5-10/52

SUMMER

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MARINE FISHERIES PROGRESS REPORT

May through October, 1952

OTTER TRAWL INVESTIGATIONS

INTRODUCTION

The main otter trawl fishing season begins in May or June when the weather becomes suitable for sustained trips to the local and distant fishing grounds. This so-called summer season comes to a close in September or October when most of the sole depart from the grounds with the advent of the autumn storms.

During this brief period of three or four months practically all of the field work must be completed. Little time remains for analysis of past or present data.

This progress report deals with the summer season of 1952. The only analytical work accomplished during this period was that done on the results of the mesh experiments, so that a report could be made to the Pacific Marine Fisheries Commission meeting in October of 1952.

Fleet Activities

During the period May 7 to June 11, the greater portion of the Oregon otter trawl fleet remained in port due to a price dispute. The settlement was reached on June 11, and subsequently the summer season began.

The principal species in demand was the Dover sole. Little or no Pacific Ocean Perch (Sebastodes alutus) was sold in the summer season until September when a small but brief demand arose. The unusually dry fall extended the normal summer season well into November.

Summer Program

The proposed summer program included market sampling (Dover sole); mink food sampling; mesh experiments; early life history studies; and routine

maintenance on the otter trawl statistical system. These subjects will be discussed separately.

MARKET SAMPLING

For the period 1948-51, inclusive, the summer market sampling program has included three species, i.e., Dover, English, and petrale soles. During the earlier years when only general biological information, e.g., age and growth, maturity, and time of spawning, were being collected, samples of only 100-200 fish were quite adequate and thus the landings of all three species could be sampled adequately during a season. However, now that this general information has been collected, the task of determining the age composition of the catch requires much larger samples, e.g., 400-600 fish per sample. No longer is it possible to adequately samples three species in a season.

Dover sole were selected to receive the major attention for the next few years at least and so, beginning with the 1952 season, no samples were taken of English or petrale sole landings.

There were two reasons for this decision. First, the Dover have risen rapidly in importance during the last three years (1948-50). The Astoria landings rose from 2.5 million pounds to 4.5 million pounds. During this same period the English sole landings fluctuated between 0.8 and 2.2 million pounds, and petrale sole landings fluctuated between 0.9 and 1.8 million pounds.

Secondly, greater than 90 percent of the annual Dover sole catch is taken during the summer season, i.e. June through September. This is also the time when extra temporary help is available to assist in the field work. The English and petrale sole landings are distributed over a longer period of time, although at least 70 percent of the annual catch for each of these species is made during April through September.

During the period June 17 through October 8, 1953, 29 Dover sole market samples totalling 8,350 fish were taken. A total of 1,209 otoliths were collected in these samples. Only three samples were taken from catches made away from the local grounds, i.e. between Tillamook Rock and Willapa Bay. All the otoliths collected were read once while fresh.

MINK FOOD SAMPLING

The Oregon Fur Producers Association is now operating a processing and cold storage plant in the Astoria area to grind and freeze whole fish and fillet scraps for use as mink feed.

Mink food samples are samples of the catches of whole fish landed at this plant for use as mink food. From July 1 through September 11, seven such samples (8,915 fish; 7,244 lbs.) were taken. In all cases the food fish, i.e., Dover, English, or petrale sole were but a small portion of the catch.

MESH EXPERIMENTS

During the winter of 1951-52, the California Department of Fish and Game generously offered the use of their research vessel, "N.B. Scofield", for otter trawl mesh experiments to be conducted during August, 1952 under the auspices of the Pacific Marine Fisheries Commission.

Details of the experiment were planned and coordinated between the biologists of the three states of California, Oregon, and Washington during the spring of 1952. The cruise began on August 14 off Eureka, California and ended September 1, 1952 off Astoria, Oregon. Cod-ends of various mesh sizes, 3" to 5½", were tried on Dover, English, and petrale soles, and black cod.

The following biologists were aboard for the cruise: W.E. Ripley and J. Squires (California); A.T. Pruter (Washington); and S.J. Westrheim (Oregon).

The results of this series of experiments together with the 1951 Oregon mesh experiments were presented to the Pacific Marine Fisheries Commission meeting at Seattle in October, 1952.

The PMFC recommended, on the basis of the evidence presented, that each of the three states adopt a minimum mesh size of $4\frac{1}{2}$" (measured between the knots), with allowances for double cod-ends and Pacific Ocean Perch nets to be determined as local conditions required.

The state of California had placed a minimum mesh size of $4\frac{1}{2}$" (inside knot) into effect in 1949. The state of Washington had a $4\frac{1}{4}$" (including one knot) minimum mesh size for inside waters, i.e., Puget Sound, but no mesh regulation for outside waters. Oregon had no regulation on the mesh size of the otter trawl nets.

When the data for the 1952 mesh experiments were compiled in September, it was decided that the results for the two years of work should be presented in terms of the percentage marketable fish in the catches of the different nets. The criterion to be used was the percentage marketable fish in the market samples of Dover, English, and petrale soles taken in Astoria over the past five years. For each of the species, the fillet plants impose a minimum size which is presumably based on the profitable recovery of fillets from the whole fish.

Thus if a mesh size could be found which would catch fish of the same size composition as is now landed, considerable savings would result. Our "sampling-at-sea" experiments conducted in 1950 and 1951 indicated that the Oregon otter trawl fleet was discarding at sea, in numbers of fish, 16 percent of the Dover sole caught, 27 percent of the English sole, and 36 percent of the petrale sole.

A more elaborate and precise analysis of the mesh experiment data was precluded due to the lack of knowledge concerning the biological statistics

of the population such as natural and fishing mortality. Furthermore, the lack of time prevented more elaborate mesh experiments to be conducted.

However, the results to be presented indicate a clear pattern of differential selectivity by the various mesh sizes used despite the more obvious limitations of the experiments.

For clarity of presentation, each of the species will be discussed separately, although it will be noted that some experiments provided information on two or more species simultaneously. All mesh measurements mentioned refer to the distance between the knots, i.e., the hole through which the fish must escape. The net manufacturers and fishermen take a net measurement from the inside of one knot to the outside of the next knot. Since the size of the knot is variable and further is a function of the weight or strength of the twine used, these complications were neatly avoided by measuring between the knots.

Since earlier workers had demonstrated that some 85 percent of the escapements occurred in the cod-end of the net, only the mesh size of the cod-end was altered during the experiments. However, the recommendations made from the results of the experiments included the entire net for the minimum mesh size. This was done largely to obtain the maximum simplicity in the proposed regulations and thus simplify enforcement procedures.

Dover Sole

The 1951 experiments conducted by Oregon were largely fragmentary in nature for the Dover sole, because at the time (May and June) that a boat was available for charter, the Dover sole were not yet on the grounds in quantity. Furthermore, in some cases the only available boat was too small to fish successfully in areas where the Dover sole were present because of the strong currents caused by the outflow of the Columbia River at its freshet stage.

Cod-ends of three mesh sizes, i.e., 3"-single mesh, 4"-single mesh, and 5"-single mesh, were alternately attached to a 4"-single mesh net and fished for a day at a time. Each evening the cod-end was replaced by one of a different mesh size. Generally two or three drags could be made during each day.

A sample of fish was taken from the catch of each drag, and each fish was measured to the nearest one-half centimeter. Owing to the previously mentioned adverse currents it was not always possible to fish the same area each day.

The 1952 experiments were conducted on the Dover sole grounds off Eureka, California and were somewhat more refined. In this case the cod-end was changed at the end of each drag and, with the exception of the first three drags, all drags were made on the same location. The 3"-single cod-end was used as a control to indicate the size composition of the fish on the grounds. All Dover, English, and petrale soles, and black cod caught were measured, with the exception of approximately 60 percent of the black cod caught in two drags off Destruction Island.

The results of these two experiments are presented in Table 1. The 1951 experiments have been combined by experiment (one to three day trips). The percentage marketable fish for each mesh size represents the results of one day's fishing.

The 1952 experiments are presented on a daily basis, and each percent marketable figure represents the result of one drag.

The numbers in parentheses represent the numbers of fish measured.

For the Dover sole, the accepted minimum size at the Astoria fillet plants is 14½" (37 cm), and in the market samples taken over a five year period, 1948-1952, 80-85 percent of the Dover sole are larger than 14 inches (36 cm).

Table 1. Percent Marketable* Dover Sole in Gross Catch, by Mesh Size, by Experiment, 1951 and 1952.

EXPERIMENT NUMBER	COD-END MESH SIZE** (Inches) 3" (single)	4" (single)	4.5" (double)	4.5" (single)	5" (single)
	(1951-Oregon Experiments)				
1	12 (194)	42 (31)***	—	—	—
2	—	—	—	—	87 (176)
3	58 (304)	—	—	—	—
5	—	61 (153)	—	—	99 (247)
AUGUST	(1952-PMFC Experiments)				
15	75 (280)	—	—	—	93 (226)
17	69 & 58 (166)(126)	—	—	98 (325)	—
18	47 (923)	—	64 (771)	95 & 94 (129)(230)	—
20	36 (381)	52 (812)	—	90 (174)	—
21	31 (386)	—	54 (895)	—	88 (121)

* Greater than 36 centimeters.
** Measured between knots.
*** Figures inside parentheses represent numbers of fish measured.

For mesh sizes smaller than $4\frac{1}{2}$"-single, the percentage marketable fish is less than 70 percent, whereas for meshes of $4\frac{1}{2}$"-single and 5"-single the percentage marketable fish is greater than 85. The $4\frac{1}{2}$"-double mesh produced a size composition similar to that of the 4"-single mesh. This has been taken to indicate that the doubling of the mesh reduces the effective opening by approximately 1/2 inch. Thus, the minimum allowable mesh size for double mesh cod-ends was placed at 5".

It is interesting to note in the 1952 experiment that, although the percentage marketable fish in the 3"-single mesh declined from 69 to 31 in consecutive days on the same grounds, the percentage marketable for the $4\frac{1}{2}$"-single only declined from 98 to 90. This appears to indicate that the larger meshes are less sensitive to the size composition of fish on the grounds.

The 1952 replications which occurred on consecutive drags on August 17 with the 3"-single net and on August 18 for the $4\frac{1}{2}$"-single net indicate that despite the small numbers of fish involved, the selectivity is consistent.

Considering our goal of 80-85 percent marketable fish in the gross catch at sea, it appears that the $4\frac{1}{2}$"-single net fulfills the requirements most closely.

English Sole

The 1951 experiments made by Oregon were more successful for English sole. Contrariwise, the 1952 experiments were not so successful. The design and time of experiments was the same as that previously described for Dover sole. The 1952 experiments on English, petrale, and black cod took place in the vicinity of Destruction Island which is off the Northwestern coast of Washington.

In the case of the English sole the minimum size imposed by the fillet plants is $13\frac{1}{2}$" (34 cm), and from the Astoria market samples it was found that 75 percent of the English sole landed were equal to or larger than this minimum size.

Considering Table 2, with the figure 75 percent in mind, the data appear to be contradictory. For the 1951 experiment, the 5"-single mesh seems most desirable. For the 1952 experiment the percent marketable is quite high for all mesh sizes. This apparent contradiction was explained when it was found that the English sole were unusually large on the grounds fished in 1952. Consequently, the pattern of selectivity of the nets was obscured.

The 1951 data were used for presentation to the Pacific Marine Fisheries Commission. In this case the 5"-single net appeared to be the most desirable net for English sole. However, since the English sole are not the principal species sought by the Oregon otter trawl fleet, no recommendations were made that a minimum size of 5"-single be imposed as a general rule for the exclusive benefit of the English sole. It was also deemed impractical to impose a minimum mesh size of 5"-single for English sole only.

Petrale Sole

For petrale sole, the minimum size acceptable to the fillet plants is 14½ inches (37 cm), and in the market samples 75 percent of the petrale were equal to or larger than this size.

Considering the results of the two years' experiments (Table 3), it appears that no mesh size up to and including 5½"-single will effect much saving of small petrale sole. These fish are much broader than either the Dover or English sole and are also quite rigid. Thus their ability to escape through a mesh opening is more limited than that of the slender English sole and the limber Dover sole. Since it is impractical to initiate individual minimum mesh sizes for each species of fish, no recommendations were made regarding petrale sole.

Black Cod

A limited amount of data were collected on the selectivity of the various nets on young black cod. These small black cod have a modal size of 40

Table 2. Percent Marketable* English Sole in Gross Catch, by Mesh Size, by Experiment, 1951 and 1952.

EXPERIMENT NUMBER	COD-END MESH SIZE** (Inches)					
	3" (single)	4" (Single)	4.5" (double)	4.5" (single)	5" (single)	5.5" (single)
	(1951—Oregon Experiments)					
1	58 (79)	60 (252)***	—	68 (117)	—	—
2	—	—	—	—	72 (210)	—
4	42 (447)	73 (553)	—	—	79 (508)	—
5	24 (409)	46 (394)	—	—	61 (309)	—
AUGUST	(1952—PMFC Experiments)					
26	—	—	70 (192)	—	—	—
27	70 (316)	—	80 (647)	—	—	—
28	63 (546)	—	—	—	78 (758)	86 (389)
29	62 (481)	66 (405)	—	76 (445)	—	—

* Greater than 33 centimeters.
** Measured inside knots.
*** Figures inside parentheses represent numbers of fish measured.

Table 3. Percent Marketable* Petrale Sole in Gross Catch, by Mesh Size, by Experiment, 1951 and 1952.

EXPERIMENT NUMBER	COD-END MESH SIZE** (inches)					
	3" (single)	4" (single)	4.5" (double)	4.5" (single)	5" (single)	5.5" (single)
	(1951--Oregon Experiments)					
1	59 (88)	54 (340)***	—	—	74 (190)	—
2	—	—	—	—	68 (126)	—
3	62 (42)	—	—	—	—	—
4	40 (237)	55 (516)	—	—	56 (311)	—
5	—	28 (121)	—	—	—	—
AUGUST	(1952--PMFC Experiments)					
26	—	—	59 (51)	—	—	—
27	44 (185)	—	43 (129)	—	—	—
28	44 (208)	—	—	—	44 (160)	47 (130)
29	52 (251)	40 (247)	—	53 (284)	—	—

* Greater than 36 centimeters.
** Measured between knots.
*** Figures inside parentheses represent numbers of fish measured.

centimeters. They are quite abundant on the inshore grounds (less than 50 fathoms) in certain areas. Large quantities are caught by the otter trawlers incidental to the sole. They are too small to market. The adult black cod are not found in any abundance in the shallower waters where the young abound.

These young black cod were encountered off Destruction Island during the 1952 experiment on English and petrale soles. Table 4 presents the total numbers caught by day, by drag (mesh size).

The 3"-single mesh caught 400-1200 black cod per drag, whereas all the larger meshes caught only 0-64 per drag. However, it is not possible to conclude that any mesh larger than 3"-single will necessarily prevent the capture of large numbers of these fish. The regular commercial nets in operation at the present time are largely $3\frac{1}{2}$" and 4" nets and at times they do catch large quantities of these small black cod.

Table 4. Numbers of Small Black Cod* Caught, by Drag, by Mesh Size, by Date, 1952.

	COD-END MESH SIZE** (Inches)					
	3" (single)	4" (single)	4.5" (double)	4.5" (single)	5" (single)	5.5" (single)
AUGUST			(PMFC Experiments)			
26	—	—	10	—	—	—
27	1,057	—	0	—	—	—
28	1,198	—	—	—	64	25
29	414	30	—	8	—	—

* Length-frequency mode at c. 40 centimeters.
** Measured between knots.

Pacific Ocean Perch

The otter trawlers have stated that when fishing for Pacific Ocean Perch (a small rockfish, 35-45 cm long) with a mesh greater than 4", considerable gilling of the fish in the net was encountered. This gilling was of sufficient magnitude to seriously inconvenience the fishermen in lost fishing time and the hazards associated with removing these spiny fish from the meshes.

Furthermore, the "perch" are found in deep waters, 100-200 fathoms, and only small quantities of sole are caught together with Pacific Ocean Perch. This last statement was readily verified by examination of the otter trawl landing records. Under normal market conditions, i.e., no limits imposed, landings containing Pacific Ocean Perch contained only small poundages of any other species. The "Perch" generally amounted to 90 percent or more of the total landing.

The investigation of this gilling was included on the agenda of the 1952 experiment, but sufficient time was not available in which to conduct the experiments. This portion has now been tentatively planned for July, 1953 and is to be conducted jointly by Oregon, Washington, and possibly California aboard a chartered Oregon otter trawler.

Because of the fishermens' firm insistence that the minimum mesh size of $4\frac{1}{2}$" would work a severe hardship upon them when fishing Pacific Ocean Perch, an exception to the general law was recommended. This was, to wit, that nets of a minimum mesh size of 3" could be aboard the vessel if 80 percent or more of the total catch was Pacific Ocean Perch.

Summary

The mesh experiments conducted in 1951 by the Oregon Fish Commission and in 1952 by the Pacific Marine Fisheries Commission have indicated that a $4\frac{1}{2}$"-single cod-end would be most desirable to prevent the capture of under-sized, non-marketable Dover sole.

For English sole, at least a 5"-single cod-end would accomplish the same purpose.

For petrale, there was no apparent improvement with mesh sizes as large as $5\frac{1}{2}$"-single.

For black cod, a mesh size of 4"-single or greater appeared to release large numbers of small black cod of the 40 centimeter size group.

Since Dover sole is considerably more important than English or petrale sole, the minimum mesh size of $4\frac{1}{2}$"-single was recommended to the PMFC at the October meeting.

An allowance was made for the use of double-mesh cod-ends, but the minimum mesh size for such cod-ends must be 5 inches.

An allowance was made for the use of a minimum mesh size of 3" for Pacific Ocean Perch, provided that when such net is aboard the vessel, Pacific Ocean Perch must make up 80 percent or more of the total catch.

EARLY LIFE HISTORY STUDIES

Monthly trips were taken to Newport for a day's fishing with the try-net in Yaquina Bay. The small English sole and commercial crabs thus caught were measured and sexed.

The otter trawl portion of this investigation consists of a study of the growth and activities of juvenile English sole which inhabit Yaquina Bay.

STATISTICAL SYSTEM

Monthly trips were taken to Portland to code all the otter trawl and long-line landings for more rapid summarizing by the IBM machine at the end of each fiscal year.

In addition, all otter trawl landings containing missing information concerning fishing areas and fishing effort (number of drags) were recorded so that this information could be obtained directly from the fishermen.

ALBACORE PROGRESS REPORT

May through October, 1952

Preparatory to the start of the season, thermometers and log books for catch and temperature records were placed on six tuna trollers: "Argo" Mr. Fred Wolleson; "Destiny" Mr. Wilbur Northup; "Wauna" Mr. Reino Mattila; "Jessie B" Mr. J. B. Brandt; "Scarab" Mr. Clifford Driskell; and "Clara B" Mr. A. Berthelson, boat and skipper, respectively. Interview forms were prepared for collecting catch information when landings were made. The object was to compare the two methods in order to learn the most advantageous way to collect this information in the future. Also certain data were required along with the length-frequency samples to be exchanged among the three states and Canada starting with the 1952 season. The exchange had been planned and was to be carried out through John T. Gharrett, research coordinator of the Pacific Marine Fisheries Commission. This was done and will be reported upon later in this report.

An early season, July 19 to 28, trip was taken by Ed Holmberg aboard the troller "Scarab". The purpose was to observe the early scouting effort and gain firsthand knowledge of the availability of tuna off the Oregon coast. Blood samples were collected for Dr. John Cushing, Santa Barbara College, who is interested in seriological identification of tuna races. The 24 blood samples were collected by making cardiac punctures, freezing in brine and preserving in ice. The samples were subsequently packed with dry ice and sent to Santa Barbara College via air express. Dr. Cushing reported the blood arrived in good condition for study. Length-frequency measurements were also collected.

For the first four days we scouted westerly reaching a point 125 miles SWxW of the Columbia River lightship. We caught one fish 80 miles SWxW of the river. Another boat reported catching several fish 45 miles SWxS of the light-

ship, and a course was set for this position. All the next day was spent trolling toward this spot in the company of another troller. The other troller caught one fish that day. Fishermen claim that this would not have occurred in a good season. We should have intercepted fair schools of fish while proceeding to the location of the discovery. About 30 vessels were attracted to this spot which gives a comparison to the 1951 season when 300 boats were reportedly attracted to the first fish find in that season. The boats averaged about 22 fish per day for five days after which the fish could not be relocated. This is not considered commercial production. Between 80 and 100 fish per day is considered by most fishermen as about the minimum feasible average catch per day. We returned to port July 28 with 202 albacore weighing 3,313 pounds for an average of 16.4 pounds.

There was less effort expended in scouting for albacore this year, but there were vessels from ports north of Astoria traveling south to the tuna grounds throughout the early season. These fishermen make it a point to scout areas enroute that have been productive in the past. Also a few vessels return to their northern ports to unload in season as they usually receive better prices for their fish by doing so. Therefore, any commercial abundance of tuna off Oregon would have been discovered.

Tuna food was observed and reported to be scarce this season. Great schools of anchovies and other small fish were reported in 1951, but there were no such reports in 1952.

A good run of fish was discovered off northern California in early August, and the bulk of the 2.6 million pounds of albacore landed in Oregon came from this region. The fish and fishermen moved up to the vicinity of Cape Arago, Oregon for a short time, and then moved southward until the fishing rate dropped to about 50 fish per day in early November SW of Pt. Arena, California and the season ended. The trollers using jigs averaged 87 fish per day for the

season. This figure was derived from the vessel interview material. In all, 54 interviews were made in Astoria and by Joe Cicrich in Newport. Of these 39 contained complete data. Most of the tuna fishermen count the fish caught, but a few do not, which was usually the reason for the incomplete interviews. The interviews covered 450,000 pounds of the landings (17.3 percent). The bait boats averaged 262 fish per day or three times the fishing rate of the jig method.

Of the six log books and thermometers given to skippers of tuna troll boats three turned in useable records. Messrs. Wolleson and Northup gave us complete records of their catches, landings, water temperature and weather records. Mr. Mattila started out keeping good records, but tapered off toward the season's end. These fishermen hit the early season run in Mexican waters in early July. Mr. Wolleson did especially well. He is an above-average fisherman as his 131 fish per day average for the season attests. He and a partner fished 113 days, took 14,775 tuna for 205,716 pounds. Mr. Northup fished alone, has no refrigeration, and had the "Destiny" on the ways for a week in the early season trying to get the fish detracting noises out of the shaft and stem bearing. He fished 78 days for around 5,352 fish or 69 fish per day. He landed about 74,000 pounds. Mr. Mattila and his brother have refrigeration in their boat the "Wauna", enabling them to stay with the fish longer. Without refrigeration a vessel will run out of ice in 8 to 10 days. Often the fishermen have just gotten in to good fishing at this time and must return to port. Last year the boats encountered 72° water which would melt ice rapidly. The Matilla brothers fished 80 days, took 6,859 fish for 88,297 pounds at 86 fish per day. At this fishing rate they would qualify as an average boat.

The range of water temperatures where albacore are caught widens each season, and this factor thus becomes less important in scouting the fish. Albacore have been caught in water temperatures of from 57° to 72° F. Naturally,

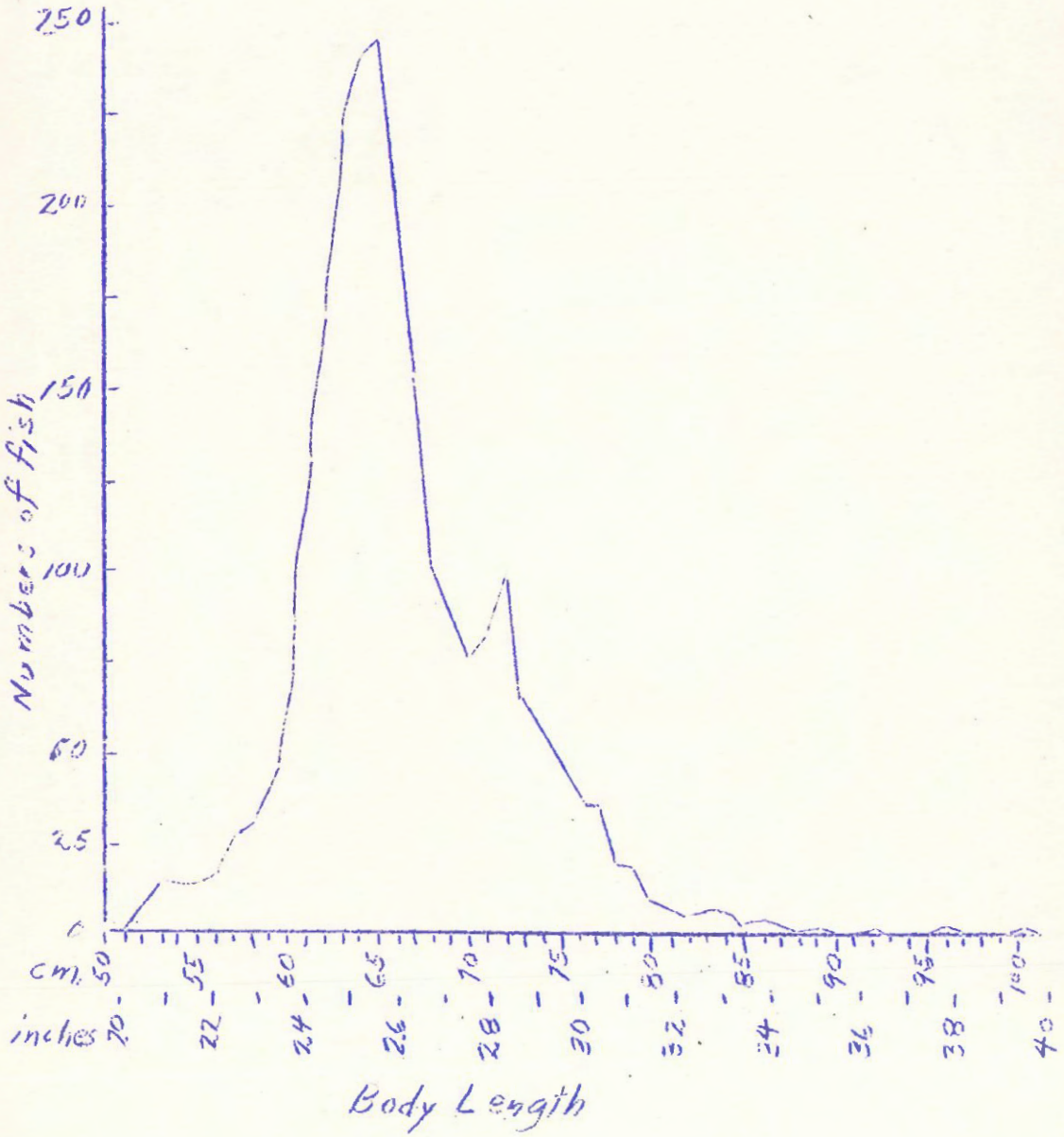
these temperatures include all the offshore waters from Canada into Mexico. Fishermen do not rely on the thermometer as much as they did a few years ago. From the vessel interviews we find that the bulk of the catch was taken in mid-September when 61° to 62° F. water temperatures prevailed. The catch per day was best in 62° F. water. Fred Wolleson kept traveling when he found himself in less than 60° water. He spent the most time, 32 days, in 60° water for an average of 87.3 fish per day. His best fishing was 4 days in 67° water at 298.5 per day. Sixty-two degree water produced his next best at 235 per day. He caught the greatest number of fish in 64° water.

A few northern boats ventured into Mexican waters early again this season and were well repaid for their gamble. One boat came back with 22 tons of fish on his first trip in early July. This is in contrast to the half ton he caught on the first trip in 1951 season. Many boats were still fishing after the Thanksgiving Day holidays, but most northern boats had returned to their home ports by mid-November.

The length-frequency samples show about the same pattern found in the 1951 season. The usually 62 centimeter group was slightly larger at 64 centimeters all along the coast this year, and this size group predominated the catch. Although this is written in May, 1953, the final 1952 landings are not available to properly weight the sampling to the fishing rate. Therefore, this phase will be reported upon later rather than recompute the curve when the final statistics are made available. A graph of the unweighted length-frequency curve is shown in Figure 1.

An exchange of length-frequency measurements was carried out in the 1952 season between the three states and Canada through the Pacific Marine Fisheries Commission research coordinator, Mr. John T. Gharrett. All the original samples were sent to Mr. Gharrett including pertinent data, which included vessel name, sample number, location of sampling, dates of catch, date of sampling, area of

Figure 1
1952 Albacore Length-frequency
2357 fish unsmoothed and unweighted

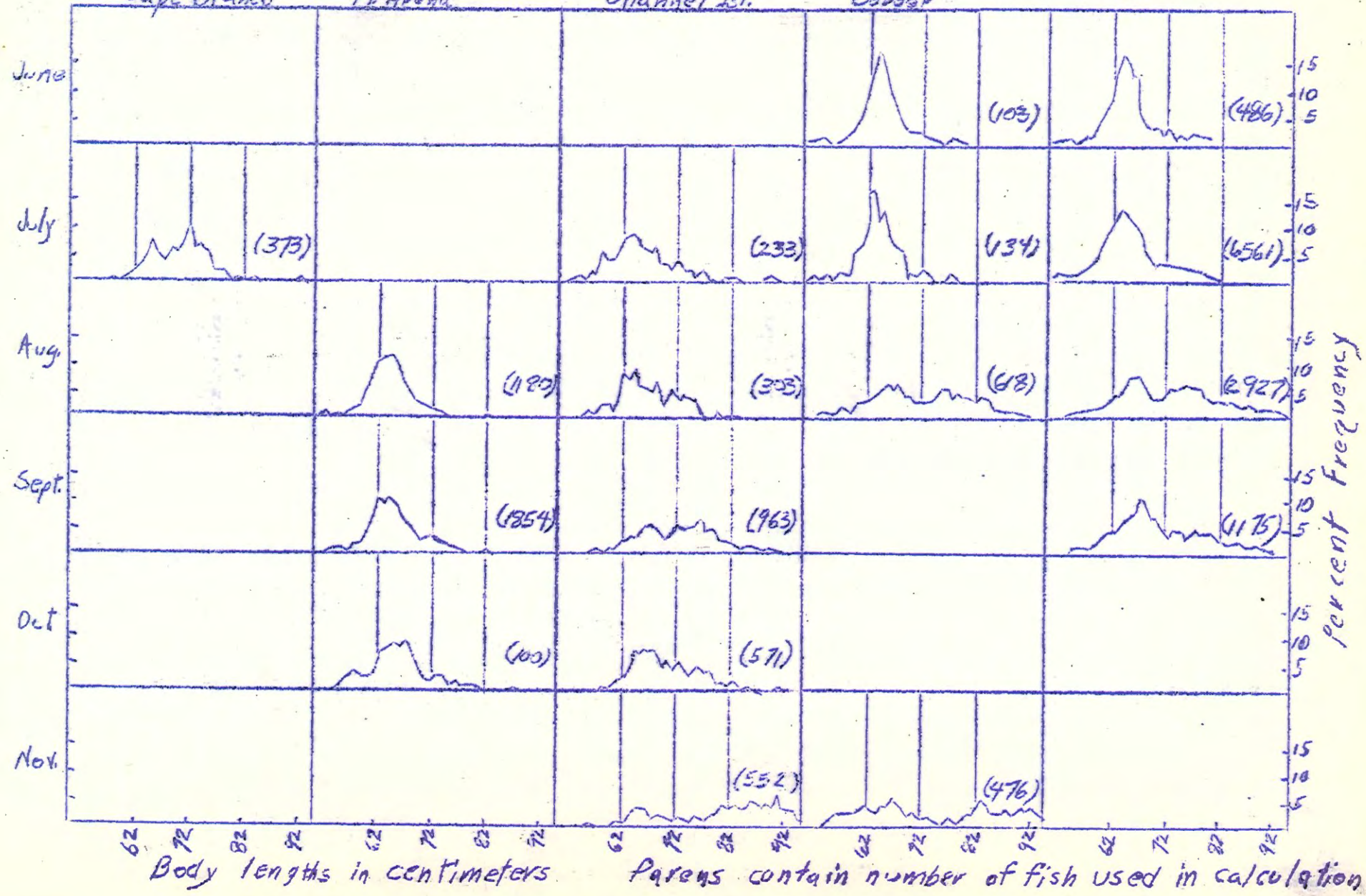


catch, gear used, and name or names of samplers. Copies were made of the original data in Mr. Charrett's office and sent to each agency. The plan is to continue the exchange each coming season. In 1953 plans were made to exchange the grouped data. Grouping will be made on the whole centimeter. All fish measuring 655 to 664 millimeters in body length, for instance, would be called 660 millimeters. Many hours of tabulating the original measurements by each agency individually would be saved. The majority of the exchange data for 1952 has been tabulated, and the final results are shown in Figure 2. About half of the samples taken in San Diego (Mexico catches) were tabulated for August and September. The sampling of this region was more than adequate. Toward the north there was a lack of fish to sample. The curve for July, north of Cape Blanco represents the early season scouting off the Oregon coast, and if the curves had been weighted to the catch, this curve would have all but disappeared. The curves are based upon percentage frequency of fish. This method, although not as comparable as weighted data, allows comparison of the catches in time and space. The catch statistics are not available at this time for weighting the curves to the catch. The Californians realize the need for more follow-through at the season's end, and plan to sample later next season to fill the gaps in the sampling. The areas chosen are quite large, and some detail may have been lost. Figure 3 of the catches off Guadalupe Island shows much more movement of fish through that area than is displayed in the graph including the bulk of the data.

Figure 2 shows that the bulk of the 62 centimeter fish appeared first in southern California and Mexico and was largely jig caught in 1952, at least. The vertical lines over the curves show the usual modal groups at 62, 72, and 82 centimeter lengths. This season the smaller 62 centimeter group were larger than usual at the season's start averaging about 64 centimeters coastwise. The 62 centimeter group seem to move northward rather rapidly to the northern

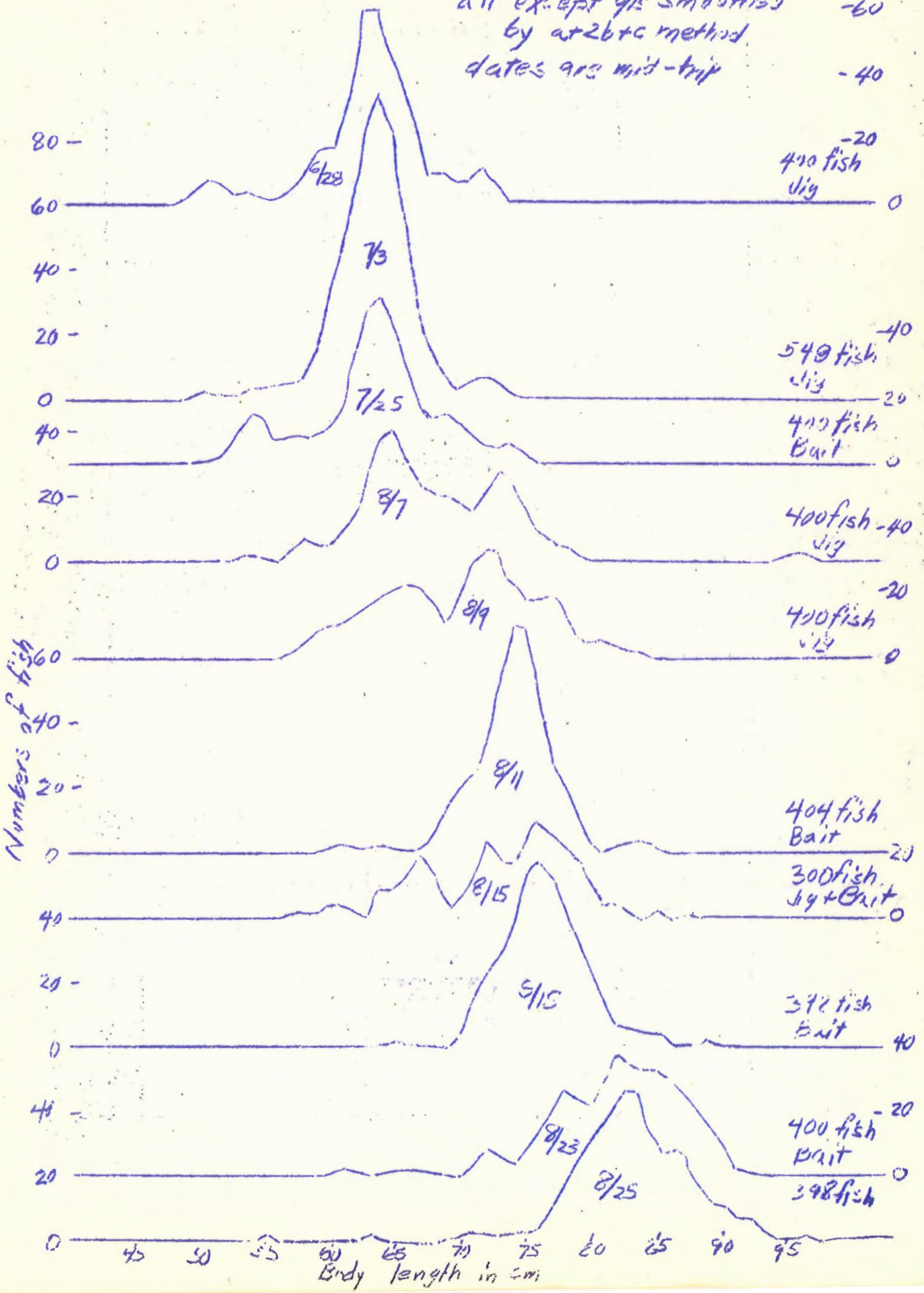
Figure 2

Percent length-frequencies of Albacore from exchange data 1952 season



Parens contain number of fish used in calculation

Figure 3 1952 Guadalupe Island Albacore Length-freq
all except 8/15 smoothed
by ar2b+c method
dates are mid-trip



California area and then back southward and become scarce after October. However, the larger fish, 82 centimeters long, in abundance in November, may have caused the 62 centimeter group to appear smaller percentagewise. Such is the disadvantage of dealing in percentages.

Another difficulty is that the samples are dependent upon the commercial fishery, and the data may show movements of the fleet rather than movements of the fish. It is the habit of the trollers to start in Mexican water, fish northward during the summer and swing back south as the season ends. This is evident from the graph. The August curve for Mexico contained only 50 percent troll catches, and in September the percentage had dropped to 30 percent troll or jig. Fishermen explain and our logbook records show that the effectiveness of jig fishing drops as the fish tend to school up. Later in the season the schools tend to disperse and the efficiency of the two methods, jig and bait fishing, reverses. We must assume that, except for obvious gaps in sampling in southern California and Mexico late in the season, the fleet's activities were adequate to follow the movements of the fish.

The blood samples taken for the seriological identification of tuna races were mentioned. The field of chemistry has produced another possible method of distinguishing races of fish also. The method is called paper partition chromotography. A small amount of unknown material is touched or smashed on a long piece of filter paper in the form of a spot. One end of the paper strip is placed in a solvent, and as the solvent flows down soaking the strip the unknown material flows with it but at a slower rate. The ratio of the unknown to the solvent flow identifies the unknown substance. The people at Scripps are interested in this work, and a few samples of local and Japanese albacore were sent to them.

Calculations were begun on all the albacore morphometric measurements collected here on local fish and the measurements on fresh Japanese albacore

taken by Mr. McKernan during his trip to Japan. At this point in the study we had samples from 1951 in an effort to find the factor that caused comparisons of our local samples to produce statistical differences nearly as great as those produced when local samples were compared with the Japanese samples. The factor was found to be difference in samplers. After the measurements taken by certain samplers were discarded the local samples gave no statistically significant differences. Comparisons could then be made with the fresh Japanese measurements, and it was to this point that the study had progressed at the time covered by this report. We planned to finish the calculations and publish the findings.

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