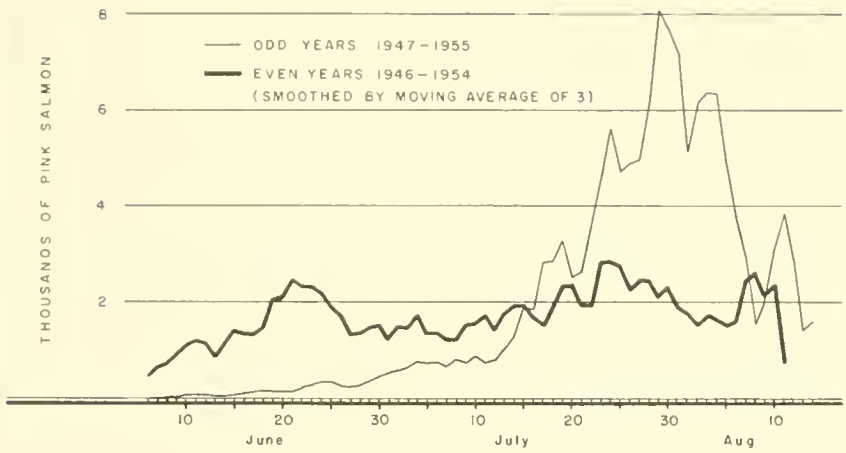

Figure 1. Seasonal occurrence of pink salmon as shown by average daily trap catches

of difference are apparent. An alternation of cycles exists in which the early runs, those before July 1, are more abundant in even years. From 1946 to 1955, the early trap catch in even years was about 33 percent of the season's total; in odd years about 4 percent.

Cannerymen of the district and others have long observed and speculated on the small size of pink salmon taken during the early season. These fish vary in average size from 25 to as high as 35 per standard 48-pound case, as compared to the general seasonal average of 18 to 25 per case. If the pink salmon found in June were to remain in the fishery until late July, it is quite possible that they would reach the larger size. Whether the fish are small because of the time of the year in which they are captured or because of a distinct racial character is as yet unknown--it is a matter for further study.

Description of Tagging Program

The 1958 tagging program was carried out during most of the commercial fishing season. Salmon for tagging were captured between June 23 and August 3 in commercial traps and by purse seines at sites between False Pass and Ivanof Bay (figure 2). Serially numbered plastic disc tags one-half inch in diameter were attached to the fish with nickel pins at the base of the dorsal fin. These tags bore a number, notice of reward, and the address where they were to be returned. To stimulate returns from the commercial fishery, tag-return envelopes and posters that described the program and detailed the information desired were distributed. A reward of one dollar was paid for each tag returned. Canneries in the region and Bureau of Commercial Fisheries employees in the field collected tags and paid the rewards.

To gain information on home stream destinations and timing of the runs in relationship to the fishing seasons, a tag recovery program in streams was carried out after the commercial fishing season.

The tagging experiments are summarized in table 1. The number and percent recovered from commercial fisheries and the personal-use fisheries in Kuskokwim Bay and northward are also shown.

Separation of local and migratory runs

Pink salmon runs vary in time of occurrence and have characteristic peaks of abundance in different sections of the Alaska coast. The characteristics of the Peninsula runs (the long period pink salmon are available to the fishery; two peaks of abundance in even years, and size variations within the season) indicate that the fishery is operating on a complex of races. In particular, it may be argued that pink salmon taken in June are intercepted while en route to other areas. Three points in support of this hypothesis can be demonstrated from results of the 1958 tagging program.

1. Returns from individual experiments- For comparison, in figure 3 the percent recovery from each experiment is shown in chronological order of tagging. The percent of tags returned per experiment varies sharply with the time of season. The extremely low recovery of fish from June experiments, which coincide with the first peak of the even-year runs, can be explained only

by assuming that these fish were traveling through the district. Had these fish remained in the area, recoveries should have been as great as those from experiments between July 10 and 20, because fish would have been available to the fishery for a longer period.

The increase in returns during early July and the high rate of recoveries during mid-July are explained by the entrance of increasing numbers of pink salmon of local origin into the fishery. These for the most part are available to the fishery for a longer time. The decrease in returns at the end of July and early in August is due to the fact that chances for recapture were limited by the ending of the fishing season on August 5. Stormy weather at this time hampered fishing activity, and pink salmon began to enter streams of the district, further reducing recovery.

2. Destinations of tagged pink salmon- The low rate of recovery from the early tagging experiments needs additional explanation before it can be completely accepted as evidence of traveling fish. The explanation lies in the destination of the tagged fish. Pink salmon that were tagged during June and early July were first recaptured near the tagging sites and later at the following widely divergent points along the Bering Sea Coast: Makushin Bay and Dutch Harbor on Unalaska Island, Kvichak and Nushagak Bays in Bristol Bay, the Kanektok River which enters Kuskokwim Bay, the Yukon River, an unnamed creek near Nome in Norton Sound, and the Unalakleet, Shaktoolik, and Koyuk Rivers, which enter Norton Sound. Three pink salmon were also captured in the Kodiak Island area. The scattered recoveries from Nushagak Bay and north, which comprise a major portion of the low total return from the early experiments, are extremely significant, because no commercial fishing for pink salmon is carried on in the area (except in Nushagak Bay). The chances of tagged fish being recaptured are relatively small. Further, no effort was made to secure returns from this section of the coast. The small number of local recoveries from these tagging experiments may represent the first of the local spawners to enter the fishery. But more likely the low recovery rate reflects the rapid movement of fish out of the area. The dispersion of tagged pink salmon to widely separated points is evidence of the broad

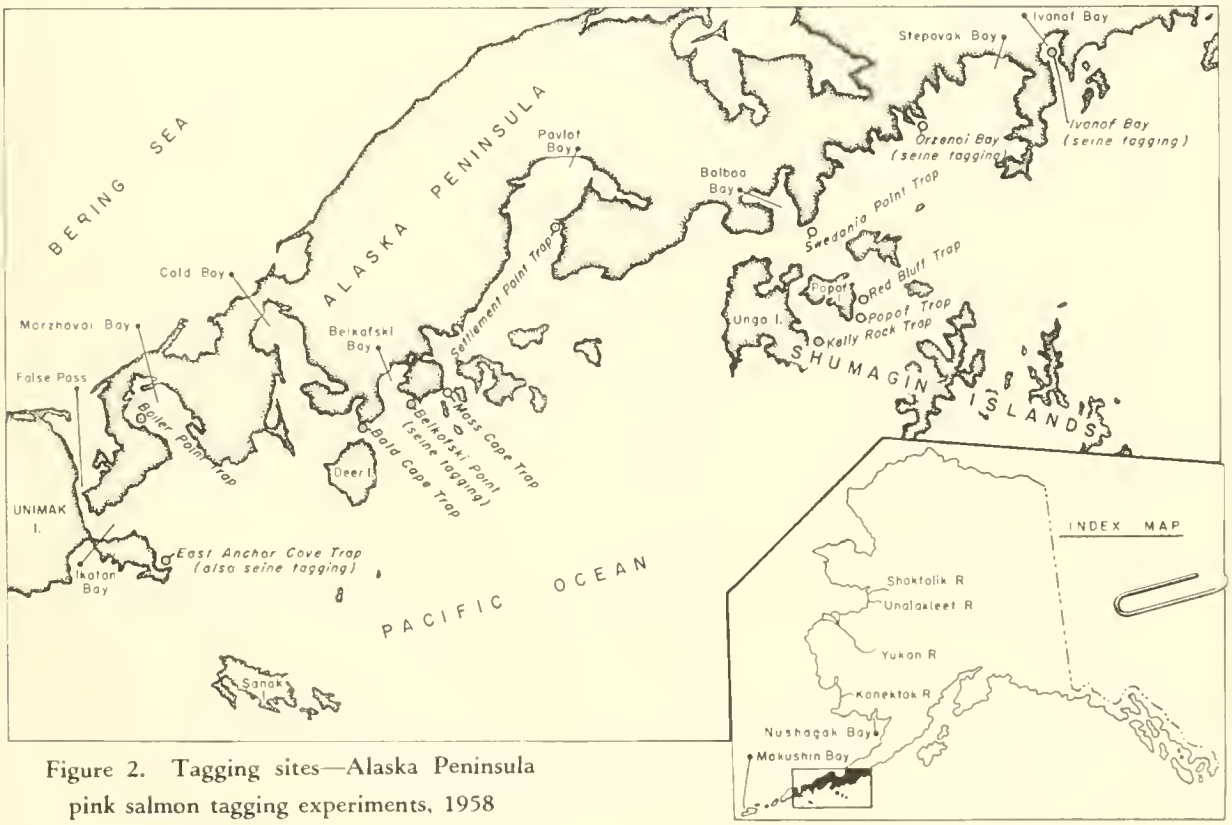

Figure 2. Tagging sites—Alaska Peninsula pink salmon tagging experiments, 1958

mixture of races that make up the June run in the Peninsula area.

3. Isolation of migratory runs-Time of occurrence of migratory runs in the fishery is best shown by comparing local and nonlocal tag recoveries in relation to time tagged (figure 4). Most pink salmon bound for distant places have passed through the area by July 10; few traveling fish are found after July 1. Additional analysis is needed to determine if all pink salmon in the area during June are migrants, or if the runs consist of a mixture of local and nonlocal stocks. Present evidence indicates that most of the early-run fish should be considered migrants. From tag returns, it is apparent that local fish far outnumber migrants after July 1. For practical purposes this date should be used to separate and distinguish the two groups.

Patterns of movement within the area

After July 1, when the catch can be considered to be composed mainly of Peninsula fish, the patterns of local movement are of primary interest. Results of tagging after July 1 indicate that these runs can be differentiated both in space and in time.

For the purposes of discussion and comparison, the results of tagging experiments performed over short intervals of time at the same

Table 1. Summary of pink salmon tagging experiments on the Alaska Peninsula

Date tagged	Tagging site	Number tagged	Number recovered	Percent recovered
June 23	Kelly Rock Trap	155	8	5.2
26	Kelly Rock Trap	166	13	7.8
28	East Anchor Cove (Seine)	142	7	4.9
29	East Anchor Cove Trap	137	8	5.8
29	Swedania Point Trap	74	10	13.5
30	East Anchor Cove Trap	85	5	5.9
July 1	Red Bluff Trap	229	50	21.8
2	Popof Trap	115	32	27.8
2	Boiler Point Trap	60	14	23.3
7	Boiler Point Trap	216	100	46.3
9	Kelly Rock Trap	211	61	28.9
10	Boiler Point Trap	311	174	55.9
15	Boiler Point Trap	257	182	70.8
16	Boiler Point Trap	377	213	56.5
17	Boiler Point Trap	209	105	50.2
18	Boiler Point Trap	210	118	56.2
18	Ivanof Bay (Seine)	95	64	67.4
20	Ivanof Bay (Seine)	257	149	58.0
20	Belkofski Point (Seine)	81	45	55.6
21	Bold Cape Trap	124	47	37.9
22	Bold Cape Trap	101	41	40.6
23	Bold Cape Trap	198	91	46.0
24	Popof Trap	344	125	36.3
27	Bold Cape Trap	202	83	41.1
27	Kelly Rock Trap	499	132	26.4
28	Kelly Rock Trap	498	119	23.9
29	Swedania Point Trap	199	69	34.7
29	Settlement Point Trap	200	103	51.5
30	Settlement Point Trap	213	77	36.2
August 1	Orzenoi Bay (Seine)	399	8	2.0
3	Moss Cape Trap	204	37	18.1
3	Kelly Rock Trap	496	68	13.7
Total		7,064	2,358	33.4

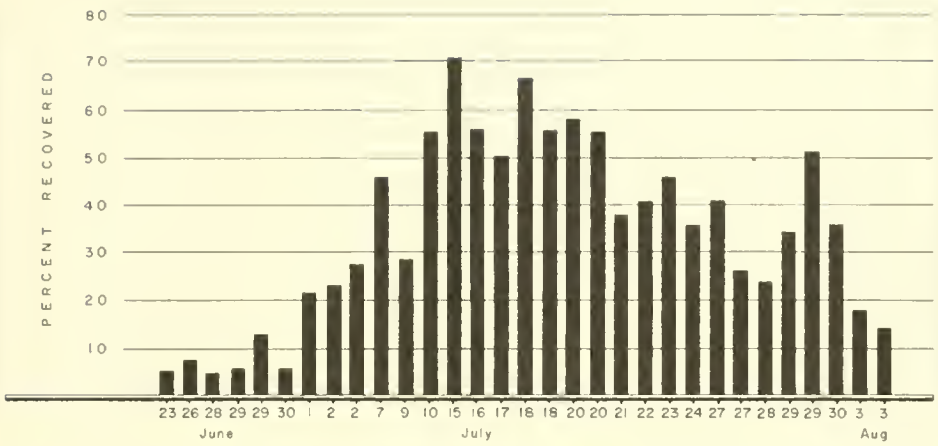

Figure 3. Recoveries of pink salmon tagged in the Alaska Peninsula area during 1958

site have been combined. (Experiments carried out at traps located in the Shumagin Islands and at Swedania Point have been considered as one site and are termed Shumagin experiments.)

Segregation of local runs-Figures 5 and 6 illustrate the dispersion of fish tagged at sites in Morzhovoi Bay, Pavlof Bay, and the Shumagins. They show there is little intermingling between pink salmon of the eastern and western sections of the coast.

Pink salmon tagged in Morzhovoi Bay remained almost exclusively in waters at the southwestern part of the Peninsula. Eighty-six percent of the recaptures were from this section--Cold Bay, Morzhovoi Bay, and Ikatan Bay. Only 4 percent of the returns were from areas east of Cold Bay. No salmon tagged at Morzhovoi Bay were recaptured east of the Shumagin Islands (figure 5). On the other hand, pink salmon that were tagged in the Shumagins showed a wide range in movement, both in easterly and westerly directions. The movement to areas west of Pavlof Bay was minor and decreased as the season progressed. Tag recoveries in this section of the coast from the Shumagin experiments were as follows: July 1 to 9, 13 percent; July 24 to 28, 5 percent, and July 23 to August 3, 0 percent. Even more significant is the fact that recoveries from areas on the mainland east of the Shumagin Islands were almost entirely from Shumagin experiments. This indicates that runs in the western and eastern section of the coast are independent.

The Pavlof and Shumagin experiments illustrate further segregation. The Shumagin traps are located in outside waters, at outer points, capes and headlands. The wide range of recoveries from tagging at these sites indicates that the gear deployed in these localities intercepts runs composed of a mixture of races. A similar pattern of dispersion was observed for all experiments carried out at the other outer points--East Anchor Cove, Bold Cape, Belkofski Point, and Moss Cape. In contrast, the distribution of fish tagged in bays was limited, indicating separation into distinct populations.

Tagging experiments performed in Ivanof and Orzenoi Bays also demonstrate this clearly. Two experiments were carried out in Ivanof Bay; 95 pink salmon were tagged on July 18 and 257 on July 20. Returns from both experiments were extremely high, 67 and 58 percent, respectively, but not one recapture was reported from outside Ivanof Bay. Later in the season, on August 1, 399 pink salmon were tagged in Orzenoi Bay. Only 8 of these fish were recaptured in the commercial fishery. They were in the bay or adjacent waters. However, 173 of the tagged fish were found in the stream that enters Orzenoi Bay.

Segregation into distinct units in the bays is a natural function of time--as the season progresses and the fish approach sexual maturity, they seek out their natal streams--so these results are to be expected. The significant point demonstrated by these experiments is that there is apparently little tendency on the part of the fish to leave once they have entered a bay. This is in contradiction to the results of the Morzhovoi Bay

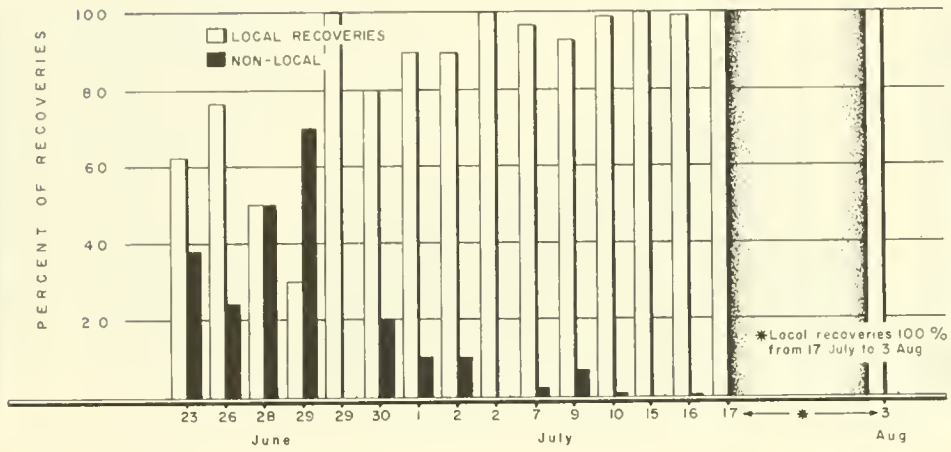

Figure 4. Comparison of local and nonlocal recoveries by time of tagging

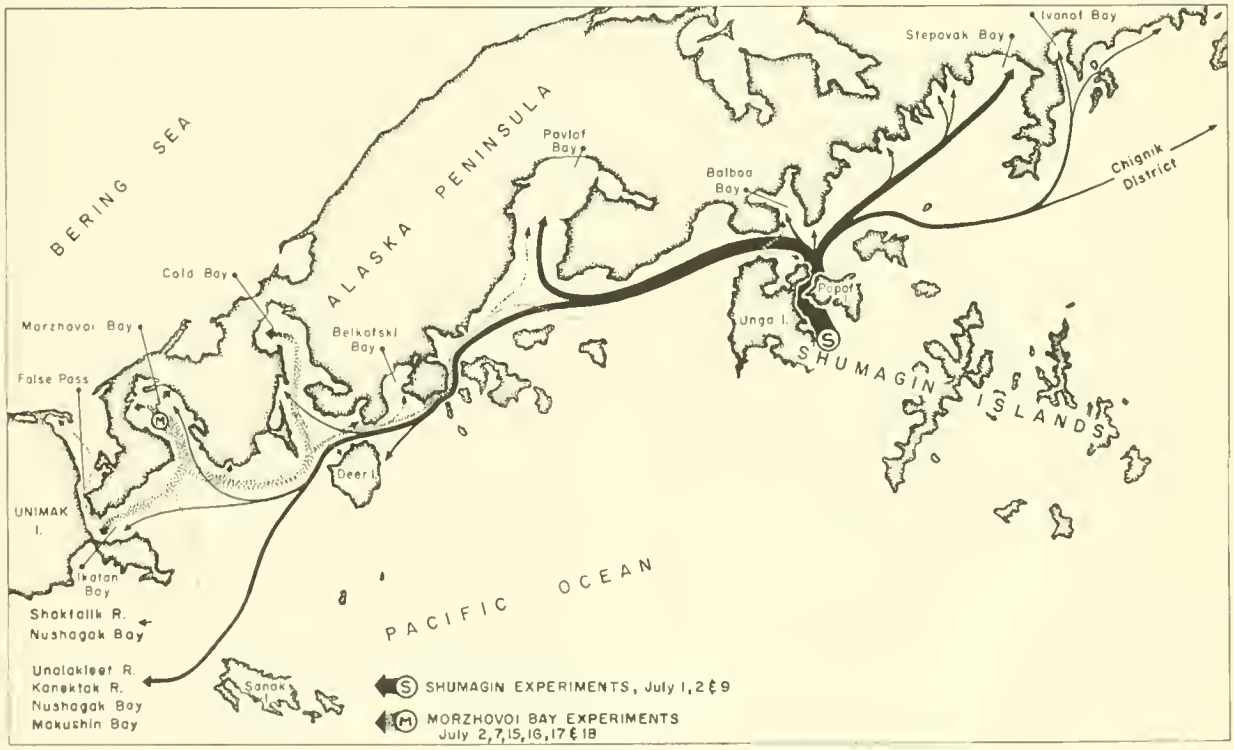

Figure 5. Dispersion of pink salmon tagged in Morzhovoi Bay and the Shumagins

experiments, which showed considerable movement out of the bay. The difference and explanation lie in the fact that the Morzhovoi Bay experiments were carried out relatively early in the season when the salmon were still en route to their parent streams.

Conclusion

This report is a partial analysis of the 1958 tag recovery data. Much detail has been omitted, and much remains to be done before the analysis is complete. The distribution of fishing effort and the relative abundance of pink salmon in the various sections of the Peninsula area have not been considered in relation to the distribution of tag recoveries. This must be done before the true significance of these results can be stated. Yet, incomplete as they are, the results of this study have immediate value in the management of the fishery.

During June the fishery is supported by runs of pink salmon bound for Bristol Bay and areas along the northeast Bering Sea coast.

There is little intermingling of fish that appear in the fishery west of Bold Cape with those that appear in the waters of the Shumagin Islands and the mainland coast north and east of the Shumagins. Pink salmon bound for mainland bays north and east of the Shumagin Islands, particularly that reach of coast from Balboa Bay through Stepovak Bay, pass through the Shumagins. The fishery west of the Shumagins does not appear to draw on these runs.

For practical purposes, the western limit of migration of fish passing through the Shumagins after July 1 should be considered as Pavlof Bay. The data indicate that the area comprised of Ikatan Bay, Morzhovoi Bay, and Cold Bay should be considered as a unit.

Once pink salmon enter bays of the area they show little tendency to leave, especially after mid-July. Further, populations within a given bay after this time tend to be distinct; tagging within bays showed very few individuals traveling to either adjacent or distant waters. Under these circumstances it can readily be seen that heavy fishing could reduce the runs to dangerously low levels.

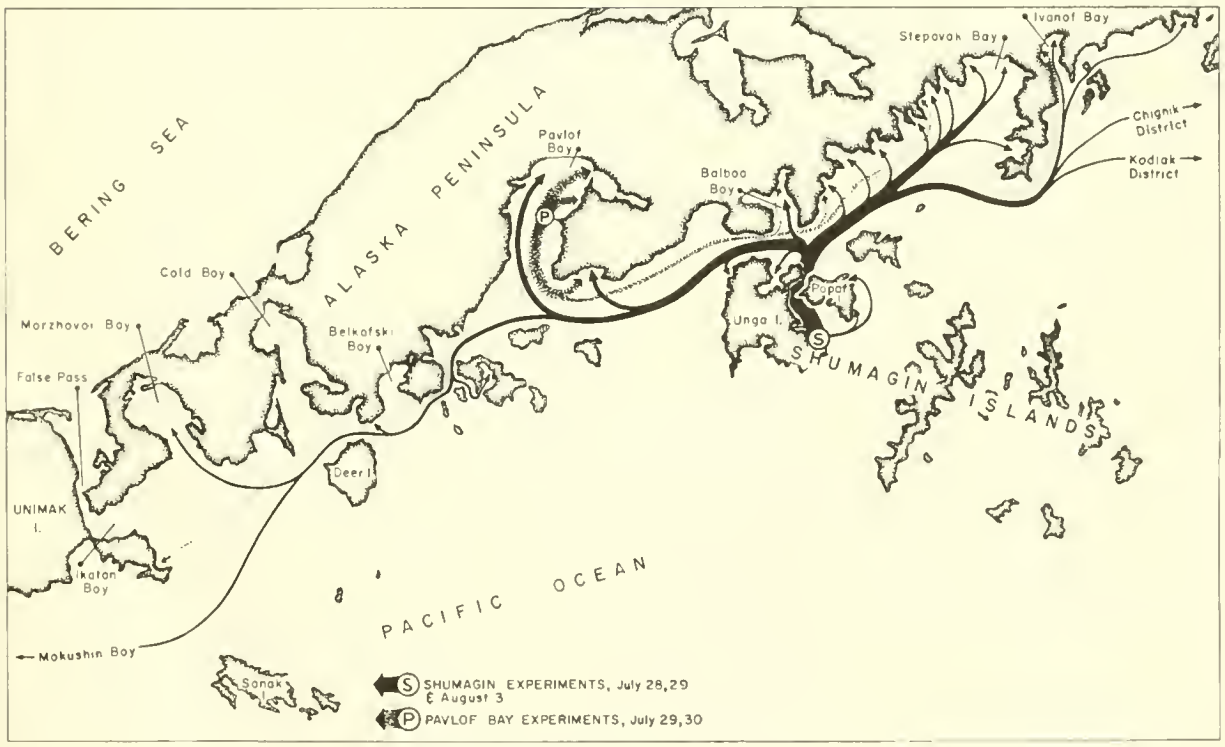

Figure 6. Dispersion of pink salmon tagged in Pavlof Bay and the Shumagins

SALMON MIGRATIONS IN SOUTHEASTERN ALASKA

Wallace H. Noerenberg

A salmon tagging program conducted off the west coast of Prince of Wales Island in southeastern Alaska in 1957 and 1958 was planned primarily to determine destinations and migration routes of the runs of pink (Oncorhynchus gorbuscha) and red salmon (O. nerka) that are intercepted by the fishery in the vicinity of Noyes Island. The tagging was done by the Fisheries Research Institute of the University of Washington under contract to the Bureau of Commercial Fisheries. The area studied is the region referred to by the Bureau of Commercial Fisheries as the West Coast Management District (figure 1).

This report comprises only preliminary general summaries of the release and return of the tagged fish and some interpretation of results. Detailed analysis of the data has just been started.

The timing and abundance of pink salmon runs at Noyes Island have been variable and, at times, apparently unrelated to the appearance of runs in adjacent inshore areas of southeastern Alaska. Catches of pink salmon at Noyes Island nearly always remain low throughout the early seine season (July). The general open season for the use of seines and traps begins during the last week of July, but catches usually do not become large until mid-August. The peak of the catch generally occurs during the last two weeks of August, following which the fishing season is closed.

In contrast to the usual situation, the 1957 run of pink salmon at Noyes Island occurred very early in the season and was unusually heavy. Peak catches were made during the last week of July and the first week of August. Owing to exceptionally calm weather and poor runs elsewhere in southeastern Alaska, almost the whole southeastern Alaska seine fleet appeared at Noyes Island during this period. In 1958 pink salmon catches were unusually poor at Noyes Island throughout the season, although a small peak occurred in mid-August. Scarcity of fish and poor weather limited the activity of seine boats. The atypical character of the pink salmon runs of the two years should be considered in assessing results of the tagging.

Location and extent of tagging

The West Coast Management District has been divided into two sections for the purpose of summarizing the tagging results in this report. The "outer section" consists of the west coasts of Noyes, Baker, Suemez, and Dall Islands and includes tagging locations at Cape Ulitka, Roller Bay, Cape Addington, and Granite Point. The "inner section" consists of all waters of the district east of the outer section and includes the tagging locations at Point Desconocida, Tranquil Point, Ruth Bay, and McLeod Bay. These locations are shown in figure 1.

The principal sources of fish for tagging in both 1957 and 1958 were two salmon traps on the north shore of Noyes Island at Cape Addington and Cape Ulitka. Additional tagging was done during the early seine fishery in the vicinity of these same capes on Noyes Island and at Granite Point, Baker Island, in 1958, and from other salmon traps in both years.

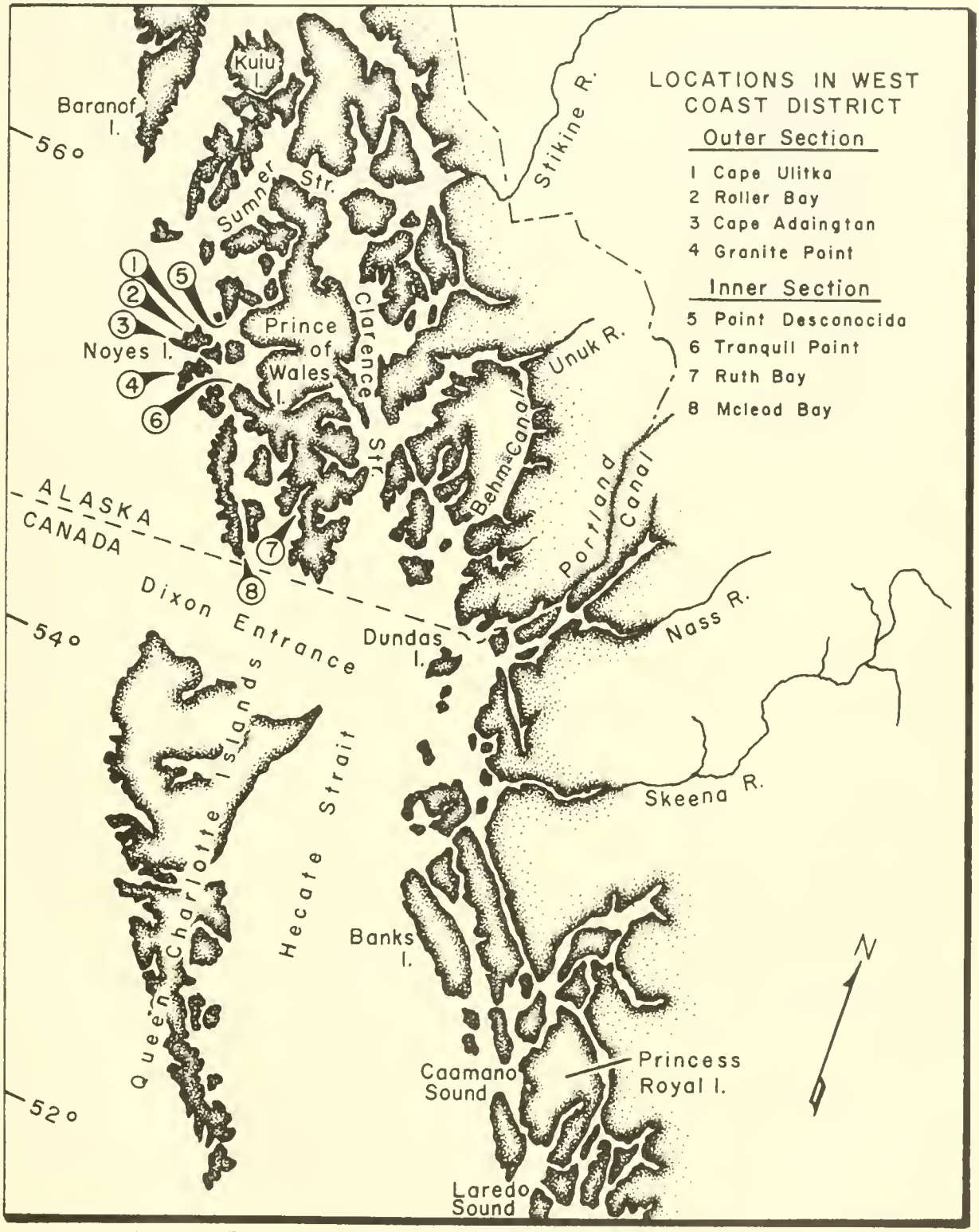

Figure 1. Dixon Entrance and vicinity showing 1957 and 1958 tagging locations

Table 1 shows the numbers of pink and red salmon tagged each year in the outer and inner sections of the West Coast Management District. The dates of tagging are also given. In addition to the pink and red salmon listed in the table, taggings in 1958 included 492 chum (O. keta), 574 coho (O. kisutch), 9 king salmon (O. tshawytscha), and 4 steelhead trout (Salmo gairdneri gairdneri).

Preliminary results from returns

Table 1 shows gross returns from tagging of both years for each of the following four components: American fishery, American spawning grounds, Canadian fishery, and Canadian spawning grounds. It should be noted that, in total, the proportion of both pink and red salmon tags returned was about equal for the two years. Some components of these returns, however, exhibit very great differences between the years. During the 1958 season, American fishery returns came principally from inside waters, while in 1957 a large proportion of the tagged salmon came from the immediate vicinity of the tagging locations at Noyes Island. Despite the dispersion of the American fleet from the immediate tagging area in 1958, the percentage recovery of tagged fish increased over 1957. The percentage of recovery on American spawning grounds was almost the same for the two years for pink salmon, but for red salmon it was slightly greater in 1958. Of major interest was the large decrease in 1958 of the percentage recovery of both species from the Canadian fishery. Spawning ground recoveries of tagged pink salmon in Canada were almost nil in 1958 (3 compared to 88 in 1957) but substantially more tagged red salmon were observed at the Babine River fence weir than in 1957 (95 compared to 10 in 1957). The Babine Lake system is the major red salmon producer of the Skeena River in Canada.

Factors to be considered in the analysis of the returns are the differences in the patterns of

Table 1. Summary of results from pink and red salmon experiments on the west coast of Prince of Wales Island—1957 and 1958

Tagging location	Dates of tagging	Year	Number tagged	Number returned	Percentage returned from: American fishery	American spawning grounds	Canadian fishery	Canadian spawning grounds	Total
				PINK SALMON					
Outer section	7/16-8/25	1957	11,478	5,058	26.9	1.4	15.1	0.7	44.1
	7/ 9-8/24	1958	4,925	1,868	31.4	3.2	3.3	0.04	37.9
Inner section	8/17-9/ 2	1957	5,057	2,024	23.9	16.1	0.02	0.02	40.0
	7/22-8/25	1958	3,885	1,804	36.5	9.7	0.3	0.0	46.4
Total		1957	16,535	7,082	26.0	5.9	10.5	0.5	42.8
		1958	8,810	3,672	33.7	6.0	2.0	0.02	41.7
				RED SALMON					
Outer section	7/25-8/11	1957	499	187	18.6	0.0	16.8	2.0	37.5
	7/ 9-8/24	1958	1,483	613	25.6	0.5	9.0	6.3	41.3
Inner section*	7/22-8/25	1958	715	225	29.5	1.7	0.0	0.3	31.5
Total		1957	499	187	18.6	0.0	16.8	2.0	37.5
		1958	2,198	838	27.1	0.9	6.1	4.6	38.7

*No red salmon were tagged in this section in 1957

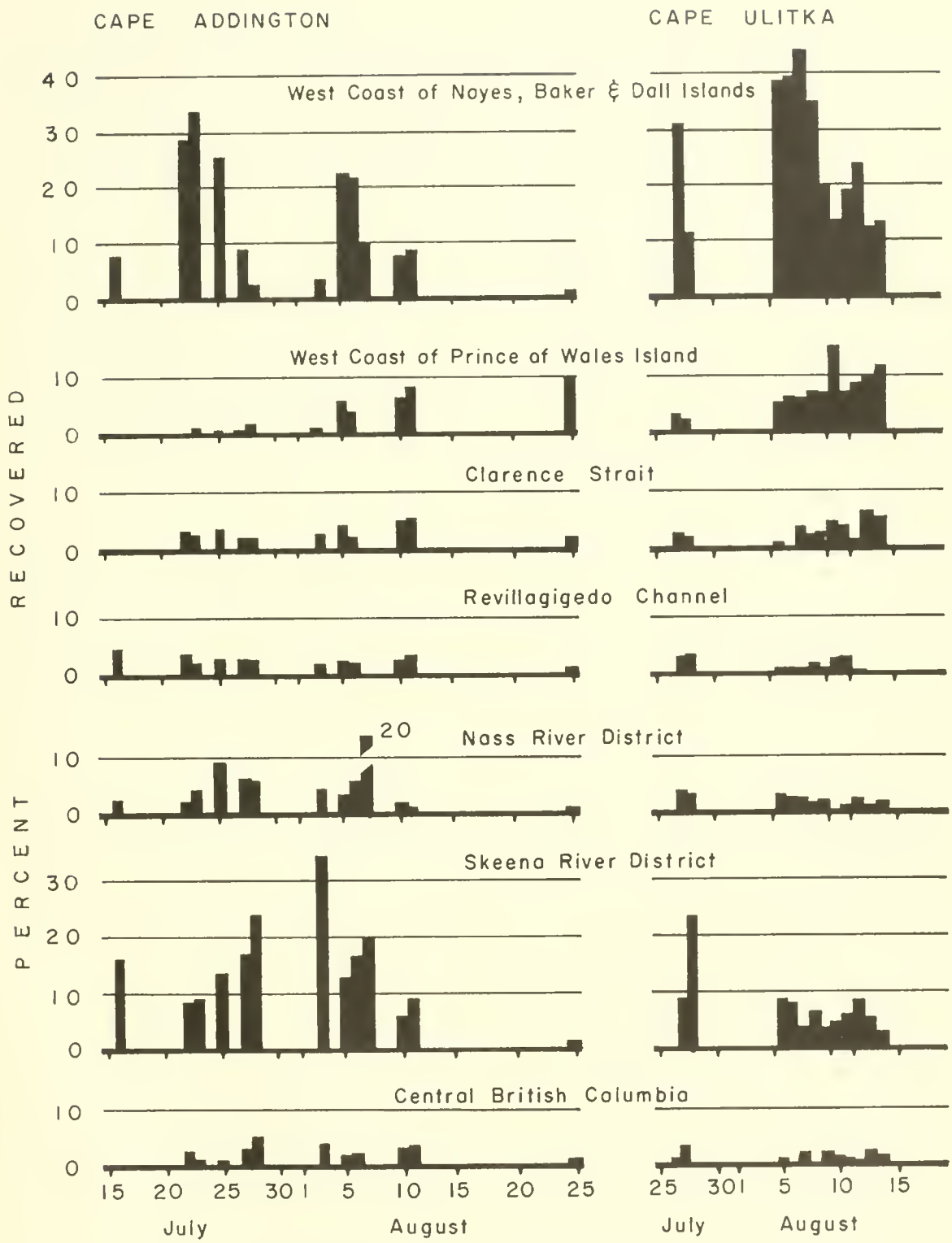

Figure 2. Percentage recovery of pink salmon in principal recovery districts from tagging experiments at Noyes Island, 1957

the returns between tagging locations in the West Coast District. Tagging each year from the traps in the inner section of the district at Point Desconocida and McLeod Bay and all experiments at Ruth Bay in 1957 and Tranquil Point in 1958 revealed insignificant Canadian returns of both pink and red salmon. Most tags were recovered in the waters surrounding Prince of Wales Island, and as the season progressed these tags tended to be more and more associated with spawning grounds in the vicinity of the tagging locations. Because of this factor, and because there was a difference between the two years in the proportion of the total tagging accomplished in the outer and inner sections, the results obtained in the two sections should be considered independently. This breakdown is given in table 1.

Seasonal variations have been noted in the percentage of recovery of pink salmon in the several recovery districts from the tagging experiments at Noyes Island in 1957 (figure 2). Pink salmon destined for Canadian and mainland areas of southeastern Alaska were most abundant in the tagging areas during late July and early August. Salmon tagged in mid-August consisted primarily of Clarence Strait stock, while late August fish were recovered from the fishery and spawning grounds of the west coast of Prince of Wales Island.

The routes taken by a considerable number of the pink salmon, tagged at Noyes and Baker Islands in July and early August of both years, appeared to be southward. These were outside the other sections of the west coast fishery and via Dixon Entrance to Clarence Strait and mainland areas north and south of the International Border. Evidence of northward movement into Sumner Strait was almost completely lacking in 1957 but was apparent for a small proportion of the salmon tagged in 1958.

In late August most pink salmon from Noyes Island moved directly inshore to the fishery of the inner waters of the West Coast District and adjacent spawning grounds. All waters in southeastern Alaska, east of Clarence Strait, were closed to fishing after mid-August, and this may have had some effect upon the pattern of returns at this time of the season.

Red salmon were important in the catches at Noyes Island during July and early August and migration patterns in most respects resembled those of the early pink salmon mentioned previously. Recoveries came principally from southern Clarence Strait and the Skeena area in both years. A small part (5 fish or 1 percent of the salmon tagged) of the red salmon returns in 1957 came from Johnstone Strait, but no returns were reported from there in 1958 although three times as many red salmon were tagged at Noyes Island as in 1957.

During both years, the movement of pink salmon tagged at Ruth and McLeod Bays in the southern part of the West Coast District was generally northward along the east and west coasts of Prince of Wales Island. Returns from the pink salmon tagged at Point Desconocida, Heceta Island, in both years and from Tranquil Point in 1958 came almost entirely from the fishery and streams along the northwest coast of Prince of Wales Island adjacent to Klawak Inlet.

Summary

This is the initial report on this project, and the conclusions drawn at this time are only preliminary. In summarizing the results in regard to the presence of salmon bound for Canadian fishing waters, the following points are evident:

1. The American fishery recovered about $2\frac{1}{2}$ times as many pink salmon tags as the Canadian fishery in 1957; 16 times as many in 1958.

2. The American fishery recovered a slightly larger number of red salmon tags than did the Canadian fishery in 1957; more than 4 times as many in 1958.

3. Returns of both pink and red salmon from Canadian fishery and spawning grounds were confined almost exclusively to fish tagged at Noyes and Baker Islands in both years.

4. More Canadian returns came from salmon tagged during late July and early August of 1957 than from those tagged during mid and late August of 1957.

5. It is necessary to make a thorough analysis of the data to obtain estimates of the number of fish bound for Canada from fishing waters along the west coast of Prince of Wales Island.

THE UNEXPECTED APPEARANCE OF PINK SALMON IN THE KVICHAK RIVER

Clarence D. Becker

In the fall of 1958 there was abundant spawning by pink salmon (Oncorhynchus gorbuscha) in the Kaskanak Flats area of the Kvichak River in Bristol Bay, Alaska. The Kvichak River, which is approximately 55 miles long, drains from Lake Iliamna and flows into Kvichak-Naknek Bay. The unexpected appearance of these fish occurred simultaneously with a tremendous, and also unexpected, run of pink salmon in the neighboring Nushagak River.

Occasional pink salmon were observed in the upper section of the river by biologists of the Fisheries Research Institute, who were working near the native village of Igiugig at the outlet of Lake Iliamna. However, no pink salmon spawning surveys were performed on the Kvichak River prior to 1958. Surveys of red salmon spawning grounds in streams tributary to Lake Iliamna revealed no spawning pink salmon populations. No observations were made in the tidal area below Kaskanak Flats.

On the basis of catch data and timing of the run, it is apparent that the 1958 pink salmon run to the Kvichak River escaped the commercial fishery almost entirely. Only about 11,000 pink salmon were delivered to the cannery at Koggiung after the close of the red salmon season in late July.

Personnel of the Fisheries Research Institute made the following observations on the pink salmon escapement from September 9 to 12.

Spawning area

Extensive spawning occurred in the surveyed section of the Kaskanak Flats, a series of shallow channels extending upriver approximately eight miles from the head of tidewater. Above the flats, spawning took place largely in shallow side branches of the main channel. The head of the Kvichak River at Igiugig was the upper limit of the spawning.

Number present

An accurate estimate of the total number of pink salmon could not be made because only one channel of Kaskanak Flats was surveyed, covering the navigable section of the river from Igiugig to Ole Creek. In this area alone, 10,000 to 15,000 pink salmon were spawning--one or two pairs of fish per ten square feet of gravel. If it can be assumed that pink salmon were present in similar numbers throughout the flats, then the spawning population in the Kvichak River in 1958 would probably have been between 150,000 and 250,000.

Time of spawning

On September 9, the time of the main survey, most pink salmon were paired on the grounds and actively spawning. The survey disclosed only occasional small groups of schooled fish. White fungus patches were present on about 50 percent of the live fish, and there were only a few dead salmon. This evidence indicates that the survey was made just after the peak of spawning.

GRAVEL REMOVAL AND THE FISHERIES

Robert McVey

Removal of gravel from streams offers a potential source of damage to Alaska's fishery resources. Although it has not been a matter for great concern in past years, continuing development will so increase gravel requirements for construction purposes that the problem may become serious. It is vital that Alaska's valuable fishery resources receive proper consideration during this period of development and growth.

Since most major construction to date has been federally financed, and appropriations for these activities have fluctuated little from year to year, Alaska's sand and gravel requirements did not show any distinct upward trend the past several years. From 1950 to 1958, over 6 1/2 million short tons of gravel, worth approximately 6 million dollars, were used each year.

Danger of damage to the fisheries would be eliminated if gravels were never taken from the streams. However, streams are often the only source from which gravels can be obtained inexpensively, and the quality of this stream-worn material frequently makes it the more desirable. Removal from streams is relatively simple and not costly since trucks can be loaded by dragline right at the stream bank.

Although the need for additional construction and road building might seem so important that it should override consideration of the fishery problem, a brief look at the value of the Alaskan salmon resource will show that to do this would be an error. Throughout the years salmon have provided the backbone of Alaska's economy. Recent years have witnessed a decline in production but the value of the annual pack has remained high (figure 1).

The value of some salmon runs should not be measured only in terms of dollars and cents. Certain native villages are highly dependent upon local runs of salmon for food; for these people, preservation of the resource is essential. Many people derive enjoyment each year from observing the salmon runs as they enter the streams. The annual enactment of this drama will become increasingly valuable as a source of recreation.

The sport fisheries of Alaska are sustained almost entirely by salmon, trout, char, and grayling, most of which are stream spawners. While a reliable estimate of the value of these fisheries is not available, their importance should not be underestimated.

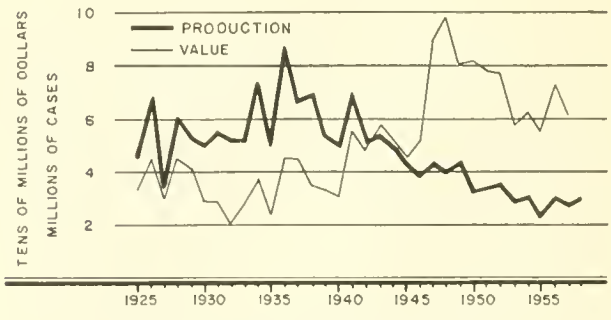

Figure 1. Production and value of Alaskan canned salmon

Although occasional gravel removals might cause only a slight decrease in a stream's potential productivity, experience has shown that complete spawning grounds may be lost if removals are carried on indiscriminately and on too large a scale. Siltation normally accompanies any removal operation in a greater or lesser degree, and the fine silt particles that are washed downstream impair percolation of water through the gravels and tend to smother both eggs and fry. Heavy equipment used on the stream bed during removal operations frequently crushes the eggs and fry. Merely the activity of the operation itself and the resultant turbidity prevents adults from spawning. More permanent effects are produced when large portions of the actual spawning beds are removed. In addition, fish might be blocked from reaching long stretches of spawning area as a result of dewatering or diversion associated with gravel excavation.

Examples of the effects of indiscriminate removal of gravels are conspicuous in a group of streams on the northeast side of Kodiak Island (figure 2). These streams, Russian River, Kalsin and Sargent Creeks, an unnamed stream which flows into Anton Larsen Bay, and a tributary of Buskin Lake, historically supported valuable runs of pink and chum salmon and Dolly Varden char. Some of them also contained runs of red and silver salmon and steelhead trout. During World War II, it became necessary to construct numerous buildings, airport runways, and an extensive network of roads. Great amounts of gravel were required, and the most expeditious method of obtaining it was by removal from stream beds. Owing to the emergency situation, there was little consideration given to the fishery values. Entire stretches of stream beds were removed to depths of 20 feet, and at some locations the tailings and silt from the washing and screening were permitted to reenter the stream channel.

Large stretches of spawning beds were removed in Russian River (figure 3) and Sargent Creek. The re-entry of tailings from washing and screening processes so reduced the average size of the stream gravels that the stream bed is now unstable and the channel pattern shifts repeatedly. As a result, the fish-producing potential has been reduced.

The effects on the tributary of Buskin Lake, the east fork of Kalsin Creek, and the unnamed stream entering Anton Larsen Bay were of a different nature. In these, stream bottom materials for distances up to 2 miles above the removal site broke up and were washed downstream. Natural layering of the silt, sand, and gravel was completely disrupted. As a result, stream flow was limited to subterranean seepage in the "slipped" area during periods of low water. Without surface flow these sections had no value as spawning grounds and, in addition, fish were not able to reach the large areas of spawning gravels farther upstream. Several miles of excellent spawning grounds were rendered completely inaccessible. This is believed to be relatively permanent since the removals described took place largely before 1944, and the gravels of only one of the streams ---that which enters Anton Larsen Bay---have shown signs of stabilization since that time. Redeposition of the layer of silt that prevents subterranean flow is largely dependent on the silt load carried by the stream. Thus, complete recovery in these clear waters will require many years.

It is possible that the decline in the fish runs of these streams could be the result of factors other than gravel removals; however, the streams where the decline was most severe were Russian River and Sargent Creek, both of which were subjected to extensive removal operations for several years. Salonie Creek flows into the same bay and is comparable in many respects with these streams, but only minor amounts of gravel were removed from here and the fish runs have remained at a high level. A similar comparison between the two forks of Kalsin Creek reveals that fish runs of the east fork from which large amounts of gravel were removed have declined markedly, while those of the west fork, which was subjected only to very limited removal operations, have remained in good condition.

Although the undesirable effects of a single gravel removal project may seem insignificant in relation to the total Alaskan fishery resource, the aggregate effect of several projects is extremely significant. For this reason, the Bureau of Commercial Fisheries reviews each proposal for removal of stream gravels that is brought to its attention. Responsibility for this work rests with the Branch of River Basin Studies, which operates under the authority of the Fish and Wildlife Coordination Act. In Alaska, this Branch presently maintains a permanent staff of four biologists in Anchorage and three in Juneau.

For information concerning gravel removal projects, the Branch of River Basin Studies relies on the District Management offices of the Bureau of Commercial Fisheries, the Bureau of Sport Fisheries and Wildlife, and on the three Federal agencies that arrange and administer gravel sales

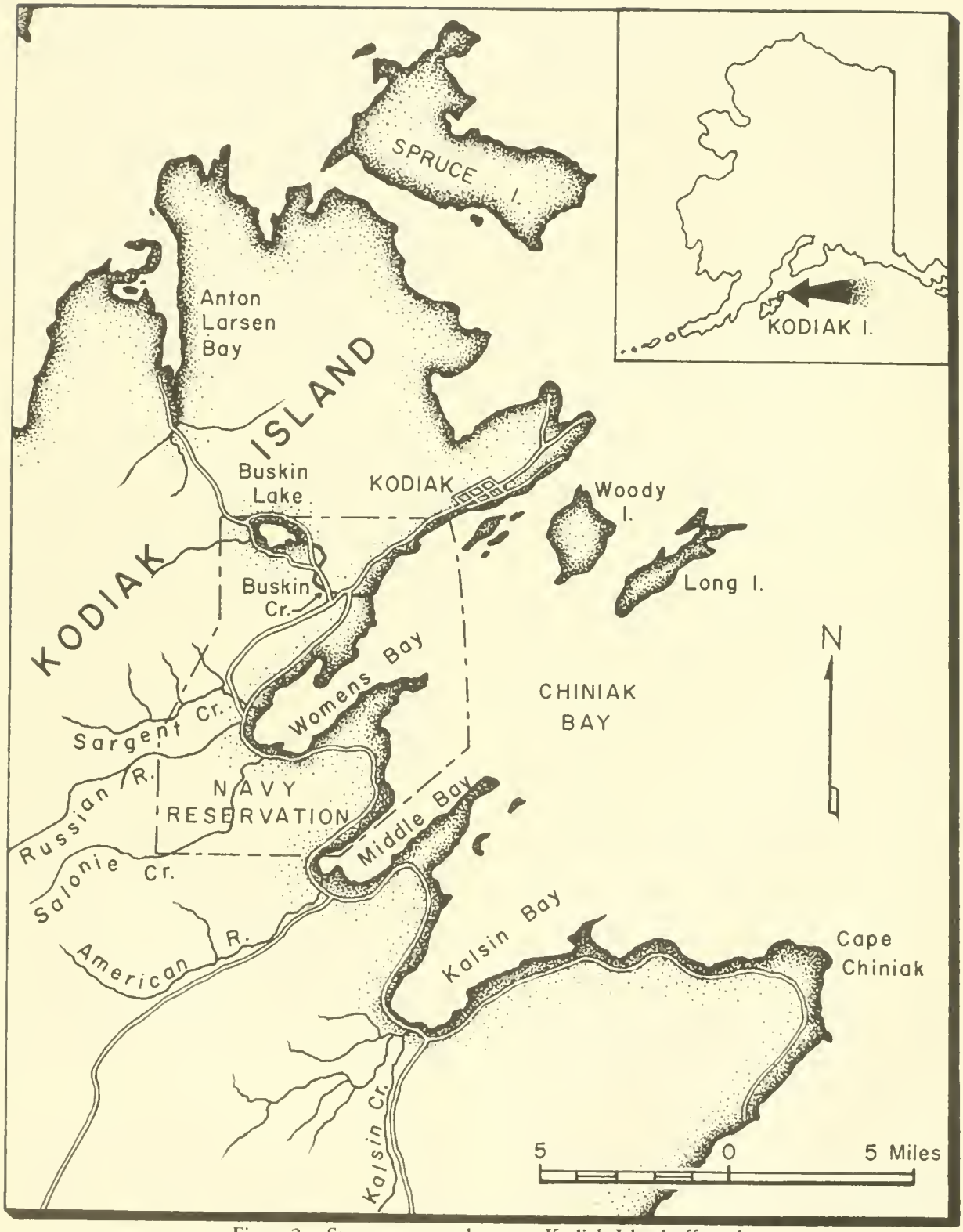

Figure 2. Streams on northeastern Kodiak Island affected by gravel removal during World War II

FWS photo by Jack Lentfer

Gravels formerly utilized by spawning salmon have been windrowed for removal

FWS photo by Jack Lentfer

Gravels have been removed from large section of the original stream channel

Figure 3. Views of Russian River showing changes brought about by gravel removals

FWS photo by M. A. Monson

Excavation includes parts of the natural stream

--the Forest Service, the Bureau of Land Management, and the Army Corps of Engineers. The Forest Service has jurisdiction over the National Forests down to the mean high tide line. Below the mean high tide line and on state-owned lands, the State of Alaska has jurisdiction. The Army Corps of Engineers is responsible for all navigable waters and reviews any projects on these waters that involve removal of gravels by means of dredging. To assure that each proposed project is carefully evaluated for its effect on the fishery, close liaison is maintained between the Bureau of Commercial Fisheries and the three administering agencies.

An effective working arrangement between the Bureau of Commercial Fisheries and the Bureau of Public Roads assures that all gravel removals associated with the latter's construction projects are reviewed in advance of making an application. This permits adequate consideration of a project and allows time for working out detailed recommendations for protection of the fishery resources.

Upon being notified of a proposal for gravel removal, the Branch of River Basin Studies conducts a field survey of the area involved, often in the company of personnel from the administering agency. The proposed excavation is located in relation to the stream, and possibilities concerning removal methods and effects are discussed. In this way, both the construction interests and the fishery values receive on-the-spot consideration. Persons familiar with the project area are interviewed. If the project involves anadromous fish, several surveys of the area may be made by River Basin personnel to determine the number of fish that will be affected.

Flow data concerning the streams may be obtained from the U. S. Geological Survey. Previous fishery surveys of the Bureau of Commercial Fisheries, the Alaska Department of Fish and Game, and the Fisheries Research Institute, University of Washington, are examined. Quantitative information on fish populations of former years is usually very limited or nonexistent, since removal projects are often situated on streams that have not been routinely surveyed in the past.

When information concerning a stream and its fishery resources has been examined, recommendations are formulated on methods and time of gravel removals. The Bureau of Commercial Fisheries policy concerning the removal of gravel from streams is based on the premise that, by sound management methods, Alaska's development can proceed concurrently with perpetuation of the fishery values. If the fisheries will be adversely affected, and means cannot be found to prevent these effects, the Bureau will recommend that other sources of gravel be sought; however, it is usually possible to prescribe practices and dates of operation that will minimize or eliminate injury to the fisheries.

Recommendations on times for gravel removals are based on periods when no eggs, fry, or adults are present in the stream. In streams in which the dominant species are chum and pink salmon, this condition usually exists during June and July. For streams that contain trout or the other species of salmon, prescribing dates of operation is a much more difficult task since fry and fingerling are normally present throughout the year.

Generally it is recommended that gravels be removed only from areas that are located away from the existing stream channel. However, if it is unavoidable to excavate adjacent to a stream channel, it is recommended that a dike or levee be built that will stop the stream from flowing into the excavation. Heavy equipment is usually prohibited from the stream bed. If washing or screening of gravels is required, provision must be made to prevent entry of silt-laden water into the stream channel. In most instances, special recommendations are made that apply to particular characteristics of the project involved.

When recommendations have been formulated, the Regional Director, Bureau of Commercial Fisheries, submits them to the administering agency. Since close liaison has been maintained throughout the entire process, approval of these recommendations is usually a routine matter and they are incorporated into the gravel permit.

Summary

Removal of gravels from stream beds has resulted in losses to Alaskan fishery resources in past years. Removal operations will be intensified as development of the State and its natural resources progresses. The importance of the fisheries warrants careful consideration of proposed gravel removal projects. To insure the protection of these resources, it is essential that each proposal be reviewed individually.

ESTIMATING ABUNDANCE OF SALMON FINGERLING

Howard S. Sears

Estimating the abundance of pink salmon (Oncorhynchus gorbuscha) fingerlings by means of various types of sampling gear was attempted in 1957 and 1958 in southeastern Alaska to establish an index of abundance that could be used to predict the size of future pink salmon runs. Fishing gear tested during 1957 included beach seines, set gill nets of variable mesh, an Isaacs Kidd midwater trawl, and a Canadian meter hoop net.

Insufficient numbers of fish were taken by these types of gear; and in 1958 experiments were conducted with a lampara bait seine. Operations were carried on in Ernest Sound and Clarence Strait and in Revillagigedo Channel as far south as Dixon Entrance. Results obtained were more encouraging than with the other nets that had been tested.

A conventional lampara seine consists of a large central bag or bunt section and two tapered wings. It differs radically from the purse seine in that its mesh size is not uniform, and there are no purse rings or purse line. The bag section is of small mesh and is about one-fifth of the total net length. The wings are tapered, and the mesh varies from about 5 inches at the base to as much as 14 and 16 inches at the wing tips. The function of the large wing mesh is to guide fish into the bag where they are held until the lead line is closed by pulling both wings simultaneously. The foot or lead line is considerably shorter than the cork line. The net is hung so that it is in the shape of a large scoop.

The modified seine used in the 1958 experiments was 120 fathoms long at the cork line, 96 fathoms long at the lead line, and 12 fathoms deep at the point where the bag and wing bases meet. Mesh sizes were 6-inch, 6-thread Marlon in the wings; 3-inch, 6-thread Marlon in the apron (floor of net), and 1/2-inch, 26-thread Marlon in the bag. Dry weight of the net was 285 pounds.

The method of fishing differed from that generally used by commercial bait seiners using a conventional net. Their method is to make a circling set from a towed skiff by paying out one wing, which is anchored or buoyed, followed by the bag and second wing. Setting of the net is complete when the end of the first wing is retrieved. Both wings are then pulled simultaneously until the bag is brought close to the skiff.

Instead of a single towed skiff, two 18-foot flat bottom boats (called Cordova skiffs in Alaska) powered by outboard motors were used in the 1958 experiments. The bag and one wing were placed in one skiff, and the other wing was placed in the second skiff. A large circling set was made by setting the bag from the stern of the first skiff. The wings were then payed out from the respective skiffs. After the wings were set, the two skiffs towed the wing ends together. The wings were then hauled aboard the skiffs. A schematic view of the modified lampara seine in fishing position is shown in figure 1.

In the summer of 1958, 260 sets were made with the lampara seine to evaluate its usefulness in the prediction program. A total of 2,509 fingerling salmon of all 5 species were taken. The higher catches of this type net over those used heretofore suggest that it may be possible with random sets to relate the average number of fingerling per seine haul to the number of returning adults.

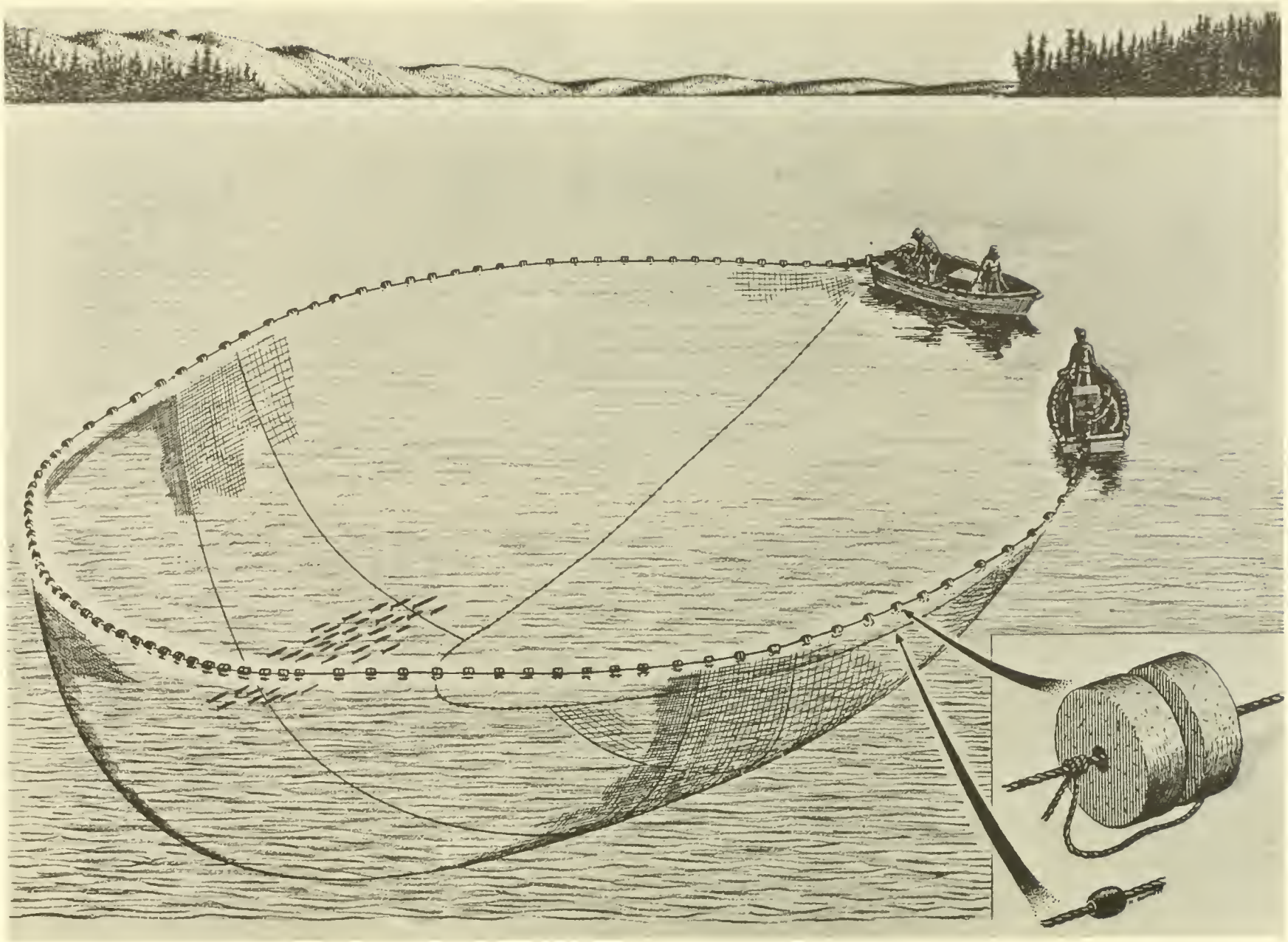

Figure 1. A modified lampara bait seine in fishing position

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