REPORT OF THE INTERNATIONAL FISHERIES COMMISSION

APPOINTED UNDER THE TREATY BETWEEN THE UNITED STATES AND GREAT BRITAIN FOR THE PRESERVATION OF THE NORTHERN PACIFIC HALIBUT FISHERY

NUMBER 2

LIFE HISTORY OF THE PACIFIC HALIBUT

(1) MARKING EXPERIMENTS

BY

WILLIAM F. THOMPSON AND WILLIAM C. HERRINGTON

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p. 67 line 15. Should read:
"$y = ab^{-x}$, or $\log y = K_1 - K_2 x$, where y is the percentage value, K_1 and K_2 are"

p. 77 Figure 24. Substitute in upper graph: $y = ab^{-x^{\frac{1}{2}}}$ for $y = ab^{x^{\frac{1}{2}}}$
in lower graph: $y = ax^{-b}$ for $y = ax^b$

p. 79 lines 3 to 9 should read:
"of the numbers recovered in each 10 mile unit decreased as the square root of the distance increased (Table 14, Figure 24, upper). If the numbers of returns be called y, the distances x, and constants a and b, the formula is $\log y = \log a - \sqrt{x} \log b$, or $y = ab^{-x^{\frac{1}{2}}}$ where $a = 6091.5$ and $b = 2.218$. This formula does not fit the more distant migrants even approximately. A better one from this standpoint is $y = ax^{-b}$ (or $\log y = \log a - b \log x$) where for all returns, $\log a = 4.13335$ and $b = 1.56607$, for the number of individuals shown in the tables (using"

p. 79 Figure 25. Substitute: $y = ax^{-b}$, for $y = ax^b$

p. 80 Table 14. Substitute: $y = ab^{-x^{\frac{1}{2}}}$, for $y = ab^{x^{\frac{1}{2}}}$
$y = ax^{-b}$, for $y = ax^b$

FOREWORD

The present is the second report made by the International Fisheries Commission, and forms the first publication of scientific results obtained under the terms of the Convention between the United States and Great Britain for the preservation of the halibut fishery of the Northern Pacific Ocean, including Bering Sea.

The first report presented the recommendations of the commission for the further regulation of the halibut fishery, and has been published by the Canadian Government in 1928, by the Province of British Columbia in the Report of the Commissioner of Fisheries for 1928, and is in press for publication by the United States Bureau of Fisheries in the current year.

Further reports made will bear serial numbers and will be issued separately by the commission.

The investigations have been carried on by a staff under the direction of William F. Thompson, with headquarters and laboratory at the University of Washington, Seattle, U.S.A.

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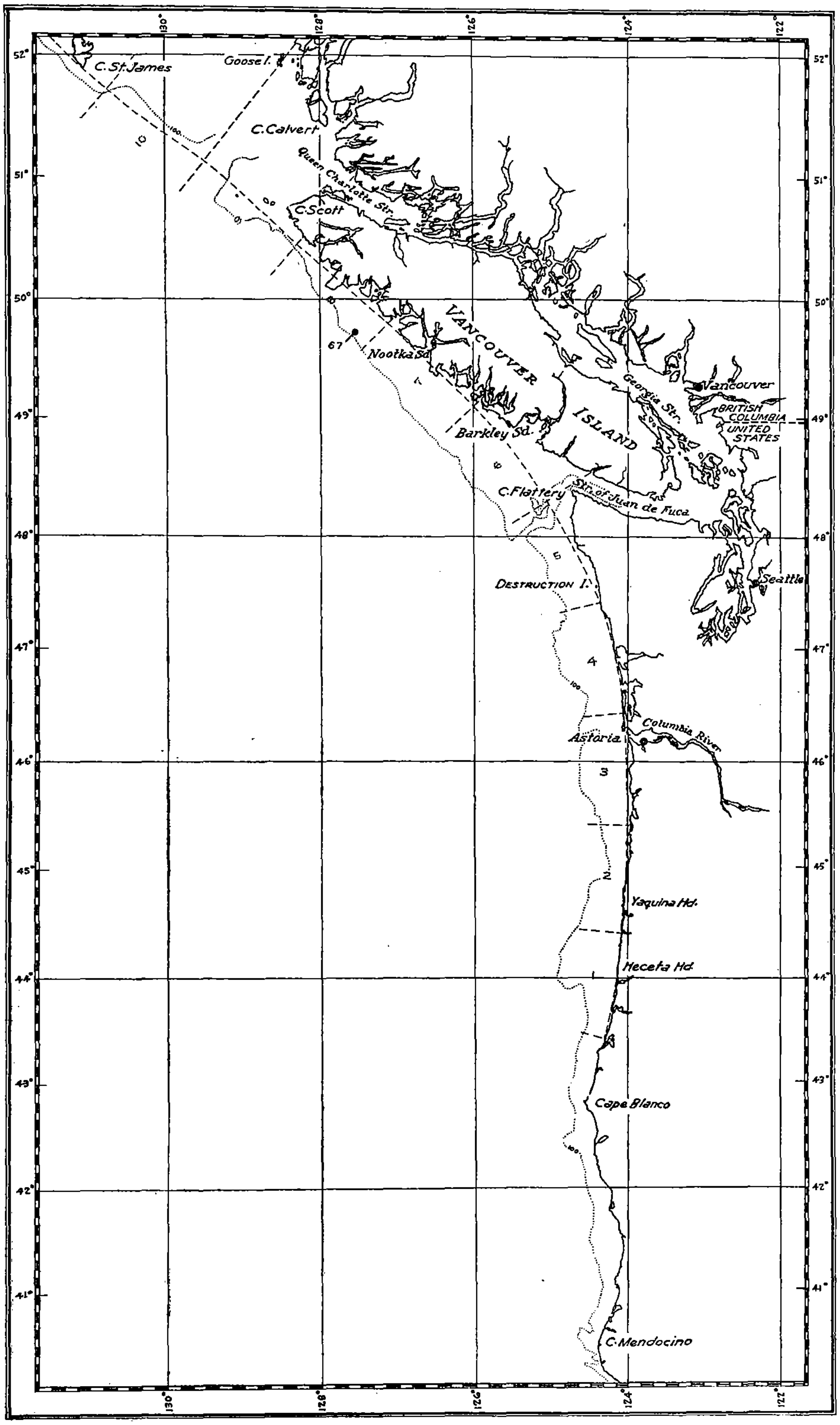

FIG. 1.—Pacific Coast from Cape Mendocino to Cape St. James, showing the tagging localities in black and the statistical areas by dotted lines. The numbers given for each tagging location refer to Appendix A.

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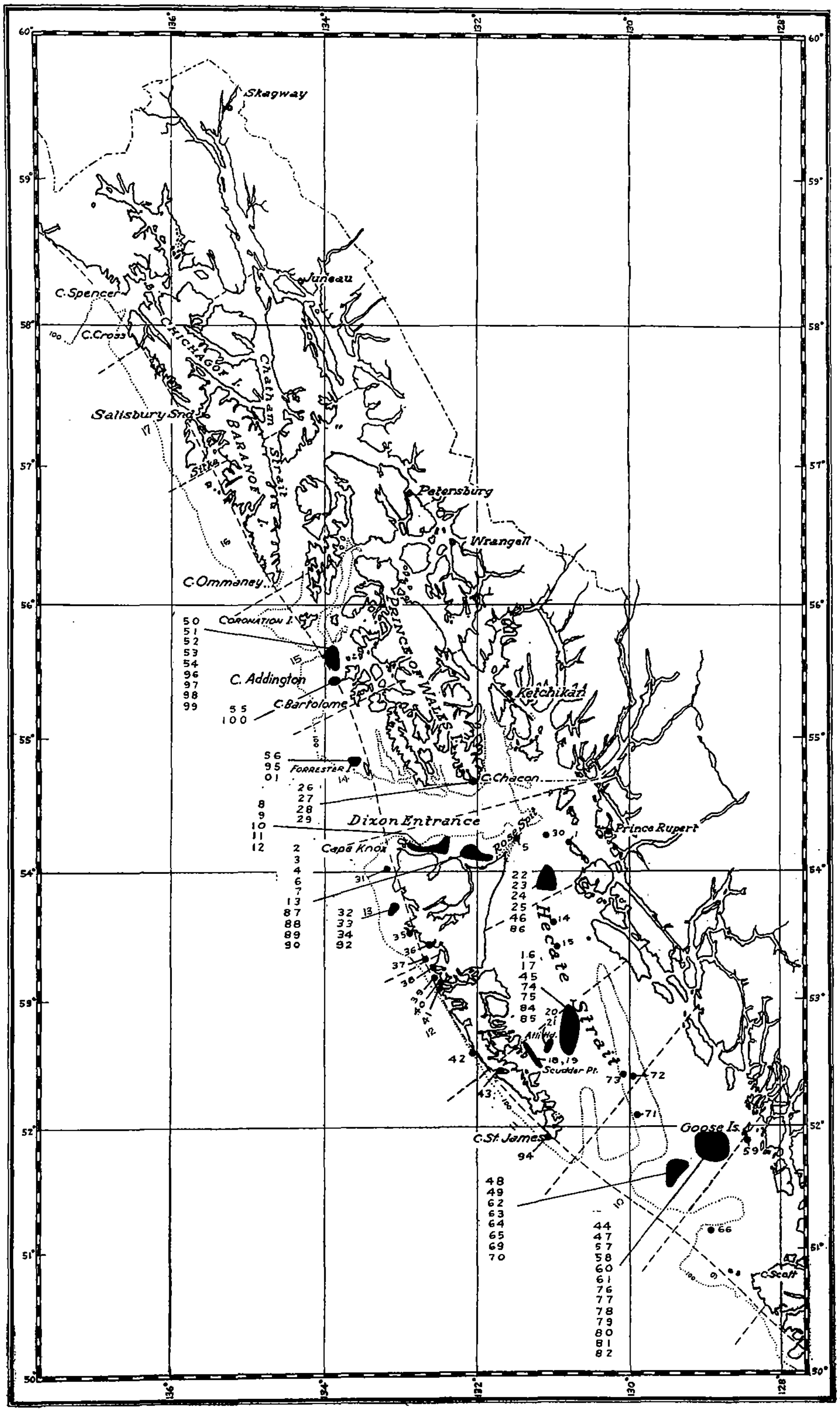

FIG. 2.—Pacific Coast from Cape Scott to Cape Spencer, showing the tagging localities in black and the statistical areas by dotted lines. The numbers given for each tagging location refer to Appendix A.

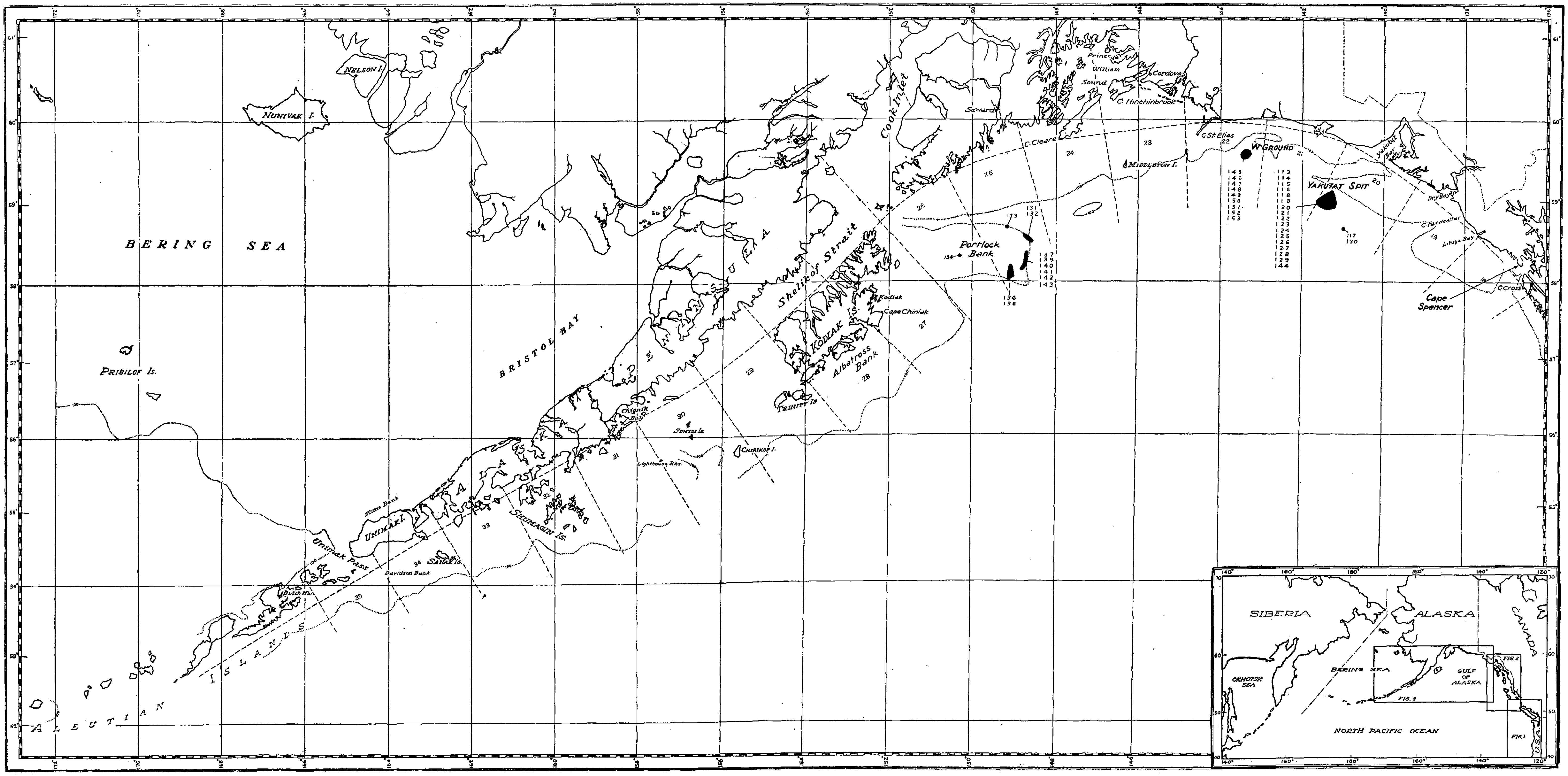

FIG. 3.—Pacific Coast from Cape Spencer to the Aleutian Islands, showing the tagging localities in black and the statistical areas by dotted lines. The numbers given for each tagging location refer to Appendix A. The insert shows the entire coast line divided into sections shown in Figs. 1, 2, and 3.

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ERRATA

(1) Page 112, column 4, the 7th item should read: 141:14:30.

(2) Page 122, No. 2335, column 10, should read: 97.7.

(3) Page 122, No. 2357, column 4, should read: 141:17.

INTRODUCTION

The investigations of the International Fisheries Commission, established under the treaty between the United States and Canada for the regulation of the Pacific halibut fisheries, were begun in the summer of 1925. They were designed to answer questions of primary importance in regulation. The most important was the amount of migration between banks, this to be stated in terms which could be actually applied to a given problem. Another, hardly less urgent, was the rate at which the fish were removed by the fishery or by natural death. These two questions pertain to the problem of providing for the administrator a knowledge of the history of the stock of fish on any bank, both as the fishery affects it and as it disperses, or adds to itself by migration.

No review of the literature is needed to show that our knowledge of methods to be applied in this problem is extremely scanty. The most direct approach, and at the same time the one at present followed with what seems the crudest technique, is that of marking.

Studies of racial characters, of differing growth rates, and of relative abundance in the several areas have been carried on and will be reported elsewhere.

The prominence of migration as a factor in regulation has been sharply emphasized by the observed effect of the existing closed season of three winter months. This has restricted the fishery at a time when it would otherwise be largely concentrated on the famous Yakutat spawning grounds. The drain upon the stock there has been greatly reduced, but an equally great intensification has occurred on adjacent areas during the remainder of the year, and the total amount taken has not been reduced. If the stocks of fish on the protected and open banks are the same, both areas being included in the migratory range of the same fish, then the net amount of drain necessarily has been unchanged. But if the stocks are different, that one which breeds at Yakutat is being protected. It has become evident that the distribution and movements of this stock determine the value of the regulation.

This important part played by migration is equally evident when future regulations are considered. There are very few of them which do not involve differences in the treatment to be accorded various areas, or various stages of the life history, and in each case the degree of migration and rate of recapture is of primary importance.

ACKNOWLEDGMENTS

The members of the staff of the International Fisheries Commission have all had part in the present work. This is because, in the operation of the vessel and in the collection of returns, extensive co-operation among the men concerned with the several lines of work was necessary. The senior author is responsible for the planning of the experiments throughout, and until the fall of 1927, for their execution, with the assistance of Mr. Harry A. Dunlop in particular.

In that year the junior author was given responsibility for the carrying out of the marking program. Messrs Harry A. Dunlop, F. Heward Bell, Richard Van Cleve, Norman L. Freeman, Olaf E. Eriksen, Ernest Pegler, and Roger S. Chute have all participated actively at sea and in collection of tags. During the past year Mr. J. L. Kask has collected tags in Prince Rupert. Permanent members of the staff assisting in correspondence with fishermen and in preparation of records or manuscript are Mrs. Fred Eastman, Miss Dorothy Myers, and Miss Olivia Froula.

The cordial co-operation of the fishermen, the captains, and the dealers has been fundamentally important and has always been obtained. Assistance and accommodations have been received from the United States Bureau of Fisheries, the Biological Board of Canada, and the Canadian Department of Marine and Fisheries.

The University of Washington at Seattle has furnished laboratory accommodations throughout the entire work. To the President and members of the faculty, the commission is obligated for many courtesies. Without these and the library facilities which were freely granted, effective research would have been very difficult.

The program has been discussed and approved by the scientific advisory board, appointed by the commission, and the several members of this board have aided the work in every way possible. The members of this board have been Dr. C. McLean Fraser, Dr. W. A. Clemens, Mr. N. B. Scofield, and the late John N. Cobb.

GENERAL DISCUSSION OF THE EXPERIMENTS AND THE CONCLUSIONS REACHED

The halibut fishery is one of the oldest on the Pacific Coast. But it is so only because the settlement of that region has been relatively recent. The fishery has developed with it since 1888 as the result of railroad communication with the eastern markets. The total catch had climbed rapidly to fifty-three millions of pounds by 1910, to fluctuate since at about the same level.

This maintenance of total yield has not meant stability, for it has been at the cost of rapid expansion of the grounds and of multiplied efficiency. The industry has, indeed, survived as a major fishery only by constant development of the fleet and its methods. Upon this development, as it may be served by scientific and technical advance, depends its future.

The story is, indeed, that of a constantly intensified and broadened strain. Under this the abundance on each section of the banks has declined, as yet without cessation. This depletion is an accepted fact and conservation is universally desired, but how it is to be brought about has been a serious question, one deeply involved with economic and biological considerations.

The trade has advocated two principal measures, one a winter closed season, the other the closure of areas inhabited by small fish, hence popularly termed nurseries. The former, based upon the belief that winter spawning should not be hindered, has been embodied in the existing treaty, the latter has been repeatedly urged as an additional regulation.

The effectiveness of both of these depends upon the migratory habits of the halibut. The closed season restricts the activities of the fleet when it would otherwise be largely concentrated on the famous Yakutat spawning grounds, thus protecting the mature fish which gather there. But to what banks do these belong during the open season? Are they confined to those off Yakutat, or do they migrate from up and down the coast to spawn? In the extent of this migration lies the answer to the question as to the true value of the closure, whether the schools concerned are taken at no other time in quantity, or whether from them an undiminished yearly total is taken while they are on other grounds. The closed areas for young fish present a similar problem, in a simpler and more direct fashion.

The movement of the fish is important from another viewpoint, that of the fleet. The fleet is broken into sections each interested in a different part of the banks. Does one section catch from a different stock of fish than do the others, or from the same? Can the fleet be given diversified treatment in accord with its varied needs, or must it be treated as a unit?

Although the present fleet is divided between several ports, these geographic divisions do not come into conflict over the desired regulations to the same degree as the two classes known as "big-boat" and "small-boat" men. The former use the western grounds in great part and the latter only the southern. In the case of the present closed season the big-boat men feel that it is conservation at their expense because it affects their fishery most. Any other regulation which may be proposed will be judged similarly. It was to be able to meet just such contrasting interests that the commission undertook a study to see how far the fish taken by one of these groups was dependent on that used by the other. Whether, in other words, one group could logically leave the burden of conservation with the other.

In fact all possible regulations are conditioned by the movements of the fish concerned. And if regulations should be framed without regard to these movements, then a knowledge of the latter is needed to understand the results that will come.

Migration is best studied by marking experiments. It is true that if there is no movement to and fro the halibut on each bank will develop their own physical peculiarities, and much can be learned by the study of these. But the most direct and simple way is to mark fish and see where they are recovered. It is an old method, having been in use on salmon from the earliest days, even Isaac Walton describing the use of silk marks.

In the experiments of the commission, the results of which are here spoken of, the tags used were simple straps of monel metal bent over the edge of the cheekbone, through which one pointed end passed, to be clamped into the other. On each tag was a number. The fish were caught by ordinary methods of commercial fishing. Those not seriously injured formed less than 50 per cent of the total. These were selected and were quickly tagged, a record was made of each length and of locality of liberation, and the fish were thrown overboard. A reward was offered for their return with information, and a larger reward was offered for the fish with the tag attached.

The marking experiments were carefully distributed, so as to represent the species fairly. The results are therefore applicable to the banks as a whole, rather than to any individual area.

The first marking was done in 1925, when the motor vessel "Seamaid," 65 feet in length, was used to tag 3,339 fish in Hecate Strait, Dixon Entrance, and the outer coast from Cape Ommaney to Cape St. James. During 1926 another motor vessel, 100 feet in length, the "Scandia," was used to tag 3,215 fish on the Goose Island ground north of Vancouver Island, in Hecate Strait and near Cape Addington in Southeastern Alaska. In 1926 the same vessel tagged 1,748 fish on the famous Yakutat spawning grounds, and in the following year, the "Dorothy," of the same size, tagged 1,338 on the nearby W Ground and 1,214 on Portlock Bank near Kodiak Island.

The banks south of Cape Spencer and those north and west are treated separately in the returns as southern and western grounds. The fish tagged on the former were nearly all immature, those on the latter mainly mature, a very convenient division which has allowed a clear presentation of results. The migrations shown were very different for the southern and western fish, and this difference corresponds to the condition of relative maturity. In Figure 23 for the south and Figure 34 for the west the movement of each individual is shown according to the time free, the height above the base line representing the distance travelled.

The percentage returns were 37.4 per cent in the four years of the southern experiments, and in this region 20 per cent were retaken during the first complete season. In the western experiments, 7.8 per cent were returned the first season, the only one for which complete returns are available.

The immature marked in 1925 and 1926 on the southern grounds moved very little, 92 per cent less than 50 miles and 96 per cent less than a hundred, an average for all returns of about 22 miles. The net amount of movement increased slowly with the period of freedom, 98 per cent the first season moving less than 50 miles, 90 per cent the second, and 78 per cent the third, while the fourth season returns were not numerous enough to give a comparable figure. The increased net movement may have resulted from greater age or longer time out. But it seemed random in nature, the direction governed rather by the limits of the banks than by the existence of any apparent routes. It conformed to the results which would be expected theoretically from random movements of small extent.

The mature fish marked on the western, or Yakutat and W Grounds, differed greatly from the immature in these regards. In the various experiments only 14 per cent moved less than 50 miles, and only 29 per cent less than a hundred, or an average of about 250 miles, more than ten times that of the southern fish. The average net movement during the first season was equal to that during the second in the only experiment for which two years' returns were available, hence whatever movement took place was complete within the first year. This would give good reason to believe that the gradually increasing random scatter of the immature had been replaced by either a definite seasonal movement or one quickly complete within the available grounds.

But such returns were modified by the way in which the intensity of the fishery was distributed. If tagging was done between two localities, in one of which a large fishery was carried on and in the other a very small one, the recaptures were necessarily in the former regardless of where the fish actually went. So in studying the results this was allowed for and the chances of recapture were calculated on a basis of the amount of gear fished in each 60 mile section of the coast.

The result showed that in the case of the immature southern fish the distribution of returns was entirely dissimilar to that of the chances of recovery, for 88 per cent were retaken in the area of tagging, as compared to an expected 6½ per cent if the fish had distributed themselves completely among the known banks. And of course the recoveries in other than the home area were greatly below the expected. But in the western fish only 13 per cent were retaken in the home area, as compared to an expectation of 3½ per cent. Among the remainder of the areas to the west, the actual recoveries corresponded approximately to those expected on a basis of the amount of gear fished if distribution of migrants had been complete and without limitation. The conclusion is unmistakable, that the mature western fish migrate freely and extensively while the immature southern fish do not.

But this was not all. The western mature fish did not migrate south, but rather to the west from Yakutat. Only 5 per cent of the fish marked beyond Cape Spencer were returned from the intensive southern fishery. This is a mere dribble, as compared with the numbers which moved westward. But its presence recalls the fact that the southern grounds still support a small fishery for mature fish. As yet we have not been able to decide whether this 5 per cent that moves southward is all that maintains the southern fishery for matures. A shrewd guess would be in the affirmative.

This brings us to another interesting point in our analysis of returns. Do enough of the southern fish survive to provide spawning schools? In other words, what is the intensity of the fishery on those southern banks? The numbers of tags returned give us some indication. From these an estimate has been made that if natural mortality is discounted, the fishermen would account for over 40 per cent of the stock each year. This estimate is based upon the average for all sizes, but further examination shows that for those between 28 and 36 inches in length the rate of return is higher, about a sixth.

Yet to the fishery is added natural mortality, to produce a much more rapid rate of decline. We find that for the 1925 experiment the number of returns for each year decreased about 58 per cent below that for the previous one. Assuming that the tags dropped from living fish are relatively few, these returns must represent a more or less constant percentage of the tagged stock existent at the start of each year. If so, this tagged stock is decreasing at about 58 per cent annually. This would mean the survival of 42 per cent after the first year, and about 7 per cent after the third. Granting the very approximate nature of such calculations it can be seen that a school of five year old fish would have few of its members left by the time they were nine or ten years old. And yet it is not until the twelfth year that half the females are found to be spawning. Our catches in southern waters show that there is just such a lack of mature fish as our reasoning would indicate, except on the outer edges where there is a small fishery in late fall and early spring.

No such intensity of fishing prevails on the western grounds. Although the returns the first year are very much less, the work has not gone far enough to enable any estimates to be presented. It still remains to be seen how sustained the rate of return will be, for if the tags cease coming within a year or two it will be fair to assume that the tagged stock has disappeared, however few of the tags have by that time found their way to us.

The conclusions to be drawn from these results are very important to the industry and through it to the public. They affect profoundly the judgment to be passed on the condition of the banks and on the regulations that have already been, or will be in the future, adopted.

They show that the western and southern fisheries are now biologically nearly separate as far as the commercial sizes are concerned, whatever the larval history may show. It cannot, in the future, be denied that each region must bear the burden of its own conservation, for both big-boat and small-boat men can be held responsible for allowing the growth of necessary spawners.

It is proved that within these southern banks the existing stocks of immature fish are largely non-migratory. They inhabit their home banks during the fishing season, whatever they may do during times they are not taking the bait. For that reason regulations protecting particular banks are desirable and will be efficient. The proposed nurseries are justified, in principle, although the small size of the areas presumably protects but a small proportion of the total number of fish. That such protection is necessary is shown by the alarmingly high intensity in the fishery and by the small numbers surviving to spawning size.

The proof that mature fish migrate freely and widely on the western banks indicates the necessity of treating that district as a unit in protecting the mature stock. This does not affect any need which may arise in regard to the immature fish on these banks. It indicates the essential correctness of the commission's previously announced conclusion that the spawning fish protected by the closed season are taken freely at other times, and that while this regulation is a step in the right direction, it cannot be adequate in itself. The results indicate that the western banks will tend to decline together as long as the mature stock predominates, but not necessarily so when the immature only remain.

The report made here does not completely analyze the fish tagged to date. Only the returns of the earliest experiments are complete enough for adequate treatment. From the detailed returns now on hand there yet remains to be presented much that is vital in regard to the individual banks and to the nature of the movements made thereon.

A great deal remains to be done by further experiments before our knowledge is complete enough for purposes of regulation. We do not yet know whether the southern mature fish are migratory or not, and cannot recommend properly for the protection of the small spawning schools now to be found on the banks off the Queen Charlotte Islands and elsewhere. Nor do we know whether the western immatures are as stationary as those in southern waters —yet at the present rate of depletion the time will soon come when, as on southern grounds, there will be practically nothing but these immatures to protect. Beyond this work remaining on the known banks, there is the problem of the grounds untouched to the far westward, for the range of the halibut extends along the Aleutians and into Bering Sea. We know nothing of the relation of the stock there to that on our banks, whether it replenishes our supply or not.

So also, our study of intensities is but barely begun. Our present material has been handled according to methods which must be revised and perfected. Our returns from the western mature stock are so sparse as to fail in the reliability of the average rates of return which are obtained. It has been demonstrated that there is an alarming intensity on the southern banks, but this intensity varies with size, and the commercial catch must be analyzed to give us data as to these sizes.

Finally, from the standpoint of the future, these marking experiments present the possibility of gauging from time to time the intensity of the fishery and of estimating the percentage surviving to reach spawning size. It seems that in this a direct means of observation can be developed, one which is independent of the collection of complete statistics of catch. Marking experiments should become a really effective and much needed instrument in the control of the halibut fishery. It should be possible to follow the fate of the stock on any bank, its decrease through death, capture, and emigration, and its increase through immigration.

A more detailed summary of results is presented on page 105.

SECTION A.—METHODS

METHOD OF ATTACHMENT

The marking experiments were begun in June of 1925. In considering the method of tagging, the characteristic shape and habits of the halibut, as well as the methods of the fishery, were deciding factors.

The halibut is, of course, large in size, and more valuable per pound than the majority of species. A fish of 15 pounds weight is worth from $1.50 to $2.50 or more to the fisherman, and many fish weigh as much as 80 or more pounds. A system of rigid inspection and culling by the buyers is in operation. As a result, no tag could be considered which would injure or blemish the body of the fish in any way, primarily because it was necessary to retain the good-will of the fishermen. If the body had been injured it would have been necessary to pay the cost of the fish in addition to any rewards offered.

This decision on economic grounds against the usual body tag was reinforced by a consideration of the shape of the halibut, it being a thick-bodied fish. To successfully attach a tag on the body would have meant a long wire through its center in the vicinity of the back bone. To attach it elsewhere would have necessitated the placing of the tag on very oblique surfaces, where it would soon have worked loose or even become entirely detached. Finally, to thus tag the young of a fish which would ultimately become large-sized, meant that if the tag became firmly fixed, it would be buried in flesh and perhaps in time become invisible. Such arguments may not apply to the tagging of a species like the salmon, where recovery is expected within the immediate future. But they are of great importance in experiments which involve recovery over many subsequent years.

It was possible therefore to tag only on the head or well out on the fins. The latter location was impractical because of the insecurity of attachment, and there remained only the head. On this, the opercular bones were the obvious places.

In considering the opercular bones, the eyed side of the fish seemed most logical, because of the habits of the fish. Like all other *Pleuronectids,* it spends some, or much, of its time buried in the mud or sand, and anything which would interfere with this habit would affect the degree of movement and the liability of capture. A tag on the blind, groundward side would necessarily irritate the fish whenever it rested on the bottom or attempted to burrow, and moreover, would catch on obstacles, damaging the tissue, which is frailer on the blind than the eyed side. As was later found, it is not unusual for a tag on even the eyed side to show evidences of abrasion. These considerations overbalanced, in the director's opinion, those of greater visibility to fishermen when the tags were placed on the blind side, and of the danger of attack by other fishes upon any exposed bright object. The opercle of the eyed side was therefore chosen as the point of attachment.

In choosing this point of attachment, full cognizance was taken of the lack of success in tagging experiments upon the cod, where the recoveries—reasonably numerous at first—fell soon to nearly none. The opercle is, of course, in constant movement with the respiration or feeding of the fish,

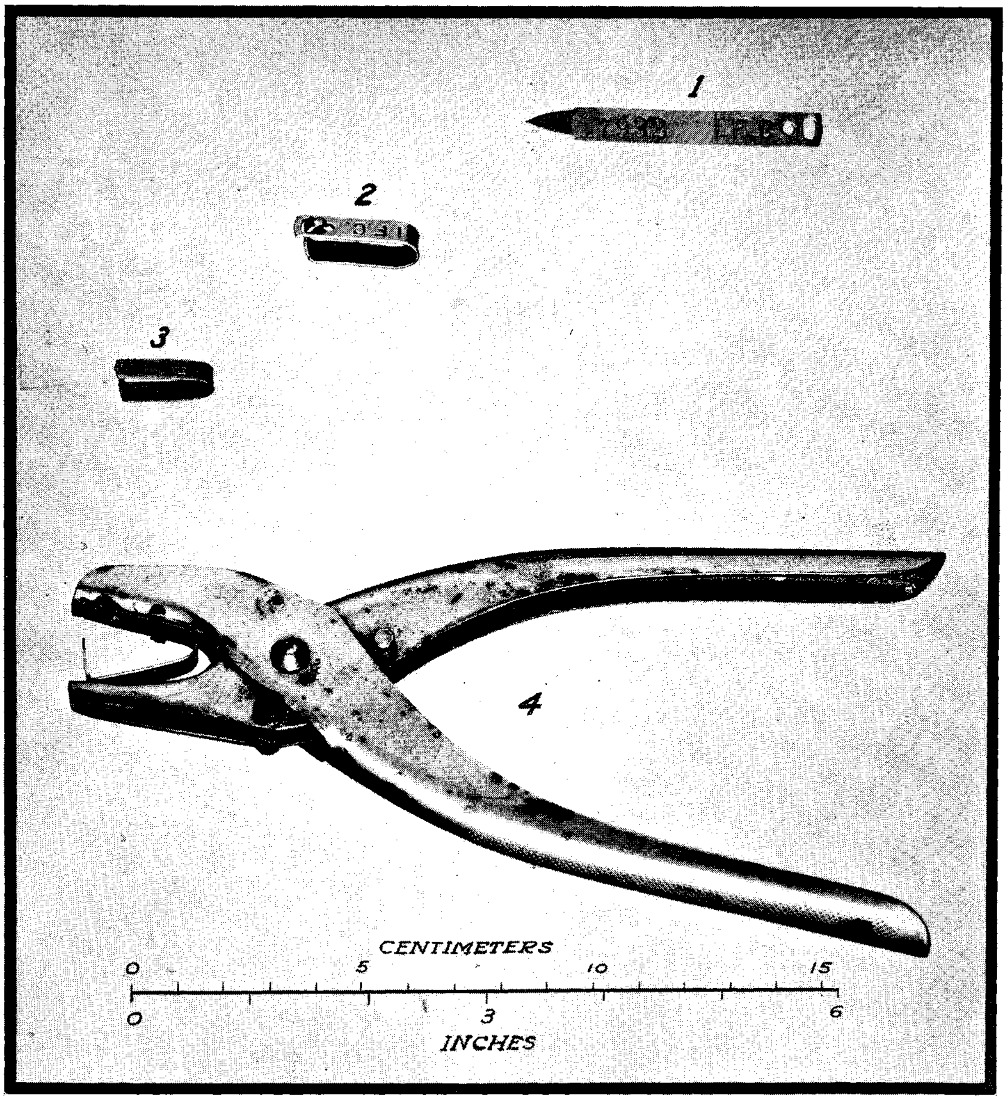

FIG. 4.—Strap tags and pliers used in the tagging work. No. 1 (Large) strap tag straightened out to show shape. 2.—No. 1 strap tag clinched. 3.—No. 2 (Medium) strap tag clinched. 4.—Pliers with No. 1 tag inserted ready for attaching.

and it was a debatable point whether a mark could be successful under such conditions. The chief danger of loss seemed to be the wearing away, or sloughing off, of tissue around the mark until it fell off. This seemed to indicate that a tag so shaped that a very considerable amount of tissue would need to be worn through would be most successful.

The upper angle of the gill opening, and the upper part of the opercular bone were chosen for marking, because (1) the tag reached across a ridge of bone, and (2) the motion of the gill covers in feeding seemed least there. There is some doubt as to whether the motion due to respiration is not greater at that point.

Having thus chosen the opercle as the site for the mark, the question arose as to the type of tag to be adopted. A button tag of either the Danish or German type might have been chosen, since such is generally used in plaice marking experiments in Europe. The principal objection to such opercular marks appeared to be the danger of early loss by decay of tissue around the buttons and their supports, allowing the tags to fall out.

CHOICE OF MARK USED

All available types of tags manufactured at the time in the United States were obtained and compared. These were of many shapes, designs, and sizes, including rings, spring clamps, and tags attached by wires; and were of many different metals, such as brass, aluminum, monel metal, and silver. They were, for the most part, cattle tags. Among others were round silver tags discarded from previous salmon experiments by the United States Bureau of Fisheries.

There appeared to be little choice among them from the standpoint of irritability to the tissues. It seemed, in fact, wisest to adopt that tag which would require the greatest wear of tissue before loss. This was the strap or ear tag, most commonly used for cattle, and also used for marking salmon and cod by the United States and Canadian Governments. There is nothing inherent in the tag pattern which renders it exceptional, save the large part of the opercle it is possible to include within its grasp, and the fact that it has but one fastening point, which renders it convenient to attach. These were the points which led to its wide usage on cattle.

For a time it appeared desirable to construct a long flat tag with two penetrating points and a second part with two eyes to receive those points. This appeared desirable because the cattle tag projected over and around the opercular edge and might for that reason be subject to unusual motion. On the other hand, the projection beyond the opercular edge seemed a desirable feature because any slack developed by wear would simply allow the tag to project freely to the rear, whereas in the other types any slack would cause the tag to project and be torn off.

However, there was some doubt as to whether the actual wearing of the tissue would be the cause of loss, and in view of this doubt, a type of button tag was made and used simultaneously with the strap tags. The outcome showed the conclusion to be well justified, that wear, or sloughing off, was the principal cause of loss, and the button tags, held by a comparatively small area of tissue under compression, were seldom retaken more than three months after attachment.

The strap tag is shown in Figure 4, together with the pliers used in attaching it. This has proved reasonably simple in use. It is easily and rapidly attached, with a minimum of loss because of defective shape or action. The initial cost, $37 a thousand for the medium-sized tag, was small compared to that of any type of more than one part.

The choice of material was not difficult. Monel metal offered all the advantages any other did, and in addition was very resistant to corrosion. It was hard enough to enable the point of the tag to be run through bone, yet it was malleable and easily made. It was not conspicuously bright, as was silver, but was readily seen by the fishermen.

The strap forming the larger tag, "Number 1," was 69 mm. from end to end, 8 mm. wide and 1 mm. thick, weighing 4 grams. Partly because of difficulties in making, the tags numbered 17,201 and over were made .65 mm. thick, and incidentally, .1 mm. wider. The larger tag then weighed 2.6 grams. These were used in 1929 in westward areas. The strap of the "Number 2" tag was 58.0 by 6.5 by .6 mm. and weighed 1.6 grams. When closed and the point properly clinched, the space enclosed by the larger tag was 25 mm. in length and 7 mm. in width; by the smaller, 20 by 5.5 mm. thus easily accommodating the halibut opercle.

When attached, the tags were fitted snugly to the opercle as far into the upper angle of the gill opening as possible (Figure 5). The soft flap, or valve, which seals the gill opening during inspiration through the mouth was interfered with, but not to a serious extent if the tag was fitted snugly.

STRAP TAGS SUCCESSFUL

The strap tag proved very successful from the start. When the recaptured fish were brought in, the majority of marks were still firmly attached to the opercle. In many, a short slot had been worn, and in a few the tag had worked out to the point where it might in the near future be lost. On the tagged fished recaptured after a lapse of two and three years, the tags were in most cases firmly attached with the flesh grown around and over the tag until it was securely held.

The round tags, both monel and silver, proved unsuccessful. The returns during the first season following the tagging were 4.7 per cent, but the following year only 0.3 per cent were recaptured, and in the next year none. The rapid cessation of returns following the first year was apparently due to the loss of the tags from the fish. Moreover, during the first season many of the marks turned in had worked nearly free and a number of cases were reported of fish caught with a round hole in the opercle, apparently caused by a round tag which had been lost.

The material used for the tags appears to have been quite satisfactory in so far as resistance to corrosion and effect on the tissues are concerned. The silver tags returned over a period of one year showed little or no corrosion. Monel strap tags were returned which had been out from one to four years and in all cases the numbers were as clear and distinct as on the day they were attached. In an occasional case the tag was partly covered with small barnacles but when they were cleaned away the numbers were found

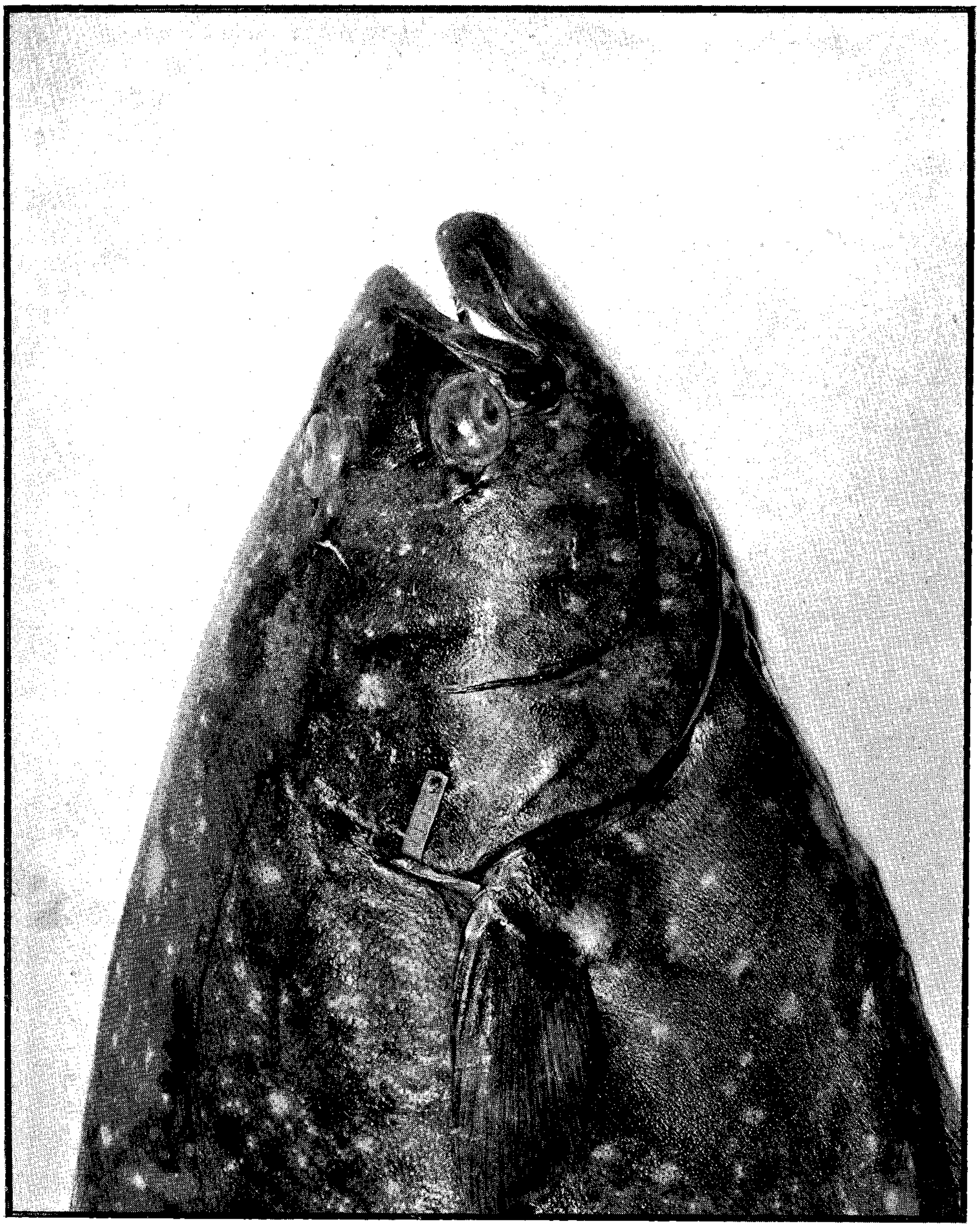

FIG. 5.—Halibut with tag attached ready for liberation.

to be unaffected. Furthermore we have not been able to observe any irritating effects other than friction, produced by the contact of the metal with the flesh.

The results of our 1925 experiment proved the strap tags in the two sizes used, Number 1 (large) and Number 2 (medium), to be so much superior to the other types tried that they have been used exclusively since that time in our regular marking experiments. As has been said, in the 1929 work a somewhat modified strap tag was used, being lighter than the original. The results of this modification will not be evident until it has been more extensively used and until we have had returns over a considerable period, but in view of the consistency of results obtained from large and small tags, it will doubtlessly be impossible to detect any effect the change in weight may produce.

It has been deemed necessary that no considerable changes be made in method during the course of the experiments. Such changes would prevent a unified treatment of the results from the standpoint of rate of return, or in fact from almost any standpoint.

VESSELS AND PERSONNEL EMPLOYED

In all of our marking experiments the work has been done on a commercial halibut vessel chartered for the purpose and used without any extensive changes. The period of charter has been from three to six months in length each year.

The fishing operations and navigation of the vessel have been in the immediate charge of an experienced captain from the halibut fleet, acting under the scientist in charge, the vessel being handled and fishing carried on by a crew of fishermen, while the scientific work was handled by members of the scientific staff on board. The fishermen were paid by a bonus system, and the captain was allowed to choose the best available fishing grounds within the area designated by the director's instructions. The result of these arrangements was a highly efficient operation of the vessel, in every way comparable to those of regular commercial vessels.

The conditions under which the work has been done have been most difficult, particularly during the winter in the Gulf of Alaska. All work was done on the open deck except for canvas shelters built over the scientific instruments during the colder seasons.

In 1925 the "Seamaid" was used. She was a small halibut vessel of Canadian registry with a length of about 65 feet and with a 65 horse power Diesel engine. She carried 2 men from the scientific staff and a crew of 6, including the captain. Her size was not sufficient to allow of much work except tagging on her decks at any one time.

In 1926 the "Scandia" was chartered, a halibut schooner of United States registry about 100 feet in length and with a Diesel engine of 140 horse power. She carried a scientific staff of 4 to 7 men and a crew of 8 to 10, the number depending on the work to be performed. This vessel was lost with all equipment by shipwreck, during severe weather in February of 1927, while engaged in tagging operations off Kodiak Island.

In 1927 and 1929 the halibut schooner "Dorothy" (Figure 6), of United States registry, was used. She is a vessel of 102 feet in length powered with a 270 horse power Diesel, and on the two tagging trips in 1927 carried a scientific staff of 7 and a crew of 9. With this vessel we have been able to stay at sea in all weather, even during the winter.

In addition to the tagging undertaken on these fishing trips, work was simultaneously carried out on race, age, growth, and maturity studies, and experiments were made with different kinds of fishing gear.

CAPTURE AND HANDLING OF FISH FOR MARKING

The capture of halibut for marking purposes has in all cases been accomplished by the commercial hook and line method. This was considered the most obviously practical as the use of the otter or beam trawl has never been sufficiently followed on the banks to give any indications of the grounds upon which they could be successfully used, what sizes of halibut they would take, or the condition of the fish when taken.

The commercial method of fishing was, however, somewhat modified in order to obtain the fish in as strong and vigorous a condition as possible. The gear was allowed to "soak" (remain on the bottom) from two to four hours only, instead of the more protracted period which is the accepted practice now among the commercial vessels, especially the long-liners.

When brought to the surface on the gear, each halibut was lifted inboard as carefully as possible by the fisherman at the roller. If the fish was hooked in such a manner that the injury was obviously mortal, it was thrown into the checkers. From it racial measurements, otoliths, and scales were taken, and it was afterwards iced down and brought into market. If the injury did not appear to be certainly mortal the ganging (short line from the hook to the ground line) was immediately cut and the fish passed over to one of the scientific assistants for tagging. Throughout the fishing operations, a watch was kept on the fishermen to insure that all possible fish were saved. The fishermen themselves developed great interest in the work and made every effort to land the fish without injury.

After the halibut had been turned over to the scientific assistant, the hook was carefully and quickly removed by means of pliers, cutters, and a specially designed wooden instrument somewhat similar to the fisherman's "gob stick." The degree of injury to the fish was then ascertained. If an important artery had been cut, the gills injured, or the visceral cavity punctured or opened, the fish was discarded for tagging purposes. In all of the marking work on the banks south of Cape Spencer 36.9 per cent of the halibut caught have been tagged, and on the banks north and west of Cape Spencer 29.8 per cent. A more complete discussion of the proportion tagged and the effect of various injuries is given on pages 36 to 44.

The halibut, having been accepted for marking, was measured. To aid in measurement, the halibut was placed on a board, or tagging "cradle." This was a heavy wooden trough, with a head piece across one end so designed as to fit the convex under surface of the fish. Thus the fish was held in a natural position, and when the longitudinal axis of the cradle was placed

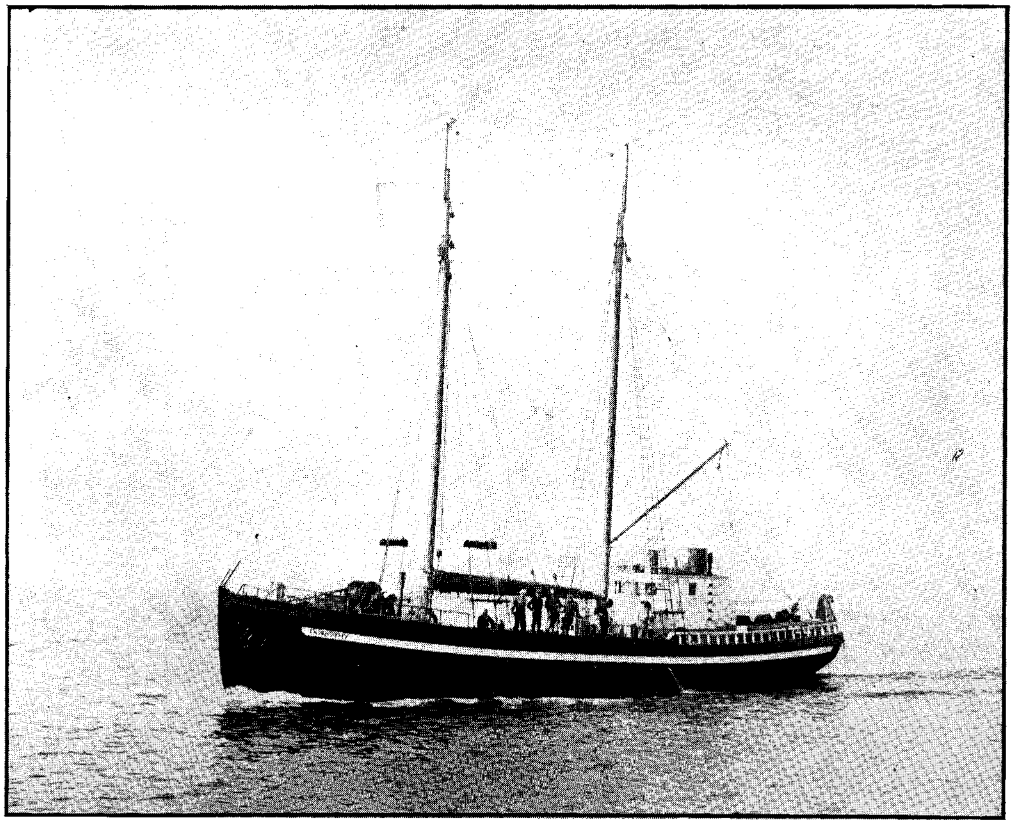

FIG. 6.—Halibut vessel "Dorothy." The boat used by the International Fisheries Commission for tagging operations in 1927.

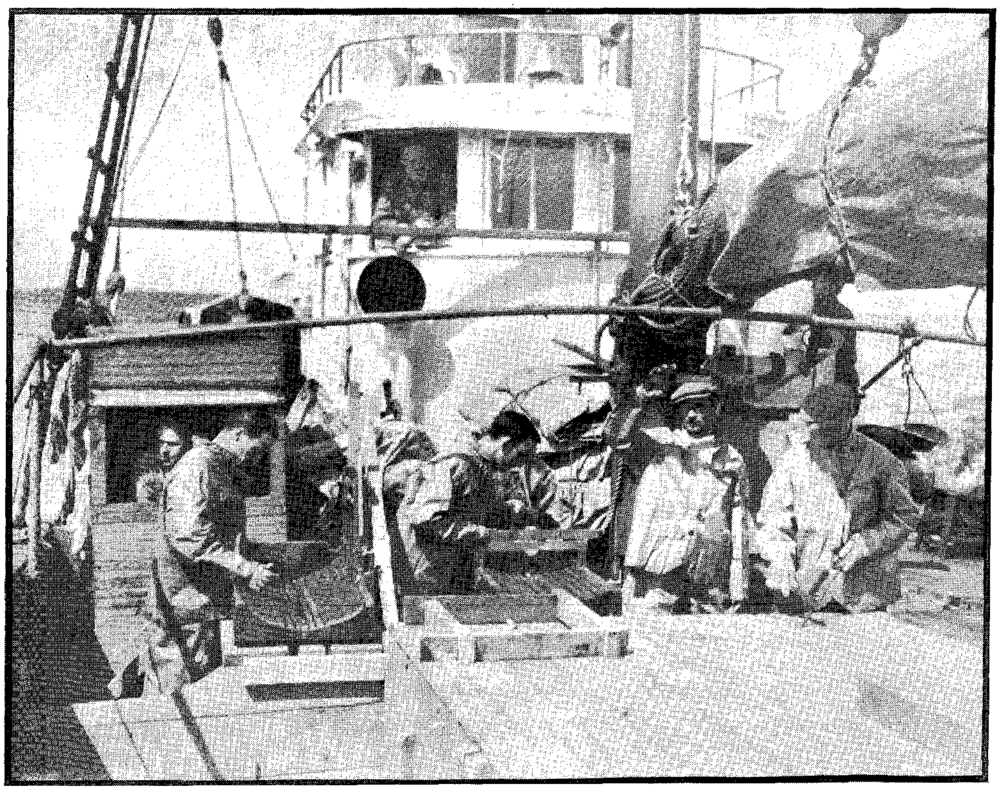

FIG. 7.—Deck view of M.S. Dorothy, May, 1929. The photograph shows the arrangement amidships for the tagging cradle, race cradle, weighing, cleaning, etc. The picture was taken after the tagging operations were completed and the boat was running for port. During the actual operations it is almost impossible to obtain good photographs of operations as the workers and appartus are covered by a canvas shelter stretched over the pipe framework shown, to protect the work from the severe weather frequently encountered

parallel to that of the ship, the concavity prevented the sliding of the fish from side to side with the roll of the vessel. This position of the cradle relative to the ship was chosen because the pitch of the vessel was much less disturbing to careful measurement of length than the quicker and more violent roll. Although the design of this cradle was modified considerably, the fundamental principle of a head piece and lengthwise concave trough to fit the fish, was not altered. A photograph of this cradle, as used in 1929, is shown in Figure 7.

Measurement of length was made by a scale adjusted to zero at the headpiece, and extending lengthwise along the bottom of the concavity. During the early work in 1925, the scale was a steel tape, frequently renewed; but in 1926 a brass bar divided to millimeters was found to be much more satisfactory and permanent. The halibut was placed in the cradle so that with the mouth firmly closed the tip of the mandible came into contact with a brass plate on the head piece, and the length was read to the end of the middle caudal rays.

The man acting as recorder listed data both on manila coin envelopes and on waterproofed paper in a notebook. The envelopes had previously been given the tag numbers in consecutive order as already arranged on the sticks holding the tags, and in each, after checking the numbers of the tag and the envelope, there were placed a few scales from just above the posterior section of the median line on the eyed side, while on the outside the length of the fish was recorded. In the notebook the tag number and length of fish were listed under the proper heading showing date, position, depth, etc. In some of the experiments a record of the injury caused by the hook was kept. The numbers and the data on the envelopes were later checked against the notebook.

The time required for the complete procedure and the return of the halibut to the water was largely dependent on the difficulty of removing the hook and quieting the fish for measuring. Measurement and the attachment of the tag were quickly done. The greatest number tagged in one day was 361, although the average was much below this. It was found that the fish could be handled as fast as brought in on the gear, so that, practically, the limiting factor for the number marked was the rate of capture. The work was first done on the open deck but later, when working during the winter on the northern banks, a shelter was constructed of heavy canvas over a pipe framework. The recorder occupied a small weather-proof office within the canvas shelter.

COLLECTION OF RECOVERED TAGS

Perhaps the most vital point in the tagging experiments is the recovery of recaptured tags. Not only is there great danger that the fishermen will overlook the tags, but also that they will not turn them in. The fishermen are usually ashore but a day or two between trips, and it would be very unlikely that any of them would take the time or make the effort to write letters reporting the tag. Consequently it was sought to bring the knowledge of the tagging experiments to the attention of all persons concerned in the capture and handling of fresh halibut and to make it as easy and simple as possible for them to turn in the tag and information and obtain the reward.

TAG No. 11300

CERTIFICATE OF PAYMENT OF REWARD FOR RETURN OF HALIBUT TAGS.

Fish Buyers, Dealers, or other Agents with whom arrangements have been made by the International Fisheries Commission or its representatives are authorized to pay one dollar ($1.00) in cash upon the delivery to them of a tag taken from a halibut, this tag bearing the initials I.F.C. and a number, and accompanied by the information called for in the following blanks. Tags accompanied by incomplete information should not be paid for, but should be forwarded to the International Fisheries Commission subject to redemption at reduced rate. The International Fisheries Commission, at the following address, will redeem tags at the price paid for them, when accompanied by this certificate properly filled out.

INTERNATIONAL FISHERIES COMMISSION,
University of Washington, SEATTLE, WASH.

The right is reserved to alter the amount of the reward or to withdraw it upon due notice.

(1.) Upon what date was the fish carrying this tag taken? Mar. 31, 1929

(2.) In what locality (be sure to be exact)? 89 miles NE 1/4 N from Williams Reef

(3.) In what depth? 95 fathoms

(4.) When did you see tag (roller, deck, cleaning)? Cleaning

(5.) Length overall of fish (greatest length)? 67.0 cm.
(If rule not available, cut a string to proper length—do not guess.)

(6.) How many skates of gear were fished in that locality during the trip when the fish was taken? 195 skates

(7.) What was the total catch made there (estimate)? 17000 #

(8.) What was approximate average weight of fish in this catch? 10 - 20

(9.) My mail address is 100 Blank St - Seattle

(10.) I have received the sum of one dollar ($1.00) in payment for this information and the accompanying Tag, No. 11300

(Signed) John Doe
(Fisherman or Finder.)

Boat Blank

Name of person or firm presenting this certificate for redemption N L Freeman

Date of redemption 4/28/29

Any officer of the United States Bureau of Fisheries or the Dominion Department of Marine and Fisheries, Fisheries Branch, will forward this if requested. Offices will be found as follows:—

INTERNATIONAL FISHERIES COMMISSION,
Parliament Buildings, Victoria, B.C.
University of Washington, Seattle, Washington.

DOMINION DEPARTMENT OF MARINE & FISHERIES, Fisheries Branch,
202 Winch Building, Vancouver, B.C.
Dominion Building, Prince Rupert, B.C.

U.S. BUREAU OF FISHERIES,
L. C. Smith Building, Seattle, Washington.
Charles & Hardcastle, Ketchikan, Alaska.

Information as to the place and the date of tagging can be obtained through any of these offices or will be mailed to the address of the finder as given on the face of this form.

Please add on opposite side any remarks as to condition of fish or sores caused by tags.
2M-529-6562

FIG. 8.—Facsimile of the certificate distributed among the agencies authorized to redeem recaptured tags, showing the information required with each tag turned in.

Publicity was arranged for in three ways. Posters were issued and every firm engaged in buying halibut was asked to place copies in a conspicuous place. Notices were printed on the fly leaf of log books which were issued to the fishing captains for keeping a record of their catches. In addition, at open meetings held in 1927 at Ketchikan, Prince Rupert, Vancouver, and Seattle the commissioners and the senior author presented and discussed with the fishermen the aims and problems of the work and invited their interest and cooperation.

This method of publicity was used as it was scarcely possible to reach the fishermen otherwise. They obtain copies of daily papers only occasionally when in port, and fishing journals are rarely seen in their possession.

In order to make it as easy as possible for the fishermen to turn in the tags and information and collect the reward, it was arranged with governmental agencies and with every buyer or dealer to accept the tags and pay for them in cash. To that end a form has been distributed, to be filled out with the desired information concerning the recaptured fish. This form, or redemption certificate, guarantees repayment by the commission. A facsimile of this form is shown in Figure 8.

In 1925 the tags and certificates were collected personally from the dealers and other agencies authorized to redeem them. Later the procedure was adopted of sending mailing tubes to each dealer or agent, thus facilitating the return of tags and information.

The reward offered for the recovery of tagged fish varies with the amount of information secured. If the data as to locality, time of catch, and length of fish are incomplete a reward of 50 cents is paid. If the information is complete the reward is $1. Since early in 1926, $1 additional has been paid if the tag is brought in with complete information and the fish is kept separate so that it can be examined by a member of the scientific staff.

Following the offer of the $2 reward, an increasing proportion of the recaptured fish have been handled under this arrangement. From February to June, 1926, 27 per cent of the reported recaptures were examined, from July to November, 1926, 58 per cent, during 1927, 71 per cent, and during 1928, 80 per cent.

This method of redeeming the tags enables the collector to obtain any information required directly from the captain of the boat and gives an accurate and uniform measurement of the length of the fish instead of the fishermen's measurement.

The determination of the sex of tagged halibut has, from the beginning, proved to be impossible. It cannot be ascertained at the time of tagging without serious injury to the fish, unless they are actually spawning. It cannot be ascertained after recovery with any degree of probability, save by inspection of the gonads. The pockets in which the gonads lie are deeper in the females than in the males, but only on the average, and the depth depends upon degree of maturity to a large extent. An immature female cannot be distinguished from a mature male of the same size.

As far as accurate returns as to sex by the fishermen are concerned the case is nearly hopeless. Even when the gonads are greatly enlarged, the fishermen must be personally instructed as to sex differences, and when young immature fish are in question, even trained tag collectors may make mistakes. Fishermen frequently state positively that fish they are cleaning have no gonads, and they are as a rule much interested in demonstrations of sex differences. It was, therefore, not even attempted to require information as to sex when tags alone were returned.

When fish with tags attached were brought for examination, it might have been expected that information as to sex would be available. This, however, is not so. The fish when captured are promptly cleaned, and all traces of gonads removed along with the kidneys, etc., with a careful thoroughness resultant from long training in the proper care of the catch. The fish are very often cleaned before the tags are discovered, and if not, either the force of habit or the fear of having the fish spoiled or rejected leads to thorough cleaning. At all events the tendency is to give the fish the usual treatment, merely distinguishing them from their fellows by some mark, as a string around the tail.

It might be possible, by purchasing the fish in addition to giving the reward, to have from the more careful crews, a fair number of fish giving sex determinations, providing the fish were not cleaned before discovery of the tag. This would necessarily be exceedingly expensive and could at best provide information as to sex for but a small proportion of the recoveries. This proportion would be a selected category of fish, largely from southern banks, where fish are handled more carefully, and insufficient to give consistent differences in any of the finer analyses. They would be largely immature because of their southern origin.

As will be seen later, the mature fish on the western banks migrate widely, but the immatures on the southern banks move very little. Sex differences can, therefore, be but a factor of minor importance when the movements of these immature are concerned. Available information on sex differences in returns of tags must await a later report.

After the information concerning each recaptured fish has been received, the time out, movement, and growth are calculated. A letter is then written to the fisherman thanking him and informing him as to the date and place of tagging and the amount of growth. Most of the fishermen have shown a considerable interest in this information, and occasionally when the letter of acknowledgment has been delayed they have made special request for it. In case the amount of movement shown has been unusual the fisherman is requested to corroborate the recovery location.

ACCURACY OF CALCULATIONS

The calculations of the distances between points of tagging and of recovery can in the great majority of cases be considered accurate within 5 or 10 miles. The error may, in some cases, be in excess of 5 miles even over short distances. It may have arisen in part during determination of the tagging locality, but more especially in the determination of that of recovery.

When tagging, the initial position of the vessel may in each case have been known within a mile, by dead reckoning, or in good weather either by cross bearings or by use of the sextant. But movements subsequently made were complicated and many, with fish constantly being taken on all parts of the ground covered. To ascertain the exact place in which each fish was taken was nearly impossible. The operations were usually plotted and it was found that ground covered in a day's fishing of about 50 skates of gear as a rule equalled 10 or 12 square miles. Occasionally, but not often, this was stretched to some 8 or 10 miles between extremes. This involved an error of less than 4 miles if one locality was given for the day.

If this has been true of the tagging vessel, it has been even more true of the vessels retaking marked fish. Fish caught are accumulated on deck and some of the tags are not noticed until the time the catch is cleaned, usually twice a day or oftener. Marked fish therefore may have come from any part of the area of 10 square miles or so covered during the intervening fishing. Evidence of this confusing effect of the fishing location is given by the fact that frequently the recorded depth and the locality do not correspond as they should, simply because the location given was the initial one for the day in question, the depth one of a number actually found during subsequent movements.

Localities of recapture are therefore subject to an error which varies with the extent of ground covered, and will in general be 3 or 4 miles

There are, of course, the errors usual to statistics gathered from non-scientific men, but the level of intelligence among the captains is high and their information unusually trustworthy *as a rule.* We know of no deliberate falsifications, but we do know of carelessness. An error of a mile in plotting a position from a point 20 miles distant is not uncommon, and there is occasionally some confusion as to the exact point of departure, whether for instance the highest point or nearest edge of an island is used in measuring distance. More often, the location is given vaguely, from lack of appreciation of our need, as "off Massett," or "N from Massett." The records with indefinite locations have, during the later years, been almost completely avoided by the present system of personal collection of data. For such errors there is, naturally, no remedy, but fortunately they are relatively few and small, being included in a general estimate that our recovery locations are accurate within 7 miles on the average.

We have, generally, calculated the distance of movement as that between the center of the grounds over which tagging was carried on and the locality given for returns. Where depths given did not appear correct they were ignored. We believe the resultant distance is usually within 10 miles of the correct one, and that when many returns are averaged, the errors largely counterbalance each other.

In Appendix A, where the detail regarding each tag is given, it will be found that among the early returns especially, the migrations were calculated from the precise point of tagging. This method was later abandoned as unnecessary and tedious, but the distances already determined were left unchanged in the tables, having been used in calculations. Discrepancies of from one to three miles between the migration shown and the distance between points given can therefore be expected.

SECTION B.—THE PROGRAM AND THE CONDITIONS DETERMINING IT.

THE PROGRAM

In planning the marking experiments, two possible methods were considered. One was the tagging of large numbers of fish at one time in a single area. The other was to make the distribution of the tagged fish represent, at least roughly, the general distribution of the species according to its varying abundance.

Objections to a single centralized experiment were many. In the first place, sufficient numbers could be obtained only by prolonged operations and the relative scarcity of these large fish rendered the work extremely costly per fish tagged unless the vessel and gear were used as efficiently as possible. This could not be done unless the fishing localities were selected for their productivity and varied with the season just as is the case in commercial fishing. In the second place, the probability was very great that a centralized experiment would not represent the whole species, due to the variability in conditions and possible returns.

This probability that a single centralized experiment would not be representative seemed deserving of serious consideration. The coast line is long and the continental shelf narrow, with areas of abundant halibut yield separated by considerable extents of coast line. The intensity of the fishery was, therefore, not at all uniform, being highest, of course, wherever the abundance was greatest. Were the tagging carried on in an isolated, unused place, the returns must be slow, consisting almost solely of the migrants to the nearest zone of active fishing operations. But were tagging to be carried on in a much frequented locality, or "spot," with heavy yield, the returns would be rapid, complete, and without apparent migrations. Such spot fishing, as it is called, has been characteristic of the halibut fishery and is due to the occasional discovery and rapid depletion of a localized dense school of fish, which is, as a rule, largely caught off before much migration can occur. (See Cape Chacon experiment, p. 60.) Accordingly, the decision was made to decentralize the experiments, carrying them on in as great a variety of places as possible and distributing them more or less according to the general concentration of the commercial fishery within the individual statistical areas (Figures 1, 2, and 3) as well as on the banks as a whole.

The great advantage of such a course was that it would be possible to give a massed presentation of the data from many experiments. The average rate of recapture, the average movement, and the average rate of interchange determined thereby would include a reasonable range of conditions, representing more or less closely those of the populations which regulation must take into account. Were the experiments extensive enough, different types of banks could be segregated and their characteristic rates of recapture and movement determined.

Such experiments would be representative in another sense, in that when a migration occurred, the experiments would reflect that of all stocks throughout the geographic range of the movement.

It is also anticipated that, as the study of the mature migrants progresses, it will be possible under this program to focus attention on the rate of immigration from the several directions around a given locality, rather than on the rate of emigration. This, done even without reference to fishing intensities, should be an aid in studying the direction of migration. To do this the marking must be done on each side of the locality and the returns from each compared. The experiments, partly with this in mind, have consequently been diffuse, particularly as immigrants from considerable distances were expected.

The reasons for the adoption of the present program of well distributed marking experiments may be briefly summarized.

(1) Economy and efficiency of vessel operations.

(2) Necessity of making the experiments representative of the various banks and populations of halibut, to facilitate generalized conclusions.

(3) Desirability of focusing attention on relative immigration as well as emigration.

It did not seem vital to any phase of the marking experiments that they should be simultaneous.

RELATION TO INTENSITY OF FISHERY

Mention has been made of the effect of the varying intensity of the fishery in distorting the rate of return. It follows that when the direction of migration from a single tagging locality is determined by comparison of migrants retaken in the several areas surrounding it, the relative or summed intensities in these areas may actually determine the apparent direction. This is particularly true when tagging has been done on the edge of a bank, the whole movement—a false "migration"—being necessarily toward its center. But it is equally true and more confusing, when there is an indefinite inequality between intensities on two sides of a tagging locality. Unless it is assumed at once that the direction of migration is shown by the activities of the fishing fleet it follows, as a rule of procedure, that seeming migrations must in some way be corrected for the varying opportunities for recovery in the several directions.

The importance of the distribution of the intensity of the fishery will be emphasized also by the results of our measurement of the amount of movement and the rate of returns. In the present paper the values given these two are derived from the fishery as our tagging experiments represent it. They are generalized values based upon many factors, and are similar to averages in their meaning. Our results are therefore useable in so far as the tagged population actually represents the population to be regulated, but for a complete understanding and full scientific use of the method of tagging there must be obtained a much more complete statistical knowledge of the fishery. The variations in the intensity both with area and with time must be known.

In the halibut fishery, measures are definitely under way to ascertain as closely as possible the definite origin of the commercial catches, which will show the relative intensities according to area. Since the banks are stretched over a large coast line the practical difficulties are not great, but at the date of issuance of this report legal powers are not yet available. Partial success has nevertheless already been met with in this attempt, and it is possible to study in a preliminary way the relationship of tagging returns and distribution of the fishing fleet. Sufficient records are at hand to be useable, although they are approximate.

This method of correlating intensities, numbers tagged, and returns is, we believe, infinitely superior to a centralized experiment considered with out relation to the fishery.

Other information, to be derived from the marking experiments, includes the highly important determination of the percentage of the stock yearly removed and incidentally, the rates of growth. The program of tagging has not been altered to provide such information specifically.

TAGGING LOCALITIES

In accord with this program, marking operations were carried on along the whole coast (Appendix A, Figures 1, 2, and 3).

Work was begun in 1925 on the southern banks, in the vicinity of the Queen Charlotte Islands and Cape Addington, with the motor vessel "Seamaid." In the summer of 1926, using the "Scandia," attention was paid to the famous Goose Island Ground off the southern end of Hecate Strait, also to various localities in Dixon Entrance and Hecate Strait which had not previously been sufficiently studied. An intensive fishery on the nursery grounds off Timbered Islet attracted attention, and many tags were placed there. The number of fish marked in southern waters has been 6,554, of which 4,936 were marked with the approved strap-type tag.

In the winter of 1926, operations were extended to the more distant banks. In November and December two trips were made to the very important spawning bank at Yakutat Spit, marking 1,748 fish, and in January of 1927 a few fish were marked on Portlock Bank, just eastward of Kodiak Island. This work was terminated for the time being by the wreck of the "Scandia" and the loss of equipment.

In November and December of 1927, the "Dorothy" operated on Portlock Bank and on the W Ground easterly of Cape St. Elias, placing in the two localities 1,214 and 1,338 tags, respectively. No tagging was done during 1928, but in the spring of 1929, 926 halibut were tagged in the vicinity of the Shumagin Islands. This brought the total tagged in waters west of Cape Spencer to 5,281.

It will be noted that the tagging was done according to the season of the fishery in each place. This was during the summer on the southern grounds and during the winter on the banks along the eastern side of the Gulf of Alaska. Again the work was during the spring on the far western banks. Only by thus varying the experiments, could each region receive its due allotment of marked fish, or, indeed, could sufficient fish be taken to justify the expenditures.

It is realized that at the time of these experiments we had a very vague idea as to the distribution of the intensities of the fishery in each place. Our knowledge of this is becoming increasingly perfect, so that it will be possible to remedy any failure in distribution. But even so the numbers of tags placed in areas south of Cape Spencer are not greatly out of proportion to the distribution of the fishery. The western marking experiments are, however, not complete, and only the nearer banks have received adequate attention.

The localities in which tagging was done are shown in Figures 1, 2, and 3.

SCOPE OF REPORT

At the time of writing, returns from the above experiments are complete to the end of 1929. A few more tags may be turned in which were taken by fishermen before the above mentioned date but not in sufficient numbers to affect the results. The end of 1929 does not by any means represent the completion of results, since at the present time tagged fish are being retaken from all of the above experiments. The recoveries from the 1925 experiments have, however, decreased to an annual amount which is inconsiderable in comparison to the number retaken up to the end of 1929. The 1929 experiment has been so recent that there has not yet been time for any considerable number of fish to be returned, and its results are not considered.

The present report will make a first survey of data provided up to the end of 1928 by our tagging experiments, with what additions can readily be made from 1929 returns. A more detailed analysis of certain phases of the work must await a later date when the returns from our experiments are more nearly complete.

DIVISION OF FISHERY

The banks of the Pacific Coast halibut fishery can be placed in two groups, southern and western. These banks differ both in the type of fishing vessel employed in their exploitation and in certain characteristics of the halibut caught. For the purposes of this paper we will define the southern banks as those south of Cape Spencer (area 18) and the western banks as those north and west of Cape Spencer. After a general discussion of results the southern banks will be dealt with more in detail in a following section, the western in another.

The fishery on the southern banks is carried on largely by small vessels, working out of Seattle and Prince Rupert and also to a lesser extent from Ketchikan, Petersburg, Juneau, and Sitka. In addition some of the larger boats fish part of the time on the southern banks and part on the western. The fishery in the latter region reaches its height during the summer months from April to August, while for individual banks within this region the season's peak, usually not well marked, ranges anywhere within the above limits. All returns to the end of 1928 from this region are here dealt with.

The western fishery is essentially different and is pursued chiefly by the schooners working out of Seattle, Prince Rupert, and Ketchikan. The season there is spread more evenly throughout the year from February to November, but for individual banks there is a wide difference. For instance the Yakutat Spit fishery has been almost entirely a winter one until that season was closed, and it still shows an increase in the fall, while the fishery in the vicinity of the Shumagin Islands is confined to the spring and summer.

The material from the experiments on these western grounds, which is at present available for analysis, includes the 1927 and 1928 returns from the Yakutat experiment, and the 1928 returns from those tagged on the W Ground and Portlock Bank. Insufficient time has elapsed since the completion of the Shumagin Island experiment to permit the accumulation of an amount of data sufficient for analysis.

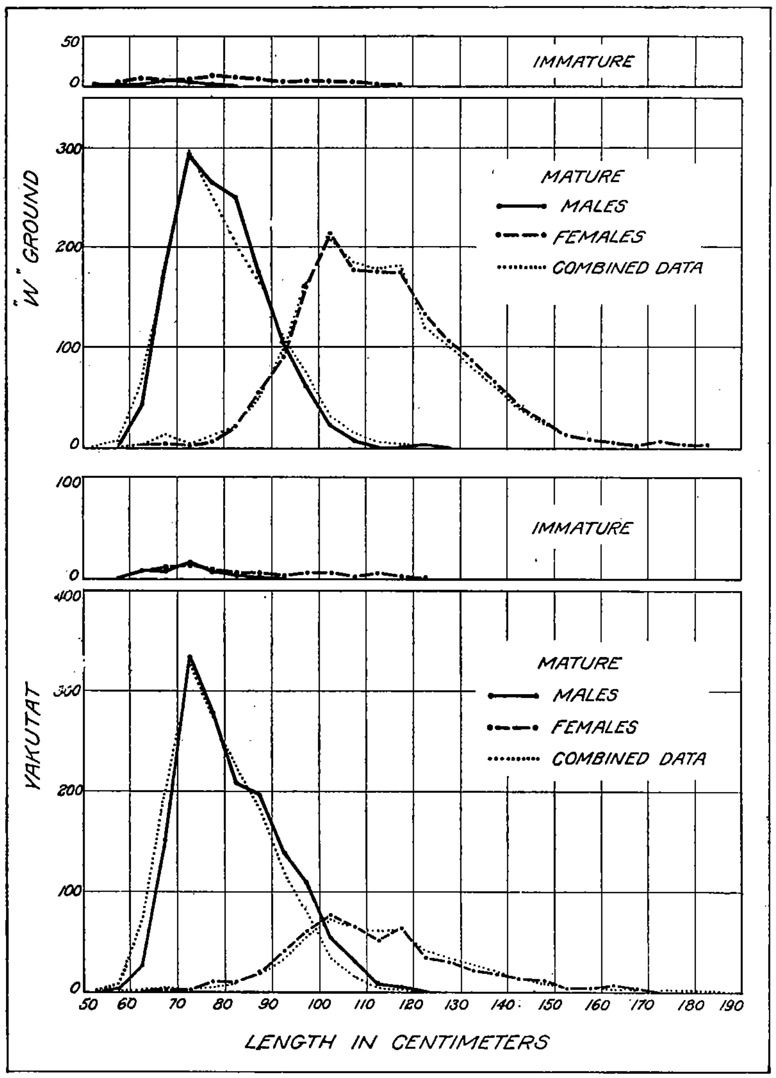

FIG. 9.—Length frequencies for males and females, mature and immature, for halibut examined during the Yakutat and W Ground experiments. The light dotted line on each of the charts for mature represents the combined curve for all western experiments reduced to the same graphic range as the curve to which it is compared.

The composition of the catch on the two areas is radically different. On the southern banks the catch is made up almost entirely of small immature fish with occasionally a few of the larger sizes. The western catch is a mixture of large and small, mature and immature halibut. On certain of the western banks, exploited during the winter months, the catch is almost exclusively of mature fish.

To illustrate this difference in composition of the catch, an analysis of the length frequencies on the western grounds is given in Table 1 and Figures 9 and 10 for the three banks dealt with. Mature and immature males and females are segregated.[1] Whereas practically all of the southern fish were im-

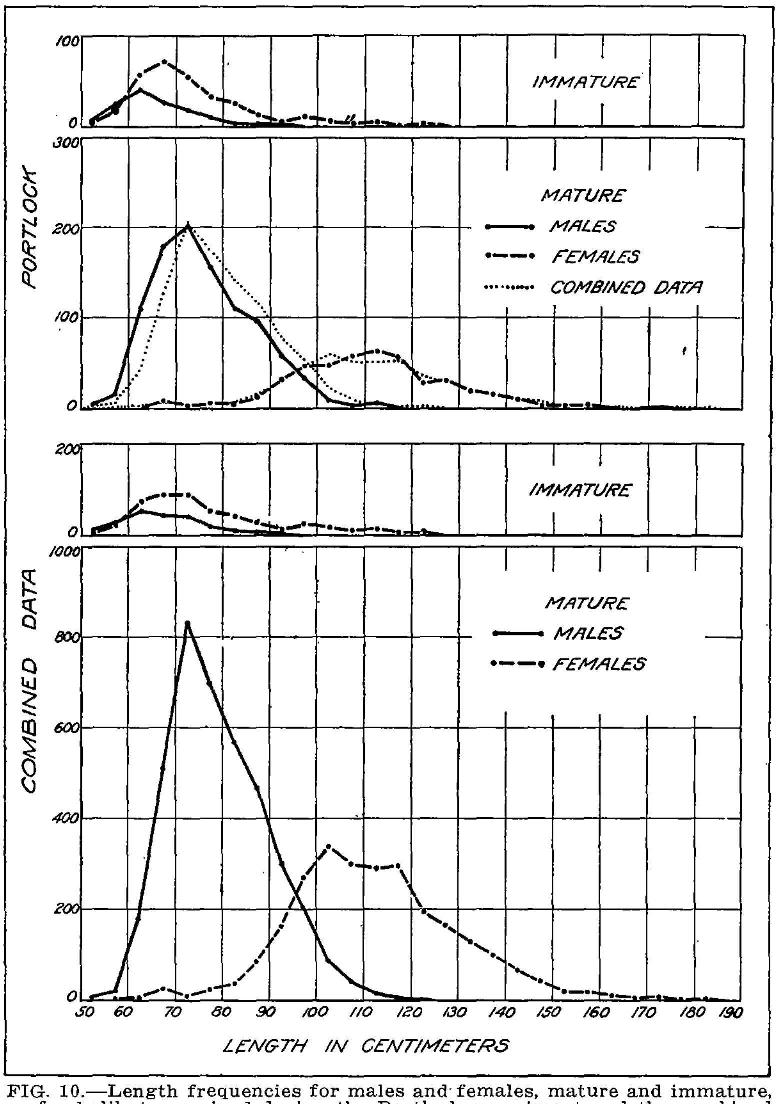

FIG. 10.—Length frequencies for males and females, mature and immature, for halibut examined during the Portlock experiment and the combined data for all western experiments. The light dotted line on each of the individual charts represents the combined curve for all western experiments reduced to the same graphic range as the curve to which it is compared.

[1] From manuscript data by Richard Van Cleve.

mature, it will be noted that only 4 per cent of the Yakutat fish were immature, 3 per cent of the W Ground fish, and 23 per cent of the Portlock fish. These facts, we believe, justify us in contrasting, as two sections of our report, the southern and western fish, considering Portlock separately under the western.

TABLE 1.—*Sex and state of maturity of fish dissected during tagging experiments west of Cape Spencer*

Length	YAKUTAT NOVEMBER 1926					YAKUTAT DECEMBER 1926					W GROUND DECEMBER 1927					PORTLOCK NOVEMBER 1927					TOTALS				
	Males		Females			Males		Females			Males		Females			Males		Females			Males		Females		
	Mature	Immature	Mature	Immature	Total	Mature	Immature	Mature	Immature	Total	Mature	Immature	Mature	Immature	Total	Mature	Immature	Mature	Immature	Total	Mature	Immature	Mature	Immature	Total
50- 54.5	..	..	..	..	..	..	..	..	..	..	..	1	..	..	1	2	6	..	2	10	2	7	..	2	11
55- 59.5	2	..	1	..	3	1	..	..	..	1	1	1	..	3	5	15	24	..	20	59	19	25	1	23	68
60- 64.5	12	5	..	5	22	13	2	..	2	17	43	1	2	8	54	110	40	..	55	205	178	48	2	70	298
65- 69.5	63	3	1	9	76	89	4	..	2	95	179	5	3	5	192	177	25	7	69	278	508	37	11	85	641
70- 74.5	173	9	1	13	196	160	6	..	1	167	295	3	2	17	317	201	18	3	54	276	829	36	6	85	956
75- 79.5	146	3	9	6	164	131	3	1	2	137	265	1	5	9	280	155	8	5	31	199	697	15	20	48	780
80- 84.5	110	..	5	3	118	98	3	3	2	106	250	..	21	8	279	110	1	5	25	141	568	4	34	38	644
85- 89.5	102	1	14	4	121	95	..	4	1	100	172	..	54	6	232	96	1	11	12	120	465	2	83	23	573
90- 94.5	84	..	28	2	114	54	..	13	1	68	105	..	90	3	198	58	1	28	4	91	301	1	159	10	471
95- 99.5	66	..	44	4	114	44	..	15	1	60	62	..	161	5	228	32	..	48	11	91	204	..	268	21	493
100-104.5	38	..	53	4	95	15	..	23	1	39	23	..	213	4	240	9	..	47	5	61	85	..	336	14	435
105-109.5	23	..	54	1	78	6	..	10	..	16	6	..	177	3	186	3	..	57	3	63	38	..	298	7	343
110-114.5	7	..	42	3	52	..	..	10	1	11	..	..	175	1	176	4	..	63	4	71	11	..	290	9	310
115-119.5	5	..	48	1	54	..	..	15	..	15	..	..	174	1	175	1	..	56	..	57	6	..	293	2	301
120-124.5	..	..	25	..	25	..	..	9	..	9	1	..	134	..	135	..	..	27	2	29	1	..	195	2	198
125-129.5	..	..	23	..	23	..	..	6	..	6	..	..	105	..	105	..	..	30	..	30	..	..	164	..	164
130-134.5	..	..	19	..	19	..	..	3	..	3	..	..	87	..	87	..	..	20	..	20	..	..	129	..	129
135-139.5	..	..	14	..	14	..	..	3	..	3	..	..	65	..	65	..	..	15	..	15	..	..	97	..	97
140-144.5	..	..	13	..	13	..	..	..	..	..	..	..	41	..	41	..	..	9	..	9	..	..	63	..	63
145-149.5	..	..	9	..	9	..	..	1	..	1	..	..	26	..	26	..	..	2	..	2	..	..	38	..	38
150-154.5	..	..	2	..	2	..	..	1	..	1	..	..	12	..	12	..	..	3	..	3	..	..	18	..	18
155-159.5	..	..	3	..	3	..	..	..	..	..	..	..	9	..	9	..	..	3	..	3	..	..	15	..	15
160-164.5	..	..	4	..	4	..	..	1	..	1	..	..	4	..	4	..	..	..	..	..	..	..	9	..	9
165-169.5	..	..	1	..	1	..	..	1	..	1	..	..	1	..	1	..	..	..	..	..	..	..	3	..	3
170-174.5	..	..	..	..	..	..	..	..	..	..	..	..	4	..	4	..	..	1	..	1	..	..	5	..	5
175-179.5	..	..	..	..	..	..	..	..	..	..	..	..	1	..	1	..	..	..	..	..	..	..	1	..	1
180-184.5	..	..	..	..	..	..	..	..	..	..	..	..	1	..	1	..	..	..	..	..	..	..	1	..	1
Total	831	21	413	55	1,320	706	18	119	14	857	1,402	12	1,567	73	3,054	973	124	440	297	1,834	3,912	175	2,539	439	7,065
% of all fish caught ..	62.9	1.6	31.3	4.2		82.4	2.1	13.9	1.6		45.9	.4	51.3	2.4		53.0	6.8	24.0	16.2		55.4	2.5	35.9	6.2	

SECTION C.—REPRESENTATIVE CHARACTER OF EXPERIMENTS AND ERRORS AFFECTING THIS.

The results of these experiments are designed to aid in the formulation of regulations, and the ideal of the present incomplete work is to make these results apply to the stocks of fish exploited by the fishing fleet. It therefore becomes of interest to note any failure of the marked fish to represent properly the stock used commercially. This failure cannot, where the range of sizes is a small one and is sampled throughout, be of magnitude, and for purposes of present regulations, can be ignored.

It must be acknowledged at once that no thorough treatment can be given to this subject until the commercial catches are analyzed. Fishermen discard, during their operations, many of the very small fish, and the catch landed does not in that respect represent the catch taken by the hooks. This is a difficult thing to measure, however, without more effort than we have been able to give it. The error is greatest on the banks south of Cape Spencer and more particularly on the so-called "baby chicken" grounds or nurseries. It is least on the spawning grounds, such as those off Yakutat and the W Ground.

We have presumed, however, that the catch of the tagging vessels represents approximately the actual catch of commercial vessels. But whereas the very small fish taken by the latter are discarded, in our operations they were tagged, thus making the tagged fish more nearly representative of the actual than the landed catches.

Commercial fishermen, however, weigh very carefully the relative values of the first class medium-sized fish against that of the usual bulk of small second class "chickens", and shift their grounds so as to maintain the most profitable balance between them. They pick out schools of medium-sized fish (12 to 80 pounds) wherever the decrease in the catch is not so great as to counterbalance the better prices obtained. They avoid the very smallest fish whenever the percentage to be discarded is so high as to render the remainder insufficiently profitable. It is fair to conclude, therefore, that the tagging vessels include a higher percentage of small fish, especially on southern grounds, than does even the actual catch of the commercial vessels.

There is, then, some interest in showing to what extent the tagged fish represent the catch of the tagging vessel, but it becomes of much more importance to see how the rates of return and the degree of movement vary according to the sizes tagged, because these rates can be applied to any subsequent analysis of the halibut population. However, in the present stage of our work, no correction will be made in any of our calculations. This must await the greater precision possible with the returns over a longer period of years, experiments on more sections of the banks, and above all a better knowledge of the commercial catch.

REPRESENTATIVE CHARACTER OF EXPERIMENTS SOUTH OF CAPE SPENCER

The percentage the tagged fish form of the total caught varies widely on different grounds and at different times. This would have little effect on the representative nature of those tagged, were the causes of these variations not connected with the percentage of each size class marked.

Considering the banks south of Cape Spencer, the proportion of the halibut tagged to the total caught varied considerably on the different trips. In 1925 the highest percentage for any one trip was 68.6, the lowest was 50.7, while for the entire summer the proportion was 56.3 per cent, or 3,339 marked out of 5,933 caught. In 1926 the proportion was much lower running from 8.4 per cent to 39.2 per cent for the different trips. For the combined experiments, 27.1 per cent were tagged, or 3,215 out of 11,838 caught. The primary cause of this large difference was the fact that in 1925 the work was principally for marking purposes, and in 1926 other work was carried on in conjunction with the tagging.

On two trips in 1926, tagging was done but incidentally, and as a result, on these trips but 8.4 per cent and 17.0 per cent of the fish were marked. Another contributing factor was the use in 1926 of a larger boat with a more rapid method of handling the fish. This resulted in somewhat greater injuries to the halibut, especially for the larger sizes, and may very possibly have counterbalanced whatever effect the greater care in choosing fish for tagging during 1926 had in raising the percentage recaptured by the fishermen since this percentage was nearly the same in the experiments of the two years.

However, the proportion of the caught fish which were tagged has little bearing upon any points at issue, except that of the total marked in the several experiments. This must, of course, be considered during the analysis of the results of those experiments.

For our present purposes, the variation in the precentage, according to the length of the fish, is of more immediate importance to our knowledge of the representative character of the marking. We have, therefore, in presenting in graphic form the data as to this variability, adjusted the scale of the ordinates so as to bring the general levels of the several series of percentages to an approximate equality on the charts. This focuses attention on the variability rather than on the total proportion tagged (Table 2, Figure 11, lower).

To accompany this information we show frequency graphs (Figure 11, upper) representing the distribution according to length of halibut caught. At times, on account of weather or darkness, it was impossible to measure all fish taken, and the catch on such days was omitted from the counts. Hence the totals in these frequency graphs vary somewhat from those of all fish caught. Thus in 1925, the total number caught was 5,933, whereas 4,838 were measured, in excess of 81 per cent. In 1926 the total caught was 11,838, and 10,132 were measured, nearly 86 per cent, counting only days on which tagging was done. The numbers measured were therefore compared with the numbers

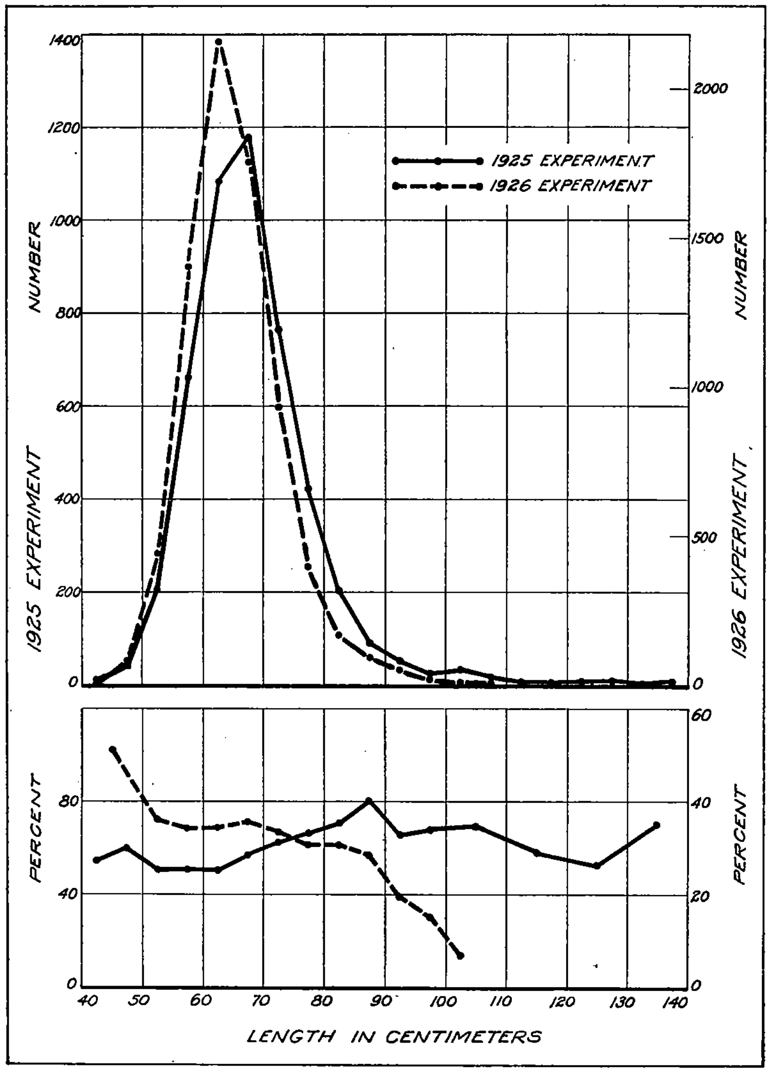

FIG. 11.—Halibut caught during tagging operations in the southern experiments, 1925 and 1926. Upper—Length frequencies. Lower—Percentage tagged of total caught in each 5 cm. length category. The scales used have been adjusted to give the curves the same graphic range.

tagged on the same days, that is, those on which all the fish were measured; and the percentages tagged as given in the preceding paragraphs are based on the comparison. This gives, we believe, an adequate picture of the catch of the tagging vessel and of the proportion of this catch tagged. It provides a basis upon which, if the catch of the tagging vessel is regarded as typical, the results of the present experiments can be corrected.

TABLE 2.—*Percentage of halibut tagged of total caught all tagging work. Data for days on which all halibut caught were measured. Also total halibut caught and total tagged for all tagging work*

Length	SOUTHERN 1925			SOUTHERN 1926			YAKUTAT 1926			W GROUND 1927			PORTLOCK 1927		
	Caught	Tagged	Per cent Tagged	Caught	Tagged	Per cent Tagged	Caught	Tagged	Per cent Tagged	Caught	Tagged	Per cent Tagged	Caught	Tagged	Per cent Tagged
Below 45	11	6	54.5	3	2	51.2	...	...	...	...	...	...	...	...	...
45- 49.9	40	24	60.0	81	41		...	...	...	...	...	...	1	1	35.0
50- 54.9	205	104	50.7	443	160	36.1	...	...	...	...	...	...	19	6	
55- 59.9	663	337	50.8	1,404	481	34.3	2	...	...	4	2	37.0	85	31	36.5
60- 64.9	1,085	549	50.6	2,158	742	34.4	13	3	23.1	50	18		252	88	34.9
65- 69.9	1,179	672	57.0	1,756	629	35.8	59	21	35.6	158	51	32.3	393	150	38.2
70- 74.9	765	479	62.6	934	313	33.5	94	33	35.1	240	75	31.2	378	154	40.7
75- 79.9	423	281	66.5	398	121	30.8	68	20	29.4	227	77	33.9	293	127	43.3
80- 84.9	205	145	70.7	172	53	30.8	58	22	37.9	226	77	34.1	247	118	47.8
85- 89.9	91	73	80.2	91	26	28.6	60	28	46.7	191	68	35.6	217	112	51.6
90- 94.9	53	35	66.0	51	10	19.6	56	25	44.6	182	73	40.1	187	96	51.3
95- 99.9	25	17	68.0	20	3	15.0	38	11	28.9	193	64	33.2	148	61	41.2
100-104.9	49	34	69.4	14	1	7.1	34	10	29.4	152	48	31.6	87	33	37.9
105-109.9				9	...	...	22	3	13.6	114	34	29.8	82	19	23.2
110-114.9	12	7	58.3	16	...	...	11	2	18.2	105	17	16.2	72	11	15.3
115-119.9				...	...	...	14	...	...	76	6	7.9	54	5	9.3
120-124.9	17	9	52.9	...	...	...	4	...	...	66	4	6.1	27	...	...
125-129.9				...	...	...	5	...	...	55	...	...	21	...	...
130-134.9	10	7	70.0	...	...	...	1	...	...	49	...	...	20	...	...
135-139.9				...	...	...	...	...	...	24	...	...	14	...	...
140-144.9	5	4	80.0	...	...	...	6	...	...	18	...	...	4	...	...
145-149.9				...	...	...	2	...	...	9	...	...	2	...	...
150-154.9	...	...	...	...	...	...	...	...	...	11	...	...	7	...	...
155-159.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
160-164.9	...	...	...	...	...	...	1	...	...	...	...	...	...	...	...
Total	4,838	2,783	57.5	7,550	2,582	34.2	548	178	32.5	2,150	614	28.6	2,610	1,012	38.8
Total — All Tagging Work	5,933	3,339	56.3	11,838	3,215	27.1	6,695	1,748	26.1	5,754	1,338	23.3	3,141	1,214	38.7

The percentage curve for 1926 ranges from between 40 or 50 per cent for the smallest sizes to 9 per cent for the very few fish above 105 cm. For the great bulk of the fish, which fall within the 50 to 90 cm. size class, the percentage tagged ranges from 36 to 20.5 per cent. Considered from the more apropos standpoint of variability from length to length, as shown in the graphs, the 1925 and 1926 experiments show opposite trends for the percentages tagged. Together, independently of the numbers of fish involved, the two should represent the actual catch of the vessels very evenly between 50 and 90 cm. sizes, which range includes over 97 per cent of all the fish. Where, in later pages, any direct combination of returns is made, the numbers tagged should be taken into consideration.

REPRESENTATIVE CHARACTER OF EXPERIMENTS NORTH AND WEST OF CAPE SPENCER

During the marking work on western banks there has been a wide variation from experiment to experiment in the percentage of halibut tagged of the total caught. This percentage has on the average been considerably lower than for the work on the southern banks, amounting to 27.7 per cent for all marking on western banks to the end of 1928 and to 36.9 per cent for all marking on southern banks.

The principal causes of this difference in the results for southern and western experiments appear to be the size of the halibut caught and the severity of the weather. The western fish average considerably larger than the southern and consequently are more difficult to land without injury, especially during the rough weather more prevalent in the western fishery.

The differences between the various western experiments are also to some degree explicable by the above mentioned factors. The percentages are 38.7 for Portlock, 26.1 for the first Yakutat Spit experiment, and 23.3 for the W Ground experiment. Corresponding to this the halibut tagged on Portlock averaged the smallest, 77.4 cm. in length, while those on Yakutat Spit and the W Ground averaged the largest, 84.9 cm. and 86.1 cm., respectively. Usually a considerably smaller proportion of the very large halibut can be marked than of the smaller sizes, consequently for a catch such as that on the W Ground where many very large halibut are taken, the average size of the halibut caught is proportionately greater than the average size of the tagged fish would indicate.

We cannot, however, expect to completely explain, by these factors, the differences found in the percentages tagged of the total caught. There are numerous other personal factors as well as natural ones which will affect our results.

The catch in the experiments on the spawning grounds off Yakutat and on the W Ground were of fish of fair size. No such extensive culling, or "shacking off" of small fish by commercial fishermen in these regions occurs as in the case of the southern grounds. What is brought up on the hooks can as a rule be marketed. The tagging vessel fished on the same grounds as the rest of the fleet and with the same incentive to take the commercial sizes. The actual catch of the tagging vessel can therefore be assumed to represent the commercial catch on the banks, at the season of the experiments, until some direct analysis is made of this commercial catch.

The variation in proportion tagged according to size is dealt with in the same manner as in the case of the southern experiments. The number of days on which all fish were measured was greatly reduced, resulting in the measured samples being a much smaller percentage of all fish taken. Whereas 6,695 fish were taken on the Yakutat Grounds, 548 were available for our comparison, or about 8 per cent. On the W Ground 5,754 fish were taken and 2,150, or about 37 per cent were thus available. On Portlock 3,141 fish were taken and 2,610 used in comparison, or 83 per cent. Nevertheless, the results are so uniform in these experiments as to lead us to believe that the samples were adequate.

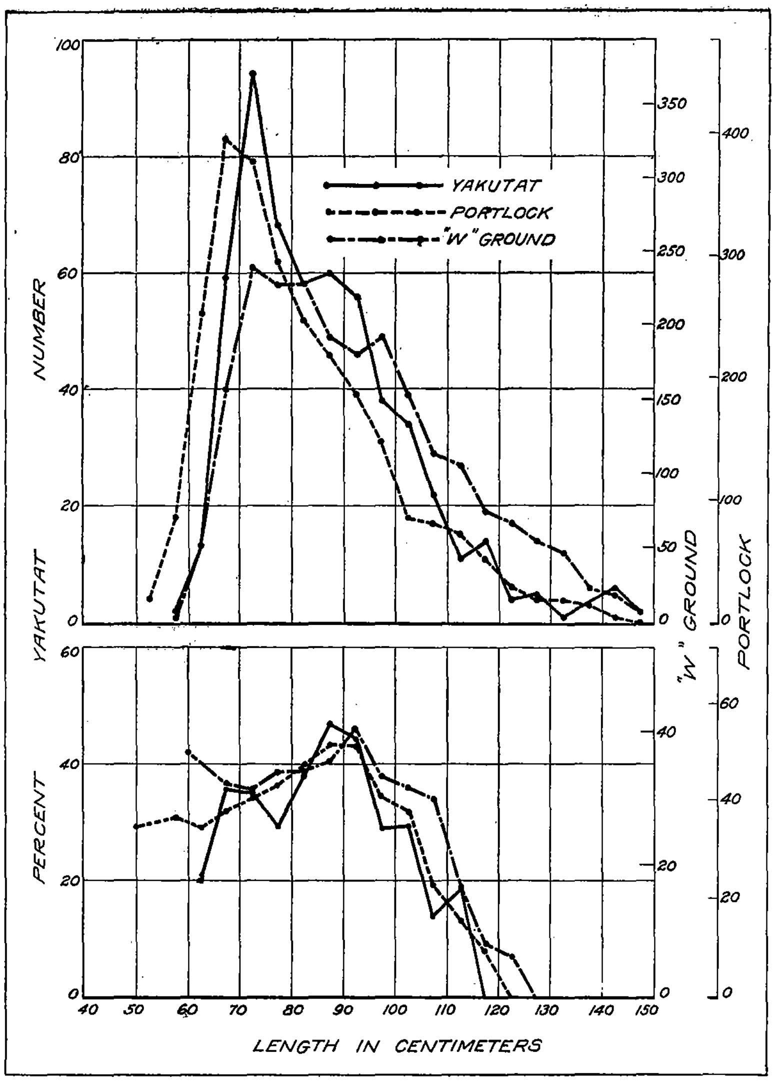

FIG. 12.—Halibut caught during tagging operations in the western experiments. Upper—Length frequencies. Lower—Percentage tagged of total caught in each 5 cm. length category. The scales used have been adjusted to give the curves the same graphic range.

The frequency and percentage graphs are shown in Table 2 and Figure 12. The same method of plotting the ordinates to different scales for the several localities was followed as in the case of southern fish. As will be seen by comparison with Figure 11, showing the southern fish, the sizes in general are very much greater. Among the three western localities, the fish from the W Ground are largest, and those from Portlock Bank smallest.

The percentages tagged are high for lengths from 85 to 95 cm. and decline very rapidly for large fish. The trend of the curves (Figure 12, lower) is similar in all three instances. If comparison is made with the data as to sex composition (Figures 9 and 10) it will be seen that this decrease in percentage beyond 95 cm. operates to reduce the representation of mature females in our tagging experiments.

FACTORS AFFECTING RETURN OF TAGS

The representative nature of the return of marks by the fishermen is altered by causes which are distinct from those which affect the percentages tagged, and which are related to the methods of fishing and of handling.

When hauling the gear in "long-lining" a fisherman stands at the side of the boat near the roller over which the incoming line is passing. He watches the line to see that the tension is not too great, clears the hooks and gangings, and removes the fish from the hooks. Any halibut landed are dropped into a "checker" at his side and are later cleaned and "iced down" in the hold. When the vessel ties up at the fish buyer's landing slip the halibut are unloaded in slings or large buckets and dumped on the grading table where the ice is removed from the visceral cavity and the fish are graded for first class, second class, and culls. They are then weighed, dumped on the fish floor, and "headed" by slashing off the head just at the posterior edge of the opercles. Sometimes the heads are first removed and the fish afterwards weighed. In the past the heads were taken out in scows and dumped, but during the last few years they have been utilized in reduction plants. Some of the halibut are iced and boxed, heads on, for shipment to local dealers.

The great majority of the recovered tags are noticed between the time of capture and icing down in the hold. During 1927, the tag was noticed during this time in 93 per cent of the cases of the halibut recaptured from experiments south of Cape Spencer, 4.4 per cent were found at the landing slip, and the remainder, 2.6 per cent, on the floor of the fish house or at the reduction plants. From the experiments north and west of Cape Spencer 74 per cent of the tags were noticed between the time of capture and icing down, 21 per cent at the landing slip, the remainder, 5 per cent, later.

The principal cause of the difference in the manner of discovery of tags in southern and western experiments is that the western fishery is to a larger extent a winter one and fishing operations are carried on day and night. As a result there is less likelihood of observing the tags when first landed. This is reflected in our records which show that a considerable proportion of the western tags are not noticed until the fish are unloaded at the landing slip, while a very much smaller percentage of the southern tags (4.4 per cent compared to 20.8 per cent for the western) are noticed during unloading.

If the tag is not seen before the halibut are dumped on the fish floor and headed there is very little chance that it will be found. That the tags may occasionally pass through the above operations unnoticed is witnessed by the fact that a tag was found at Vancouver, B.C., on a halibut in a shipment of frozen fish, and another was sent in from Trochu, Alberta, where it had been found in a shipment.

In southern waters it is probable that the culling out of recaptured small fish by the commercial fishermen with consequent death and loss of tags has the greatest effect in reducing returns from that size. The extent of this practice varies widely with the vessel and with the market fished for. At times, when prices for smaller sized fish, so-called chickens, have been good, vessels have fished intensively on the grounds frequented by such sizes, picking out only the larger marketable fish, perhaps 50 per cent of those hooked. But even during ordinary fishing operations, among schools of better sized fish in southern waters, these small fish are found in some numbers and are roughly shaken off the hooks, shacked off in fishermen's terms.

The percentage returns obtained from the marking experiments must also be affected to some extent by the immediate mortality due to the hook injuries received prior to tagging, to bringing the halibut to the surface from varying depths, to absence from its native element, and to the handling it receives during the process of tagging. These causes of loss between liberation and recapture may or may not be the same in southern and western fisheries.

The change in pressure experienced by the halibut when brought to the surface from a depth of 30 or even more than 100 fathoms, appears to affect it little or not at all. Halibut brought to the surface from even greater depths, when landed on deck, show no signs of distress from the change in pressure and are vigorous and active. When thrown overboard they disappear in an instant into the depths.

The handling the halibut receives and the absence from its native element, when not too prolonged, does not seem to affect it seriously. Occasionally a halibut has been kept on deck for ten minutes or more, yet when it is released it has appeared nearly as vigorous as those returned after but one or two minutes.

The extent to which injuries caused by the fishing gear will affect percentage returns depends largely on the skill and care exercised in selecting the fish to be marked, and this strictness of selection may be affected by the presence or absence of other uses for the fish.

During the work in 1925 a record was kept of the injury each fish had suffered from the gear. In that year, in all areas exclusive of Cape Chacon, 1,462 halibut were marked with strap tags. Of these 33.9 per cent had been recovered at the end of 1928. At Cape Chacon 258 halibut were marked with strap tags and 64.3 per cent recovered by the end of 1928.

The records show that outside of the Cape Chacon area 55 halibut hooked through either the right or left eye ball were marked. Of these, 20 or 36.4 per cent had been recovered by the end of 1928. At Cape Chacon 25 fish in this category were marked and 15, or 60 per cent, recovered by the end of 1928.

We have also tabulated for the Hecate Strait, West Coast of Queen Charlottes, and Cape Chacon experiments, the fish hooked about the maxillary, premaxillary, mandible, or other mouth parts. For Hecate Strait the returns from this group were 25 per cent compared to 30 per cent for all Hecate Strait fish. For the West Coast of the Queen Charlottes the returns were 28 per cent compared to 28 per cent for all fish. For Cape Chacon the returns were 67 per cent compared to 64 per cent for all fish.

For Cape Chacon we have also tabulated those fish listed as hooked in the roof of the mouth. Of the 60 so listed, 34 or 57 per cent have been recovered compared to the above 64 per cent for all fish.

For all halibut marked with strap tags (omitting Cape Chacon experiment) in 1925, 37 are listed as badly injured or feeble. Of these but 3, or 8 per cent, have been recovered compared to 33.9 per cent for all fish.

The data as to injuries are given in Table 3 for better comparison.

The uniformly close agreement in the percentage returns from fish listed with different injuries, with one exception falling well within one or two probable errors of the total, would imply that there is little difference in the seriousness of the various types of injuries. The one exception in the above table is for halibut listed as being in doubtful condition. For this category the returns are much lower than for any other.

In our opinion, based on the examination of thousands of halibut, the injuries about the external mouth parts are the least serious. But the fact that the percentage returns from this category are approximately the same as that from the others, and for the total, would indicate that none of the categories had been seriously affected by the mortality from hook injuries. This contention is supported by the returns from the Cape Chacon experiment where between 60 and 70 per cent of the tagged fish were retaken within a period of two years. The accuracy of determination of condition is further attested by the low returns from fish listed as being in doubtful condition.

A third factor affecting returns is the loss of some of the tags from the fish. Data on this subject are not at present extensive enough to warrant a detailed analysis. The present remarks will be confined to a consideration of the general indications. We have for some time, for all halibut examined, been preserving the part of the opercle on which the tag is attached, together with the tag. An examination of this material gives an idea of the firmness with which the tags remain on the fish.

In most cases the tag is securely fastened to the opercle, at times the bone is somewhat worn, and occasionally the tag has worked out to the point where it is rather insecurely held. On the fish which have been out two or three years the tags are almost always quite firmly imbedded with the flesh grown over and somewhat around parts of the tag. The material in general indicates that a certain proportion of the tags may be lost in this manner, but this proportion appears to be small.

The rate of returns is also affected by the halibut's natural mortality. In figuring the returns over a number of years, this factor must have a considerable effect in reducing the rate of recapture.

TABLE 3.—*Effect of injuries on rate of recapture percentage returned by end of 1928 from halibut tagged in 1925*

CLASSIFICATION OF INJURIES	CAPE CHACON				ALL EXPERIMENTS EXCLUSIVE OF CAPE CHACON				HECATE STRAIT				WEST COAST QUEEN CHARLOTTES			
	Tagged	Recaptured	Per cent Recaptured	P.E.[1]	Tagged	Recaptured	Per cent Recaptured	P.E.	Tagged	Recaptured	Per cent Recaptured	P.E.	Tagged	Recaptured	Per cent Recaptured	P.E.
Eye	25	15	60.0	6.6	55	20	36.4	4.4	..	..	...	..	..	..	...	..
Mouth parts	88	59	67.0	3.4	..	..	...	..	80	20	25.0	3.3	116	33	28.5	2.8
Roof of mouth	60	34	56.7	4.3	..	..	...	..	..	..	...	..	..	..	...	..
Condition doubtful	..	..	...	..	37	3	8.1	3.0	..	..	...	..	..	..	...	..
All halibut tagged	258	166	64.3	2.0	1,462	496	33.9	0.8	357	106	29.7	1.6	332	94	28.3	1.7

[1] P.E. = $.6745 \frac{\sigma}{\sqrt{n}}$.

In addition to these errors which have just been considered, certain limitations must also be recognized in the data collected for the recaptured halibut. Most of this information was collected directly from the captains of the fishing vessels by a member of the scientific staff. In 1928 more than 80 per cent of the cases were handled in this way. In the remainder the information was collected through the co-operation of government representatives and fish buyers. In all cases a standardized form was filled out with the information desired.

The information provided by fishermen is in most cases quite accurate. Eighty-nine per cent of the tags recovered in 1927 were found on the boat during fishing operations, and the captain could accurately give the place and time of recapture. Eight per cent of the tags were noticed during unloading operations and the fishermen could tell, from the part of the hold in which the fish were stored, the time of recapture within a day or two and the place of recapture within a few miles. Thus in 630 cases out of 651, the tags were found in time so that the place and time of recapture could be determined with at least a fair degree of accuracy.

Another possible but very unlikely error in the data might arise as a result of the intentional falsification by disgruntled fishermen who desired to hinder the work of the commission or to further ideas of their own. The only data which could be appreciably affected in this way would be those regarding recovery location, and the fishermen's lack of knowledge of the tagging locations would discourage this.

The records were examined for evidences of any such attempt with the following results. Of the halibut recaptured during 1925 to 1928 from experiments south of Cape Spencer, 70 showed a movement of 100 miles or over. These tags were turned in from 56 different boats, 3 each from 2 boats, 2 each from 10, 1 each from the remainder. This diversity of origin hardly suggests any intentional misrepresentation of data on the part of any one crew.

Although there is some doubt as to the percentage of tagged fish lost before being returned, we have found in the causes discussed no reason to doubt that the percentage remains fairly constant from year to year. This fact is of considerable importance in any conclusions based on the comparison of returns from year to year or from bank to bank. Since, for instance, the fact of a low intensity should be evidenced as much by a prolonged period of return as by a low rate of return, there are possibilities of reaching useful conclusions through examination of the period of this return, in other words, the change from year to year in its rate.

Consideration of errors and of the representative character of the experiments therefore tends to turn attention not merely to the determination of the actual percentage returned, etc., but to the variation in this between size categories and from year to year.

SECTION D.—PRESENTATION OF RETURNS FROM ALL REGIONS

The detailed returns up to the end of 1928 are shown in Apendixes A and B, where the tag number, locality of marking and of recovery, distance travelled, increase of size, and other information are given. These returns have been classified by area for convenience in presentation and shown in Table 4 and Figure 13 in a summarized form.

The areas used (Figures 1, 2, and 3) are based upon a line following the general trend of the coast, the line included in each area being equal to 60 minutes of mean latitude of the area in question. They are the same as are used in our statistical returns. The divisions between them extend seaward and perpendicular to the line mentioned. It will be found that several tagging localities may be included within each such area and that the latter are necessarily unequal in extent of fishing ground. The advantage in their use lies in the fact that they represent fairly the linearity of the narrow continental slope.

TABLE 4.—*Recoveries of marked halibut to end of 1928 according to areas of liberation and recovery; strap tags only*

Area of Recovery	Area of Liberation												
	8	9	10	11	12	13	14	15	20	22	25	26	Total
0	..	..	..	..	..	..	..	..	..	1	..	..	1
1	..	..	..	..	..	1	..	..	1	..	..	..	2
2	..	..	..	..	..	2	..	..	..	..	..	..	2
3	..	..	..	..	..	..	..	..	..	..	..	..	0
4	..	..	..	..	..	..	..	..	..	..	..	..	0
5	..	..	..	..	..	3	..	..	..	..	..	..	3
6	..	..	3	2	..	3	..	1	1	..	..	..	10
7	..	..	..	..	..	..	..	1	..	..	..	..	1
8	2	..	1	..	..	..	..	1	..	..	..	..	4
9	..	2	29	2	..	6	..	1	2	..	..	..	42
10	..	1	622	16	..	4	1	3	1	..	..	..	648
11	..	..	4	85	..	4	1	2	2	..	..	..	98
12	..	..	1	13	4	6	1	3	..	..	..	..	28
13	..	..	2	1	1	296	7	8	1	1	..	..	317
14	..	..	1	..	..	24	175	2	1	..	..	..	203
15	..	..	2	..	1	10	5	252	3	..	..	..	273
16	..	..	..	..	..	3	..	7	3	2	..	..	15
17	..	..	..	..	..	2	..	..	1	..	1	..	4
18	..	..	..	..	..	..	1	..	2	..	..	..	3
19	..	..	..	..	..	..	..	..	23	1	..	..	24
20	..	..	..	..	..	..	..	..	35	2	..	..	37
21	..	..	..	..	..	..	..	..	7	3	1	..	11
22	..	..	..	..	..	..	..	..	20	4	1	..	25
23	..	..	..	..	..	..	..	..	7	2	..	..	9
24	..	..	..	..	..	..	..	..	9	8	..	..	17
25	..	..	..	..	..	..	..	..	23	19	43	2	87
26	..	..	..	..	..	..	..	..	11	19	24	1	55
27	..	..	..	..	..	..	..	..	11	11	8	..	30
28	..	..	..	..	..	..	..	..	13	9	9	..	31
29	..	..	..	..	..	..	..	..	8	1	2	..	11
30	..	..	..	..	..	..	..	..	6	3	3	..	12
31	..	..	..	..	..	..	..	..	4	1	..	..	5
32	..	..	..	..	..	..	..	..	7	2	3	..	12
33	..	..	..	..	..	..	..	..	1	1	..	..	2
34	..	..	..	..	..	..	..	..	1	..	1	..	2
Total	2	3	665	119	6	364	191	281	204	90	96	3	2,024
Area Unknown	0	0	9	6	0	24	3	12	17	8	3	0	82
Grand Total	2	3	674	125	6	388	194	293	221	98	99	3	2,106
Number Tagged	14	13	1,547	417	40	1,183	373	1,349	1,748	1,338	1,218	49	9,289
Per cent Recovered	14.3	23.1	43.6	30.0	15.0	32.8	52.0	21.7	12.6	7.3	8.1	6.1	22.7

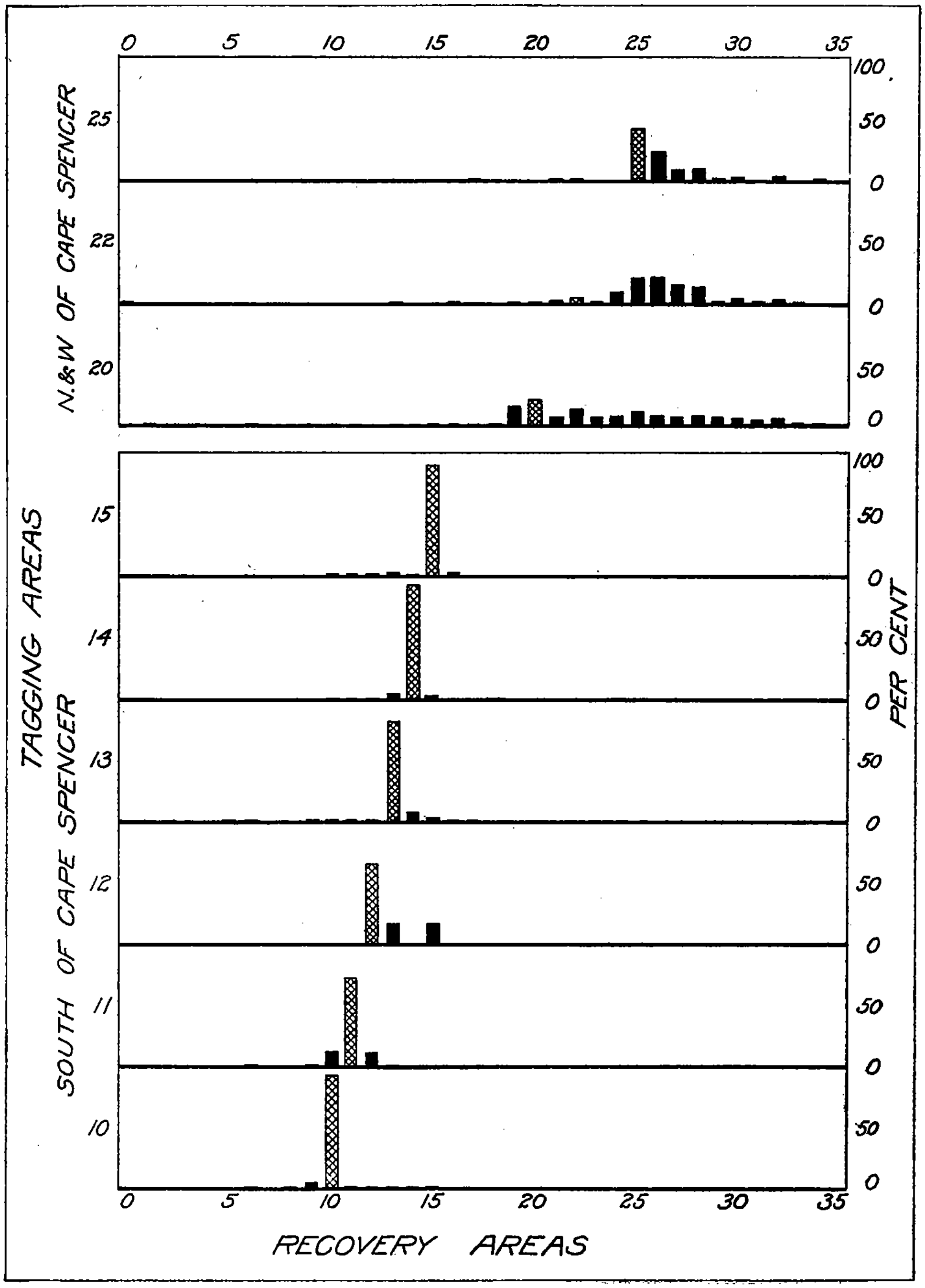

FIG. 13.—Recoveries of marked halibut to end of 1928 according to areas of liberation and recovery. The percentage recovered in each area shown on the horizontal scale, of the total tagged in the area shown on the vertical scale.

In Table 4 the number of recoveries from all fish tagged in any given area is shown at the bottom, and the distribution of those recoveries among the various areas is shown in the vertical divisions. In Figure 13 the distribution of these is shown horizontally instead of vertically, the sum of the columnar graphs in each horizontal division being equal to 100 per cent, equal to the sum in per cents of each other horizontal division, and equal to the fish originally tagged in the area in question. This renders it possible to compare the relative scatter of the returns from experiments in each area, and to compare directly the percentages retaken in the same area in which they were tagged. The latter, as recoveries within the area of the experiment, are shown in the graph by double hatched instead of solid bars.

As a consequence of the use of the linearly defined areas, this arrangement of returns gives only the major migration components parallel to the coast. Furthermore, when the tagging location has been near the boundary, the returns may be shown from two areas without any considerable movement having occurred. Minor movements within individual or adjacent areas, or in a direction at right angles to the coast must be studied in a more detailed way whenever the banks are appropriately situated. It should be noted that in area 12 there were but six recoveries, four within the area of tagging. Hence the graph, in percentages, gives undue prominence to the migration in this area.

Areas 6 to 18, between Cape Flattery and Cape Spencer, show very slight evidences of migration. Occasional fish seem to stray considerable distances. For all recovered fish tagged within these areas the average movement was 21.4 miles,[2] as shown by Table 16, p. 86. This contrasts strongly with the average movement of fish tagged between areas 20 and 38, which is 209.2 miles, hence very much greater despite the shorter time since marking (Table 19, p. 91.

The direction of movement of the recovered tags is of great interest, even as shown by Figure 13. Fish tagged in areas 20 and 22 show a decided tendency to move westward, as can be seen by comparison of the double hatched columns with the solid, the double hatched representing recoveries in the area of tagging. South of 18, areas 10 and 15 show opposing migrations, such as they are, as evidences of the possible existence of a self-contained unit of migratory stock (pp. 58, 84, and 101).

The two main regions, those from 18 to 38 and from 6 to 17 are practically distinct as far as returns are concerned. As has already been said, the fish tagged therein are very different as to maturity and the state of depletion of the stock differs widely. The amount of movement shown, great in the westward area and small in the southern, is undoubtedly correlated with the differences in maturity.

Particular attention should be given to the fact that only about 5 per cent of the recoveries from fish tagged in areas 20, 22, and 25 were retaken in areas south of 17, while but one of those tagged in areas 10 to 15 was retaken beyond area 17. This expresses the almost complete independence of the two general regions, a fundamental fact in the following treatment of data (compare also Figures 15 and 17).

[2] Throughout this report the mile used is equal to a minute of latitude.

Fish tagged from populations known to be largely immature should be analyzed separately from those known to be mature. All the experiments south of Cape Spencer were on immature fish. Those on areas 20 and 22 were on mature. Those on areas 25 and 26 were on mixed populations. The southern and western divisions have therefore been considered separately.

It is, of course, the distribution of the recovered tags in which the major interest lies, but the relationship of these recoveries to the number marked in each area is of considerable significance. The numbers marked, and the recoveries in each area (including immigrants) are shown in Figure 14

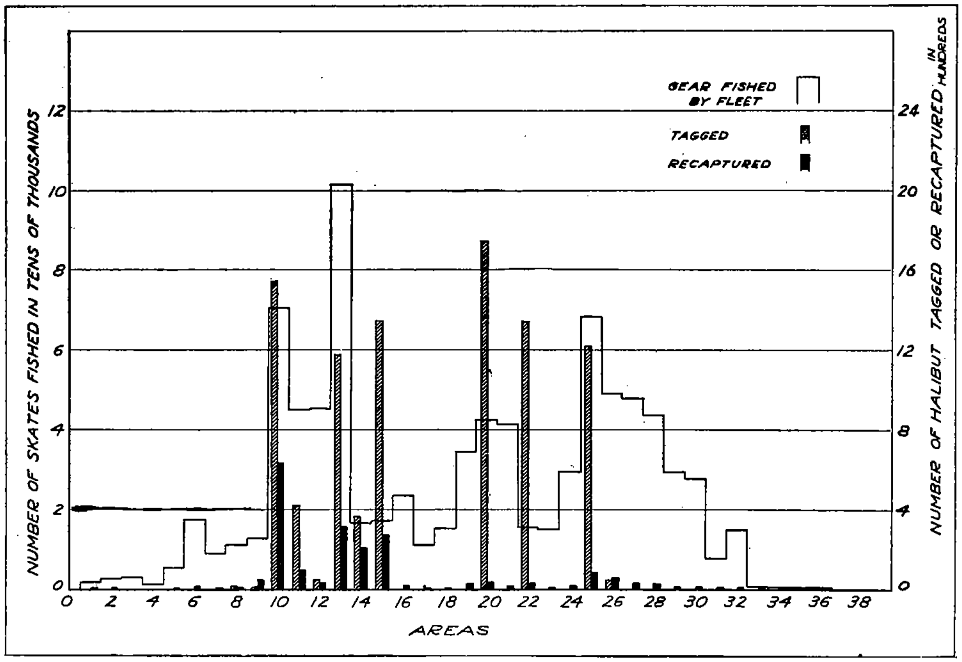

FIG. 14.—Number of skates of gear fished compared with the number of halibut tagged and number recaptured in each area.

from Tables 4 and 5. It is evident from inspection that there is a fairly close correlation between the distribution of numbers marked and of those recovered south of area 18, but very little north. This is in accord with the lack of migration in the former and the extensive movements in the latter.

It is also evident that there is a marked difference in the percentage returns south and north of area 18. This is due, as has been said, to the fact that a highly localized and completely exploited population was tagged to the south and that to the north the population tagged may be a part of a larger migratory stock, only a section of whose range falls within the scope of the fishery.

TABLE 5.—*Number of halibut tagged and recaptured compared to total halibut landings and gear fished. Tabulated by areas*

AREA	No. OF SKATES FISHED	No. OF POUNDS CAUGHT	No. TAGGED	NO. TAGGED FISH RECAPTURED		
				Southern Experiment 1925-1928	Yakutat 1927 and 1928 W Ground 1928	Portlock 1928
0	....	....	....	....	1	..
1	1,844	79,409	....	1	1	..
2	2,771	119,349	....	2	..	..
3	3,381	145,615	....	....	..	..
4	1,253	53,966	....	....	..	..
5	5,615	241,820	....	3	..	..
6	17,631	605,268	....	9	1	..
7	9,094	312,204	....	1	..	..
8	11,365	390,174	14	4	..	..
9	12,846	551,473	13	40	2	..
10	70,611	3,060,282	1,547	647	1	..
11	45,383	2,344,956	417	96	2	..
12	45,624	2,030,250	40	28	..	..
13	101,524	5,187,877	1,183	315	2	..
14	16,777	785,145	373	202	1	..
15	17,312	919,285	1,349	270	3	..
16	23,759	1,282,963	....	10	5	..
17	11,265	585,797	....	2	1	1
18	15,395	903,687	....	1	2	..
19	34,273	2,152,348	....	....	24	..
20	42,253	2,797,170	1,748	....	37	..
21	41,776	2,661,130	....	....	10	1
22	15,368	1,040,420	1,338	....	24	1
23	15,297	1,205,421	....	....	9	..
24	29,562	2,226,011	....	....	17	..
25	68,489	4,855,580	1,218	....	42	45
26	49,106	3,614,223	49	....	30	25
27	47,964	3,419,856	....	....	22	8
28	43,811	3,334,051	....	....	22	9
29	29,686	2,250,171	....	....	9	2
30	27,899	2,142,626	....	....	9	3
31	7,865	718,089	....	....	5	..
32	15,026	1,238,121	....	....	9	3
33	749	85,251	....	....	2	..
34	670	63,938	....	....	1	1
35	486	1,522	....	....	..	..
36	451	16,137	....	....	..	..
Total.....	884,181	53,421,585	9,289	1,631	294	99

COMPARISON OF RETURNS WITH FISHING INTENSITIES

The bearing of the relative intensity of the fishery upon the distribution of the returns from the tagging experiments has already been discussed from the standpoint of the program adopted. As was pointed out there, the rate of recapture depends upon the activity of the fishermen, and the greatest returns from any given experiment with fish that migrate in all directions, will come from the direction in which lies the most active fishery.

There may be some question whether the intensity of a fishery should be judged by the amount of gear fished, or by the total catch made thereby. But the amount of the total catch made is dependent upon two factors, the amount of gear used and the catch per unit. The latter reflects the abundance of the fish and the density of the school. It has little relationship to the proportion of the total stock taken. The chance of recapturing a particular tagged halibut accompanying the school depends entirely upon the proportion of the latter taken and not upon the actual number of fish in that proportion. The catch per unit therefore does not indicate the chance of recovery of tags, and it must be concluded that the amount of gear run in a given area is a better measure of the chances of recapture than is the total catch.

It may, of course, be true that where the fish school very densely indeed, as they did in the early days of the industry, the maximum number which can be caught by the unit of gear is the limiting factor, this number forming a variable proportion of the fish on the ground. The result must be that under such circumstances neither the total catch nor the amount of gear run reflects the proportion of the stock taken. But at present this density of population rarely exists, except during the now closed spawning period.

The use of the total catch as an indication of the number of returns to be expected from an area is also hindered by the presence of differing numbers of immature fish on the various banks. In our southern experiments, these have proved to be relatively non-migratory. The tagging experiments beyond area 18, Cape Spencer, were largely in areas 20 and 22, where a mature population was spawning. As a result, even though the mature tagged fish might distribute themselves equally, the catch would be rendered unequal in the several areas by the varying proportion of immature non-migratory fish.

The returns of tagged fish may therefore be considered in relation to the amount of gear fished in each area. In case a tagged population distributes itself equally over all fishing ground, by virtue of perfect mobility and unhindered random migration, a unit of gear fished anywhere should produce the same number of tagged fish at each trial.

CALCULATION OF INTENSITIES

Our measures of the varying intensities of the fishery are not as yet perfect, but they will suffice for the present purposes.[3] Complete information is out of the question without legal powers and without assistance of port officers, neither of which is as yet given to the commission by law. Lacking this, the entire fleet landing at principal ports has been canvassed and log records of each day's fishing secured whenever the vessel captains could furnish them. Fortunately a large part of the fleet co-operated willingly. Nevertheless the task has been a very considerable one, fully equalling the effort involved in the tagging experiment proper.

The distribution of tag returns varies so widely from the distribution of intensities as between southern and western grounds and within the southern group of areas, as to dwarf any possible error. The grounds north and west of Cape Spencer are fished by the larger vessels of American registry, a more or less homogeneous group of men and vessels, and the records should be correspondingly representative, as from area to area. As will be seen, the comparison with tagging returns from these banks needs such exactness.

An excellent representation of the catch records of the fleet selling at Prince Rupert, the principal halibut port, is available from 1926 to date. Those for the year 1929 cannot be prepared in time for this publication, but since the tag returns considered are entirely in 1927 and 1928 for the grounds

[3] From manuscript data by Harry A. Dunlop, F. Heward Bell, and William F. Thompson.

beyond Cape Spencer, we have been content to use the catch records for 1928. This series includes almost all vessels fishing from areas 12 to 38 inclusive, as far as they are accessible to inquiry, whether the catches were landed at Seattle, Prince Rupert, or ports in Alaska, because all of these vessels at some time during the year call at Prince Rupert and are interviewed. We may therefore adopt this series as representative of fishing intensities north of area 11, provided the returns are weighted to make them represent the total poundage taken instead of a fraction (Table 5).

The collection of similar data for Seattle could not be begun before 1929. But for that year the area of origin of about 86 per cent of the landings in Seattle was obtained. This was without records of amount of gear save in a certain percentage of cases where log records were obtained. It was assumed that this was representative of the distribution in 1928 of the catches for areas 11 and south. It then became necessary to weight this distribution to equal the total poundage taken. The Seattle and Vancouver landings comprise the greatest part of these. For 1928 the landings in southern ports were:

Seattle (IFC records)	13,818,672
Vancouver (Canadian Government records of Canadian vessels amended by IFC records)	1,188,031
Vancouver (IFC records of American vessels)	26,740
Canadian Government District No. 3	424,300
Total	15,457,743

These total landings were distributed in accordance with those of the Seattle landings for 1929, and the first part of the third column of Table 5 was obtained, for the estimated pounds taken from each area, 1 to 11, inclusive.

But nearly 49 per cent of the Seattle catch was brought in from grounds north of area 11, by vessels represented in the Prince Rupert series of records. This proportion of the 1928 southern landings was therefore credited to these more northern banks, in addition to landings in northern British Columbia and Alaska, as follows:

Southern landings from areas north of 11	7,553,226
Canadian District No. 2 (Canadian Government)	28,813,300
Alaska (IFC records)[4]	9,150,544
Total	45,517,070

This poundage was distributed among the statistical areas 12 to 38 in accord with the log records obtained by inquiry at Prince Rupert, previously discussed.

[4] This total was changed subsequently to completion of this report, but not sufficiently to affect the calculations.

The two series of records for pounds caught in the statistical areas have been united, giving a continuous record for catches north and south of the line between areas 11 and 12. The result is shown in Table 5.

The catch per unit of gear, the skate, has been determined for areas 11 and south, for all existing records of vessel catches, for the years 1928 and 1929, in order to secure averages reasonably free from chance variability, since the above mentioned Seattle records for 1929 did not give the amount of gear fished for each locality. The averages for 1928 for areas north of these were sufficiently representative and stable. The total pounds for each area were then divided by this catch per skate to give the number of units fished in each area (Table 5, Column 2).

This is an approximation, first, because no legal powers exist whereby it can be made completely representative of the fleet, second, because the need for an exact measure of intensities was not realized until the present analysis was undertaken, and third, because the present report must be made at once without further refinement.

In Figure 14 these estimates of the number of skates fished in each statistical area are shown as histograms.

The numbers of fish returned from the several areas south of 18 show a higher correlation with the numbers tagged than with the various intensities of the fishery. That the reverse is the case north of area 18, is apparent although the scale of presentation makes comparison difficult. There the returns are correlated with the fishery, not with the tagging experiments of which those of two areas only are considered. This difference is more clearly shown in Figure 13, where the areas of maximal returns shift with the tagging area south of area 18, but remain more constant beyond.

COMPARISON WITH SOUTHERN AREAS

The southern areas may be examined in more detail, isolating the tagging experiments proper to that division. The planning of the experiments so as to distribute the numbers roughly according to the general distribution of intensity of the fishery obscures the essential fact that the returns from each experiment are for the most part from the tagging area itself. However, assuming that the intensity of the fishery is an index to the chances of recovery in any area to which a fish may stray, it is easily seen that if the tagging returns are figured on a basis of distance from tagging localities, so can the chances of recapture be thus arranged, and the actual rate of return at various distances can be compared with the possible.

Consider first the tagging experiments and their returns. The area in which tagging was done may be numbered zero, and the areas in either direction numbered from one up. In each such numbered area the number of returns can be entered. This having been done for all experiments, the entries in the zero areas can be summed, to represent the actual returns in the areas of tagging, and the same can be done for the areas once, twice, etc., removed. This has been done in Table 6 and Figure 15 for the southern experiments.

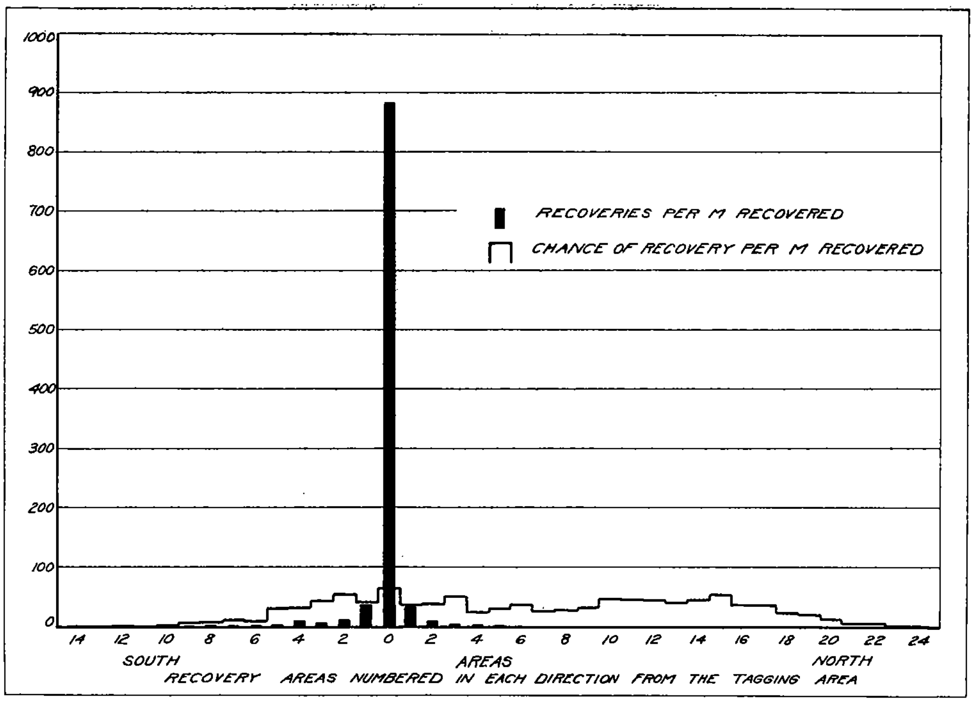

FIG. 15.—Number of halibut recaptured from southern experiments, according to areas numbered each way from area where tagged, compared to chances of recapture if population were freely migratory within the range of the fishery.

The same may be done with the chances of recovery, as represented by the number of units of gear fished in each area. For summation of these chances, each zero point must be superimposed and the chances of recovery summed for each distance from the tagging area. Since in each experiment the chances of recovery from any one area vary with the total number recovered, each corresponding array must be weighted according to the total tags recovered from that experiment.

The result is the graph shown in Figure 15, for experiments in areas south of 18. It will be seen that the vast preponderance of recoveries were in the home area and that there was relatively nothing obtained elsewhere despite abundant opportunity, especially west of area 18.

TABLE 6.—*Comparison of actual recoveries with chances of recovery as based on fishing intensity, tabulated according to areas numbered each way from tagging area.*

SOUTHERN EXPERIMENTS				YUKUTAT AND W GROUND			
Area	Chance of Recovery per 1,000 Recovered	Actual Recoveries	Recoveries Per 1,000 Recovered	Area	Chance of Recovery per 1,000 Recovered	Actual Recoveries	Recoveries Per 1,000 Recovered
14	.6	....	....	22	....	1	3.4
13	1.1	....	....	21	.9	....	....
12	1.7	1	.6	20	1.4	....	....
11	1.1	2	1.2	19	2.8	1	3.4
10	2.9	....	....	18	2.4	....	....
9	7.1	1	.6	17	4.9	....	....
8	7.3	4	2.5	16	9.5	....	....
7	10.2	4	2.5	15	8.0	....	....
6	8.2	1	.6	14	16.9	1	3.4
5	30.0	5	3.1	13	12.1	....	....
4	30.9	12	7.4	12	41.9	....	....
3	41.8	8	4.9	11	30.5	2	6.8
2	53.6	16	9.8	10	67.6	1	3.4
1	38.4	60	36.8	9	78.9	3	10.2
0	64.4	1,438	881.7	8	37.4	....	....
1	35.0	55	33.7	7	73.4	1	3.4
2	36.7	12	7.4	6	22.4	3	10.2
3	50.4	6	3.7	5	16.6	3	10.2
4	23.1	4	2.5	4	22.8	3	10.2
5	28.8	2	1.2	3	24.1	2	6.8
6	35.6	....	....	2	30.6	4	13.6
7	25.4	....	....	1	42.4	26	88.4
8	26.4	....	....	0	34.6	39	132.7
9	31.2	....	....	1	34.2	9	30.6
10	46.9	....	....	2	24.4	28	95.2
11	45.9	....	....	3	43.4	26	88.4
12	44.8	....	....	4	43.0	28	95.2
13	40.0	....	....	5	67.3	34	115.6
14	43.8	....	....	6	52.9	20	68.0
15	52.6	....	....	7	45.3	12	40.8
16	35.7	....	....	8	41.7	16	54.4
17	34.8	....	....	9	22.9	9	30.6
18	22.8	....	....	10	25.2	8	27.2
19	18.1	....	....	11	5.4	5	17.0
20	11.4	....	....	12	9.9	7	23.8
21	4.7	....	....	13	.7	1	3.4
22	5.5	....	....	14	.7	1	3.4
23	.5	....	....	15	.3	....	....
24	.4	....	....	16	.3	....	....
Total ...	1,000	1,631	1,000		1,000	294	1,000

COMPARISON WITH AREAS NORTH AND WEST OF CAPE SPENCER

To examine the western areas more in detail the recoveries from the experiments in areas 20 and 22 have been plotted on a larger scale relative to the gear fished in each area, making on the graph the sum of all recoveries west of area 17 equal to the sum of the gear fished (Figure 16). The returns from areas south of 18 fail entirely to compare with the chances of recovery, but from areas 18 to 34, the recoveries vary fairly closely with the chances calculated.

Absolute correspondence would, as has been noted, require perfect mobility on the part of the fish tagged, leading to complete and random dispersion over the grounds. It is exceedingly unlikely that any such simple distribution is attained. In fact the conditions under which the mature fish were tagged form an exception, in that the mature spawners were densely congregated. This afforded an opportunity to secure an unusual representation of the tagged class by each set of gear. Such schooling occurs each fall in the areas in which the tagging was done, and there is a corresponding fish-

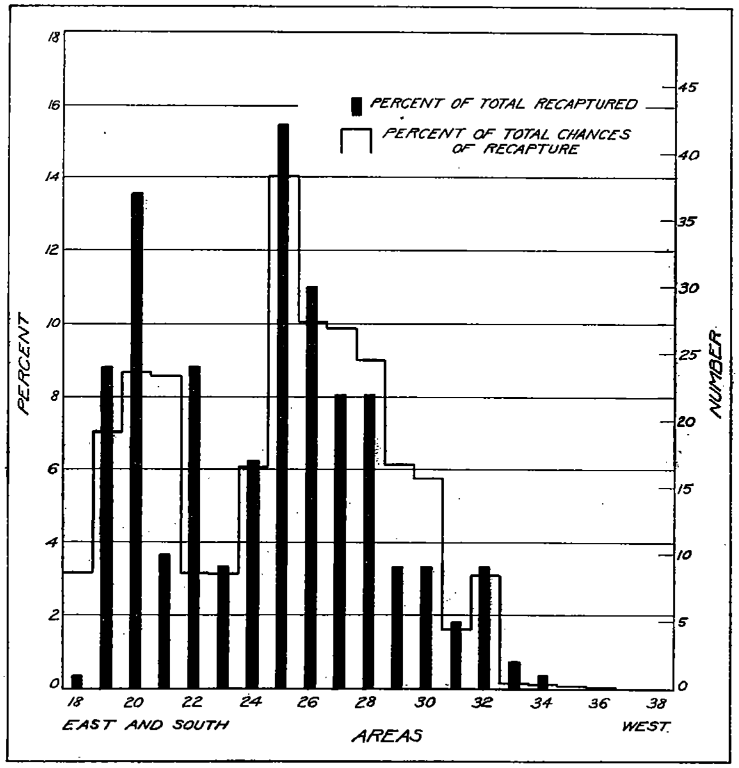

FIG. 16.—Number of halibut recaptured in each area west of 17 from the Yakutat and W Ground experiments compared to chances of recapture if population were freely migratory within the range of the fishery.

ery which returns many tagged fish. It will be noted that the returns from areas 20 and 22 are much in excess of the chances of recovery, as represented by the intensity of the fishery.

The returns are higher, relative to the chances of recapture, in areas 19 to 26 inclusive, than in some of the more western areas. This is brought out clearly (Table 6, Figure 17) by the method of combination of tagging areas used in the case of the southern banks. The actual recaptures are greater in proportion to the chances in the proximal areas to the west than in the distal.

This discrepancy may be due to two factors. Either there is an increasing concentration of the spawning schools as the eastern grounds are approached during the fall and spring fisheries, or there is some degree of limitation to the migrations made. This will need further investigation as the experiment proceeds. It must be noted that there are relatively few returns upon which to base any such exact method of treatment, and that, if the spawning schools met with in areas 20 and 22 are the same such treatment is not necessary, the actual distribution of returns being sufficient.

The mixed populations of areas 25 and 26 have not been included in this analysis because of the presence of relatively non-migratory immatures. As can be seen from Table 16 the movements of such schools are small.

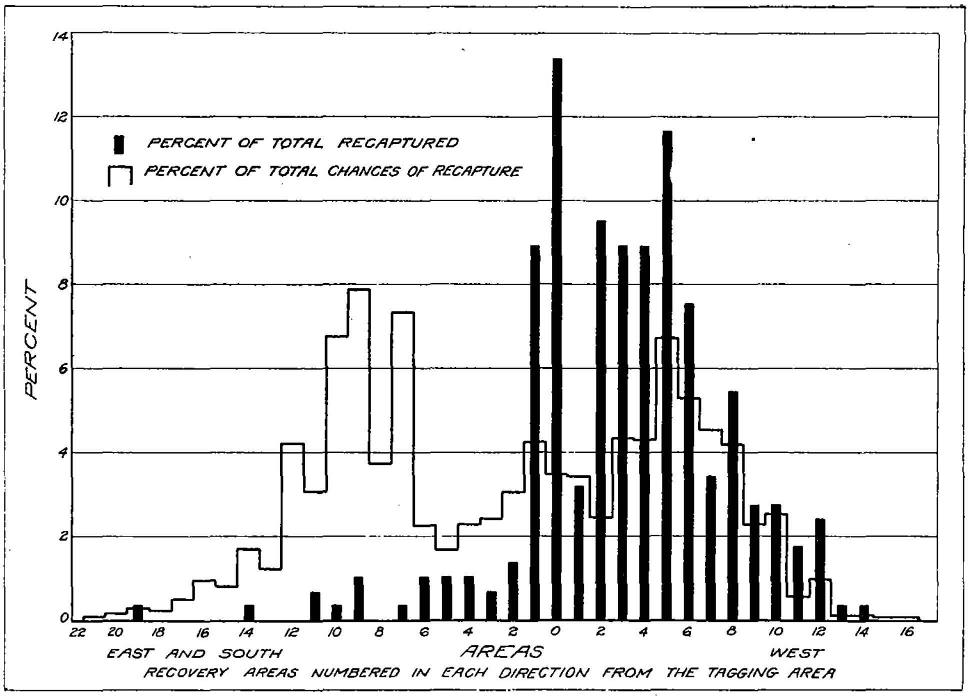

FIG. 17.—Number of halibut recaptured from Yakutat and W Ground experiments, according to areas numbered each way from area where tagged, compared to chances of recapture if the population were freely migratory within the range of the fishery.

It is therefore to be concluded that the immature population characterizing the areas south of 18 is practically non-migratory. But the mature halibut of the Gulf of Alaska contrast sharply with these immature, and migrate with relatively great freedom. The limitations upon this movement of mature may be more apparent than real, and for all practical purposes, the spawning schools between areas 18 and 38 are the same stock. It is shown very well by Figure 17 that the recoveries of these mature fish to the westward of the tagging areas are grossly in excess of the recoveries to the south, despite the nearly equal intensities.

If this is so, the catch of mature fish on the western grounds is everywhere interdependent and must decline everywhere nearly in unison. It follows that differences in relative abundance on the western grounds cannot persist for long, unless they are caused either by unusual predominance of immature fish in certain areas, or by peculiarities of the annual spawning migrations.

Our results to date indicate that the mature halibut of the Gulf of Alaska form a freely intermingling biological unit extending beyond the limit of the present fishery, but not southward.

The two main regions, south of Cape Spencer and west of Cape Spencer, will be dealt with seperately as regards rate of dispersion and rate of recovery. Under each of these headings, the variation according to length of fish and to time will be considered.

SECTION E. DISCUSSION OF RETURNS SOUTH OF CAPE SPENCER TO THE END OF THE YEAR 1928

RATE OF RECOVERY ON SOUTHERN BANKS

The number of tags of standard strap pattern placed on fish south of Cape Spencer was 4,936, of which 1,720 were placed in the year 1925 and 3,216 in the year 1926. Those of 1925 were well scattered between Cape Ommaney on the north and Goose Islands on the south (Appendix A, Figures 1, 2, and 3). Those of 1926 were largely confined to the West Coast of Prince of Wales Island and to the grounds off Goose Islands.

The percentage of these returned during the first three seasons was 35.9 for the 1925 experiment, and 31.7 for that of 1926. The returns for the fourth season were 4.1 per cent from the 1925 experiment and approximately 7.2 per cent[5] from the 1926 experiment. This gives a return during four seasons of 1,843 tags from the total of 4,936, or 37.4 per cent of all marked in the two experiments.

The returns during the fifth season are not likely to be enough to greatly increase these figures.

The returns from the halibut marked with round tags are not included in the above, nor in the results given below. There were 1,916 halibut marked thus in 1925, of which 4.7 per cent were recaptured the first season, 0.3 per cent the second, and none thereafter, making 5 per cent in all. These results differed so markedly from the returns of the strap tags that they have not been included in the subsequent analysis.

Data as to the strap tags recovered are given in Table 7 where they are grouped according to the year of recapture. The returns are given in the second and third columns according to the several calendar years following the marking in 1925 and 1926. In the fourth and fifth columns these returns are shown as percentages of the total marked in each experiment, namely of 1,720 in 1925 and of 3,216 in 1926.

TABLE 7.—*Table of recoveries from southern experiments, inclusive of Cape Chacon*

Seasons (to Jan. 1)	Number Recovered		Per cent of Total Recovered	
	1925 Experiment	1926 Experiment	1925 Experiment	1926 Experiment
1	147	227	8.5	7.1
2	352	560	22.4	18.7
3	119	235	9.7	9.7
4	45	158	4.1	7.2
Total	663	1,180	38.5	36.7
Total Marked	1,720	3,216		

[5] Returns for 1929, the fourth season of the 1926 experiment, are not complete.

CAPE CHACON RECOVERIES

The results are fairly comparable as between the two experiments, but included in the results from the 1925 experiment there is a group of tags which were liberated at Cape Chacon (Southeastern Alaska on Dixon Entrance) which deserves special consideration. This group illustrates a feature of the halibut fishery which was in the early days characteristic but has become less and less so, namely the discovery and temporarily intensive exploitation of a small "spot" yielding high returns. In 1925 there were 258 halibut tagged near Cape Chacon, during the middle of July, while a heavy fishery was concentrated there upon a newly discovered dense school of high grade fish. Table 8 shows the rate of recapture season by season.

TABLE 8.—*Recoveries of Cape Chacon fish (number tagged 258)*

Season (to Jan. 1)	Number Recovered	Per cent of Total 258	Per cent of those not Recovered Previously
1	77	29.8	29.8
2	79	30.6	43.6
3	6	2.3	5.9
4	3	1.2	3.1
Total	165	64.0	

The returns, compared with those for the whole 1925 experiment (Table 7), show an excessive rate of recapture in the first season and a much more abrupt decline in returns the third season. The fishery at Cape Chacon was exceedingly intense during the months immediately following the marking, and this persisted through 1926, but in 1927 the school was so far depleted that fishing operations were no longer productive, leading to the partial abandonment of the locality, and a sharp fall in returns.

No such spot fishing was encountered during the remainder of the 1925 experiment nor during that of 1926, so it has been deemed necessary to consider the Chape Chacon results separately, as not representative of the present fishery.

REVISED RATE OF RECOVERIES

In Table 9 the returns of the round tags and those from the Cape Chacon experiment have been omitted.

The returns have been expressed as percentages of the total number of marked fish not accounted for at the beginning of each season. The returns for any such season should obviously be given in terms of the total number of tagged fish available for capture at the time.

Table 8 for Cape Chacon fish illustrates well the fact that the returns for the several seasons, when in percentages of the total tagged, do not express directly the effect of the intensity of the fishery. Corrections cannot here be made for fish from which the tags have dropped, nor for tagged fish which have died or been caught without report of the tag, but correction can be made for fish which it is known have been recaptured. This obviously does not meet the situation adequately, but since it does so partially, is worthy of adoption. Each season's returns have therefore been calculated as percentages of the total left *unaccounted for* at its beginning.

TABLE 9.—*Recaptures of strap tags by years, southern experiments, omitting Cape Chacon*

Season	NUMBER RECOVERED FROM		PERCENTAGE OF NUMBER NOT ACCOUNTED FOR		COMBINED EXPERIMENTS	
	1925 Experiment	1926 Experiment	1925 Experiment	1926 Experiment	Number of Recoveries	Per cent of those not previously recovered
1	70	227	4.8	7.1	297	6.3
2	273	560	19.6	18.7	833	19.0
3	113	235	10.1	9.7	348	9.8
4	42	158	4.2	7.2	200	6.2
5	23	...	2.4	...	23	...
Total ..	521	1,180	35.6	36.7	1,701	36.4
Total Tagged..	1,462	3,216			4,678	

The similarity in the rates of recapture in the two experiments indicates their representative nature and accuracy. The error in any single-locality experiment would be principally that dependent upon the numbers tagged, but a far larger error would arise were its results regarded as typical of the whole fishery. The multiplication of tagging localities as the units of possible variability must therefore be given the credit for the degree of dependability which the consistency of results indicates. Such consistency, in so far as present, justifies the program of so scattering the tagging localities as to furnish a representation of the population from which the commercial supply is taken.

From the similarity in the rate of return it would seem that substantially the same average intensity of fishery was met with in the two experiments. This might be expected, because a fundamental principle followed by commercial fishermen is the concentration of efforts upon the most profitable ground. This principle leads to a leveling of abundance in all localities, with consequently somewhat even distribution of fishing intensities. The tags of the 1925 experiment were distributed generally around the Queen Charlottes, whereas those of 1926 were largely concentrated on Goose Island Grounds and the West Coast of Prince of Wales Island. The similarity in returns, therefore, evidences the uniform level of intensity of fishing effort, in accord with the varying stocks of fish, and the accuracy with which our experiments express this level.

Before these returns, as given in Table 9, can be accepted as representing the intensity of the fishery on southern banks, their significance must be understood. One source of error arises from the seasonal nature of the fishery, another from the loss of tags otherwise than by capture and return.

The distribution of the returns throughout the year reflects the seasonal nature of the halibut fishery. This is shown in Table 10 and Figure 18, where the number of tagged fish returned each month is given for the 1925 and 1926 experiments. The per cent returned each month from the two experiments is also shown. Compared according to season of recapture the two experiments give quite similar results.

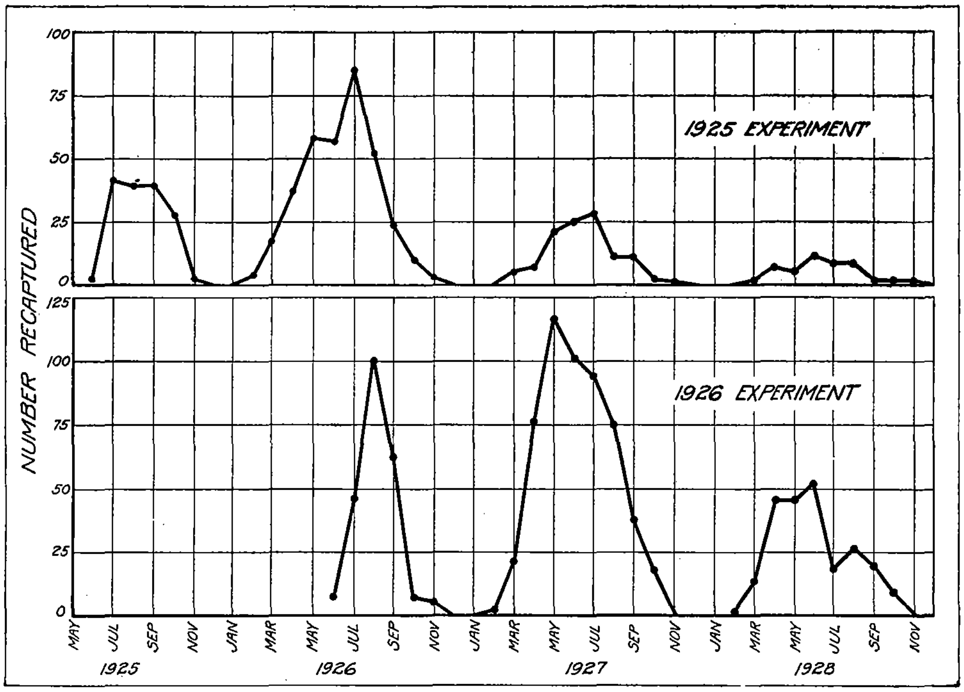

FIG. 18.—Number of halibut recaptured from the southern experiments during each month.

The concentration of the fishery in the summer months (aside from that of the year of tagging) is well illustrated by these figures. The number of returns increases from a minimum in February to a maximum in May to July and then again falls off to a minimum in November. The heavy returns during the early summer from the 1926 experiment are largely due to the fact that more than half of the recoveries for this experiment came from Goose Island Grounds, where the fishery reaches its peak somewhat earlier than on the other southern banks. The complete lack of returns during the middle of the winter is due to the cessation of fishing operations. The legal closed season from November 16 to February 15 is but a minor factor, as is indicated by the few recoveries during the months both preceding and following this closure.

TABLE 10.—*Number of halibut recaptured each month; southern experiments*

Month	1925 EXPERIMENT			1926 EXPERIMENT		
	Not Previously Recaptured	Recaptured	Per cent Recaptured	Not Previously Recaptured	Recaptured	Per cent Recaptured
1925						
June	1,720	2	0.1	....	..	..
July	1,718	41	2.4	....	..	..
August	1,677	38	2.3	....	..	..
September	1,639	38	2.3	....	..	..
October	1,601	26	1.6	....	..	..
November	1,575	2	0.1	....	..	..
Total	1,720	147	8.5	....	..	..
1926						
February	1,573	4	0.3	....	..	..
March	1,569	17	1.1	....	..	..
April	1,552	37	2.4	....	..	..
May	1,515	58	3.8	....	..	..
June	1,457	57	3.9	3,215	7	0.2
July	1,400	85	6.1	3,208	46	1.4
August	1,315	52	4.0	3,162	100	3.2
September	1,263	24	1.9	3,062	62	2.0
October	1,239	10	0.8	3,000	7	0.2
November	1,229	3	0.2	2,993	5	0.2
Incomplete	1,226	5	0.4	2,988	0	..
Total	1,573	352	22.4	3,215	227	7.1
1927						
February	1,221	0	..	2,988	2	0.1
March	1,221	5	0.4	2,986	21	0.7
April	1,216	7	0.6	2,965	76	2.6
May	1,209	21	1.7	2,889	117	4.0
June	1,188	25	2.1	2,772	103	3.7
July	1,163	28	2.4	2,669	94	3.5
August	1,135	11	1.0	2,575	75	2.9
September	1,124	11	1.0	2,500	38	1.5
October	1,113	2	0.2	2,462	18	0.7
November	1,111	1	0.1	2,444	0	..
Incomplete	1,110	8	0.7	2,444	16	0.7
Total	1,221	119	9.75	2,988	560	18.7
1928						
February	1,102	0	..	2,428	1	0.04
March	1,102	1	0.1	2,427	12	0.5
April	1,101	7	0.6	2,415	46	1.9
May	1,094	5	0.5	2,369	46	1.9
June	1,089	11	1.0	2,323	52	2.2
July	1,078	8	0.7	2,271	18	0.8
August	1,070	8	0.7	2,253	26	1.2
September	1,062	1	0.1	2,227	19	0.9
October	1,061	1	0.1	2,208	9	0.4
November	1,060	1	0.1	2,199	1	0.05
Incomplete	1,059	2	0.2	2,198	5	0.2
Total	1,102	45	4.1	2,428	235	9.7

The seasonal nature of the fishery on southern banks is also shown by our records of halibut landings. These are given in Table 11 and Figure 19 for Prince Rupert and Seattle landings from the region of Sitka Sound to the north end of Vancouver Island. During these years nearly 81 per cent of the total landings ar recorded for the period from April to September, while 90 per cent of the halibut recaptured in 1926 from the 1925 experiment were taken during this period.

TABLE 11.—*Monthly halibut landings in Prince Rupert and Seattle from banks between Sitka Sound and north end of Vancouver Island*

Average for 1926, 1927 and 1928. These figures represent 67.4 per cent of the total halibut from this region.

February	224,767	July	2,317,750
March	1,318,710	August	2,036,794
April	1,921,200	September	1,327,267
May	2,112,917	October	826,885
June	2,488,884	November	478,983
		Total	15,054,157

The seasonal character of the fishery affects the number of returns during what is called the first season in the above tables, namely, from time of tagging to January 1. Tagging operations were carried on in 1925 between the middle of June and the middle of August, in 1926 between the first of June and the first of August. This was, roughly, at or after the crest of the season for the several banks where tagging was done. More than the first half of this first season is, therefore, lacking in each case, and very often no fishing occurred in the tagging locality until the following year.

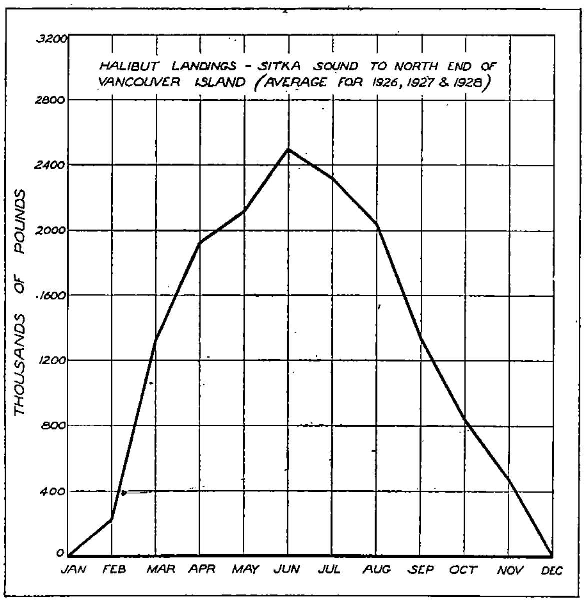

FIG. 19.—Seattle and Prince Rupert halibut landings from the region Sitka Sound to the north end of Vancouver Island. Monthly averages for 1926, 1927 and 1928 combined. The Seattle and Prince Rupert landings include approximately 67 per cent of all halibut taken from the region named.

Furthermore, the chances of recovery during the first few months are not normal. Halibut were, naturally, marked from schools which happened to be encountered, on grounds at the time heavily fished, and these schools then contained an exceedingly high percentage of marked fish. But a ground once heavily fished in a given season is not likely to be resorted to again in the near future. It is characteristic of the halibut fishery that certain areas are resorted to at certain seasons only by certain boats, and revisited a year later. Tagging having been done at or after these times, there remained in each case but a very small chance of recaptures. The chances of vessels in a widely scattered fleet of at once meeting these schools were small and as a matter of fact rarely occurred. Hence, until sufficient time had elapsed either to allow the marked fish to distribute themselves fairly in the general region or the fleet to repeat their cycles of fishing localities, the recaptures did not adequately reflect the intensity of the fishery. How soon this degree of scatter was attained is doubtful, inasmuch as the fishery shifts as fall approaches. It is therefore necessary to regard the first season's returns as abnormally small in number.

The truth of this is attested by the high rate of returns which were found in the single case in which an intensive fishery occurred in the tagging locality immediately after marking. The Cape Chacon experiment (Table 8) shows practically as many returns for the first season as for the second, despite the fact that the former was for part of a season only. The exclusion of the Cape Chacon experiment, on the ground that it is abnormal, is perhaps not justifiable, since it represents what is probably a normal first year return of a fishery subjected from the beginning to intensive fishery. But the experiment practically terminated during the second year because of the partial abandonment of the locality by the fleet.

The seasonal change in intensity also lends significance to the differing dates of the several experiments. Two methods of classifying returns, by date of recapture, or by number of days out, are available. The classification by date of recapture associates halibut which have been at liberty for periods differing by as much as three months. The other method associates halibut which have been retaken at different dates, and obscures the effect of seasonal changes. It is therefore necssary to choose the method of classification, or to adapt it, according to the purpose in view.

However, the sharply marked seasons, with a winter closure of three months, allow a natural division which holds for both methods of classification as long as a full year's returns are dealt with. The winter closure is from November 16 to February 15. The choice of January 1 as a point of division, corresponds to the point of natural division according to time out. The returns for each calendar year except the first, therefore form the natural seasonal unit usable until an examination by smaller time units is made. These returns are given in Tables 7, 8, and 9 as seasons.

We have therefore regarded the second season as the first during which the chances of recovery are normal.

CORRECTION TO REPRESENT TRUE RATE OF RECAPTURE

The outstanding feature of these returns, as presented in Table 9, is the decline which is shown in the percentage of returns, even when this percentage is calculated as of the number unaccounted for.

The number tagged during the 1925 experiments was 1,462. The returns in the successive calendar years after the first half year were 273, 113, 42, and 23. The number unaccounted for by return of tags at the beginning of the respective years was 1,392, 1,119, 1,006, and 964. The returns were therefore in the successive years, 19.6 per cent, 10.1 per cent, 4.2 per cent, and 2.4 per cent of the totals unaccounted for at the beginning of each year. This is a very sharp fall. But, were there no loss except by returned tags, these percentages should by definition have been constant year after year, because they are based on the stock not accounted for by returned tags.

There is, then, a steadily accumulating difference between the constant percentage value as it would be if there were no other loss than by returned tags and the percentages actually returned. This steadily accumulating difference is due to the inclusion, in those not accounted for, of fish actually removed from the fishery by means other than return to us. Each year's unknown loss is carried forward and added to, as a basis for new calculations. The loss is undoubtedly operative from the moment of tagging, and enters into the first or any succeeding determinations of percentage recoveries, reducing them very markedly to a greater and greater extent as the proportion of the unaccounted for losses to the actual stock existent becomes greater.

It will be well worth while to suggest, if only approximately, what correction or type of correction must be applied to obtain the true intensity of the fishery. This has been done in Figure 20, for the 1925 experiment exclusive of the Cape Chacon data.

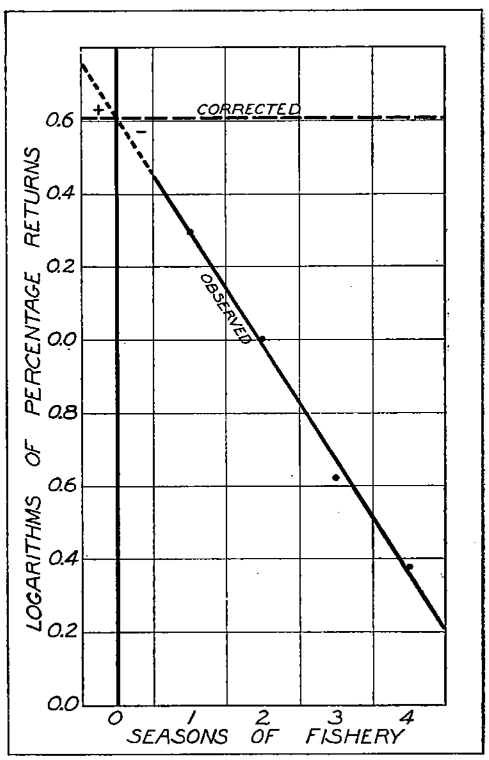

FIG. 20.—Logarithms of percentage returns from the 1925 experiment (exclusive of Cape Chacon) fitted with a straight line to show corrected rate of return. Values for each season on basis of those unaccounted for January 1.

In constructing this graph we have considered a stock of fish, originally in excess of the number tagged (1,462), on a given bank. Half way through a calendar year, 1,462 of this stock survived and were tagged. The returns in succeeding years were summed annually, at the close of each year. The summed return in each case therefore represented most probably the mid-point of the year in question, particularly as the returns were most frequent near that mid-point. Each such summed return was calculated as a percentage of the number of fish not previously returned at the beginning of that year. The percentage values obtained were found to follow a law of variation from year to year indicating that the rate of change in these percentage values was a constant, forming a logarithmic curve.

The logarithms of the percentage values obtained were therefore plotted, each at the mid-point of its proper year (Figure 20). It will be noted at once that they are best described by a straight line. It is defined by the formula $y = ab^x$, or $\log y = K_1 + K_2 x$ where y is the percentage value, K_1 and K_2 are constants, logarithms of a and b, and x is the time since tagging. Assuming conditions to have been constant from year to year, the line may be extrapolated, indicating at the y intercept a value for a of 40.4 per cent.

Before assigning any meaning to a, or this y intercept, the significance of each of the known points must be determined. As has been indicated, these are the logarithms of the percentages which the *actual returns* (not recaptures) form of the *totals unaccounted for* at the beginning of each year. Both the actual returns and the unaccounted for totals are, however, affected by several factors, the importance of which change from season to season and which may or may not be effective at the time of tagging.

For the sake of simplicity it may be assumed that the original stock was tagged at the beginning of a fishing year. At the end of each year thereafter, the returns were summed and expressed as already indicated. These resultant percentage values represented the recaptures by fishermen, modified, however, by the following: (1) natural mortality; (2) loss of tags from living fish before recapture; and (3) loss of tags after recapture and before return. We wish to eliminate these, making the percentage values the true rate of recapture. It must be assumed, lacking any specific information, that the factors concerned act at a constant rate throughout the time of the experiment, and that that include all those that affect the final values as expressed in percentages of the totals unaccounted for.

These percentage values represent an apparent rate of return which varies from the true rate of recapture because, on the one hand, the various factors reduce the number returned; and on the other, they increase the unaccounted for total, as compared with the actual available tagged stock at the beginning of each season. But the numbers returned form the numerators, the unaccounted for totals the denominators, of the expressions from which the observed percentages were obtained, and the percentage values obtained vary accordingly.

The number returned is reduced because the stock of tagged fish is constantly diminished by the factors under the first two headings above, namely, natural mortality, and loss of tags before recapture. At the time of tagging this stock is equal to a known value—the original number tagged. The subsequent decrease by death and loss of tags before recapture is, by assumption, at a constant rate. It is cumulative in effect, the proportion of lost tags to those remaining increasing steadily from one that is initially negligible to one that is of greater and greater significance in calculating the final percentage values. Whatever the equation describing the effect of these losses, they are non-existent at the time of tagging, and the extrapolation back to that date of the graph following the observed values shown in Figure 20 should give a value free of the influence of such losses upon the stock of tagged fish.

But the denominator, the unaccounted for stock, is increased. At the time of tagging, it is equal to the actual tagged stock, hence a known value, because at that time no deaths or losses have occurred. It is subsequently increased by each death or lost tag, and such increases are cumulative with time. The proportion thus wrongly classified mounts year by year from a negligible amount to one of greater and greater significance, and affects to a corresponding degree the discrepancy between the unaccounted for total and that of the tagged stock otherwise remaining. This discrepancy the correction proposed should eliminate, because the factors discussed are not effective at the date of tagging.

But the third cause of differences between the observed percentage returns and the actual percentage recapture, is the loss of tags after recapture. In this case the rate of loss of recaptured tags is by assumption constant, affecting the percentage values for the first returns equally with those for the last. Its direct effect upon the number returned is therefore not eliminated by the proposed correction. However, its effect upon the unaccounted for total is similar to that of other factors, initially negligible and cumulative in effect, and is corrected for.

The rate of recapture by fishermen is hence affected by the rate of loss of recaptured tags as a constant, applying at the time of tagging, and our corrected value indicated for that time is not the rate of recapture but is the rate of return. The true rate of return, by definition, should be a constant, and the values obtained for the percentages would form a horizontal straight line across our graph as drawn (Figure 20).

In the actual case at hand, if our reasoning applies thereto, the difference between this true rate of return, and the values as observed (and as expressed as percentages of fish not accounted for) increases at a constant rate, or nearly so, giving the logarithmic graph obtained. This observed difference is the summation of the effects of the several factors acting simultaneously upon the true rate of return but the independent effect of any single one of these factors might possibly be described by a type of equation differing from that fitting the observed values.

This difference begins at the time of tagging, is non-existent at that time, and becomes opposite in sign if the curve is extrapolated beyond; that is, for the first half of the year to which our value, a, applies. The antilogarithm of the y intercept therefore indicates the true rate of return, in case our reasoning applies to the observed case.

This rate of return, 40.4 per cent, would apply to the calendar year, at the mid-point of which tagging was done, and to the stock present at the last of the previous year, six months eariler, that is, a stock in excess of the number actually tagged. This is immaterial, however, since the percentage value would apply to any stock, the successive annual percentage values used in each case referring to a different number of the original total stock. This would not be true had the several values used been stated as percentages of the actual number of stock tagged, when the *y* intrcept value would have been meaningless and too high, for it would be based on the actual numbers which would have been returned from the stock existent six months earlier, despite the fact that it would be stated in percentages of the tagged stock.

The results therefore indicate that if no source of loss other than the intensity of the fishery were operative 40.4 per cent of any given stock would be returned within one year. We have no direct measure of the tags lost after recapture, but assume this to be small,in view of the great interest of the fishermen and the large reward offered.

The question arises as to what extent the imperfect returns of the first half year affect the results. An allowance of 271 returns in addition to the 70 for the first half year, raises the apparent rate of recapture only to 48.8 per cent. This allowance is grossly in excess of what is probable even though there were some unusual source of loss during the first half year, and indicates to some extent the limit of the error which might exist from this source.

The corrected rate, 40.4 per cent, cannot be more than an approximation, due to the abnormality of the first year and to the lack of enough years' returns to give thoroughly constant values. It may, of course, be proved finally that the intensity is not constant, and that some other equation than the one chosen will be necessary, and it may be that the rate of death otherwise than by recapture is not what we suppose. Yet, in the present state of our fishery science, the greatest value of the determination made must lie in its suggestiveness, both to the scientist concerned and to the regulative powers.

TOTAL DECLINE IN STOCK AND NATURAL MORTALITY

In considering the significance of the preceding suggestions it is necessary to bear in mind that with the eliminated cumulative error of lost tags, etc., is included the natural mortality, so that the rate of recapture as corrected does not represent the actual rate at which the stock disappears.

The actual rate at which the stock of tagged fish disappears might be assumed to be represented by the decline in actual numbers of returns. This would be true if the intensity of the fishery did not vary from year to year, for then the recoveries would represent a uniform proportion of the stock surviving at the start of each season. The number of tags lost after recapture would vary in proportion with the number returned.

So, if the returned tags form a constant percentage of the available stock of marked fish, the returns of 273, 113, 42, and 23 in successive years represent the relative magnitudes of the stocks of marked fish left at the beginning of each year from the 1925 experiment. The greatest importance attaches to the returns of greatest number, due to their lesser probable error. Weighting the values accordingly, an annual decline of 58.4 per cent would seem to be the best which can be determined from the available data. This decline should be compared to the corrected rate of recapture of tagged fish of 40.4 per cent. That is, our corrected rate of return accounts for but a fraction of the total decreases, the balance being natural mortality.

But it will be noted that the annual decline of 58.4 per cent refers to the available stock of marked fish. To regard this as the decline in the total stock on the banks involves the assumption that the stock of marked fish changes at the same rate as the total stock. This is, strictly speaking, not true, for there must be from year to year, a loss of tags without death or recapture of the fish concerned, reducing the stock of marked fish somewhat faster than the total stock. This we do not believe is considerable after the first year, but it remains an assumption that the unaccounted for decline in marked stock is entirely due to natural mortality.

We have, then, estimates of the total decline in stock, and of the actual rate of capture which contributes to this total decline. On the assumption that these estimates are nearly enough correct to lend validity to further calculations, the rather fascinating possibility of discovering the natural rate of mortality presents itself. This, of course, with the present relatively few returns and unexplored possibilities, is mainly of theoretical interest, however great the latter may be, at least until a tag is perfected which is not lost from the living fish.

Dr. A. F. Carpenter, Professor of Mathematics, University of Washington, who has been kind enough to check the reasoning of the senior author with regard to the above, suggests the following solution as of general interest. The mathematics is simple and is explainable by reference to any suitable text.[6]

Assuming a total loss each year of 58 per cent of the available stock of fish at the beginning of the year, and similarly a loss of 40 per cent due to fishing, the problem is to determine the percentage loss due to natural causes, which, together with the 40 per cent loss by fishing, will account for the total loss of 58 per cent.

The depletion due to natural causes is operative throughout the year while that due to fishing takes place during a short season. For simiplicity we shall assume that this latter loss takes place instantaneously and at exactly mid-season, and that the year begins and ends at mid-season.

Let S be the original number of fish and S' the number remaining after time t during which only natural causes for reduction of stock have been operative. Then, if r be the continuous rate of loss due to natural causes, we will have the relation

$$S' = S\, e^{-rt}.$$

[6] See Feldman, Biomathematics, p. 75.

For an original stock of say 1,000 fish, the number remaining at the end of one year, and before the loss due to fishing, will thus be

$$S' = 1000\ e^{-r}.$$

The catch at this time is 40 per cent of the original number, or 400, and after their removal there remain 42 per cent of the original number, or 420. We thus have

$$1000\ e^{-r} - 400 = 420,$$

from which $$r = \log_e {}^{50}/_{41} = 0.198$$

to the nearest tenth per cent.

If, in place of assuming that the catch is all removed at one time, we think of it as a continuous process over a period of two months at the end of the year, then we must first find what continuous rate i over a period of a year will be equivalent to the rate which produces a depletion of 40 per cent in two months. For this we will have

$$e^{-i/6} = 0.60,$$

from which $$i/6 = 0.511.$$

Our equation for the computation of r now becomes

$$1000\ e^{-(r+0.511)} = 420,$$

from which $$r = 0.356$$

to the nearest tenth per cent.

It now becomes clear that any period whatever of fishing at a continuous rate which is equivalent to a depletion of 40 per cent, will produce the same result for r. For we shall have, for any fractional part i/n of a year, the relation

$$e^{-i/n} = 0.60$$

from which $$i/n = 0.511,$$

and as before

$$1000\ e^{-(r+i/n)} = 420$$

gives, when the value of i/n is inserted,

$$r = 0.356$$

Corrections must be made in the results of our tagging experiments if we are to arrive at any idea of the rate of capture by the fishery, and they make the returns coherent and understandable, whereas otherwise they are not. The calculations are relatively simple and straightforward. In advancing such we are conscious of the fact that the underlying theory needs elaboration. So, too, are we conscious of the lack of a sufficient number of years' returns to lend accuracy to the calculations made. It is our hope to make in the future a more detailed analysis of what experiments we have, and to add to the evidence available.

This is especially true in that we have no accurate knowledge of the number of skates fished from year to year on the banks concerned. Were such knowledge available, the variability in the rate of return of tags might be definitely correlated with year by year changes in the fishery rather than with possible movements of the fish. Thus the somewhat unexpectedly high returns of tagged fish in 1929 from the 1926 experiment might be due either to a more intense fishery or to the growth of the tagged fish to a more intensively fished size. It is obvious that the lack of precise knowledge of the fishery

TABLE 12.—*Number of halibut tagged and number and percentage recaptured for each 5 cm. length category; southern experiments*

Length	1925 EXPERIMENT			1926 EXPERIMENT			TOTAL			1925 EXPERIMENT WITHOUT CAPE CHACON		
	Tagged	Recaptured 1925-1928	Per cent Recaptured	Tagged	Recaptured 1926-1928	Per cent Recaptured	Tagged	Recaptured	Per cent Recaptured	Tagged	Recaptured 1925-1927	Per cent Recaptured
35– 39.9	1	...	...	...	...	...	1	...	...	1	...	...
40– 44.9	6	...	...	4	...	...	10	...	...	6	...	...
45– 49.9	28	3	10.7	58	2	3.4	86	5	5.8	28	...	...
50– 54.9	70	16	22.9	200	26	13.0	270	42	15.6	66	13	19.7
55– 59.9	197	45	22.8	543	111	20.4	740	156	21.1	188	31	16.5
60– 64.9	326	122	37.4	875	290	33.1	1,201	412	34.3	293	90	30.7
65– 69.9	401	161	40.1	774	288	37.2	1,175	449	38.2	330	110	33.3
70– 74.9	278	141	50.7	403	179	44.4	681	320	47.0	212	91	42.9
75– 79.9	185	80	43.2	174	65	37.4	359	145	40.4	142	51	35.9
80– 84.9	84	38	45.2	80	30	37.5	164	67	40.9	63	24	38.1
85– 89.9	44	24 }	45.2	50	14 }	29.1	94	38	40.4	37	20 }	41.9
90– 94.9	29	9 }	{	29	9 }	{	58	18	31.0	25	6 }	{
95– 99.9	21	10 }	41.7	13	5 }	33.3	34	15	44.1	21	9 }	36.1
100–104.9	15	5 }	{	5	1 }	{	20	7	35.0	15	4 }	{
105–109.9	12	4 }	33.3	2	...	...	14	4	28.6	12	3 }	23.8
110–114.9	9	3 }	{	1	...	...	10	3	30.0	9	2 }	{
115–119.9	1	...	...	...	...	...	1	...	...	1	...	...
120–124.9	2	...	...	1	...	...	3	...	...	2	...	...
125–129.9	2	1	...	...	...	...	2	1	...	2	1	...
130–134.9	2	1	...	...	...	...	2	1	...	2	1	...
135–139.9	1	...	...	...	...	...	1	...	...	1	...	...
140–144.9	2	...	...	...	...	...	2	...	...	2	...	...
145–149.9	...	...	...	...	...	...	...	...	...	...	...	...
150–154.9	2	...	...	...	...	...	2	...	...	2	...	...
155–159.9	...	...	...	...	...	...	...	...	...	...	...	...
160–164.9	...	...	...	1	...	...	1	...	...	...	...	...
Not given	2	...	...	3	2	...	5	2	...	2	...	...
Total	1,720	663	38.5	3,216	1,022	31.8	4.936	1,685	34.1	1,462	456	31.2

hinders the development of scientific methods of observation. There cannot be any doubt of the importance of a sound statistical system.

RATE OF RECOVERY FOR DIFFERENT SIZE CATEGORIES

This leads us to a consideration of another source of variation which is also very important in any analysis of the rate of returns as representing the intensity of the fishery. The rate at which the marked halibut have been retaken is different for the various sizes of fish. This is shown by the percentages of each size category which have been recaptured.

In Table 12 and Figure 21, we have shown the length frequencies for all halibut marked on southern banks in 1925 and 1926. In addition there is

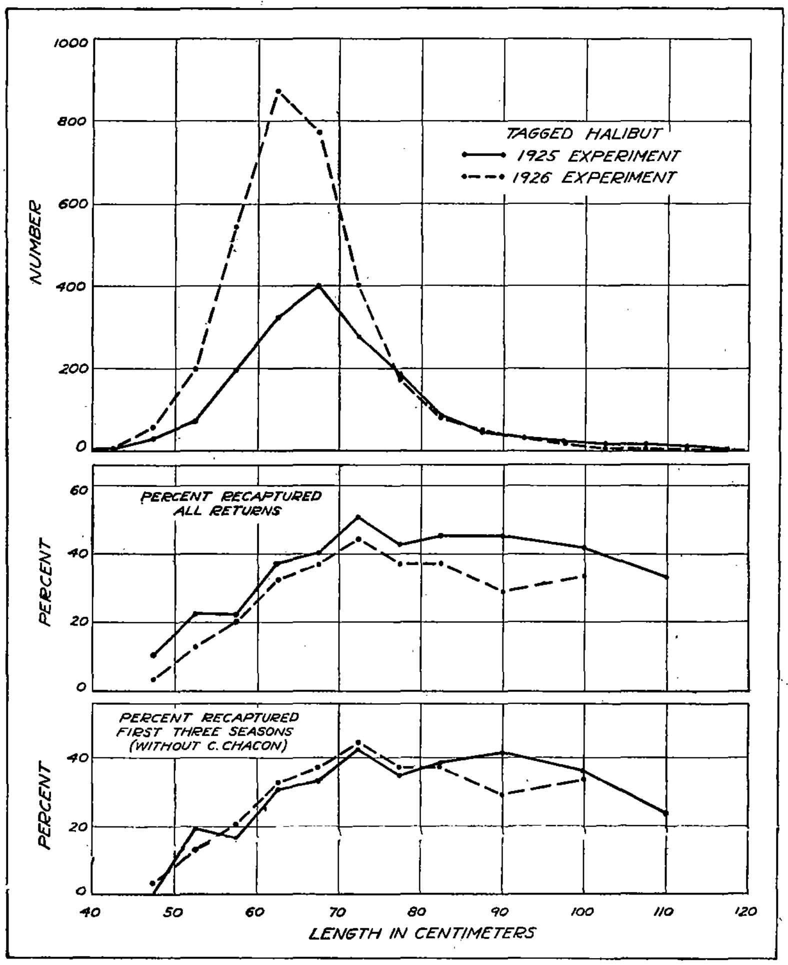

FIG. 21.—Length frequencies of halibut tagged during southern experiments and percentages recaptured. Upper—Length frequency curves for halibut tagged in 1925 and 1926. Middle—Percentage recaptured to the end of 1928 of the number tagged at each length. Lower—Percentage recaptured from each experiment during the first three seasons, by lengths. Cape Chacon data not included.

given for the different lengths the percentage recaptured (more strictly speaking, returned) of the number tagged. The percentages include all fish recaptured from 1925 to 1928 for the 1925 experiment and from 1926 to 1928 for the 1926 experiment.

The rate of return from the 1925 experiment for the four seasons, from 1925 to 1928, is lowest for halibut 50 cm. or less in length. From 11 per cent at this size, it increases rapidly to about 45 per cent for fish between 70 and 90 cm. For the sizes above 90 cm., the rate is less, but it is not reliable because of the small numbers of returns involved.

The rate of return, according to size, during the 1926 experiment was very similar to that for 1925. But the values are somewhat lower inasmuch as three seasons' recoveries (1926 to 1928) are included instead of four as for the 1925 experiment. Again we find the rate increasing from a minimum of less than 5 per cent for halibut under 50 cm. in length to a maximum near 40 per cent for fish from 65 to 80 cm. For the larger sizes the percentages are again somewhat less but are unreliable because of the few returns.

In order to compare more readily the returns from the two experiments there are shown graphically in Figure 21, lower, the percentages for the 1925 to 1927 recoveries from the 1925 experiment. In the 1925 curve the data from the Cape Chacon tagging are omitted since the conditions and results of this experiment differed so markedly from any of the others. The two curves are very similar, rising from a minimum for the smallest sizes to a maximum around the 70 to 80 cm. lengths. Above this size the general trend is downward although there are some discrepancies which can be expected because of the small numbers and correspondingly large probable errors.

The difference in the rate of recovery for variously sized fish can be explained largely by the nature of the halibut fishery. As has been mentioned before the halibut in schools are more or less equal in size. The principal effort of the fleet is then directed at those schools containing fish sufficiently large to be marketable and in sufficient numbers to be remunerative. Consequently there is greater effort directed against the fish of intermediate sizes and there is a higher percentage of recaptures in those categories.

The returns of small fish are further lowered by the fishermen's practice of shacking off all which are too small to be of much market value. In such cases, they are snapped from the hook back into the water with a flip of the arm and wrist. There is then but small likelihood that any tags present will be noticed and as the injury received is usually fatal, the tag is lost to our experiment. The size of halibut shacked off varies somewhat from time to time, from area to area, and from boat to boat, but in the end is largely determined by the markets. There is presented in this connection, a graph showing the relationship between length and weight (Figure 22).

The fewer returns from the larger sizes can probably be ascribed to a lessened concentration of the fishery upon such fish, and rather doubtfully, to a greater dispersion of these to outlying areas where the fishery is less intense.

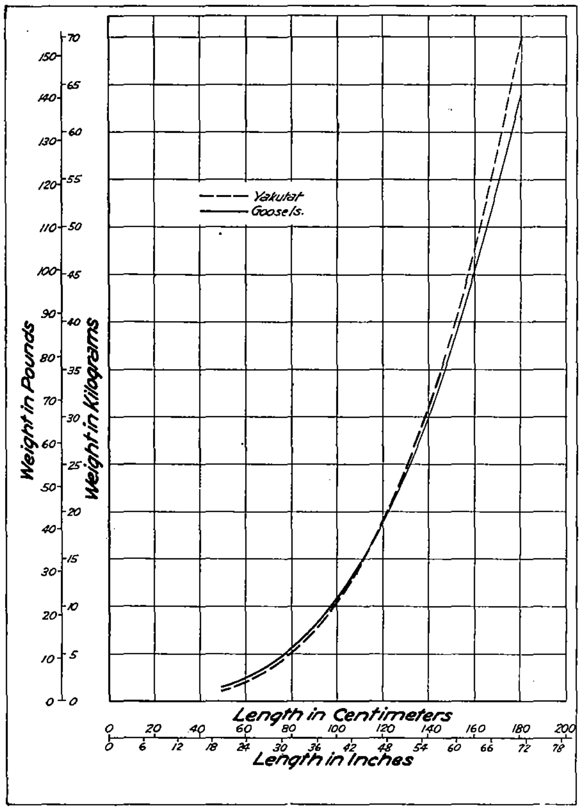

FIG. 22.—Weight-length curves for Goose Island (southern) and Yakutat (western) fish. Eviscerated but with heads on.

The results thus prove that these returns of marked fish as given for the whole do not represent the maximum intensity which prevails for certain sizes. If the cumulative error is the same for all sizes, the corrected rate of recapture for the sizes between 70 and 90 cm. would be as much above 40 per cent as the uncorrected percentage returns for those sizes are above the average for all sizes. The thought then occurs to us that this cumulative error we observe is not equally distributed between the sizes, that as a result our calculations of the rate of recapture might be very different for the several sizes. Whether the data at hand are extensive enough to support the analysis necessary remains to be seen in a later report if such is made.

The work shows very plainly the high intensity of the fishery. It cannot be doubted that subsequent to the sixth year, when halibut first enter the commercial catch in quantity, the rate per year of removal by the fishery and of loss by natural death is nearly 60 per cent at best, and is such as to leave but a very small fraction by the time the age of average maturity, twelve, is reached.[7]

[7] Thompson, W.F. A Preliminary Report on the Life History of the Halibut. In Report of the Commissioner of Fisheries for 1914, Province of British Columbia, 1915, p. 92.

The commercial fishery resembles a barrier, past which but few fish can win, and against which the incoming schools of young are spent vainly in their attempt to reach maturity. No other explanation is needed for the prevailing lack of mature fish on southern banks than the existing intensity of the fishery.

At one time the average size of the fish on these southern grounds was large, and the mature abundant.[8] It cannot, of course, be assumed that whatever persistence or lack of persistence the stock on southern grounds shows is the direct result of the rate of removal, since many other factors affect the supply of young. But at present the ages of fish on these banks lie largely between 5 and 9, with a few as old as 12 or 13. It is therefore in harmony with the actual facts that a very high rate of decline in the stock should exist.[9]

The significance of more exact studies than we have made can hardly be overestimated. This is very plain in considering the effect of changes in intensity upon the chances of reaching maturity. Were, in accordance with our estimates, the rate of survival 42 per cent per year but 5 fish out of a thousand would reach the age of 12, after entry into the commercial catch as six year olds. Were the rate 60 per cent, over 45 fish would reach the age of 12.

We would also urge a more precise analysis of the principles underlying the determination of the rate of capture and death. We would wish for it more carefully planned and extensive experiments. The numbers of fish tagged in each area should be greater, so that the results might be more uniform. The method gives promise of being a most valuable tool in determining the relative merits of such regulations as closed areas.

DISPERSION ON SOUTHERN BANKS

In the preceding section information has been secured as to the rapidity with which the present stock of halibut on the southern banks is being exhausted. This is at a high rate, and if the fishery is to endure, must be balanced by an annual income (1) of young, or (2) of migrants from other banks. The source of this supply of young is being studied by other means, but the marking experiments here described throw direct light upon the rate of natural drainage from, and the renewal of, the stock of adults upon the banks concerned, in addition to what they throw upon the rates of death and recapture.

In this section the endeavor will be made to arrive at some general measure or expression of the extent of migration on the southern grounds. In favor of this method of treatment is the distribution of the tagging over many banks, so that the expression of the extent of movement will partake of the character of an average.

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[8] Thompson, W. F. Statistics of the Halibut Fishery in the Pacific. In Report of the Commissioner of Fisheries for 1915, Province of British Columbia, 1916, p. 97.

[9] Data from manuscript on age determination by Harry A. Dunlop.

FIG. 23.—Dispersion of tagged fish with time. Each spot on the chart represents, on the vertical scale, the distance between the position of release and that of recapture; on the horizontal scale, the elapsed time between the day the halibut was tagged and that on which recaptured. The total absence of returns around the 175, 550, and 925 day points is due to the closed season (November 16 to February 15).

In Figure 23 the marked fish returned are shown (abscissae) according to the time elapsed between tagging and recapture and (ordinates) according to the distance between the localities of tagging and of recovery. Each fish is represented by a spot. The distance of this above the base line therefore represents graphically the net movement of the individual concerned, whatever the direction or whatever the intervening migrations may have been.

DISTRIBUTION OF RETURNS

The most noticeable feature of these returns is their grouping, reflecting the highly seasonal nature of the halibut fishery. Tagging was in each case done while the fishery in the locality was at or near its crest. The returns show by the evident grouping that they tend to be at a maximum annually at the season of marking. The recoveries, then, took place, just as the marking, during the seasonal fishery, and the grouping is therefore largely the result of the distribution of the fishery upon the class of fish tagged, namely the immature.

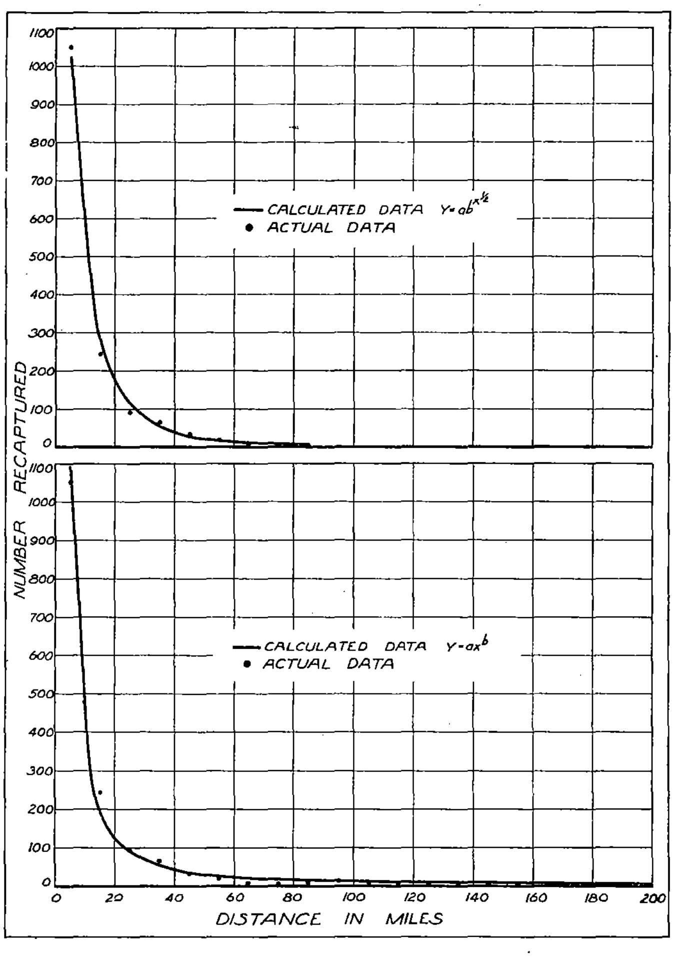

FIG. 24.—Number of tagged halibut recaptured between 0 and 10 miles, 10 and 20, etc., from the tagging location. First three seasons' returns from combined southern experiments.

A very direct method of studying the scatter of the tagged fish is to range the number of halibut according to the extent of movement. This has been done in Table 13 and Figure 24 for the recoveries up to the end of 1928. The number of fish moving less than 10 miles is 1,061, those between 10.0 and 19.9 miles, 241. The numbers fall off rapidly as the distance increases.

TABLE 13.—*Number of tagged halibut recaptured from the southern experiments to end of 1928 according to year of return and distance from tagging location*

Miles	TAGGED IN 1925					TAGGED IN 1926				1925 AND 1926	
	Recaptured in					Recaptured in				First Three Seasons	All Returns
	1925	1926	1927	1928	Total	1926	1927	1928	Total		
0- 9	124	258	52	30	464	149	345	103	597	1,031	1,061
10- 19	4	30	11	..	45	39	99	58	196	241	241
20- 29	4	13	6	4	27	19	28	19	66	89	93
30- 39	6	8	6	1	21	7	26	12	45	65	66
40- 49	4	3	4	2	13	7	7	8	22	33	35
50- 59	..	6	2	..	8	..	7	3	10	18	18
60- 69	1	2	..	..	3	1	3	..	4	7	7
70- 79	..	3	..	..	3	1	2	1	4	7	7
80- 89	..	4	2	..	6	1	1	..	2	8	8
90- 99	1	3	3	..	7	..	2	2	4	11	11
100-109	..	3	2	1	6	..	1	2	3	8	9
110-119	1	1	..	..	2	..	2	2	4	6	6
120-129	..	1	..	..	1	..	..	2	2	3	3
130-139	..	2	..	..	2	..	1	..	1	3	3
140-149	..	..	1	..	1	..	1	1	2	3	3
150-159	..	..	1	..	1	..	1	2	3	4	4
160-169	..	..	2	..	2	..	2	1	3	5	5
170-179	..	1	1	..	2	..	1	..	1	3	3
180-189	..	2	..	..	2	..	..	2	2	4	4
190-199	..	1	1	..	2	..	..	..	..	2	2
200-209	..	1	..	..	1	..	..	1	1	2	2
210-219	..	..	1	..	1	..	1	..	1	2	2
220-229	..	..	1	..	1	..	..	1	1	2	2
230-239	..	..	..	1	1	..	1	..	1	1	2
240-249	..	1	..	..	1	1	1	2	4	5	5
250-259	..	..	..	..	..	..	1	..	1	1	1
260-269	..	..	..	..	..	..	..	..	..	..	..
270-279	..	..	..	..	..	..	1	..	1	1	1
280-289	..	..	..	..	..	..	1	..	1	1	1
290-299	..	..	..	..	..	..	..	..	..	..	..
300-309	..	..	..	..	..	..	..	..	..	..	..
310-319	..	..	..	..	..	..	1	..	1	1	1
320-329	..	..	2	..	2	..	1	1	2	4	4
330-339	..	..	..	..	..	..	..	..	..	..	..
340-349	..	..	..	..	..	..	..	..	..	..	..
350-359	..	..	..	..	..	..	..	..	..	..	..
360-369	..	..	..	..	..	..	..	1	1	1	1
370-379	..	1	..	..	1	..	..	..	..	1	1
380-389	..	..	..	..	..	..	..	..	..	..	..
390-399	..	1	..	..	1	..	..	..	..	1	1
400-409	..	..	..	..	..	..	..	..	..	..	..
410-419	..	..	..	..	..	..	..	1	1	1	1
420-429	..	..	..	..	..	..	..	..	..	..	..
430-439	..	1	1	..	2	..	1	1	2	4	4
440-449	..	..	..	..	..	..	1	..	1	1	1
450-459	..	..	1	..	1	..	..	..	..	1	1
460-469	..	..	..	..	..	..	..	..	..	..	..
470-479	..	..	..	1	1	..	..	..	..	..	1
519	..	..	..	..	..	..	..	1	1	1	1
683	..	..	1	..	1	..	..	..	..	1	1
750	..	..	1	..	1	..	..	..	..	1	1
Complete	145	346	102	40	633	225	539	227	991	1,584	1,624
Incomplete	2	6	17	5	30	2	21	8	31	56	61
Total	147	352	119	45	663	227	560	235	1,022	1,640	1,685

This fall in numbers with distance traversed is of so regular a nature, that it can be expressed by a formula. Up to 80 miles distance, the logarithm of the numbers recovered in each 10 mile unit varied inversely as the square root of the distance (Table 14, Figure 24, upper). If the numbers of returns be called y, the distances x, and constants a and b, the formula is $\log y = \log a + \log b \sqrt{x}$, or $y = ab^{x^{\frac{1}{2}}}$ where $a = 6091.5$ and $b = -2.218$. This formula does not fit the more distant migrants even approximately. A better one from this standpoint is $y = ax^b$ (or $\log y = \log a + b \log x$) where for all returns, $\log a = 4.13335$ and $b = -1.56607$, for the number of individuals shown in the tables (using weighted equations). The smoothed curves thus calculated from weighted equations are shown in Figure 24, lower, for all data and in Figure 25 for the three seasons separately, combining the 1925 and 1926 experiments. The second

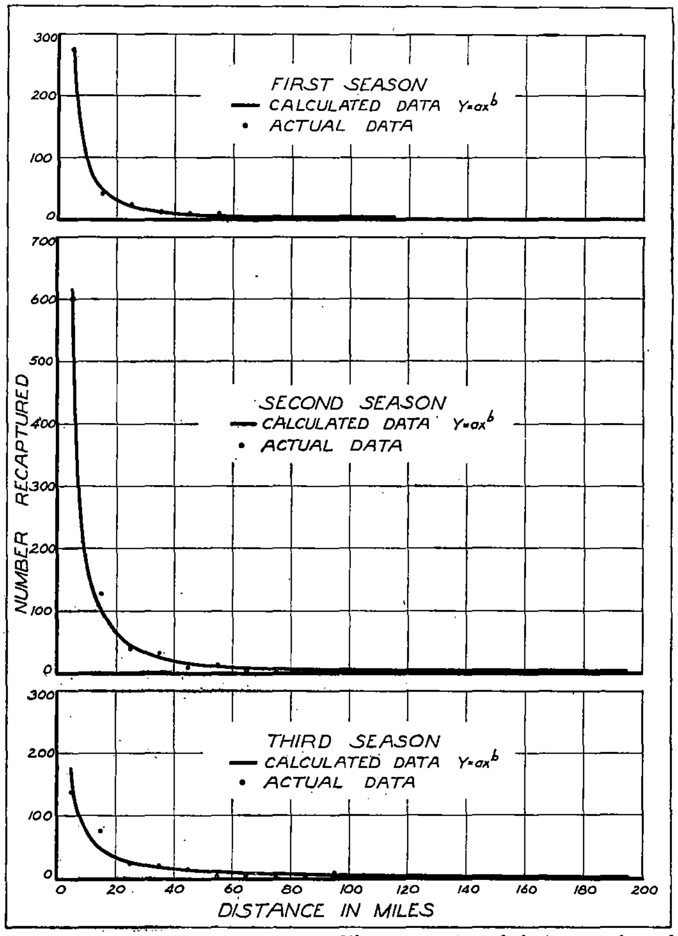

FIG. 25.—Number of tagged halibut recaptured between 0 and 10 miles, 10 and 20, etc., from the tagging locations. 1925 and 1926 southern experiments combined by first, second, and third seasons.

formula fits the returns for the first and second seasons with nearly identical slopes and very much better than it does that for the third season especially within 85 mile distances.[10]

[10] Without weighting the values of y, the slope b becomes -2.002, -1.764 and -1.604 for the three seasons, expressing the increase in dispersion with time. See p. 82.

The conclusion to be made from the regularity of the data is that the returns tend to be distributed in accord with certain laws, expressive of random distribution at a definite rate and other than what might be expected were there definite migrations.

TABLE 14.—*Number of halibut recaptured from southern experiments by distance from tagging location*[1]

Distance	All Seasons			Individual Seasons					
	Actual	Calculated		Actual			Calculated $Y=ax^b$		
		$Y=ab^{x^{1/2}}$	$Y=ax^b$	1st	2nd	3rd	1st	2nd	3rd
0- 9	1,052	1,025.0	1,093.2	274	600	149	275.0	617.5	175.4
10- 19	246	278.0	195.6	43	128	75	46.0	102.6	46.8
20- 29	91	113.2	88.0	23	40	24	20.0	44.5	25.3
30- 39	65	54.6	51.9	13	33	18	12.0	25.7	16.9
40- 49	35	29.0	35.0	11	10	12	7.7	17.0	12.5
50- 59	18	16.5	25.6	..	13	5	5.5	12.3	9.8
60- 69	7	9.9	19.7	2	5	..	3.8	9.3	7.2
70- 79	6	6.1	15.7	1	5	..	3.3	7.4	6.0
80- 89	8	3.9	12.9	1	5	2	2.7	6.0	5.8
90- 99	12	..	10.9	1	5	6	2.3	5.0	5.1
100-109	8	..	9.1	..	3	4	1.9	4.3	4.5
110-119	7	..	8.1	1	3	3	1.7	3.7	4.0
120-129	3	..	7.1	..	1	2	..	3.2	3.6
130-139	4	..	6.3	..	3	1	..	2.8	3.3
140-149	3	..	5.6	..	1	2	..	2.5	3.1
150-159	3	..	5.0	..	1	2	..	2.3	2.8
160-169	5	..	4.6	..	2	3	..	2.0	2.6
170-179	3	..	4.2	..	2	1	..	1.9	2.4
180-189	4	..	3.8	..	2	2	..	1.7	2.3
190-199	1	..	3.5	..	1	..	..	1.6	1.9

[1] Final returns differ slightly from figures given here, due to data received subsequent to the time these calculations were made (Table 13).

These formulas express in convenient form the amount of movement shown by the immature halibut of the grounds south of Cape Spencer. From the data to which they apply, it should be possible to calculate the interchange between banks, provided some estimate of the relative abundance of fish on these banks can be arrived at.

The returns may be handled in a somewhat more convenient fashion by calculating the percentages of the total number which moved less than any given distance. It is natural and easy to refer to the percentage which moved less than 10 miles, for instance. Curves based on such values, by the use of a reverse scale on the opposite side of the figure, show the percentage of recaptured halibut taken more than any given distance from the point of release. They can be calculated, if desired, in a smoothed form from the formulas above.

There are given in Table 15 these cumulative percentages for the 1925 and 1926 experiments. The 1925 material includes the returns from 1925 to 1928, and the 1926 material covers 1926 to 1928. Figure 26 shows the cumulative percentages for the first three seasons' returns from the 1925 and 1926 experiments.

The similarity in the returns from the two experiments is very close, the percentages, after the first 10 miles, never differing by more than 3 or 4 per cent. These figures show that over a period of three seasons between 5 and 10 per cent of the halibut were retaken more than 50 miles from the point of release and but 5 per cent more than 100 miles from that point.

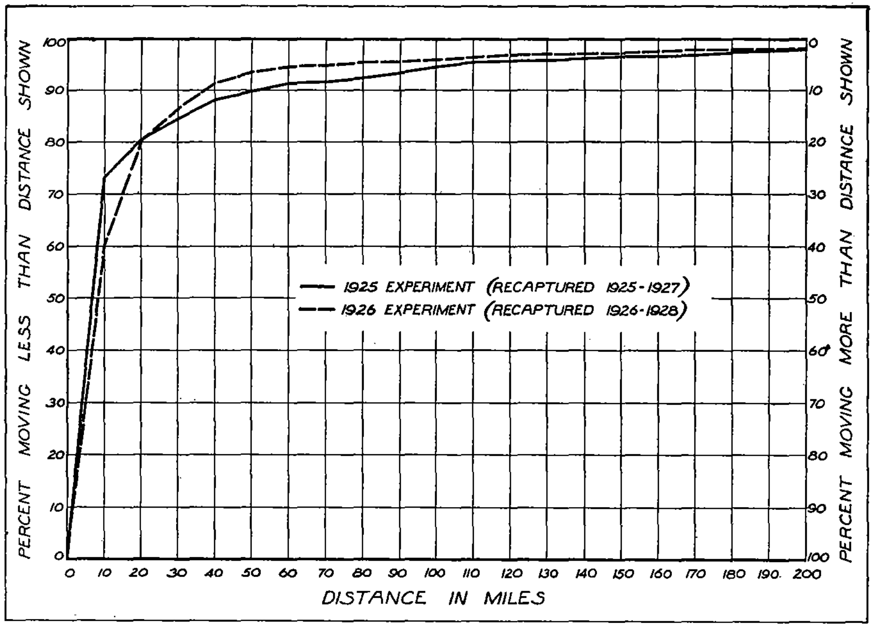

FIG. 26.—Cumulative percentage curves for recoveries according to distance travelled for the first three seasons' returns from the 1925 and 1926 southern experiments.

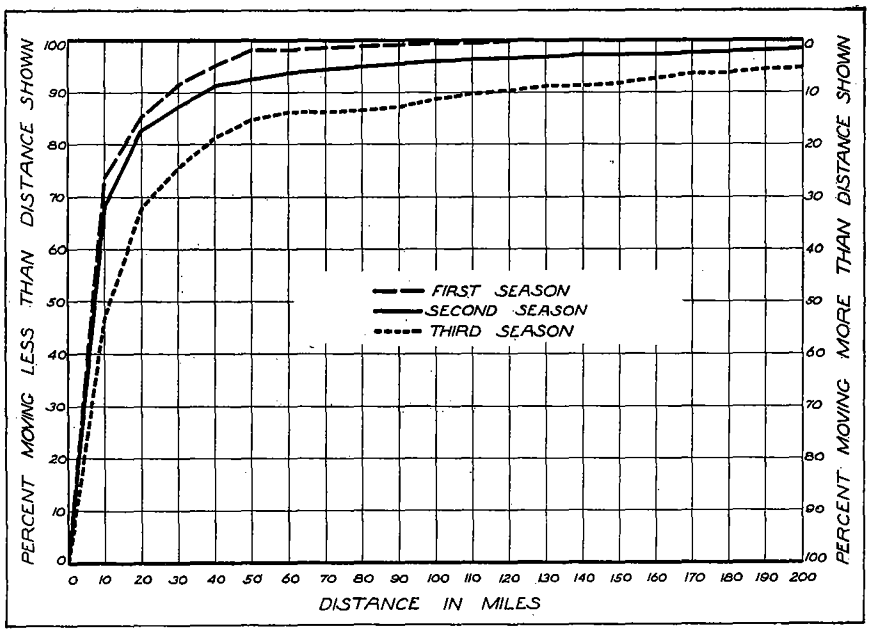

FIG. 27.—Cumulative percentage curves for recoveries according to distance travelled, for the combined southern experiments for the halibut recaptured during the first, second, and third seasons.

TABLE 15.—*Cumulative percentages of halibut tagged during the southern experiments and recaptured within any given distance of tagging location*

Miles	TAGGED IN 1925 Recaptured in						TAGGED IN 1926 Recaptured in				1925 AND 1926
	1925	1926	1927	1928	1925 to 1927	1925 to 1928	1926	1927	1928	1926 to 1928	All Recaptures
0- 9	85.5	74.6	51.0	75.0	73.2	73.3	66.2	64.0	45.4	60.2	65.3
10- 19	88.3	83.2	61.8	75.0	80.8	80.4	83.6	82.4	70.9	80.0	80.2
20- 29	91.0	87.0	67.7	85.0	84.6	84.6	92.0	87.6	79.3	86.7	85.9
30- 39	95.2	89.3	73.5	87.5	88.0	88.0	95.1	92.4	84.6	91.2	90.0
40- 49	97.9	90.2	77.5	92.5	89.9	90.0	98.2	93.7	88.1	93.5	92.1
50- 59	97.9	91.9	79.4	92.5	91.2	91.3	98.2	94.9	89.4	94.5	93.2
60- 69	98.6	92.5	79.4	92.5	91.7	91.8	98.7	95.5	89.4	94.9	93.7
70- 79	98.6	93.3	79.4	92.5	92.2	92.2	99.1	95.9	89.9	95.3	94.1
80- 89	98.6	94.5	81.4	92.5	93.2	93.2	99.6	96.0	89.9	95.5	94.6
90- 99	99.3	95.4	84.3	92.5	94.4	94.3	99.6	96.4	90.8	95.9	95.3
100-109	99.3	96.2	86.3	95.0	95.2	95.2	99.6	96.6	91.6	96.2	95.8
110-119	100.0	96.5	86.3	95.0	95.6	95.5	99.6	97.0	92.5	96.6	96.2
120-129	..	96.8	86.3	95.0	95.8	95.7	99.6	97.0	93.4	96.8	96.3
130-139	..	97.4	86.3	95.0	96.1	96.0	99.6	97.2	93.4	96.9	96.5
140-149	..	97.4	87.3	95.0	96.3	96.2	99.6	97.3	93.8	97.1	96.7
150-159	..	97.4	88.2	95.0	96.4	96.3	99.6	97.5	94.7	97.4	97.0
160-169	..	97.4	90.2	95.0	96.8	96.6	99.6	97.9	95.2	97.7	97.3
170-179	..	97.7	91.2	95.0	97.1	97.0	99.6	98.1	95.2	97.8	97.5
180-189	..	98.3	91.2	95.0	97.5	97.3	99.6	98.1	96.0	98.0	97.7
190-199	..	98.5	92.2	95.0	97.8	97.6	99.6	98.1	96.0	98.0	97.8
200-209	..	98.8	92.2	95.0	98.0	97.8	99.6	98.1	96.5	98.1	98.0
210-219	..	98.8	93.1	95.0	98.1	97.9	99.6	98.3	96.5	98.2	98.1
220-229	..	98.8	94.1	95.0	98.3	98.1	99.6	98.3	96.9	98.3	98.2
230-239	..	98.8	94.1	97.5	98.3	98.2	99.6	98.5	96.9	98.4	98.3
240-249	..	99.1	94.1	97.5	98.5	98.4	100.0	98.7	97.8	98.8	98.6
250-259	..	99.1	94.1	97.5	98.5	98.4	..	98.9	97.8	98.9	98.7
260-269	..	99.1	94.1	97.5	98.5	98.4	..	98.9	97.8	98.9	98.7
270-279	..	99.1	94.1	97.5	98.5	98.4	..	99.1	97.8	99.0	98.7
280-289	..	99.1	94.1	97.5	98.5	98.4	..	99.2	97.8	99.1	98.8
290-299	..	99.1	94.1	97.5	98.5	98.4	..	99.2	97.8	99.1	98.8
300-309	..	99.1	94.1	97.5	98.5	98.4	..	99.2	97.8	99.1	98.8
310-319	..	99.1	94.1	97.5	98.5	98.4	..	99.4	97.8	99.2	98.9
320-329	..	99.1	96.1	97.5	98.8	98.7	..	99.6	98.2	99.4	99.1
330-339	..	99.1	96.1	97.5	98.8	98.7	..	99.6	98.2	99.4	99.1
340-349	..	99.1	96.1	97.5	98.8	98.7	..	99.6	98.2	99.4	99.1
350-359	..	99.1	96.1	97.5	98.8	98.7	..	99.6	98.2	99.4	99.1
360-369	..	99.1	96.1	97.5	98.8	98.7	..	99.6	98.7	99.5	99.2
370-379	..	99.4	96.1	97.5	99.0	98.9	..	99.6	98.7	99.5	99.3
380-389	..	99.4	96.1	97.5	99.0	98.9	..	99.6	98.7	99.5	99.3
390-399	..	99.7	96.1	97.5	99.1	99.0	..	99.6	98.7	99.5	99.3
400-409	..	99.7	96.1	97.5	99.1	99.0	..	99.6	98.7	99.5	99.3
410-419	..	99.7	96.1	97.5	99.1	99.0	..	99.6	99.1	99.6	99.4
420-429	..	99.7	96.1	97.5	99.1	99.0	..	99.6	99.1	99.6	99.4
430-439	..	100.0	97.1	97.5	99.5	99.4		99.8	99.6	99.8	99.6
440-449	..	..	97.1	97.5	99.5	99.4	..	100.0	99.6	99.9	99.7
450-459	..	..	98.0	97.5	99.7	99.5	..	..	99.6	99.9	99.8
460-469	..	..	98.0	97.5	99.7	99.5	..	..	99.6	99.9	99.8
470-479	..	..	98.0	100.0	99.7	99.7	..	..	99.6	99.9	99.8
519	..	..	98.0	..	99.7	99.7	..	..	100.0	100.0	99.9
683	..	..	99.0	..	99.8	99.8	..	..	..	..	99.9
750	..	..	100.0	..	100.0	100.0	..	..	..	..	100.0

From this material it seems evident that the great bulk of the halibut population of the southern banks remains on the home bank at least 3 or 4 years after they have reached the ages tagged. Limited numbers, it is true, appear to have spread widely over areas up to several hundred miles distant but those which have done so are but a small fraction of those marked. If seasonal migration increases with maturity, the mortality seems to be sufficiently high to prevent enough tagged fish reaching a migratory stage to show in the data.

The difference in the dispersion of marked halibut in successive years is illustrated in Figure 27 where cumulative curves are shown for the several seasons' returns, combining the first, second, third, etc., seasons, from the two experiments. Of the first season's recaptures from the 1925 experiment less than 3 per cent came from points more than 50 miles from the marking location. During the second season about 8 per cent came from more than 50 miles and in the third season about 21 per cent. From the 1926 experiment about 2 per cent of the first season's returns came from more than 50 miles, about 6 per cent of the second season's returns came from beyond this distance, and about 12 per cent of the third season's recaptures.

These data indicate an increasing dispersion in the position of the marked halibut from year to year. The decrease shown by the fourth season's returns from the 1925 experiment is based on but 40 recaptures and is therefore less reliable than the other data.

The increase from season to season in the dispersion of the localities where marked fish are recaptured indicates a similar dispersion of the stock of halibut from which they were taken. Of the fish originally liberated on a certain halibut bank a small percentage wander each year from the home bank to outlying areas or distant banks. This results in a slowly increasing dispersion of the stock of marked halibut.

This small increase in dispersion however, cannot at present be accepted as established, for a similar appearance might have been produced by the action of a differential intensity of the fishing. The greater the intensity on the original bank the more rapid the decline there in returns; the less the intensity on the outlying banks, the less rapid the decline, giving it a larger and larger share in the total of recovered tags as the years pass.

The marking work during the summers of 1925 and 1926 on southern halibut banks was done on the most intensively fished areas and approximately at the height of the season. Consequently the above mentioned factor may have been at least partly responsible for the increased displacement of the recovered halibut. But this increase is so small as to leave the dispersion at the end of the third season still inconsiderable.

The above differences demonstrate that the cumulative percentage curves for dispersion of recaptured fish from different experiments are strictly comparable only for corresponding seasons. That is, first season's returns must be compared to first season's returns, second to second or first two or three to first two or three. This was done in Figure 26 where the first three seasons' recaptures from the 1925 experiment are compared to the first three seasons' from the 1926 experiment. The two curves obtained are found to be very similar. A greater similarity cannot be expected because of the differences in the two experiments in the distribution of the locations where fish were marked on the various banks, differences which it was the express purpose of the work to include in the total. In 1926 the work was almost entirely confined to Goose Island Grounds and the West Coast of Prince of Wales Island, while in 1925 only about one-tenth of the tagging was done in these regions.

In conjunction with the already estimated rate of removal by commercial fishermen, and of death by other means, knowledge of the rate of interchange should allow of a calculation as to the future fate of the population of commercial sizes existing on a bank at any given time. The rates of immigration, of emigration, and of mortality are known, or can be determined approximately. Such calculations do not, of course, suffice to indicate the source or permanence of the supply of young fish.

The values given for the average movement express the diverse circumstances existing. These circumstances include the disposition of the areas surrounding each tagging location. Thus were the fishing banks so disposed that no other frequented grounds lay between 50 and 60 miles away, no returns at that distance could be expected. It follows that the number of returns at various distances is conditioned to some extent at least by the disposition of the banks. Furthermore, it is unknown whether halibut migrate only along the banks or move freely over great depths, for none of our experiments have been made on banks isolated completely by deep water.

The significance to the returns of the various sections of the banks is doubtful from another standpoint. They are not equally worthy of being termed fishing banks, because the intensity of the fishery upon them varies. A thorough understanding therefore awaits more complete statistical knowledge of our fisheries. The values arrived at in the equations adopted represent therefore not merely the average movement of the halibut, but the average disposition of the banks along our long narrow coastal shelf, which does not greatly impair their value for practical purposes.

Within the individual banks occurs a phenomenon which will be found again when the more migratory mature fish on western banks are studied. It was noted (p. 49) in connection with areas 10 to 15. It is well illustrated by the disposition of the recoveries from experiments on the Goose Island Grounds. Where these experiments were on opposite sides of the grounds, the resultant migrations were opposed, while those at intermediate points were indifferent in direction. This is evidence of a more or less self-contained unit, within which takes place the major share of whatever dispersion occurs. It indicates a type of movement somewhat analogous to that which would be shown by two lots of fish liberated at opposite ends of an aquarium, a movement due to simple diffusion and intermixture within a limited range. This of course may be in part seasonal. As we shall see, the mature western fish behave similarly but within a far larger range. It is therefore necessary to consider the position of each experiment with regard to the range of the stock of fish tagged in order to properly interpret the results.

The consideration in detail of this phase of the migrations cannot be undertaken at this stage of the work, but present results indicate that areas south of 18 are a unit as far as migratory stock in concerned. This has been remarked upon as regards the movements shown by experiments in areas 10 and 15 (Figure 13 and p. 49). The phenomenon is evident with varying degrees of clearness, in accord with the disposition and character of the banks.

Our results as to rate of movement are therefore not necessarily representative of this rate as it would be found over a uniform area without limit in any direction, but they are representative of conditions as they actually obtain, and thus meet the practical requirements of the situation.

SEASONAL MOVEMENTS

It would be expected that any seasonal migration would show itself by characteristic distortions of the distribution of returns. The great mass of fish should show movements instead of being predominately non-migratory as they are, and in such case no uniform law of distribution of returns concentrated around the tagging point could be expected. It may hence be surmised that seasonal migrations are minor in importance.

However, the simplest method for such an analysis is to calculate, for the halibut retaken during each month, the arithmetical mean of the distances between the points of release and the points of recovery. This has been done for both the 1925 and 1926 experiments and the results are given in Table 16 and Figure 28.

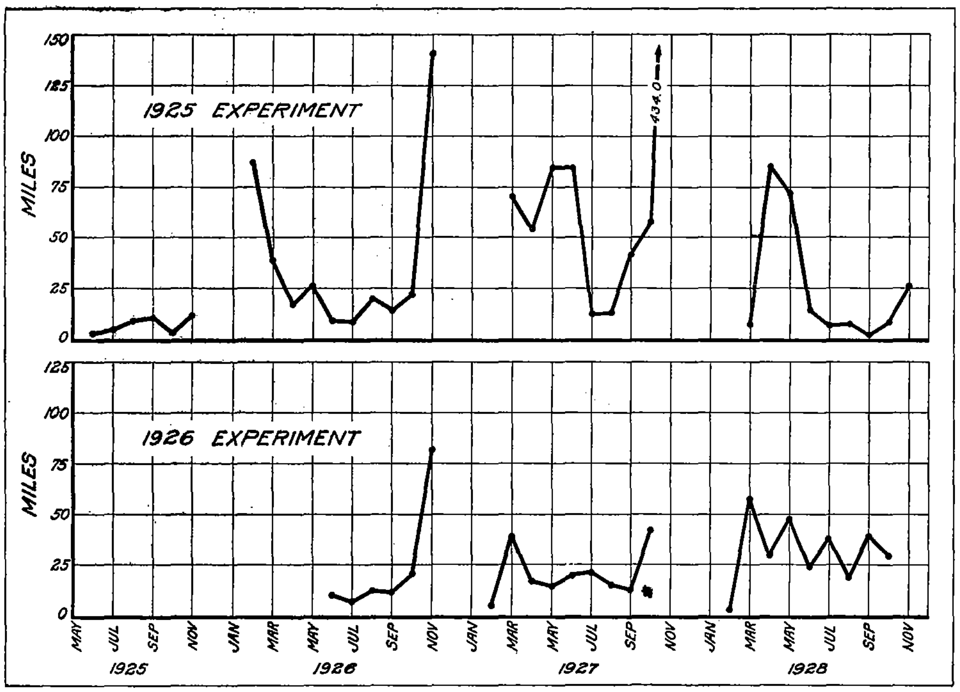

FIG. 28.—Average distance of the point of recapture from the tagging location for fish retaken during each month. 1925 and 1926 southern experiments.

The most noticeable feature of these dispersion curves is a displacement which is small during the summer months but which in most cases increases decidedly in both spring and fall. A monthly analysis has been made of the number of halibut recaptured 50 miles or more from the position of release. They are too irregular for clarity, so the several seasons have been combined to make one curve for all returns. The results are shown in Table 17 and Figure 29.

TABLE 16.—*Average dispersion and number recaptured, by months; southern experiments*

Month	1925 EXPERIMENT		1926 EXPERIMENT	
	No. Recaptured	Average Dispersion	No. Recaptured	Average Dispersion
1925				
June	2	2.6	....	....
July	39	4.4	....	....
August	36	8.7	....	....
September	37	10.3	....	....
October	26	3.1	....	....
November	2	11.5	....	....
Complete	142	6.9	....	....
Incomplete	5		....	....
Total	147		....	
1926				
February	4	86.9	....	....
March	17	39.0	....	....
April	37	16.8	....	....
May	58	25.8	....	....
June	57	9.0	7	10.1
July	84	7.7	46	6.8
August	52	19.7	100	12.2
September	24	14.0	61	11.6
October	10	21.8	6	20.5
November	3	140.7	5	81.8
Complete	346	18.1	225	12.6
Incomplete	6		2	
Total	352		227	
1927				
February	0	....	2	5.0
March	5	69.9	21	38.6
April	7	53.9	75	16.8
May	21	84.6	114	14.1
June	25	84.6	103	19.8
July	23	12.0	94	21.2
August	7	12.6	73	14.9
September	11	41.2	38	12.4
October	2	57.5	18	41.2
November	1	434.0	0	....
Complete	102	58.7	538	18.1
Incomplete	17		22	
Total	119		560	
1928				
February	0	....	1	3.0
March	1	7.0	11	57.4
April	6	85.0	46	29.6
May	5	71.6	45	47.2
June	10	13.9	52	24.0
July	8	6.4	17	37.2
August	7	7.0	26	18.5
September	1	2.0	19	38.7
October	1	8.0	9	29.2
November	1	26.0	1	74.0
Complete	40	28.7	227	33.3
Incomplete	5		8	
Total	45		235	
Total Complete All Seasons	630	22.9	990	20.6

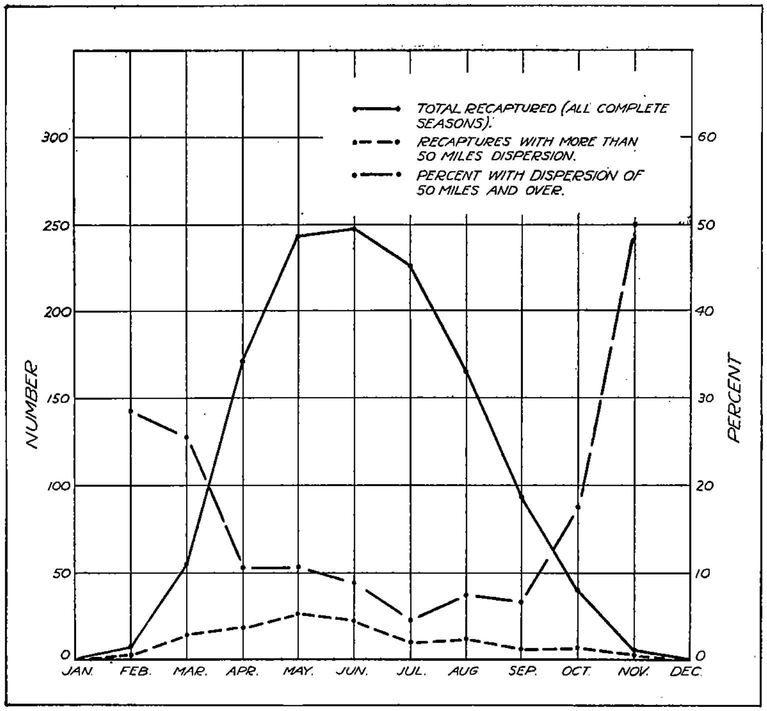

FIG. 29.—Total number of tagged halibut recaptured each month and number and percentage recaptured 50 miles or more from the tagging location. Data for all complete seasons of southern experiments.

TABLE 17.—*Number of tagged halibut recaptured 50 miles and over from the position where tagged*

Month	Recoveries Yakutat 1927 & 1928 W Ground 1928			Recoveries Portlock 1928			Southern Experiments All Complete Seasons		
	Total Recaptured	No. Recaptured 50 miles and over	Per cent 50 miles and over	Total Recaptured	No. Recaptured 50 miles and over	Per cent 50 miles and over	Total Recaptured	No. Recaptured 50 miles and over	Per cent 50 miles and over
February	17	15	88.2	15	4	26.7	7	2	28.6
March	36	35	97.2	12	2	16.7	55	14	25.5
April	35	32	91.4	5	2	40.0	171	18	10.5
May	30	27	90.0	6	4	66.7	243	26	10.7
June	35	30	85.7	14	10	71.4	247	22	8.9
July	27	25	92.6	13	6	46.2	226	10	4.4
August	23	20	87.0	16	5	31.2	165	12	7.3
September	22	20	90.9	7	2	28.6	93	6	6.5
October	34	28	82.4	6	2	33.3	40	7	17.5
November	33	15	45.4	1	0	....	6	3	50.0
Complete	292	247	84.6	95	37	38.9	1,253	120	9.6
Incomplete	27	..	....	3	..	....	58	..	....
Total	319	..	....	98	..	....	1,311	..	....

From an examination of these data it is evident that the increase in average dispersion during the spring and fall is not due to any increase in the number of halibut caught at points distant from the marking location. On the contrary, the greater number of distant recoveries are of halibut retaken during the summer months, when the average displacement is low. The movement is not seasonal, because if it were, these migrants would have returned to their original banks at the proper time.

The explanation of this seeming inconsistency is to be found in the fact that the tagging was done in localities where the fishery was predominantly a summer one, because there only could sufficient fish be obtained. Once away from this selected type of fishery, the migrants were retaken indifferently in fisheries peculiar to all seasons, and the number of returns was then governed by the general seasonal rise and fall of the fisheries. During the summer the enormous numbers retaken on the banks where tagging was done, more or less completely subordinated this change in numbers of distant migrants, reducing the average displacement of summer returns despite the increased number of distant recaptures. The increase in the average displacement in the spring and fall does not appear to be significant of any considerable movement on the part of the main body of halibut.

There is a portion of the year when no returns were made, due to cessation of fishing operations. Whether the halibut remained on the bank throughout this period or moved from the bank during the fall and winter and returned for the next summer is not relevant. The important point is—during the part of the year when they were of importance to the fishery and amenable to regulations, the great proportion of the halibut were found on the bank where they were marked, in most cases very near the position of release. They were not taken elsewhere and there is no evidence of any movement save that of straying individuals.

SECTION F.—DISCUSSION OF RETURNS FROM EXPERIMENTS NORTH AND WEST OF CAPE SPENCER TO THE END OF THE YEAR 1928

The first Portlock experiment is not included in the comparison of returns from the various western banks, as it consisted of but 53 halibut. The wreck of the "Scandia," the vessel used in the work at that time, prevented the completion of the experiment. The figures for this and the other western experiments are shown in Table 18. Standard strap tags only were used on western grounds and no correction of the tables given is necessary.

RATE OF RECOVERY ON WESTERN BANKS

At the present time we have two years' complete returns from the Yakutat experiments and one year's returns from the Portlock and W Ground experiments. The percentage recapture for each season is given in Table 18. The first season's returns from these experiments are very nearly equal. From each of the two Yakutat experiments 7.8 per cent of the marked halibut were retaken the first season, from the Portlock experiment 8.1 per cent, and from the W Ground experiment 7.3 per cent. During the second season however, the returns from the two Yakutat experiments are not so consistent. The recoveries from the first amounted to 6.2 per cent while from the second but 4.2 per cent were retaken. This difference, 2.0 per cent, however, lies within the limits of chance variation as it is less than four times the probable error of the difference (2.8 per cent). This illustrates the fact that too close agreement in the results of different experiments cannot be expected even when the same intensity of the fishery is found on the two areas.

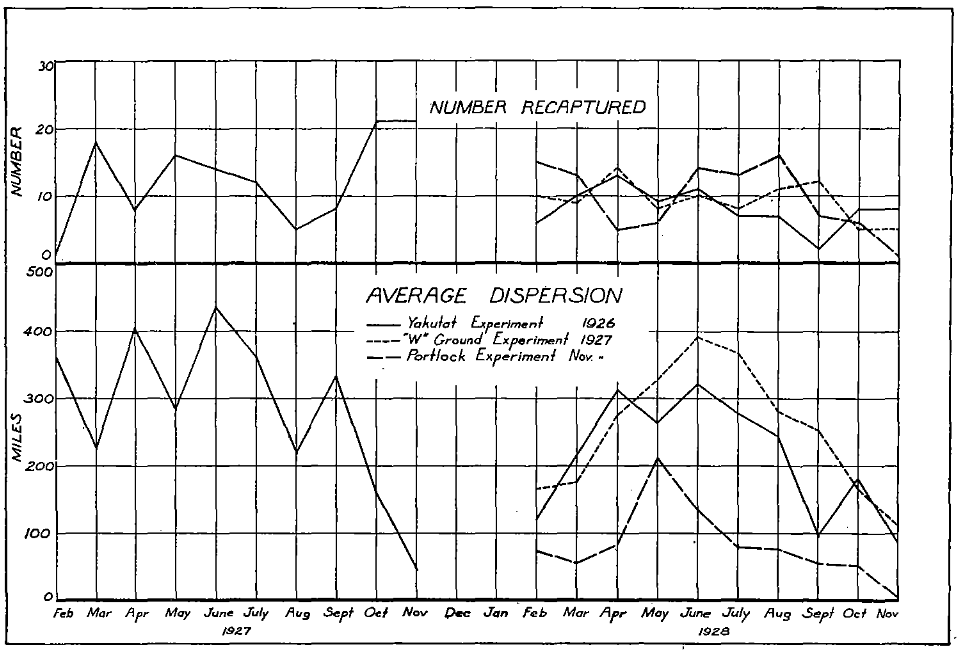

FIG. 30.—Number of halibut recaptured each month and average distance of point of recapture from tagging location for halibut retaken each month. Western experiments.

TABLE 18.—*Summary of halibut tagged and recaptured in different experiments*

EXPERIMENT		TAGGED	RECAPTURED BY SEASONS					PERCENTAGE RECAPTURED				
Southern	Date	No.	1	2	3	4	Total	1	2	3	4	Total
1925	June 16 — Aug. 15, 1925	1,720	147	352	119	45	663	8.5	22.4	9.7	4.1	38.5
1926	June 5 — Aug. 3, 1926	3,216	227	560	235	..	1,022	7.1	18.7	9.7	..	31.8
Total		4,936	374	912	354	45	1,685	7.6	20.0	9.7	4.1	34.1
Western												
Yakutat	Nov. 17 — Nov. 26, 1926	894	70	51	..	..	121	7.8	6.2	..	..	13.5
Yakutat	Dec. 12 — Dec. 19, 1926	854	67	33	..	..	100	7.8	4.2	..	..	11.7
Portlock	Feb. 11 — Feb. 12, 1927	53	2	2	..	..	4	3.8	3.9	..	..	7.5
Portlock	Nov. 7 — Nov. 16, 1927	1,214	98	..	..	..	98	8.1	..	..	..	8.1
W Ground......................	Dec. 5 — Dec. 13, 1927	1,338	98	..	..	..	98	7.3	..	..	..	7.3
Total		4,353	335	86	..	..	421	7.7	4.8	..	..	9.7

The number recovered, according to the month of recapture, is given in Table 19 and Figure 30 for the western experiments. The returns from the Yakutat marking are highest for the early spring and summer from March to July, and for the late fall months, October and November. From the Portlock fish high returns were obtained in February, March, and from June to August. The highest returns from the W Ground came in April and September.

TABLE 19.—*Number and average dispersion of recaptured halibut, by months; western experiments*

Month	1927 YAKUTAT		1928 YAKUTAT		1928 W GROUND		PORTLOCK 1928	
	No. Re-captured	Average Dispersion	No. Re-captured	Average Dispersion	No. Re-captured	Average Dispersion	No. Re-captured	Average Dispersion
February	1	362	6	119	10	166	15	73
March	17	224	10	224	9	174	12	54
April	8	403	13	311	14	273	5	82
May	16	283	8	262	6	327	6	210
June	14	435	11	320	10	391	14	133
July	12	361	7	277	8	367	13	79
August	5	219	7	242	11	281	16	76
September	8	332	2	95	12	251	7	53
October	21	160	8	180	5	165	6	51
November	21	49	7	84	5	109	1	4
Complete	123	248	79	240	90	259	95	86
Incomplete	14	..	5	..	8	..	3	..
Total	137	..	84	..	98	..	98	..

The seasonal differences in the southern and western fisheries can be seen from a comparison of the monthly recovery curves (Table 17, Figure 31). From the southern experiments 91 per cent of the recaptured halibut were taken from April to September. From the western experiments but 60 per cent were taken during this time. During the period from Novmber 16 to February 15, the closed season prevented the recovery of any tags, otherwise the returns during this time would probably have been very high as the fish are concentrated on the spawning banks at Yakutat Spit and the W Ground. Before the closed season went into effect in 1924 large amounts of halibut were taken during this period. In 1921 and 1923 sixty-six per cent of the halibut taken from the Fairweather-Yakutat-Icy Bay area were landed during the time now included in the closed season.

From the limited returns at hand, covering but two seasons of the Yakutat experiment, no clear idea can be obtained as to the necessary corrections to make the observed rates of return represent the rates of recapture. However, these rates are obviously low as compared with the returns of the southern experiments (Table 18). It is probable that the first year's returns are fully representative of the actual fishery, due to its seasonal distribution, and a surmise might be ventured, based on the decline between the first and second seasons, that an annual rate of capture of 10 per cent would apply to the western spawning stock. But the possible error in such few returns—137 the first year, 84 the next—is great, and returns for future years must be awaited, with possibly more extensive tagging.

FIG. 31.—Number of tagged halibut recaptured, by months, and percentage retaken 50 miles and more from taggnig location. Western and southern experiments compared.

RATE OF RECOVERY FOR DIFFERENT SIZE CATEGORIES

In order to determine the relationship between the rate of recovery and the size of the halibut we have calculated the percentage returns from the fish tagged in each 10 cm. class. The results are given in Table 20 and Figure 32, lower.

From the length frequency curves (Figure 32, upper) it can be seen that the halibut tagged on Yakutat Spit in 1926 and the W Ground in 1927 had very nearly the same size distribution. The fish marked on Portlock Bank averaged about 10 cm. less than those on the other two banks. As is shown by the length frequency curve, a considerable part of these fish (30 per cent) were below 70 cm. in length, compared to 11 per cent for the other experiments.

The curves giving the percentage returns for each size category show a trend similar to that found in the southern experiments. The returns from the

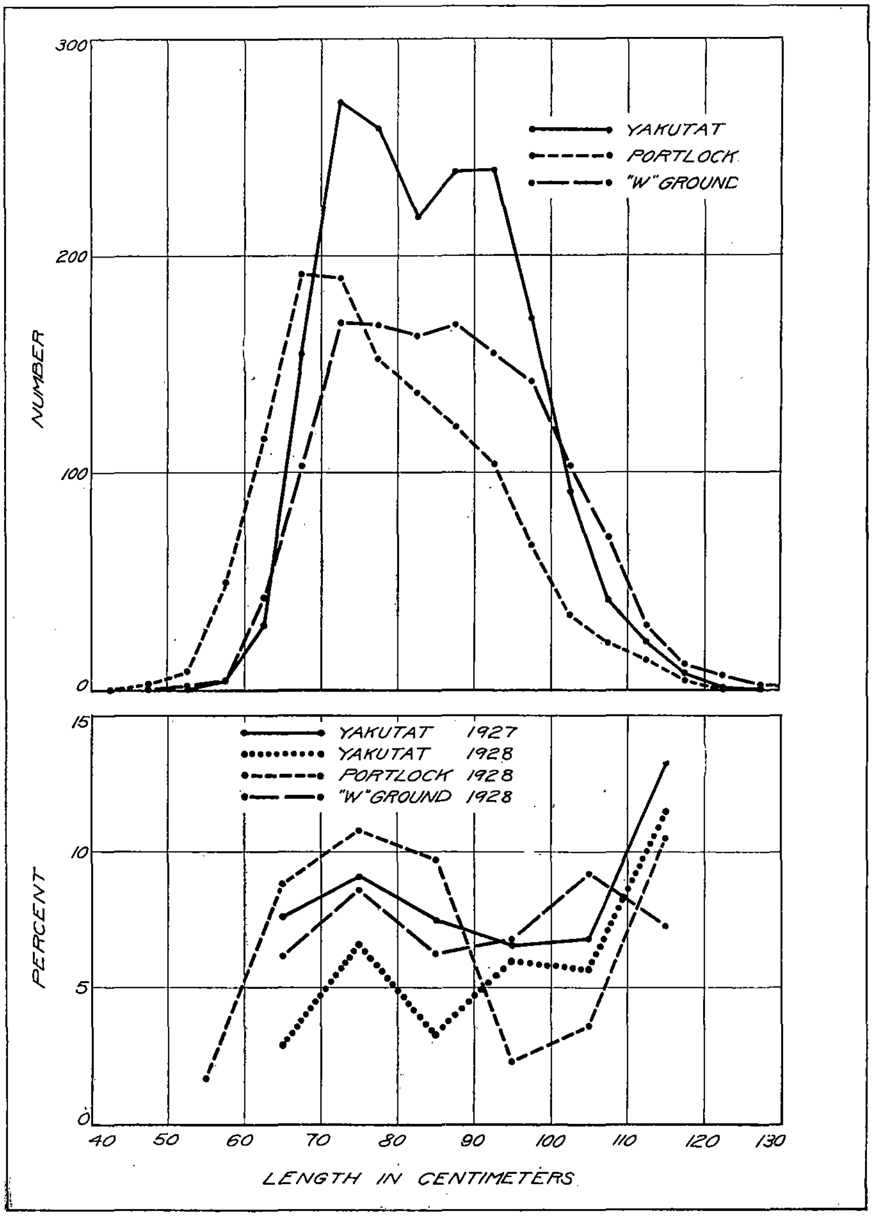

FIG. 32.—Upper—Length frequencies for halibut tagged during Yakutat, W Ground, and Portlock experiments. Lower—Percentage recaptured of those tagged in each 10 cm. length category.

smallest fish are low and increase from the lower end of the distribution up to sizes between 70 and 80 cm. Above this there is a slight decrease for the Yakutat and W Ground fish and a very pronounced one for the Portlock fish. The Yakutat and W Ground curves are similar and for the larger sizes differ considerably from that for Portlock. The returns for the second season Yakutat experiment are less numerous than those for the first, and the curve is therefore at a lower level.

Table 20.—*Number of halibut tagged and number and percentage recaptured for each 5 cm. length category*

Length	Yakutat 1927			Yakutat 1928			Portlock 1928			W Ground 1928			All Western Experiments—1927 and 1928 Recaptures			All Southern Experiments—Recaptured First and Second Season		
	Tagged	Recaptured	Per cent Recaptured	Not Recaptured January, 1928	Recaptured	Per cent Recaptured	Tagged	Recaptured	Per cent Recaptured	Tagged	Recaptured	Per cent Recaptured	Total Tagged	Total Recaptured	Per cent Recaptured	Total Tagged	Total Recaptured	Per cent Recaptured
35– 39.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...
40– 44.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	10	...	...
45– 49.9	...	...	...	...	...	...	3	...	...	...	...	...	3	...	...	86	2	2.3
50– 54.9	...	...	...	...	...	...	9	0	1.7	2	...	...	11	...	...	270	22	8.1
55– 59.9	4	...	...	4	...	...	49	1		4	...	...	57	1	1.8	740	99	13.4
60– 64.9	29	1	7.6	28	2	2.9	116	6	8.8	42	1	6.2	187	10	5.3	1,201	303	25.2
65– 69.9	155	13		142	3		191	21		103	8		449	45	10.0	1,175	356	30.3
70– 74.9	271	14	9.1	257	14	6.6	189	23	10.8	169	15	8.6	629	66	10.5	681	261	38.3
75– 79.9	259	34		225	18		153	14		168	14		580	80	13.8	359	128	35.7
80– 84.9	218	21	7.5	197	10	3.3	137	15	9.7	163	11	6.3	518	57	11.0	164	52	31.7
85– 89.9	238	13		225	4		121	10		168	10		527	37	7.0	94	32	34.0
90– 94.9	239	18	6.6	221	12	6.0	104	2	2.3	155	10	6.8	498	42	8.4	58	10	17.2
95– 99.9	171	9		162	11		67	2		141	10		379	32	8.4	34	11	32.3
100–104.9	91	5	6.8	86	4	5.7	34	2	3.6	103	9	9.2	228	20	8.8	20	4	20.0
105–109.9	41	4		37	3		22	0		70	7		133	14	10.5	14	2	14.3
110–114.9	22	3	13.3	19	2	11.5	14	1	10.5	29	2	7.3	65	8	12.3	10	2	20.0
115–119.9	8	1		7	1		5	1		12	1		25	4	16.0	1	...	...
120–124.9	1	1	...	...	...	...	...	...	...	7	...	...	8	1	12.5	3	...	...
125–129.9	...	...	...	...	...	...	...	...	...	2	...	...	2	...	...	2	...	...
130–134.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	1	...
135–139.9	1	...	...	1	...	...	...	...	...	...	...	...	1	...	...	1	...	...
140–144.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	...
145–149.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
150–154.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...	...
155–159.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
160–164.9	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...
Not given	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	5	1	...
Total	1,748	137	7.84	1,611	84	5.21	1,214	98	8.07	1,338	98	7.32	4,300	417	9.70	4,936	1,286	26.05
Mean Length	84.94	83.88	...	...	85.45	...	77.37	76.81	...	86.14	86.40	...	83.15	83.13	...	66.83	69.15	...

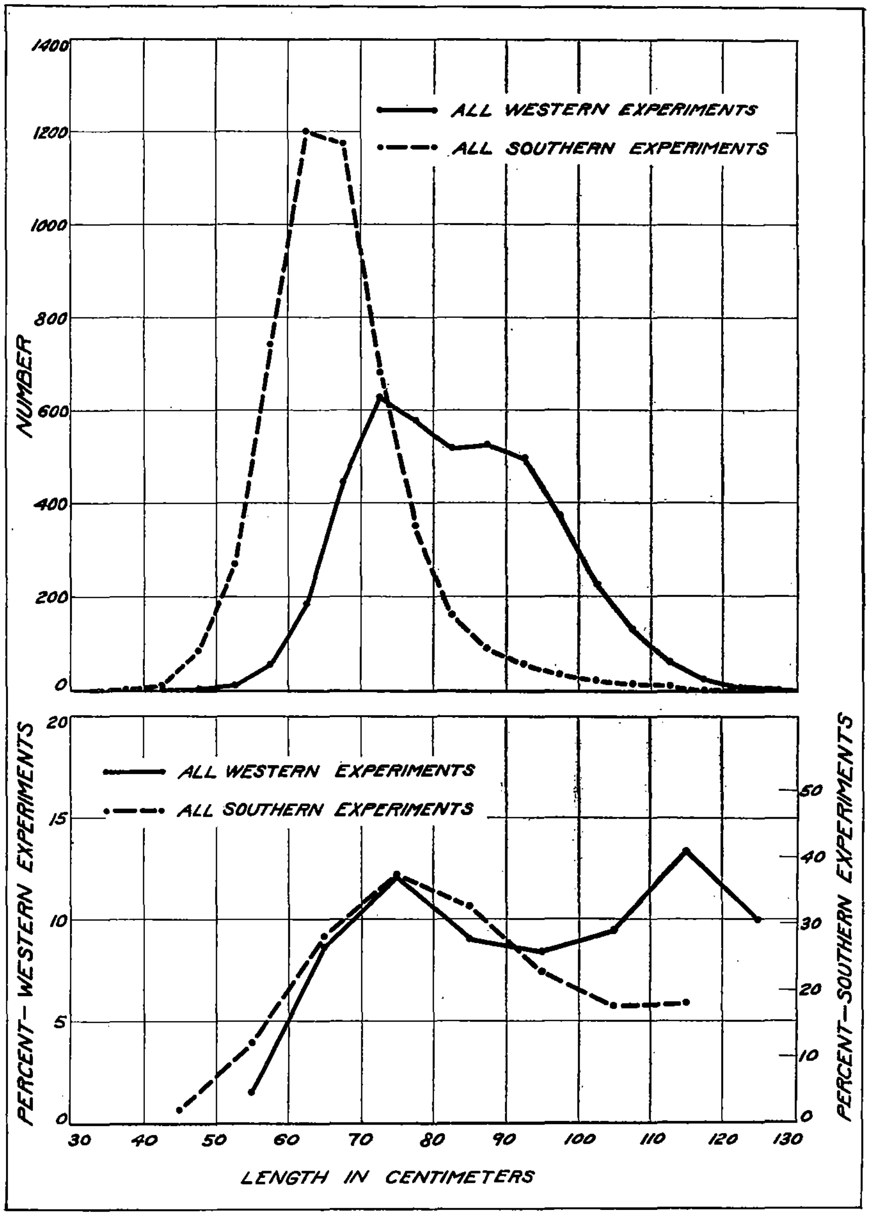

FIG. 33.—Upper—Length frequencies of halibut tagged for the combined southern experiments and combined western experiments. Lower—Percentage recaptured at each length. Western recaptures include Yakutat, 1927 and 1928 returns, Portlock, 1928, and W Ground 1928 returns. Southern recaptures include first two seasons' returns. The scales are adjusted to give the same graphic range.

For the purpose of comparison there is shown in Figure 33 the length frequency curves for tagged fish for the combined southern experiments and the combined western experiments. The fish tagged during the southern work are considerably smaller than for the western, 71 per cent of them falling below 70 cm. in length, compared to 16 per cent of the latter.

In spite of the great difference in the sizes tagged in the two major areas, the percentage returned from these experiments shows a very similar relationship between sizes. This is shown by the curves in the lower part of Figure 33. For the southern and Yakutat experiments the recoveries from the first two seasons are used, and for the W Ground and Portlock experiments the first season's returns only. The scales used for plotting the two curves are adjusted to give the values the same graphic range.

These curves show a similar trend for halibut under 90 cm. Beginning at a minimum for small fish they increase to a maximum for the fish between 70 and 80 cm. then fall off again up to 90 cm. From 90 cm. up the rate for the western fish increases somewhat. For the southern fish there is a decided and persistent decrease. In all cases the figures for the larger sizes are based on limited numbers of marked fish, as can be seen from Table 20. Consequently although the trends up to about 100 cm. can be considered as fairly reliable, especially for the Yakutat and W Ground and the southern experiment curves, beyond this size they can be accepted as merely indicative, until corroborated by consistent results from future experiments.

Whatever depression of the rate of returns from small fish exists in the western experiments is probably due, as on the southern banks, to a concentration of the fishery on the larger halibut and to the practice of shacking off the smaller fish, such few as are taken.

DISPERSION ON WESTERN BANKS

In considering the movements, or scatter, of the halibut tagged on Yakutat Spit and westward, results essentially different from those of the experiments south of Cape Spencer are found. On the southern banks the average displacement was very small and showed a slight increase from year to year.

In Figure 34 the marked fish returned are shown (abscissæ) according to the time elapsed between tagging and recovery and (ordinates) according to distance between the localities of tagging and recovery. Each fish is represented by a spot. The distance of this above the base line therefore represents graphically the net movement of the individual concerned, whatever the direction or whatever the intervening migrations may have been.

The scale of the ordinates should be contrasted with that of the southern experiments (Figure 23, insert between pp. 76-77), it being ten times as great in the latter. The much more extensive movements of the western fish are clearly shown.

The grouping of these returns is very different from that of the southern experiments. Here the tagging was done just before or in the early days of the closed period, but the returns are not grouped 365 days later but are rather evenly distributed, with some evidence of grouping both at the end and the beginning of the closed season. Moreover, there is no such grouping within the ten mile distance as was the case in the south, indeed, not even within the first hundred miles. The returns are, rather, correlated with the intensity of the fishery and the disposition of the exploited banks than with the tagging localities. The decline in number of recaptures with distance from tagging localities, as shown in Table 21 and Figure 35, is correlated with decreasing intensity of the fishery to the westward (compare Figure 16). We have been

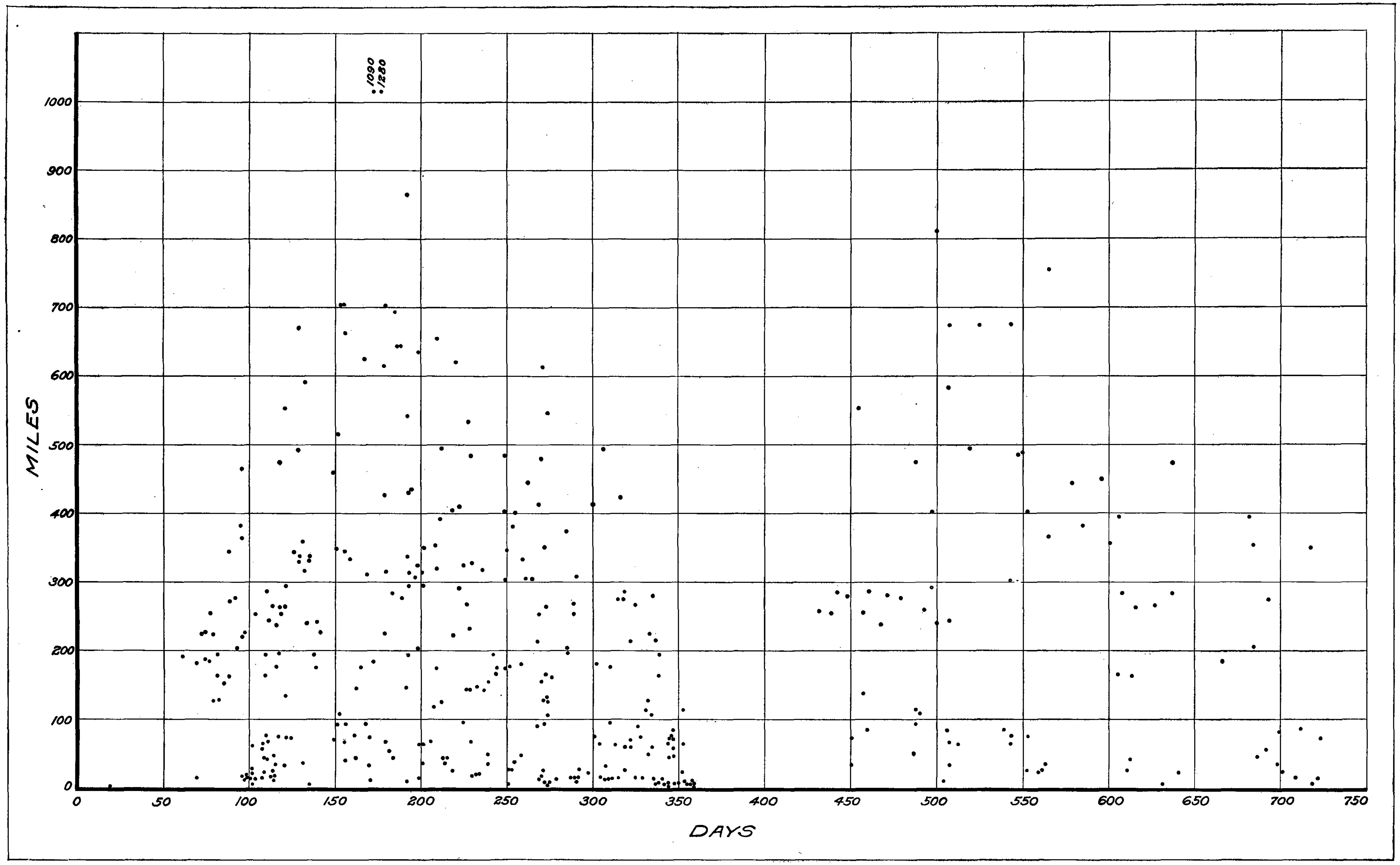

FIG. 34.—Dispersion of tagged fish with time (western experiments). Each spot on the chart represents, on the vertical scale, the distance between the position of release and that of recapture; on the horizontal scale, the elapsed time between the day the halibut was tagged and that on which recaptured. The absence of returns less than 60 days out and about 400 days out is due to the closed season (November 16 to February 15). Note that the graphical distance on the vertical scale of this chart is equivalent to 10 times the distance on Figure 24 showing the southern experiment.

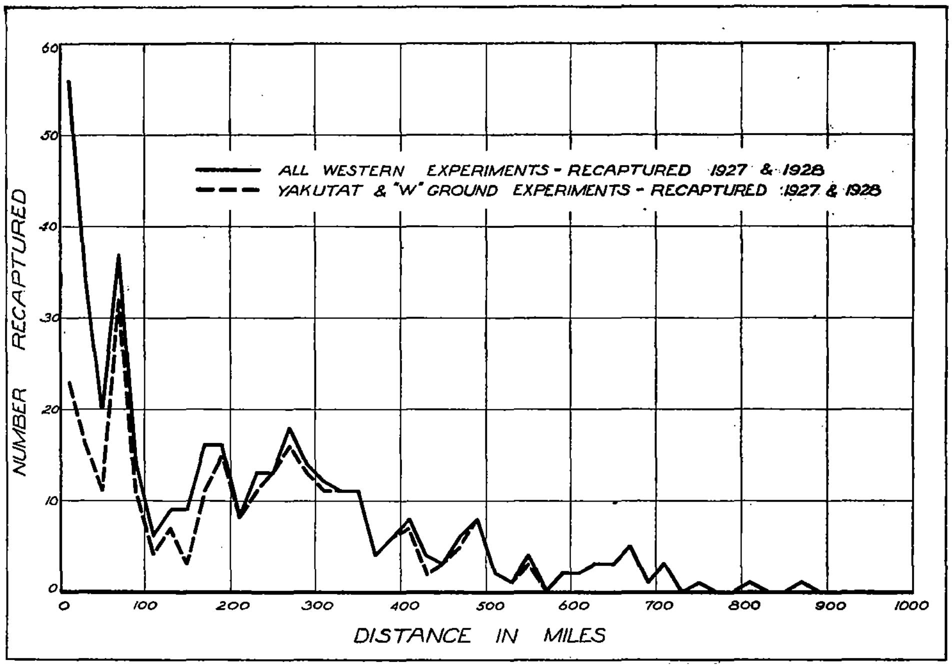

FIG. 35.—Number of tagged halibut recaptured between 0 and 20 miles, 20 and 40, etc., from the tagging location. All western experiments to end of 1928.

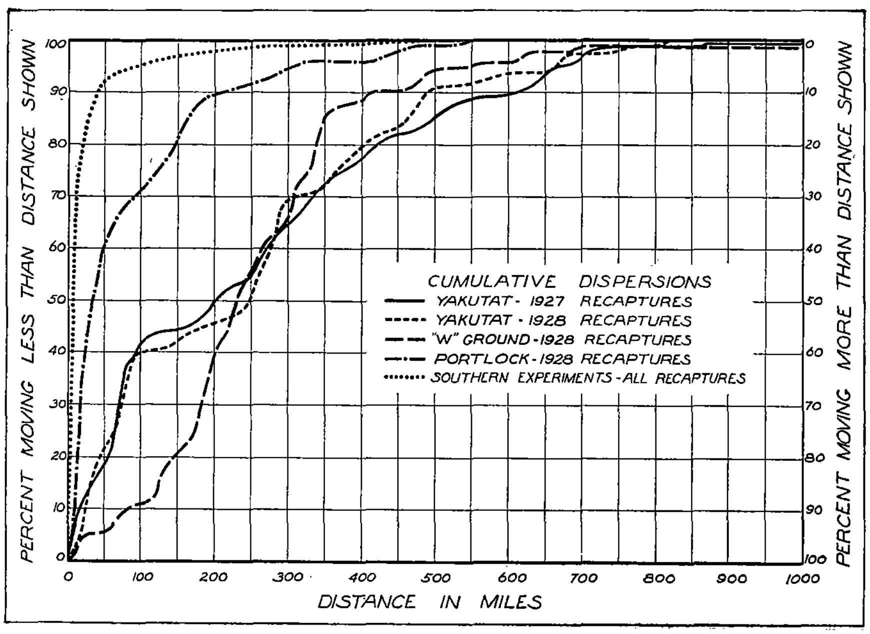

FIG. 36.—Cumulative percentage curves for recoveries according to distance travelled, for each year's returns from the western experiments compared to the curve for the combined southern experiments.

TABLE 21.—*Number of tagged halibut recaptured from the western experiments to the end of 1298, according to year of return and distance from tagging locations*

Miles	Yakutat 1927	Yakutat 1928	W Ground 1928	Portlock 1928	Total
0- 9	8	2	1	9	20
10- 19	6	3	3	24	36
20- 29	2	6	1	12	21
30- 39	3	4	..	6	13
40- 49	4	2	..	7	13
50- 59	2	2	1	2	7
60- 69	10	3	1	5	19
70- 79	11	5	2	..	18
80- 89	1	4	..	..	5
90- 99	4	1	1	3	9
100-109	1	..	1	1	3
110-119	2	..	..	1	3
120-129	..	..	4	2	6
130-139	..	1	2	..	3
140-149	..	..	1	5	6
150-159	..	..	2	1	3
160-169	2	2	2	3	9
170-179	1	..	4	2	7
180-189	1	1	4	1	7
190-199	3	..	6	..	9
200-209	2	1	2	..	5
210-219	1	..	2	..	3
220-229	2	..	5	2	9
230-239	..	1	3	..	4
240-249	1	2	2	..	5
250-259	3	3	2	..	8
260-269	3	3	3	1	10
270-279	4	2	1	1	8
280-289	1	6	2	..	9
290-299	2	1	1	1	5

Miles	Yakutat 1927	Yakutat 1928	W Ground 1928	Portlock 1928	Total
300-309	..	1	5	..	6
310-319	3	..	2	1	6
320-329	2	..	2	..	4
330-339	2	..	5	..	7
340-349	1	..	4	..	5
350-359	2	3	1	..	6
360-369	2	1	..	..	3
370-379	..	..	1	..	1
380-389	2	1	..	..	3
390-399	1	2	..	..	3
400-409	1	2	1	1	5
410-419	2	..	1	..	3
420-429	1	..	..	1	2
430-439	1	..	..	1	2
440-449	1	1	..	..	2
450-459	..	1	..	..	1
460-469	..	..	1	1	2
470-479	..	3	1	..	4
480-489	2	2	1	..	5
490-499	2	..	1	..	3
500-509	1	..	..	..	1
510-519	1	..	..	..	1
520-529	..	..	..	..	..
530-539	1	..	..	..	1
540-549	1	..	..	1	2
550-559	..	1	1	..	2
560-569	..	..	..	..	..
570-579	..	..	..	..	..
580-589	..	1	..	..	1
590-599	1	..	..	..	1

Miles	Yakutat 1927	Yakutat 1928	W Ground 1928	Portlock 1928	Total
600-609	..	..	..	..	..
610-619	1	..	1	..	2
620-629	1	..	1	..	2
630-639	1	..	..	..	1
640-649	2	..	..	..	2
650-659	1	..	..	..	1
660-669	1	..	..	..	1
670-679	1	3	..	..	4
680-689	..	..	..	..	..
690-699	..	..	1	..	1
700-709	3	..	..	..	3
710-719	..	..	..	..	..
720-729	..	..	..	..	..
730-739	..	..	..	..	..
740-749	..	..	..	..	..
750-759	..	1	..	..	1
760-769	..	..	..	..	..
770-779	..	..	..	..	..
780-789	..	..	..	..	..
790-799	..	..	..	..	..
800-809	..	..	..	..	..
810-819	..	1	..	..	1
820-829	..	..	..	..	..
830-839	..	..	..	..	..
840-849	..	..	..	..	..
850-859	..	..	..	..	..
860-869	1	..	..	..	1
1090	1	..	..	..	1
1280	..	..	1	..	1
Total Complete ..	123	79	90	95	387
Incomplete	14	5	8	3	30
Total	137	84	98	98	417

content, therefore, to deal with the results by means of cumulative frequency curves and analyses tending to indicate the seasonal shift.

In Table 22 are shown the data for the cumulative frequencies for the four experiments west of Cape Spencer, and in Figure 36 corresponding curves, compared with a curve for the massed southern experiments. In interpreting these it should be remembered that a curve of absolutely even dispersion would form a straight oblique line from the lower left hand corner of the figure to a point on the upper edge, indicating the extreme distance or end of the exploited banks. Moreover, a locality in the center of the range of movement would reach the extreme dispersion and accumulate its hundred per cent in half the distance that an experiment at the extreme of the range would. This affects very sharply the shape of the curves, particularly that of the Portlock experiment. Nevertheless, the contrast between the actual movements as far as known is shown precisely, and contrasts clearly the lack of movement of immature on southern banks with the mature at Yakutat and the W Ground. The returns from Portlock occupy an intermediate position, in conformity with the mixture there of the several stages of maturity and in conformity with its position nearer the center of the range of migration.

The dispersions of the two categories of halibut recovered in 1927 and 1928 respectively from the Yakutat experiment are remarkably similar. The cumulative curves for the two years follow the same trend, even for the minor fluctuations, and cross and recross throughout their course. The indications from this are that the halibut marked in the winter of 1926 on Yakutat Spit had become fully distributed by 1927 throughout the range of the fishery. Consequently in the following year the dispersion did not increase but remained about the same.

The rapid rise between zero and 100 miles in the curves from the Yakutat experiment is due to the halibut retaken at Yakutat Spit, Fairweather Gully, and the W Ground. This rise is followed by a flattening out, then by a more gradual and steady increase beginning at about 200 miles. It is at this point that the fish retaken on Portlock begin to affect the curve, followed by decreasing numbers taken on Albatross Bank and near the Trinity, Semidi, and Shumagin Islands.

The results of the W Ground experiment are in general similar to those from the Yakutat marking. The recaptures here, as in the case of the Yakutat experiment, were made largely to the westward of the tagging location. In this case, however, there is no important bank to the westward until Portlock is reached, consequently most of the recaptures come from Portlock and westward. This accounts for a large part of the difference in the W Ground and Yakutat curves.

The cumulative curve for the 1928 returns from the Portlock experiment is very different from that of the other two areas considered. In this case about 90 per cent of the returned tags were taken within 200 miles of the marking position, compared with 40 per cent for the W Ground experiment, and about 47 per cent for those at Yakutat. In the case of the Portlock experiment the returns on the home bank are so greatly in excess as to render any

TABLE 22.—*Cumulative percentages of halibut tagged during the western experiments and recaptured within any given distance of tagging location*

Miles	Yakutat 1927	Yakutat 1928	W Ground 1928	Portlock 1928	Miles	Yakutat 1927	Yakutat 1928	W Ground 1928	Portlock 1928	Miles	Yakutat 1927	Yakutat 1928	W Ground 1928	Portlock 1928
0- 9	6.5	2.5	1.1	9.5	300-309	65.1	70.7	71.1	94.7	600-609	89.5	93.6	95.6	
10- 19	11.4	6.3	4.5	34.8	310-319	67.5	70.7	73.3	95.8	610-619	90.3	93.6	96.7	
20- 29	13.0	13.9	5.6	47.4	320-329	69.1	70.7	75.6	95.8	620-629	91.1	93.6	97.8	
30- 39	15.5	18.9	5.6	53.7	330-339	70.8	70.7	81.1	95.8	630-639	91.9	93.6	97.8	
40- 49	18.7	21.4	5.6	61.1	340-349	71.6	70.7	85.6	95.8	640-649	93.5	93.6	97.8	
50- 59	20.3	23.9	6.7	63.2	350-359	73.2	74.5	86.7	95.8	650-659	94.3	93.6	97.8	
60- 69	28.5	27.7	7.8	68.4	360-369	74.8	75.8	86.7	95.8	660-669	95.1	93.6	97.8	
70- 79	37.4	34.0	10.0	68.4	370-379	74.8	75.8	87.8	95.8	670-679	95.9	97.4	97.8	
80- 89	38.2	39.0	10.0	68.4	380-389	76.5	77.1	87.8	95.8	680-689	95.9	97.4	97.8	
90- 99	41.5	40.3	11.1	71.6	390-399	77.3	79.6	87.8	95.8	690-699	95.9	97.4	98.9	
100-109	42.3	40.3	12.2	72.6	400-409	78.1	82.1	88.9	95.8	700-709	98.4	97.4	98.9	
110-119	43.9	40.3	12.2	74.7	410-419	79.7	82.1	90.0	95.8	710-719	98.4	97.4	98.9	
120-129	43.9	40.3	16.7	76.8	420-429	80.5	82.1	90.0	96.8	720-729	98.4	97.4	98.9	
130-139	43.9	41.5	18.9	76.8	430-439	81.3	82.1	90.0	97.9	730-739	98.4	97.4	98.9	
140-149	43.9	41.5	20.0	82.1	440-449	82.1	83.4	90.0	97.9	740-749	98.4	97.4	98.9	
150-159	43.9	41.5	22.2	83.1	450-459	82.1	84.7	90.0	97.9	750-759	98.4	98.7	98.9	
160-169	45.6	44.0	24.4	86.3	460-469	82.1	84.7	91.1	99.0	760-769	98.4	98.7	98.9	
170-179	46.4	44.0	28.9	88.4	470-479	82.1	88.5	92.2	99.0	770-779	98.4	98.7	98.9	
180-189	47.2	45.3	33.3	89.4	480-489	83.8	91.0	93.3	99.0	780-789	98.4	98.7	98.9	
190-199	49.6	45.3	40.0	89.4	490-499	85.4	91.0	94.5	99.0	790-799	98.4	98.7	98.9	
200-209	51.2	46.6	42.2	89.4	500-509	86.2	91.0	94.5	99.0	800-809	98.4	98.7	98.9	
210-219	52.0	46.6	44.4	89.4	510-519	87.0	91.0	94.5	99.0	810-819	98.4	100.0	98.9	
220-229	53.7	46.6	50.0	91.6	520-529	87.0	91.0	94.5	99.0	820-829	98.4		98.9	
230-239	53.7	47.9	53.3	91.6	530-539	87.8	91.0	94.5	99.0	830-839	98.4		98.9	
240-249	54.5	50.4	55.6	91.6	540-549	88.6	91.0	94.5	100.0	840-849	98.4		98.9	
250-259	56.9	54.2	57.8	91.6	550-559	88.6	92.3	95.6		850-859	98.4		98.9	
260-269	59.4	58.0	61.1	92.6	560-569	88.6	92.3	95.6		860-869	99.2		98.9	
270-279	62.6	60.5	62.2	93.6	570-579	88.6	92.3	95.6						
280-289	63.4	68.1	64.4	93.6	580-589	88.6	93.6	95.6		1090	100.0		98.9	
290-299	65.1	69.4	65.6	94.7	590-599	89.5	93.6	95.6						
										1280			100.0	

detailed comparison with intensities unnecessary. The explanation undoubtedly lies in the presence of non-migratory immatures and the relation of the bank to the limits of migration in either direction.

The curves of Figure 36 therefore indicate, as did the comparison with the intensities of the fishery, that the mature fish migrate freely as far west as the fishery extends. The returns from the fish tagged at Yakutat and the W Ground indicate that they were marked near the eastern extreme of the range of the stock of halibut in question. There is relatively little movement southward, especially in comparison with the intensity of the fishery there.

We find in the peculiarities of these distributions the same phenomenon as was found on the southern banks, the effect of dispersion within a limited range of migration. The case is not complete, since in the western experiments only the one extreme of distribution has been studied. In planning these the limits of the range of migration of each stock could not be foreseen, and it is entirely probable that as our work extends further west other migratory stocks with other ranges will be met with.

SEASONAL MOVEMENTS

This leaves untouched the question as to whether or not the migration is annual.

An examination throughout the year of the dispersion of the recaptured halibut indicates that the degree of scatter is a closer function of the time of year than of the length of time the fish has been free. Consequently our first analysis is of the average dispersion of the fish retaken during each month. Inasmuch as the marking work at Yakutat Spit was completed within a period of about one month and that on Portlock and the W Ground within periods of ten and nine days respectively, this method of treatment would be little affected even if the length of time free were a factor of greater importance than appears to be the case.

In Table 19 and Figure 30 there is shown the average distance between the point of release and the point of recapture for the halibut retaken during each month. The Yakutat returns cover a period of two years, the others one year each.

For the Yakutat experiment the dispersion between the months of February and September, 1927, averages around 300 miles. In the next two months the average falls off rapidly to less than 50 miles in November. In the following year the dispersion averages between two and three hundred miles up to the end of August. In the following three months it falls off to less than 100 miles in November.

In the W Ground experiment the average displacement increases from about 200 miles in February and March to 400 miles in June. In the following months it decreases as do the Yakutat displacements to little more than 100 miles in November.

The average dispersion of the Portlock fish is markedly less than that found for the halibut marked on Yakutat Spit and the W Ground. Except for the months of May and June the average in every case falls below 80 miles. In May it is 250 miles and in June 132 miles. In this experiment as in the others, the dispersion is the smallest during the last two or three months of the season.

The problem now arises as to how these results are to be interpreted. On the surface it appears that immediately following marking, the halibut scatter widely over the banks from Cape Spencer westward with a few moving to the south. The greatest dispersion is reached in the late spring and early summer and is followed by the reconcentration of the halibut on the banks where they were tagged, this concentration reaching its maximum in November or later.

From our general knowledge of the fishery, it would seem that this shift accords more or less closely with that of the fishery.

During the early spring the western halibut fleet is distributed mainly over the banks from Portlock eastward. Because of the long trip and uncertain weather the fishery west of Kodiak Island does not usually develop until late in the spring. Later in the year as the weather improves the fishery shifts more and more to the westward and remains distributed during the summer over the banks from Cape Fairweather to the Shumagin Islands. In the last few years there has been a tendency to carry on operations even to the westward of the Shumagin Islands as far as Unimak Pass. During this time the fishery on Yakutat Spit and the W Ground is practically negligible as very few fish are found on these banks except during or near the spawning season.

As the stormy fall weather approaches the fleet tends more and more to confine its efforts to the banks nearer market. At this season the halibut begin to assemble on the spawning grounds from Cape Spencer to Cape St. Elias, appearing there in increasing numbers until the spawning season in the late fall and early winter. As a result of these combined influences the fishery concentrates more and more on the eastern banks until in October and November nearly the entire western fleet, in addition to some of the boats from the southern banks, is concentrated on the banks in the vicinity of Yakutat Spit and the W Ground. During this time of year these banks at night give the appearance of a small city with the lights of the numerous boats spread over the bank while hundreds of buoy lights, marking the gear, are scattered among them. The banks are covered with a veritable network of gear with the "strings" of the different boats crossing and recrossing.

The distribution of recaptured halibut then appears to reflect the shift in the position and intensity of the fishery rather than a movement of the halibut population. Further extensive tagging experiments on the far western banks and a more complete statistical analysis of catches will be required to determine to what extent a compensatory eastern and western seasonal migration takes place between these areas. For the time being we must rest content with the conclusion that an extensive free interchange of mature stock occurs from the eastern side of the Gulf of Alaska as far as Unimak Pass and perhaps beyond.

DISPERSION IN RELATION TO SIZE

The amount of movement shown varies with the size of the fish concerned. In making a comparison, the actual distances between point of release and point of recovery are used to obtain an average for the halibut recaptured during each month.

The results of this treatment are shown in Table 23 and Figure 37. The curves represent the average dispersion for each 10 cm. length group.

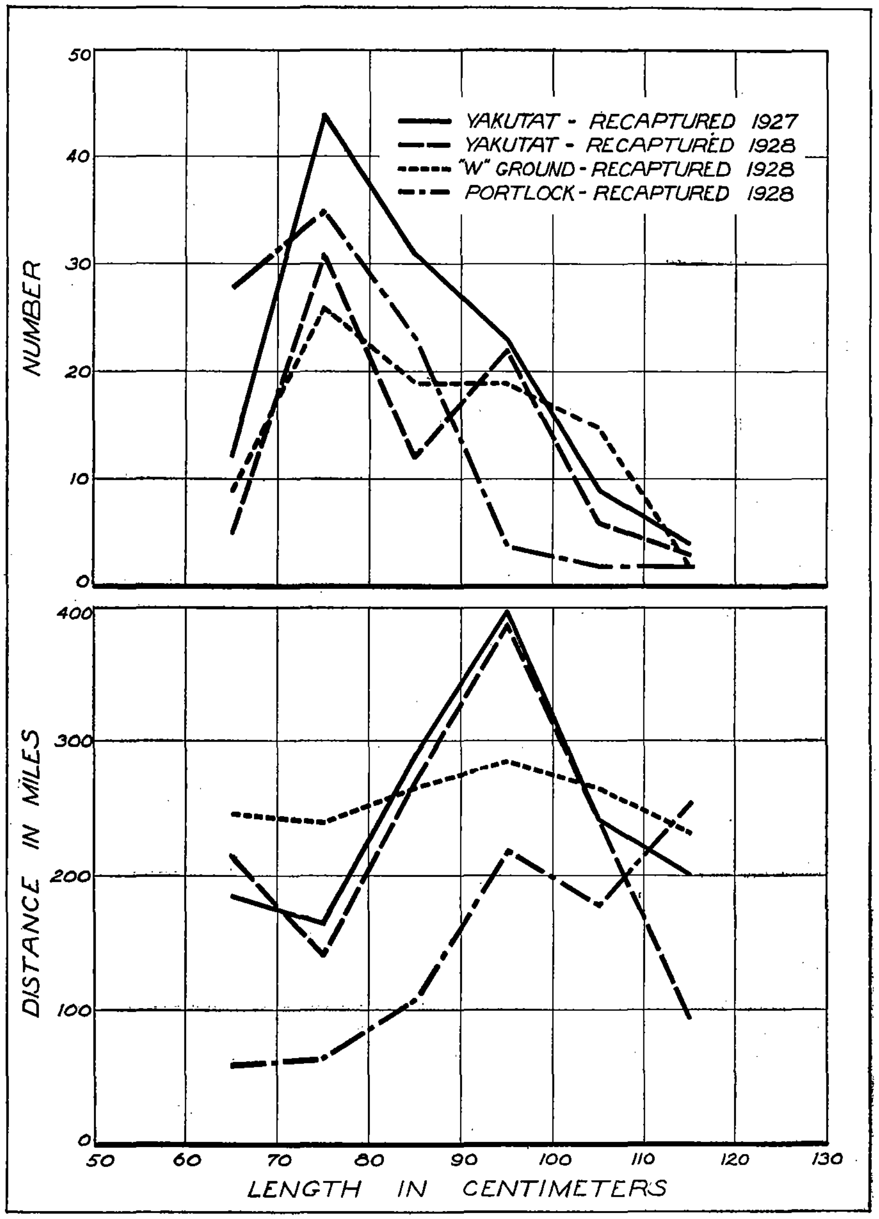

FIG. 37.—Average dispersion by lengths when tagged. Western experiments.

The 1927 and 1928 returns from the Yakutat experiment provide almost identical results. From between 150 and 200 miles average displacement for fish up to 80 cm. length, the dispersion increases rapidly to nearly 400 miles for halibut between 90 and 100 cm. From this length up the curves fall off sharply.

The curve for the W Ground material differs considerably from the Yakutat curves in absolute values at each length but shows a similar tendency, that is, there is a high positive correlation in the fluctuations in the curves. The average displacement is somewhat less than 250 miles for halibut under 80 cm., increases to nearly 300 miles for 90 to 100 cm. fish, then falls off considerably for the larger sizes.

The Portlock material provides somewhat different results from the other two experiments. The dispersion is lowest for the smaller sizes and increases for halibut up to 100 cm. in length. The last two points on the curve are based on but four recoveries each and are correspondingly unreliable.

TABLE 23.—*Average dispersion, by lengths when tagged; western experiments*

Length	YAKUTAT				W GROUND		PORTLOCK	
	Recaptured 1927		Recaptured 1928		Recaptured 1928		Recaptured 1928	
	No.	Mean Dispersion	No.	Mean Dispersion	No.	Mean Dispersion	No.	Dispersion Mean
Below 70	12	185	5	215	9	246	28	60
70- 79.9	44	164	31	140	26	239	35	64
80- 89.9	31	289	12	270	19	265	24	106
90- 99.9	23	397	22	388	19	286	4	219
100-109.9	9	241	6	242	15	264	2	178
110-119.9	4	201	3	93	2	232	2	253
Complete	123	248	79	240	90	259	95	86
Incomplete	14	..	5	..	8	..	3	..
Total	137	..	84	..	98	..	98	..

The curves showing the average dispersion according to length are alike in some respects and differ in others for all of our western experiments. They all show an increase in dispersion from small halibut up to fish 100 cm. in length. Following this there is a decrease for the larger sizes.

A large part of the difference between the Portlock dispersion and that shown by the other experiments, can be explained by difference in the tagging location as has been discussed previously. There may be other factors which have helped to effect this result but the nature of the relationship is not yet sufficiently established to justify any detailed analysis.

The reliability of the relationship between size and dispersion appears fairly well established for the Yakutat halibut by the close similarity in the results of the 1927 and 1928 returns. The results of the W Ground and Portlock experiments, however, will have to be substantiated by additional data before they can be considered typical.

SUMMARY

The experiments described are incomplete, marking not having been accomplished in all necessary localities, and only the earliest experiments have returns over an adequate number of years. The analysis deals with returns to the end of 1928.

Strap tags attached to the opercle of the eyed side were used and found satisfactory. Fish were caught by ordinary commercial methods of ground line fishing, and only those slightly injured were used.

Tagging was not centralized but was distributed, as far as knowledge permitted, according to intensity of fishing on various banks because of (1) economy and efficiency of vessel operations, (2) necessity for conclusions stated in generalized form, applicable to the banks as a whole, and (3) desirability of studying immigration as well as emigration.

In waters south of Cape Spencer, 6,554 tagged halibut were placed, 4,936 of them with the approved strap tag. North and west of Cape Spencer 5,281 were placed.

Results are regarded as sufficiently typical of the fishery for purposes of present regulation. For the purpose of correction if desired, the variation between the sizes tagged and those taken by the tagging vessel is given and discussed. There is also a need for analysis of the commercial catch, but this is lacking as yet. In southern experiments the various sizes taken were marked in approximately equal proportions, but in the western experiments the larger fish were proportionately less represented than the smaller.

The returns are given in detailed tables but are summarized by statistical areas which are here defined for the first time. Each includes 60 linear nautical miles of trend of the coast, and they are numbered consecutively from south to north and west (Figures 1, 2, and 3).

The two groups of areas separated by Cape Spencer are practically independent. Five per cent only of recoveries from western experiments were retaken south of Cape Spencer, and but one fish from the south was retaken west.

Halibut tagged in areas south of 18, at Cape Spencer, show very slight migrations, averaging 22 miles, and those tagged north and west of Cape Spencer show an average of 209 miles.

The slight migrations on southern banks from areas 10 and 15 tend to be opposed in direction. The extensive migration from areas 20 and 22 is westward.

A calculation of the pounds of halibut taken and the amount of gear run was made for each statistical area. It was decided that the chances of recovery varied with the amount of gear run rather than with the pounds taken, and the theoretical chances of recovery in each area were thus calculated.

Comparison of actual recoveries with the chances of recovery according to distance from tagging locality, showed for southern grounds recoveries almost entirely from the area of tagging, but for western grounds a wide distribution between areas 18 and 35, and recoveries nearly in proportion to the chances calculated.

The returns in areas 18 to 35 are nevertheless highest near the tagging point, indicating either a slight limitation upon freedom of migration or a concentration of marked schools there at certain seasons.

This difference in migratory habits is correlated with the tagging of schools which are nearly exclusively mature in the areas beyond 18, to the north and west, and nearly all immature to the south.

The immature fish of the southern banks are highly restricted in movement but it is concluded that the stock of mature fish on the northern and western grounds is everywhere interdependent, forming a freely intermingling biological unit extending beyond the limit of the present fishery, not however to the southward of area 18.

SOUTHERN BANKS

The southern region showed a total return of 36.0 per cent for the 1925 experiment and 31.7 per cent for the 1926 experiment in three seasons after tagging.

The rate of recovery for experiments south of area 18 for each consecutive year is expressed as the percentage of fish not accounted for. The experiments in 1925 correspond in results to those in 1926, indicating their representative nature. Combined returns were 7.6 per cent for the first (incomplete) season, 20.0 per cent for the second (complete), 9.7 per cent for the third, and 4.1 per cent for the fourth. For the last, returns from the 1925 experiments only were available.

The inadequacy of the actual percentage returns to represent the rate of recapture is pointed out, and a method of correction suggested which, although not fully established, indicates for the 1925 experiments an approximate rate of return of 40 per cent per year, and 58 per cent per year for decline of commercial stock by all causes. Natural mortality is estimated at 36 per cent per year, this value assuming the tags are permanent in attachment.

The rate of return varies with size, and a table of values is given for use in correcting calculations.

The rate of decline of the stock is in harmony with observed conditions and is sufficient to account for the practical absence of mature fish and for the predominating sizes in the commercial catch. It accounts for the rapid disappearance of the schools of young fish which annually become of commercial size.

The returns for southern grounds are presented in graphical form according to time out and distance travelled, and show marked seasonal changes. The returns show a tendency toward concentration within 10 miles of the tagging location and during the summer months.

When the dispersion on these southern grounds is expressed as the numbers which have moved various distances, it is found that this can be represented by a formula $y = ax^b$, indicating a definite rate of dispersal by chance. This is not in accord with what might be expected were there definite migrations. From the formulas given, it should be possible to calculate interchange between banks of the stock of immature fish.

The data for areas south of 18 are also presented by cumulative frequency curves, as more convenient. Only between 5 and 10 per cent were retaken more than 50 miles distant from the tagging localities. The dispersion increases slowly from year to year, as shown by comparison of seasons, but the bulk of fish remain on home grounds.

There is shown the phenomenon of migration of particular stocks within limited ranges, leading to migrations opposed in net direction from extremes to the center, and indifferent in the center. This phenomenon is recognizable within the individual bank among the immature stock, and within larger geographic units among the mature migrants, and must be taken into account in all experiments. It necessitates a decentralized series of experiments rather than a single centralized one.

The seasonal variation in extent of movement in southern experiments shows an average migration of 17 miles in summer and of from 25 to 30 miles in the spring and fall. This is not due to seasonal movement as the number of distant migrants fluctuates in the same way as does the number of non-migrants. There is a seasonal failure to capture, but as far as our results indicate, this is not due to migration, nor are the whereabouts of the fish of immediate practical importance since they are absent from the commercial fishery.

WESTERN BANKS

The experiments north and west of Cape Spencer (area 18) are as yet too few to justify extensive analysis. The fish tagged were larger than those of the southern experiments and were predominantly mature.

The rate of returns is low, from 7.3 per cent to 8.1 per cent the first year, which is complete, owing to the season of tagging, and 5.2 per cent and 7.3 per cent the second year. The decline is not as rapid as in the southern experiments, but no correction of the rate is ventured at this stage of the work.

The variation in the rate of return according to size is similar to that of the southern experiments, despite the difference in sizes tagged, but the maximum is 10 per cent instead of 40 per cent.

The dispersion of returns is very great, the graph showing a scale of hundreds of miles where that for the southern immatures has tens. There is no tendency to concentrate within the first few miles. Formulas of chance dispersion similar to those applied to southern grounds are not applicable, because of the presence of distinct migrations.

The cumulative frequency curves for distances traversed are the same for two successive years in the only western experiment with returns for the second year, showing that maximum dispersion was reached the first year, and indicating but not proving, the migrations to be seasonal. But since the fishery shifts according to season the shift in returns may be secondary to that of the fishery.

Dispersion and rate of returns are similar for the experiments in areas 20 and 22, but vary for area 25.

The phenomenon previously indicated of migration within restricted ranges is evident in the returns, 41 and 48 per cent of all returns from the experiments in areas 20 and 22 being returned from within 200 miles, and 90 per cent of those from the experiment in areas 25 and 26 being from within that distance.

Dispersion is greatest in summer. It averages 300 miles for the experiment in area 20, between April and September, and 50 miles in November, For the experiment in area 22, it averages 200 miles in February and March, 400 miles in June, 100 miles in November. That for area 25 and 26 is much less, usually below 80 miles except for May and June. The variation with size of fish is given, dispersion increasing with size up to 100 cm. lengths. It shows similarity between banks, with differences due to the position of the several areas.

It is concluded that an extensive free interchange of mature stock occurs from the eastern side of the Gulf of Alaska as far as Unimak Pass and perhaps beyond.

APPENDIX A.—*Detailed table of localities.*

Locality No.	Date	Position		Gear Run	Depth	No. Caught	Tagged (T) and Recaptured (R)									
							Large Strap		Small Strap		Round Monel		Round Silver		Total	Total
		N Lat.	W Long.	Skates*	Fms		T	R	T	R	T	R	T	R	T	R
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	14 VI 25	54:13:00	130:47:00	..[1]	....	1	..	..	1	1	..	..	..	..	1	1
2	16 VI 25	54:08:00	132:02:30	15	....	238	33	14	119	38	..	..	..	..	152	52
3	17 VI 25	54:07:00	132:12:00	8	....	86	10	4	7	..	..	..	..	..	17	4
4	17 VI 25	54:11:00	132:06:00	12	....	44	2	1	42	11	..	..	..	..	44	12
5	18 VI 25	54:16:00	131:31:00	5	....	12	..	..	6	2	..	..	..	..	6	2
6	18 VI 25	54:07:00	131:56:00	15	....	119	12	5	38	11	..	..	..	..	50	16
7	19 VI 25	54:08:00	132:01:00	24	....	172	8	3	67	30	..	..	..	..	75	33
8	20 VI 25	54:09:30	132:46:00	26	....	285	21	11	122	50	..	..	..	..	143	61
9	21 VI 25	54:12:00	132:58:00	6	....	50	3	2	9	4	..	..	..	..	12	6
10	21 VI 25	54:10:00	132:38:30	8	....	20	3	1	17	7	..	..	..	..	20	8
11	22 VI 25	54:08:00	132:26:00	10	....	19	3	2	16	7	..	..	..	..	19	9
12	22 VI 25	54:14:00	132:24:00	4	....	49	..	..	13	2	..	..	..	..	13	2
13	23 VI 25	54:06:30	131:52:30	15	....	116	10	6	48	19	..	..	..	..	58	25
Total Seamaid—Trip 1				148	....	1,211	105	49	505	182	..	..	..	..	610	231
14	30 VI 25	53:36:00	130:58:00	6	....	3	..	..	1	..	..	..	..	..	1	..
15	30 VI 25	53:25:30	130:57:00	6	....	3	2	1	1	..	..	..	..	..	3	1
16	1 VII 25	52:57:00	130:45:00	36	....	274	17	7	105	35	43	..	..	..	165	42
17	2 VII 25	52:55:30	130:43:30	14	....	51	8	4	15	4	5	..	..	..	28	8
18	3 VII 25	52:39:30	131:23:30	3	....	..	..	..	..	..	..	..	..	..	..	..
19	3 VII 25	52:29:00	131:12:30	15	....	34	6	3	8	1	..	..	7	..	21	4
20	4 VII 25	52:37:30	131:05:00	28	....	129	10	5	25	7	21	..	17	1	73	13
21	5 VII 25	52:43:00	131:00:00	20	....	50	2	..	6	..	..	..	18	1	26	1
22	6 VII 25	53:57:00	131:07:00	6	....	6	1	1	1	..	..	..	..	..	2	1
23	6 VII 25	53:59:00	131:01:30	10	....	69	1	..	13	2	5	..	30	3	49	5
Total Seamaid—Trip 2				144	....	619	47	21	175	49	74	..	72	5	368	75
24	9 VII 25	54:02:00	131:05:00	23	....	136	4	1	19	6	23	..	15	..	61	7
25	10 VII 25	53:56:30	131:07:30	9	....	59	1	1	7	2	21	..	3	..	32	3
26	13 VII 25	54:41:00	132:03:30	14	....	205	23	13	96	68	..	..	..	..	119	81
27	14 VII 25	54:41:00	132:03:30	14	....	232	14	9	120	71	..	..	..	..	134	80
28	15 VII 25	54:40:30	132:05:00	26	....	345	..	..	1	1	102	9	91	29	194	39
29	16 VII 25	54:41:00	132:03:30	26	....	222	..	..	4	3	61	2	72	23	137	28
30	17 VII 25	54:15:30	131:05:00	11	....	79	..	..	..	..	..	..	34	1	34	1
Total Seamaid — Trip 3				123	....	1,278	42	24	247	151	207	11	215	53	711	239
31	20 VII 25	54:02:30	133:13:00	6	....	40	1	0	26	5	..	..	..	..	27	5
32	20 VII 25	53:45:00	133:07:00	4	....	37	3	1	19	4	..	..	..	..	22	5
33	20 VII 25	53:44:30	133:04:00	2	....	1	..	..	1	..	..	..	..	..	1	..
34	22 VII 25	53:45:00	133:07:00	25	....	236	20	8	145	45	..	..	..	..	165	53

[1] Caught with a hand line. * Six-line skate used.

APPENDIX A. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
35	23 VII 25	53:32:00	132:52:00	12	....	70	6	4	29	4	..	..	..	..	35	8
36	23 VII 25	53:27:00	132:38:00	9	....	39	8	4	13	2	..	..	..	..	21	6
37	24 VII 25	53:19:00	132:42:00	24	....	125	4	1	..	..	67	..	9	..	80	1
38	25 VII 25	53:16:00	132:34:30	6	....	12	..	..	..	..	8	..	..	..	8	..
39	25 VII 25	53:11:00	132:34:00	6	....	33	..	..	..	..	14	..	..	..	14	..
40	25 VII 25	53:08:00	132:29:30	9	....	45	3	1	9	1	15	..	..	..	27	2
41	26 VII 25	53:06:00	132:31:00	9	....	13	9	2	4	..	..	..	..	..	13	2
42	26 VII 25	52:35:30	132:04:00	6	....	9	5	..	2	..	..	..	..	..	7	..
43	27 VII 25	52:28:00	131:42:00	14	....	34	15	10	10	2	..	..	..	..	25	12
44	28 VII 25	51:53:00	129:05:00	11	....	32	10	6	13	3	..	..	..	..	23	9
45	30 VII 25	52:57:00	130:44:00	35	....	155	21	8	80	17	..	..	..	..	101	25
46	31 VII 25	53:53:00	131:12:00	12	....	4	2	1	..	..	..	..	..	..	2	1
Total Seamaid—Trip 4				190	....	885	107	46	351	83	104	..	9	..	571	129
47	5 VIII 25	51:45:30	129:03:30	8	....	15	7	2	4	..	..	..	..	..	11	2
48	5 VIII 25	51:41:30	129:15:30	8	....	38	15	8	11	5	..	..	..	..	26	13
49	6 VIII 25	51:36:00	129:29:00	8	....	4	1	..	..	..	..	..	..	..	1	..
50	9 VIII 25	55:40:00	133:53:00	8	....	56	9	4	19	5	..	..	..	..	28	9
51	10 VIII 25	55:37:00	133:53:30	29	45–55	367	22	14	53	20	136	2	..	..	211	36
52	11 VIII 25	55:37:00	133:53:30	30	....	370	..	..	..	..	206	3	..	..	206	3
53	12 VIII 25	55:34:00	133:54:00	30	....	401	..	..	..	..	241	2	..	..	241	2
54	13 VIII 25	55:32:00	133:51:00	30	....	369	..	..	..	..	178	2	..	..	178	2
55	14 VIII 25	55:26:30	133:55:30	15	....	133	..	..	..	..	64	..	..	..	64	..
56	15 VIII 25	54:51:00	133:34:00	13	....	196	..	..	..	..	112	2	..	..	112	2
Total Seamaid—Trip 5				179	....	1,949	54	28	87	30	937	11	..	..	1,078	69
57	5 VI 26	51:52:30	128:53:30	10	40	206	..	..	70	29	..	..	..	..	70	29
58	6 VI 26	51:52:30	128:53:30	37	....	458	..	..	193	89	..	..	..	..	193	89
59	7 VI 26	51:53:00	128:27:30	5	60	8	..	..	2	1	..	..	..	..	2	1
60	8 VI 26	51:52:00	128:56:30	34	....	125	..	..	65	24	..	..	..	..	65	24
61	9 VI 26	51:51:30	128:59:30	20	.... }	194	..	..	16	7	..	..	..	..	16	7
62	9 VI 26	51:39:00	129:29:30	14	.... }		..	..	67	41	..	..	..	..	67	41
63	10 VI 26	51:39:00	129:29:30	40	55–65	322	..	..	136	65	..	..	..	..	136	65
64	11 VI 26	51:39:00	129:29:30	32	52–57	334	..	..	138	70	..	..	..	..	138	70
65	12 VI 26	51:39:00	129:29:30	12	52–57 }	59	..	..	16	11	..	..	..	..	16	11
66	12 VI 26	51:09:00	128:54:30	10	.... }		..	..	11	2	..	..	..	..	11	2
67	13 VI 26	49:43:00	127:32:00	15	60–95	32	..	..	14	2	..	..	..	..	14	2
68	14 VI 26	47:52:00	125:27:00	14	100	15	..	..	..	..	..	..	..	..	..	..
Total Scandia—Trip 1				243	....	1,753	..	..	728	341	..	..	..	..	728	341
69	19 VI 26	51:39:00	129:29:30	24	48–55	307	..	..	161	75	..	..	..	..	161	75
70	20 VI 26	51:39:00	129:29:30	27	48–60	144	..	..	59	26	..	..	..	..	59	26
71	20 VI 26	52:05:30	129:54:30	5	130	1	..	..	1	..	..	..	..	..	1	..
72	21 VI 26	52:23:30	129:57:30	15	60	39	..	..	13	5	..	..	..	..	13	5
73	21 VI 26	52:24:00	130:05:30	10	75–90	38	..	..	16	7	..	..	..	..	16	7
74	22 VI 26	52:34:30	130:48:30	10	40–65	15	..	..	10	5	..	..	..	..	10	5

APPENDIX *A.* *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
75	22 VI 26	52:49:30	130:38:00	11	50–58	43	..	..	15	1	..	..	..	..	15	1
76	23 VI 26	51:56:30	129:00:00	35	40–60	249	..	..	107	52	..	..	..	..	107	52
77	24 VI 26	51:54:30	128:59:00	42	40–70	390	..	..	138	48	..	..	..	..	138	48
78	25 VI 26	51:56:00	128:51:00	46	45–75	283	..	..	105	37	..	..	..	..	105	37
79	27 VI 26	51:46:00	128:43:00	22	40–50	64	..	..	21	12	..	..	..	..	21	12
80	28 VI 26	51:46:30	128:43:30	20	40–48	152	..	..	43	16	..	..	..	..	43	16
81	28 VI 26	51:48:30	128:45:00	11	40–75	126	..	..	33	14	..	..	..	..	33	14
82	29 VI 26	51:49:30	128:45:30	43	35–70	414	..	..	117	34	..	..	..	..	117	34
83	30 VI 26	49:33:00	127:20:00	19	80–90	17	..	..	..	..	..	..	..	..	..	..
Total Scandia—Trip 2				340	....	2,282	..	..	839	332	..	..	..	..	839	332
84	10 VII 26	52:40:00	130:53:00	25	35–55	171	..	..	17	1	..	..	..	..	17	1
85	11 VII 26	52:43:00	130:44:30	36	40–50	198	..	..	14	1	..	..	..	..	14	1
86	12 VII 26	53:52:00	131:00:00	19	30–40	40	..	..	..	..	..	..	..	..	..	..
87	13 VII 26	54:10:30	132:09:00	40	20–58	312	..	..	..	..	..	..	..	..	..	..
88	14 VII 26	54:10:30	132:09:00	41	25–50	1,018	..	..	13	3	..	..	..	..	13	3
89	15 VII 26	54:08:30	132:01:30	39	30–60	845	..	..	111	29	..	..	..	..	111	29
90	16 VII 26	54:09:00	132:01:30	39	35–55	846	..	..	129	34	..	..	..	..	129	34
91	17 VII 26	54:12:30	133:10:00	29	50–75	184	..	..	..	..	..	..	..	..	..	..
92	18 VII 26	53:41:30	133:08:20	33	50–80	292	..	..	..	..	..	..	..	..	..	..
93	19 VII 26	52:23:30	132:11:00	28	50–200	226	..	..	..	..	..	..	..	..	..	..
Total Scandia—Trip 3				329	....	4.132	..	..	284	68	..	..	..	..	284	68
94	26 VII 26	51:54:00	131:06:00	12	....	10			4	2					4	2
95	27 VII 26	54:49:00	133:37:30	11	55–80	186	..	..	67	14	..	..	..	..	67	14
96	29 VII 26	55:36:30	133:53:00	36	42–60	978	..	..	362	69	..	..	..	..	362	69
97	30 VII 26	55:39:00	133:57:00	36	....	986	..	..	285	72	..	..	..	..	285	72
98	31 VII 26	55:37:30	133:57:30	34	....	896	..	..	239	45	..	..	..	..	239	45
99	1 VIII 26	55:40:00	133:52:30	30	....	551	..	..	173	40	..	..	..	..	173	40
100	2 VIII 26	55:25:30	133:50:30	34	....	632	..	..	187	24	..	..	..	..	187	24
101	3 VIII 26	54:48:30	133:39:00	22	....	200	..	..	48	15	..	..	..	..	48	15
102	5 VIII 26	50:37:30	128:29:00	10	60–65	26	..	..	..	..	..	..	..	..	..	..
Total Scandia—Trip 4				225	....	4,465	..	..	1,365	281	..	..	..	..	1,365	281
103	11 VIII 26	47:32:30	124:57:30	10	....	..	..	..	..	..	..	..	..	..	..	..
104	13 VIII 26	44:35:30	124:21:30	12	47–55	6	..	..	..	..	..	..	..	..	..	..
105	13 VIII 26	44:40:00	124:10:00	15	35–40	51	..	..	..	..	..	..	..	..	..	..
106	14 VIII 26	44:39:00	124:10:00	25	37–40	82	..	..	..	..	..	..	..	..	..	..
107	14 VIII 26	44:35:30	124:10:00	5	38		..	..	..	..	..	..	..	..	..	..
108	15 VIII 26	44:40:30	124:14:30	15	38–40	72	..	..	..	..	..	..	..	..	..	..
109	16 VIII 26	44:01:30	124:51:00	31	50–75	33	..	..	..	..	..	..	..	..	..	..
110	17 VIII 26	44:02:30	124:45:30	21	58–100	32	..	..	..	..	..	..	..	..	..	..
111	18 VIII 26	45:46:00	124:03:00	15	40	11	..	..	..	..	..	..	..	..	..	..
112	19 VIII 26	47:50:30	124:59:00	11	50–65	1	..	..	..	..	..	..	..	..	..	..
Total Scandia—Trip 5				160	....	288	..	..	..	..	..	..	..	..	..	..

APPENDIX *A*. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
113	17 XI 26	58:55:00	141:14:30	15	135–170	116	..	..	18	3	..	..	..	..	18	3
114	18 XI 26	58:55:00	141:21:00	35	135–170	574	63	14	17	5	..	..	..	..	80	19
115	19 XI 26	58:55:00	141:21:00	35	160–180	386	48	8	13	2	..	..	..	..	61	10
116	20 XI 26	58:57:00	141:25:00	30	185–280	152	53	7	10	..	..	..	..	..	63	7
117	21 XI 26	58:39:00	140:58:00	37	115–165	384	59	10	23	2	..	..	..	..	82	12
118	22 XI 26	58:55:00	141:21:00	39	150–170	373	71	10	31	4	..	..	..	..	102	14
119	23 XI 26	58:55:00	141:14:00	24	145–170	219	15	2	7	1	..	..	..	..	22	3
120	23 XI 26	58:59:00	141:36:00	15	145–170	200	..	..	..	..	..	..	..	..	..	..
121	24 XI 26	58:59:00	141:36:00	46	145–190	654	91	7	30	3	..	..	..	..	121	10
122	25 XI 26	58:59:00	141:36:00	39	125–170	620	134	23	61	7	..	..	..	..	195	30
123	26 XI 26	58:55:00	141:21:00	40	165–180	496	105	11	45	2	..	..	..	..	150	13
Total Scandia—Trip 6				355	....	4,174	639	92	255	29	..	..	..	..	894	121
124	12 XII 26	58:55:00	141:21:00	16	165–185	161	35	3	3	2	..	..	..	..	38	5
125	12 XII 26	58:59:00	141:36:00	24	140–180	551	104	14	110	6	..	..	..	..	214	20
126	13 XII 26	58:59:00	141:36:00	42	135–180	581	126	20	62	7	..	..	..	..	188	27
127	15 XII 26	58:59:00	141:36:00	19	165–190	321	69	8	48	3	..	..	..	..	117	11
128	16 XII 26	58:59:00	141:36:00	33	160–190	558	92	8	79	13	..	..	..	..	171	21
129	17 XII 26	58:55:00	141:21:00	12	160–175	81	13	2	10	2	..	..	..	..	23	4
130	19 XII 26	58:39:00	140:58:00	27	135–180	268	65	7	38	5	..	..	..	..	103	12
Total Scandia—Trip 7				173	....	2,521	504	62	350	38	..	..	..	..	854	100
131	11 II 27	58:34:00	148:46:00	12	75–65	174	7	..	33	2	..	..	..	..	40	2
132	12 II 27	58:31:00	148:36:00	18	....	102	5	..	8	2	..	..	..	..	13	2
Total Scandia—Trip 8				30	....	276	12	..	41	4	..	..	..	..	53	4
133	7 XI 27	58:40:00	149:10:00	22	75–85	130	47	3	27	1	..	..	..	..	74	4
134	8 XI 27	58:18:00	150:17:00	22	....	116	38	3	11	..	..	..	..	..	49	3
135	8 XI 27	58:07:00	149:49:00	12	70–135	24	..	..	..	..	..	..	..	..	..	..
136	9 XI 27	58:04:00	149:02:00	31	60–85	230	95	10	11	1	..	..	..	..	106	11
137	10 XI 27	58:08:00	148:49:00	32	68	226	56	10	14	..	..	..	..	..	70	10
138	11 XI 27	58:12:00	149:06:00	56	68–70	525	159	19	43	2	..	..	..	..	202	21
139	12 XI 27	58:15:00	148:45:00	31	68–130	307	110	11	6	..	..	..	..	..	116	11
140	13 XI 27	58:11:00	148:47:00	42	68–120	386	126	13	19	1	..	..	..	..	145	14
141	14 XI 27	58:19:00	148:43:00	41	70–130	506	163	10	26	..	..	..	..	..	189	10
142	15 XI 27	58:20:00	148:42:00	41	90–160	447	129	5	32	2	..	..	..	..	161	7
143	16 XI 27	58:21:00	148:42:00	31	100–140	244	71	6	31	1	..	..	..	..	102	7
144	17 XI 27	59:06:00	141:17:00	8	....	11	..	..	..	..	..	..	..	..	..	..
Total Dorothy—Trip 1				369	....	3,152	994	90	220	8	..	..	..	..	1,214	98
145	5 XII 27	59:33:00	143:26:00	23	150–180	356	84	5	25	3	..	..	..	..	109	8
146	6 XII 27	59:33:00	143:26:00	39	150–180	906	70	1	55	5	..	..	..	..	125	6
147	7 XII 27	59:33:00	143:26:00	40	150–180	808	105	6	45	1	..	..	..	..	150	7
148	8 XII 27	59:33:00	143:26:00	35	150–180	564	62	5	31	2	..	..	..	..	93	7
149	9 XII 27	59:33:00	143:26:00	35	150–180	711	155	18	51	5	..	..	..	..	206	23

APPENDIX *A*. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
150	10 XII 27	59:33:00	143:26:00	34	150–180	807	165	11	76	5	..	..	..	..	241	16
151	11 XII 27	59:33:00	143:26:00	36	150–180	659	79	7	74	6	..	..	..	..	153	13
152	12 XII 27	59:33:00	143:26:00	40	160–180	578	88	6	59	5	..	..	..	..	147	11
153	13 XII 27	59:35:00	143:20:00	18	165–180	365	73	5	41	2	..	..	..	..	114	7
Total Dorothy—Trip 2				300	....	5,754	881	64	457	34	..	..	..	..	1,338	98
154	1 II 28	58:03:00	149:08:00	6	100–80	30	..	..	..	..	..	..	..	..	..	..
Total Dorothy—Trip 3				6	....	30	..	..	..	..	..	..	..	..	..	..
Total—All Fishing Trips				3,314	....	34,769	3,385	476	5,904	1,630	1,322	22	296	58	10,907	2,186

APPENDIX B.—*Detailed table of recoveries.*

Tag No.	Tagging Locality Number	Position Where Recaptured		Distance from Tagging to Recapture Location	Date of Recapture	Period of Liberty	Depth Where Recaptured	Length When Tagged	Length When Recaptured	Measured by	Where Seen
		N. Lat.	W. Long.	Miles		Days	Fms	Cm	Cm		
1	2	3	4	5	6	7	8	9	10	11	12
3	1	54:13	130:47	0	13 V 26	333	38	87.6	91.4	*[1]	....
4	2	52:35	132:00	140	11 VI 27	725	35	53.0	72.0	N.F.	Roller
6	2	54:14	131:36	16	13 IX 26	454	17	61.0	62.9	*	Cleaning
8	2	55:31	133:55	102	19 VI 27	733	50	60.0	73.0	*	Deck
9	2	54:41	132:01	33	3 IV 26	291	36	60.0	69.8	*	Cleaning
15	2	54:07	132:23	12	20 VII 26	399	18	58.0	61.0	*	Deck
26	2	54:10	132:06	3	8 VIII 27	783	30	65.0	68.6	*	....
30	2	54:09	131:51	8	28 VIII 25	73	18	66.0	...	...	....
31	2	54:10	131:50	9	24 VII 25	38	22	59.0	60.0	*	....
35	2	54:09	131:53	7	21 VII 25	35	30	68.0	68.5	*	....
36	2	54:10	132:06	3	6 VI 26	355	35	69.0	69.6	R.B.	Roller
38	2	54:06	131:56	5	29 VIII 25	74	35	61.0	61.9	*	....
40	2	55:24	134:05	103	28 VIII 25	73	65	66.0	66.0	*	....
47	2	54:35	131:12	41	26 VI 28	1106	20	71.0	82.0	N.F.	Deck
50	2	54:11	132:04	3	28 VII 25	42	35	68.0	67.3	*	....
52	2	54:08	132:09	4	13 VII 27	757	40	65.0	70.0	N.F.	Roller
53	2	54:10	132:34	18	13 VII 26	392	40	66.0	67.6	N.F.	L. S.[2]
58	2	54:47	131:26	44	7 IX 25	83	35	67.0	69.8	*	....
62	2	48:04	125:23	463	4 XI 26	506	72	63.0	69.3	H.L.	L. S.
68	2	54:16	132:26	15	4 XI 26	506	60	63.0	65.5	N.F.	Cleaning
71	2	54:09	132:03	1	19 VI 28	1099	40	67.0	82.0	N.F.	Cleaning
74	2	54:10	132:06	3	24 VI 27	738	30	69.0	78.7	*	Roller
77	2	54:07	132:22	11	20 VII 26	399	18	56.0	66.0	*	Deck
84	2	54:10	132:06	3	5 VI 26	354	35	65.0	65.6	R.B.	Roller
86	2	54:10	131:52	7	2 VIII 25	47	30	65.0	66.0	*	....
87	2	54:12	132:35	19	31 X 26	502	67	66.0	70.3	N.F.	L. S.
93	2	54:10	131:52	7	21 VII 25	35	30	66.0	66.0	*	....
95	2	54:09	132:31	16	7 VII 26	386	36	64.0	81.3	*	Cleaning
99	2	54:09	132:15	6	29 VII 26	408	28	63.0	67.3	N.F.	Deck
103	2	55:15	134:00	96	21 VIII 26	431	65	73.0	76.2	*	....
104	2	54:06	131:54	5	29 VIII 25	74	35	68.0	67.6	*	....
111	2	44:09	124:13	710	22 V 27	705	30	75.0	81.3	*	....
112	2	54:11	132:05	3	2 VIII 25	47	35	64.0	66.0	*	....
114	2	54:10	132:11	3	20 IX 26	461	30	59.0	63.3	N.F.	Roller
119	2	54:09	132:17	8	19 IX 26	460	45	62.0	66.0	*	Cleaning
120	2	54:41	132:39	39	27 VIII 27	802	25	73.0	82.0	N.F.	Roller
121	2	.....	.....	...	III–VIII 27	...	..	64.0	..	..[3]	....
122	2	52:40	132:10	135	21 IX 27	827	85	60.0	77.5	*	Cleaning
123	2	54:10	132:15	6	29 VII 26	408	28	51.0	57.3	N.F.	Deck
133	4	54:10	132:30	14	12 VII 26	390	30	69.0	73.4	N.F.	Cleaning
136	4	54:12	132:10	3	1 VIII 26	410	50	63.0	66.2	L.B.	Roller
138	4	54:10	132:06	1	7 VIII 27	781	30	61.0	68.6	*	....
149	4	54:10	132:05	1	5 VI 26	353	35	67.0	70.2	R.B.	Roller
152	4	54:12	132:10	2	1 VIII 26	410	50	58.0	60.5	L.B.	Roller
158	4	54:09	131:50	8	30 VIII 25	74	18	76.0	...	...	....
159	4	54:20	131:11	34	31 VII 25	44	30	77.0	76.2	*	....
168	4	55:23	134:04	99	6 V 27	688	69	64.0	69.7	N.F.	Cleaning
170	4	54:09	132:01	3	16 VII 26	394	..	61.0	62.5	*	....
171	4	....	.....	...	III–VIII 27	...	..	59.0	...	..[3]	....
172	4	54:09	132:01	3	16 VII 26	394	..	57.0	58.9	*	....
174	5	54:16	131:31	0	21 VII 27	763	30	59.5	68.6	*	Cleaning
176	5	54:15	131:28	2	4 VII 26	381	30	73.5	82.5	*	Deck
180	6	54:08	131:50	3	23 VI 25	5	15	70.0	68.5	*	....
182	6	54:08	131:58	2	22 VI 28	1100	20	78.0	104.0	N.F.	Cleaning
186	6	54:07	131:56	0	30 VII 28	1138	15	54.5	75.0	N.F.	Roller
193	6	54:07	131:49	4	5 VII 27	747	18	73.5	79.5	N.F.	Cleaning
194	6	54:07	131:50	4	27 IX 26	466	12	76.5	78.2	N.F.	Cleaning
209	6	54:10	132:05	7	25 VII 26	402	30	71.0	73.6	*	Roller
212	6	54:15	132:33	24	18 VIII 26	426	65	80.0	87.5	L.B.	Roller
213	6	54:09	131:54	2	29 VII 26	406	30	75.0	77.0	L.B.	Roller
214	6	54:10	132:06	7	26 VI 26	373	27	78.0	...	...	Deck
215	6	54:08	131:50	4	14 VIII 26	422	34	92.0	...	...	Roller
217	6	55:36	131:43	93	15 IV 26	301	25	79.0	86.3	*	Deck
218	7	54:41	132:01	33	13 IX 25	86	32	75.5	76.2	*	....
220	7	54:08	131:50	6	14 VII 25	25	25	76.5	76.2	*	....
225	7	54:09	131:57	2	6 V 26	321	34	67.0	35.5	*	Roller
228	7	54:10	132:10	5	9 X 26	477	37	72.0	...	...	....
229	7	54:10	132:05	4	26 VI 26	372	27	80.7	91.4	*	Deck
232	7	51:11	129:04	220	20 IV 27	670	40	58.5	68.6	*	Deck
237	7	54:10	132:05	3	21 VII 26	397	25	75.0	83.8	*	Roller
242	7	54:08	131:50	6	26 VIII 26	433	35	62.0	62.9	*	Roller
243	7	56:39	135:05	192	12 IV 26	297	75	65.5	71.1	N.F.	Cleaning
245	7	54:11	132:06	4	18 VII 26	394	28	67.8	...	...	Roller
246	7	44:28	124:31	660	23 VII 26	399	46	62.0	...	...	....
251	7	54:11	132:10	7	5 X 26	473	47	51.0	60.8	N.F.	L. S.
253	7	54:10	131:58	2	1 VIII 26	408	40	68.1	70.3	L.B.	Roller
254	7	54:08	131:58	2	31 VII 28	1138	6	47.5	59.0	N.F.	Roller
255	7	54:28	131:27	29	2 VIII 25	44	65	70.0	73.0	*	....
259	7	54:11	132:06	4	26 VI 26	372	27	65.1	68.5	*	Deck
260	7	54:10	132:10	6	18 VII 28	1125	18	59.5	81.0	N.F.	Roller
262	7	54:42	134:05	80	16 II 26	242	..	78.9	...	...	Cleaning
263	7	54:10	131:50	6	26 VIII 26	433	35	68.5	70.4	*	Roller

[1] Indicates fish measured by fisherman. [2] L.S.—Landing slip. [3] From scows and camps around Skeena and Nass Rivers.

APPENDIX B. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12
264	7	54:10	131:50	7	14 VIII 26	421	34	76.5	...	...	Roller
266	7	54:12	132:10	8	1 IX 27	804	48	63.0	69.5	N.F.	Cleaning
267	7	54:10	132:06	2	29 VII 27	770	30	55.0	68.6	*	Cleaning
272	7	54:12	132:10	7	1 VIII 26	408	63	66.7	72.7	L.B.	L. S.
273	7	54:10	131:51	6	13 VIII 25	55	30	...	55.8	*	....
274	7	54:10	132:06	4	18 VII 26	394	27	...	...	...	L. S.
275	7	54:10	131:51	6	13 VIII 25	55	30	...	60.9	*	....
276	7	54:07	132:10	5	19 VIII 25	61	18	...	83.8	*	....
277	7	54:10	131:50	7	6 VIII 25	48	30	...	71.1	*	....
282	7	54:40	132:40	39	18 VI 26	364	22	75.4	81.2	*	Roller
283	7	54:09	131:54	4	27 VII 26	403	33	68.0	69.8	L.B.	Roller
286	8	54:10	132:40	5	19 VII 26	394	40	72.2	77.7	N.F.	Roller
287	8	54:10	132:42	3	27 IX 26	464	..	69.5	67.3	*	....
288	8	54:10	132:38	5	16 VIII 26	422	38	64.6	67.8	L.B.	Roller
290	8	54:10	132:42	3	19 IX 26	456	40	73.4	83.8	*	....
299	8	54:11	132:40	4	12 VII 26	387	35	63.5	70.5	N.F.	Cleaning
301	8	54:12	132:52	4	18 VII 26	393	65	78.1	86.5	N.F.	Cleaning
302	8	54:10	132:35	7	2 VIII 26	408	50	78.8	81.8	L.B.	Roller
305	8	54:12	132:49	3	14 VII 26	389	65	65.6	67.8	N.F.	Cleaning
318	8	53:30	132:51	65	24 V 26	338	50	76.2	79.4	N.F.	Cleaning
322	8	....	.....	..	 27	...	..	70.3	...	...	....
329	8	54:10	132:42	2	1 X 26	468	..	65.0	74.9	*	....
330	8	54:10	132:30	9	5 VIII 25	46	35	65.4	66.0	*	....
331	8	....	.....	..	III–VIII 27	...	..	70.4	...	...	....[3]
335	8	54:09	132:28	10	15 VII 25	25	32	68.6	71.1	*	....
336	8	54:10	132:10	21	14 VII 25	24	26	76.0	...	...	Cleaning
337	8	54:10	132:46	0	10 VII 27	750	35	72.0	80.6	N.F.	Deck
338	8	53:45	133:20	39	14 V 27	693	80	65.0	69.5	N.F.	Roller
339	8	54:00	133:16	22	17 IV 26	301	38	76.8	82.5	*	Deck
343	8	54:08	132:09	22	5 IX 27	807	50	51.1	60.6	N.F.	Roller
344	8	54:10	132:40	4	12 VII 26	387	35	74.7	79.1	N.F.	Cleaning
348	8	54:41	132:05	39	7 V 26	321	40	65.5	67.6	*	Cleaning
349	8	54:10	132:37	6	29 VI 26	374	25	74.8	88.3	N.F.	Cleaning
350	8	....	.....	..	III–VIII 27	...	..	64.3	...	...	....[3]
353	8	54:12	132:39	6	13 VII 26	388	65	51.6	58.7	N.F.	Cleaning
355	8	....	.....	..	III-V 27	...	..	67.2	...	...	....[4]
356	8	53:53	130:55	84	29 IV 26	313	28	71.8	76.2	*	Cleaning
360	8	54:10	132:30	10	8 VIII 25	49	40	68.3	68.5	*	....
361	8	54:11	132:48	2	4 VIII 25	45	40	68.5	69.2	*	....
364	8	54:10	132:40	4	12 VII 25	22	16	74.4	...	...	Trolling
367	8	55:18	133:44	78	7 X 26	474	50	64.8	73.7	*	....
369	8	54:10	132:44	2	29 VI 26	374	25	66.7	72.2	N.F.	Cleaning
370	8	53:34	133:00	53	25 III 27	643	50	65.0	...	...	Cleaning
374	8	54:10	132:39	4	13 VI 27	723	30	64.1	76.5	N.F.	Deck
376	8	54:13	132:57	7	8 VII 26	383	..	69.5	...	...	....
378	8	54:09	132:38	5	1 VII 27	741	22	61.2	66.5	N.F.	Cleaning
379	8	54:10	132:44	2	30 VI 26	375	25	74.5	89.3	N.F.	Cleaning
380	8	54:41	132:01	41	24 IX 25	96	32	66.8	68.5	*	Cleaning
381	8	54:10	132:42	3	19 VII 27	759	25	71.3	83.0	N.F.	Deck
383	8	....	.....	..	III–VIII 27	...	..	63.7	...	...	....[3]
388	8	54:10	132:42	3	27 IX 26	464	..	71.3	76.2	*	....
389	8	54:12	132:49	3	14 VII 26	389	65	66.5	73.1	N.F.	Cleaning
390	8	54:10	132:44	2	29 VI 26	374	25	64.5	61.0	N.F.	Cleaning
391	8	54:10	132:44	2	29 VI 26	374	25	70.8	76.9	N.F.	Cleaning
392	8	54:41	132:01	41	11 IX 25	83	32	69.7	71.7	*	....
396	8	54:10	132:38	5	28 III 27	646	27	55.2	65.0	N.F.	Deck
397	8	54:11	132:40	2	13 VII 26	388	35	71.9	83.6	N.F.	Deck
398	8	54:10	132:43	2	1 X 26	468	..	67.2	76.2	*	....
401	8	54:10	132:40	5	19 VII 26	394	40	53.5	59.5	N.F.	Roller
402	8	54:10	132:46	0	10 VII 27	750	35	64.3	79.3	N.F.	Deck
403	8	54:41	132:01	41	 25	...	35	64.5	69.2	*	L. S.
407	9	54:11	132:56	1	22 VII 25	31	16	66.5	68.5	*	....
409	9	54:11	132:56	1	22 VII 25	31	16	65.2	64.1	*	....
410	9	54:09	133:11	10	14 VI 26	358	60	66.1	72.6	R.B.	Cleaning
415	9	54:13	133:08	8	15 X 28	1212	50	65.8	87.5	N.F.	Cleaning
419	10	54:47	133:36	50	31 III 26	283	45	65.2	57.1	*	....
420	10	....	.....	..	15 X 26	481	..	58.3	...	...	....[5]
422	10	48:29	125:02	472	25 IV 28	1039	45	66.5	75.2	O.E.	Cleaning
425	10	54:10	132:40	1	19 VII 26	393	40	62.8	66.7	N.F.	Roller
427	10	55:36	133:53	96	5 VIII 26	410	65	63.8	72.4	*	....
430	10	54:10	132:40	1	13 VII 26	387	25	64.1	74.3	N.F.	Roller
432	10	54:10	132:30	5	16 VIII 28	1152	35	59.4	71.5	N.F.	Deck
434	11	....	.....	..	.. VII 27	...	..	65.9	72.0	N.F.	L. S.
436	11	54:10	132:30	2	15 VIII 25	54	35	69.5	69.8	*	....
437	11	54:11	132:36	7	18 V 26	330	40	76.0	86.9	N.F.	Cleaning
439	11	54:11	132:36	7	18 V 26	330	40	69.6	79.2	N.F.	Cleaning
443	11	54:09	132:31	3	8 VII 26	381	36	67.7	78.7	*	Cleaning
445	11	54:10	132:31	4	14 V 26	326	35	78.5	91.4	*	Roller
446	11	....	.....	..	 28	...	..	65.2	...	...	Deck
453	12	54:07	132:29	8	1 IX 27	801	30	65.3	76.2	*	Roller
461	12	54:45	131:58	34	6 VI 26	349	40	70.1	73.6	*	Cleaning
463	13	54:09	131:50	3	24 VI 25	1	25	76.9	73.6	*	....
467	13	54:15	131:32	15	1 VII 26	373	30	78.5	81.3	*	Cleaning
469	13	54:09	131:50	3	20 VI 26	362	23	65.9	71.8	R.B.	Roller
470	13	54:07	131:49	2	27 VII 26	399	25	72.9	76.7	N.F.	Roller
475	13	52:55	130:25	105	31 V 28	1073	40	61.8	81.9	O.E.	Deck
476	13	54:10	131:50	3	3 VIII 25	41	30	68.8	68.6	*	....
477	13	44:24	124:11	683	20 VI 27	727	30	65.7	...	...	Roller
481	13	54:07	131:56	2	30 VII 28	1133	15	62.1	75.0	N.F.	Roller
485	13	54:08	131:51	2	3 VIII 28	1137	15	58.6	67.5	N.F.	Roller
487	13	54:07	131:49	2	25 IX 27	824	40	63.8	72.5	N.F.	Cleaning
489	13	54:08	131:51	2	3 VIII 28	1137	15	55.2	65.0	N.F.	Roller

[4] Found in shipment of fish at Trochu, Alberta. [5] Shipment of frozen fish.

APPENDIX B. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12
492	13	53:47	131:06	50	27 V 26	338	40	70.8	72.2	*	Cleaning
493	13	54:14	132:01	9	26 VII 26	398	20	76.6	76.6	N.F.	Cleaning
501	13	54:11	132:04	8	15 VIII 28	1149	35	72.6	84.5	N.F.	Roller
502	13	54:08	131:50	2	14 VII 25	21	25	67.0	68.6	*	....
505	13	54:10	131:51	4	14 VIII 26	417	34	69.7	80.2	L.B.	Roller
506	13	54:08	131:50	3	16 VI 27	723	23	72.8	80.7	N.F.	Roller
511	13	54:10	131:51	3	6 V 26	317	34	66.7	25.4	*	Roller
512	13	54:08	131:50	2	23 VIII 26	426	15	69.0	71.1	*	Roller
513	16	51:54	129:22	81	14 VII 26	378	55	71.5	76.2	L.B.	Deck
514	16	52:53	130:37	6	15 V 26	318	36	69.8	...	...	Deck
515	16	53:02	130:41	5	11 VI 26	345	44	78.7	81.3	*	Cleaning
516	16	52:54	130:55	7	5 VII 25	4	30	74.8	76.2	*	....
519	16	52:45	131:04	17	16 VI 27	715	65	64.5	72.0	N.F.	Cleaning
520	16	52.56	130.40	3	3 VII 25	2	40	67.5	67.6	*	....
521	16	52:54	130:49	4	28 VII 27	757	40	71.0	81.2	O.E.	Roller
526	16	53:04	130:49	7	29 VI 27	728	55	71.4	73.5	O.E.	Roller
527	16	53:04	130:49	7	29 VI 27	728	55	65.0	74.0	O.E.	Roller
530	16	52:54	129:45	36	24 VI 27	724	50	66.1	75.4	O.E.	Deck
531	16	52:58	130:40	3	12 V 26	315	42	70.3	72.7	F.B.	Deck
536	16	53:01	130:33	9	1 VIII 26	396	47	67.7	72.7	W.T.	Cleaning
544	16	52:01	129:56	63	6 IX 25	67	65	70.8	72.4	*	....
546	16	52:59	130:52	4	9 VII 28	1104	35	61.0	84.2	W.H.	Deck
547	16	52:47	130:34	13	19 VII 27	748	50	62.2	70.5	O.E.	Cleaning
548	16	52:53	130:37	7	16 V 26	319	36	67.1	97.8	*	L. S.
550	16	53:04	130:49	7	28 VI 27	727	55	66.6	97.8	O.E.	Roller
557	16	52:51	130:53	8	16 VI 28	1081	35	76.2	92.2	O.E.	Deck
559	16	52:58	130:40	3	12 V 26	315	43	69.7	74.1	F.B.	Deck
563	16	52:58	130:42	2	1 VI 26	335	45	69.6	72.4	*	Deck
568	16	52:50	130:44	7	11 VII 27	740	35	70.1	82.0	N.F.	Cleaning
570	16	52:58	130:42	2	30 V 26	333	45	69.0	71.1	*	Deck
574	16	53:01	130:37	6	20 VI 28	1085	45	60.8	77.9	O.E.	Deck
577	16	52:57	130:42	2	10 VIII 26	405	45	54.4	61.6	*	Deck
583	16	53:01	130:33	9	3 VIII 26	398	47	72.9	77.7	W.T.	....
588	16	52:58	130:42	2	30 V 26	333	45	68.3	69.8	*	Deck
590	16	52:41	130:55	17	11 VII 26	375	45	76.0	91.4	*	Cleaning
594	16	53:04	130:55	9	4 VIII 26	399	47	69.9	...	...	....
595	16	52:55	130:43	2	21 VI 27	720	54	74.7	...	...	L. S.
601	16	54:00	130:55	62	17 IV 26	290	45	78.1	78.7	*	Deck
604	16	51:45	129:34	84	21 IX 27	812	52	69.1	83.2	O.E.	Roller
606	16	52:16	131:00	42	31 VII 26	395	..	75.9	...	...	Deck
609	16	52:50	130:52	8	25 V 26	328	34	57.8	...	...	Deck
612	16	52:22	129:51	47	16 IX 27	807	95	66.6	87.9	O.E.	Deck
613	16	53:04	130:55	9	1 VIII 26	396	47	59.2	65.9	W.T.	Cleaning
620	17	48:54	125:34	314	20 V 27	687	21	65.6	...	...	Deck
624	17	51:46	129:28	83	15 VII 26	378	55	61.7	75.3	*	Cleaning
627	17	52:58	130:42	2	1 VI 26	334	45	64.8	67.6	*	Deck
628	17	52:52	130:40	4	17 V 26	319	35	70.7	74.9	*	Cleaning
632	19	52:31	131:16	3	2 VII 26	364	65	75.8	88.6	*	Roller
639	20	53:01	130:37	29	22 VI 28	1084	45	56.9	72.9	O.E.	Cleaning
640	20	52:38	131:05	0	30 V 27	695	50	68.0	76.2	*	Roller
643	20	52:35	130:57	5	16 IV 26	286	50	75.2	78.7	F.B.	L. S.
650	20	52:37	131:08	2	8 VIII 25	35	55	62.5	73.6	*	....
654	20	52:19	130:03	42	24 IX 26	447	65	71.6	76.8	L.B.	Deck
658	20	51:30	128:42	113	12 V 26	312	40	66.4	67.2	H.D.	Cleaning
661	20	51:31	129:22	91	22 IX 27	810	55	52.7	63.2	H.L.	Cleaning
674	23	54:48	131:33	51	7 V 27	670	40	71.5	99.1	*	Deck
675	23	53:57	131:07	4	21 VI 27	715	42	69.1	80.1	N.F.	Roller
684	24	53:57	131:02	6	6 VIII 27	758	50	81.7	99.0	N.F.	Cleaning
685	24	54:22	131:03	20	9 VII 26	365	35	70.0	74.8	N.F.	Cleaning
688	24	54:19	130:58	18	3 IX 26	421	40	66.6	82.2	L.B.	L. S.
690	24	53:55	130:57	9	7 IV 26	272	23	54.0	60.9	*	....
692	24	53:57	131:02	5	25 VII 26	381	48	56.0	67.0	N.F.	Cleaning
700	24	53:34	131:02	27	7 VIII 28	1125	28	49.0	64.5	N.F.	Cleaning
702	25	....	.....	..	 27	...	..	61.9	...	...	....[6]
703	25	53:58	131:02	3	19 VII 25	9	40	70.0	76.2	*	....
709	26	54:41	132:04	0	7 IV 26	268	36	71.9	81.2	*	Cleaning
710	26	54:41	132:04	0	31 VII 25	18	35	65.2	66.6	*	....
712	26	54:41	132:04	0	28 VII 25	15	35	71.1	71.1	*	....
714	26	54:40	132:05	2	6 VII 28	1089	35	68.4	83.0	N.F.	Deck
715	26	54:41	132:04	0	22 X 25	101	32	72.5	81.9	*	Deck
717	26	54:41	132:04	0	3 IV 26	264	36	73.9	83.8	*	Cleaning
718	26	54:41	132:04	0	13 IX 25	62	50	69.6	48.2	*	....
719	26	54:41	132:04	0	10 X 25	89	45	68.5	69.8	*	....
720	26	54:41	132:04	0	25 X 25	104	37	71.5	76.2	*	Roller
721	26	54:41	132:04	0	24 V 26	315	..	65.2	72.8	N.F.	L. S.
722	26	54:41	132:04	0	16 VIII 25	34	35	61.0	60.9	*	....
723	26	54:41	132:02	2	3 VI 28	1056	35	73.9	...	...	Deck
726	26	54:41	132:04	0	17 VI 26	339	40	70.1	75.8	R.B.	Cleaning
727	26	54:41	132:04	0	3 VIII 26	386	35	62.5	70.8	L.B.	Roller
728	26	54:41	132:04	0	30 VII 26	382	45	67.4	71.1	*	Deck
729	26	54:41	132:04	0	9 VIII 26	392	..	72.9	82.3	L.B.	Roller
730	26	54:41	132.04	0	7 X 25	86	42	69.0	74.3	*	....
731	26	54:41	132:04	0	24 VII 25	11	36	66.6	55.9	*	....
734	26	54:41	132:04	0	24 X 25	103	37	68.6	73.0	*	Roller
736	26	54:41	132:04	0	26 VIII 25	44	35	68.0	71.1	*	....
737	26	54:41	132:04	0	22 X 25	101	36	67.8	68.5	*	Roller
738	26	54:41	132:04	0	 25	...	..	66.0	...	...	....
739	26	54:41	132:04	0	18 VI 26	340	35	74.0	76.8	N.F.	Cleaning
741	26	54:41	132:04	0	19 VIII 25	37	..	58.3	58.4	*	....
742	26	54:41	132:04	0	30 VII 25	17	35	65.8	66.0	*	....
744	26	54:41	132:04	0	21 V 26	312	57	65.8	68.5	*	....
748	26	54:41	132:04	0	14 IX 25	63	32	71.1	72.4	*	....

[6] Found in shipment of halibut to Vancouver, B. C.

APPENDIX B. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12
749	26	54:42	132:15	7	1 IX 26	415	35	74.3	79.6	L.B.	Roller
752	26	54:41	132:04	0	28 X 25	107	37	72.1	82.5	*	Roller
753	26	54:41	132:04	0	4 IV 26	265	36	76.4	78.7	*	Deck
754	26	54:41	132:04	0	24 X 25	103	37	70.7	72.4	*	Roller
755	26	54:41	132:04	0	9 IX 25	58	..	65.0	...	...	....
756	26	54:41	132:04	0	18 V 26	309	35	72.3	77.4	*	Roller
757	26	54:41	132:04	0	10 VIII 26	393	..	75.7	86.6	L.B.	Roller
758	26	54:41	132:04	0	21 VIII 25	39	45	69.2	74.9	*	....
760	26	54:41	132:04	0	7 IV 26	268	36	60.2	69.8	*	Roller
761	26	54:41	132:04	0	22 X 25	101	32	70.9	80.0	*	Deck
762	26	54:41	132:04	0	22 IV 26	283	35	65.1	70.4	*	Roller
764	26	54:41	132:04	0	29 VIII 26	412	35	65.9	76.8	L.B.	Roller
765	26	54:41	132:24	0	7 X 25	86	42	74.0	76.5	*	....
766	26	54:41	132:04	0	20 II 26	222	35	68.5	...	...	Deck
767	26	54:41	132:04	0	9 IX 25	58	..	77.4	...	...	....
768	26	54:41	132:04	0	30 VII 25	17	35	76.3	76.2	*	....
769	26	....	.....	..	III–VIII 27	...	..	66.2	...	...	....[3]
770	26	54:41	132:04	0	13 VI 26	335	33	64.6	67.9	N.F.	Cleaning
771	26	54:41	132:04	0	22 X 25	101	37	66.6	71.1	*	Roller
772	26	54:41	132:04	0	14 VI 26	336	35	73.4	76.3	N.F.	Cleaning
774	26	54:41	132:04	0	5 IX 26	419	35	77.9	90.9	L.B.	Roller
775	26	54:41	132:04	0	15 VII 25	2	..	62.2	...	...	....
776	26	54:41	132:04	0	18 V 26	309	35	68.3	72.4	*	Roller
778	26	54:41	132:04	0	16 VI 26	338	40	68.1	74.4	R.B.	Cleaning
779	26	54:41	132:04	0	8 III 26	238	35	78.1	85.1	*	Roller
780	26	54:41	132:04	0	17 IX 25	66	36	71.1	72.4	*	....
781	26	54:41	132:04	0	3 IV 26	264	36	72.2	78.7	*	Deck
783	26	54:41	132:04	0	15 IX 25	64	36	57.1	59.7	*	....
784	26	54:41	132:04	0	21 V 26	312	57	71.0	66.0	*	....
785	26	54:41	132:04	0	26 X 25	105	37	70.9	80.6	*	Roller
786	26	54:41	132:04	0	21 VIII 25	39	..	73.2	73.6	*	....
787	26	54:41	132:04	0	11 IX 25	60	32	70.3	73.6	*	....
788	26	54:41	132:04	0	17 VI 26	339	36	74.1	80.0	*	Roller
792	26	54:41	132:04	0	12 IX 25	61	32	69.9	73.6	*	....
794	26	54:41	132:04	0	3 IV 26	264	36	78.0	87.0	*	Deck
795	26	54:41	132:04	0	9 VIII 25	27	35	61.1	61.6	*	....
796	26	54:41	132:04	0	25 X 25	104	37	57.0	63.5	*	Roller
799	26	54:41	132:04	0	15 VII 25	2	..	65.3	...	...	....
801	26	54:41	132.04	0	21 V 26	312	57	60.4	60.9	*	....
802	26	54:41	132:04	0	24 VII 25	11	36	54.1	58.4	*	....
804	26	54.41	132:04	0	7 IV 26	268	36	70.6	73.7	*	Deck
807	27	54:41	132:04	0	19 VIII 26	401	45	74.9	80.7	L.B.	Roller
808	27	54:41	132:04	0	26 VII 25	12	35	65.8	67.3	*	....
810	27	54:41	132:04	0	14 IX 25	62	32	61.7	62.8	*	....
812	27	54:41	132:04	0	4 IV 26	264	36	69.0	71.1	*	Roller
814	27	54:41	132:04	0	3 IV 26	263	36	67.9	74.3	*	Roller
815	27	54:41	132:04	0	9 X 26	452	36	64.2	83.8	N.F.	....
818	27	54:41	132:04	0	5 IX 26	418	35	54.3	58.8	L.B.	Roller
820	27	54:41	132:04	0	25 VIII 25	42	36	63.1	66.0	*	....
821	27	54:41	132:04	0	16 VI 26	337	32	62.5	70.4	N.F.	Cleaning
822	27	54:41	132:04	0	9 IX 25	57	..	62.4	...	...	....
826	27	54:41	132:04	0	28 X 25	106	37	67.4	76.2	*	Roller
828	27	54:41	132:04	0	23 VII 25	9	36	74.0	64.7	*	....
831	27	54:41	132:04	0	13 IX 25	61	32	61.8	62.2	*	....
832	27	54:41	132:04	0	5 VIII 26	387	45	67.0	72.0	L.B.	Roller
835	27	54:41	132:04	0	17 VI 26	338	35	63.2	76.0	N.F.	Cleaning
836	27	54:41	132:04	0	30 VIII 26	412	50	69.3	76.2	*	....
837	27	54:41	132:04	0	20 VIII 25	37	..	61.9	63.5	*	....
838	27	54:41	132:04	0	16 V 26	306	33	68.7	73.6	*	Cleaning
840	27	54:37	132:05	4	19 IX 27	797	72	76.3	83.8	*	Roller
841	27	54:41	132:04	0	14 IX 25	62	..	68.6	...	...	L. S.
843	27	54:41	132:04	0	.. V 26	...	32	76.4	...	...	Cleaning
844	27	54:41	132:04	0	2 VII 26	353	36	70.9	73.6	*	Deck
846	27	54:41	132:04	0	.. V 26	...	35	81.8	...	...	L. S.
852	27	54:41	132:04	0	3 VIII 26	385	35	64.9	70.8	L.B.	Roller
853	27	54:41	132 04	0	9 IX 25	57	35	68.5	69.8	*	....
854	27	54:41	132:04	0	30 VII 26	381	45	81.6	87.6	*	Deck
858	27	54:41	132:04	0	3 IV 26	263	36	66.0	70.5	*	Cleaning
863	27	54:41	132:04	0	7 IV 26	267	36	70.0	76.2	*	Deck
864	27	54:41	132:04	0	30 VII 25	16	35	71.6	72.4	*	....
865	27	54:41	132:04	0	21 VIII 25	38	45	78.9	84.4	*	....
866	27	54:41	132:04	0	14 IX 25	62	..	69.1	...	...	L. S.
867	27	54:41	132:04	0	19 VIII 26	401	45	76.0	85.8	L.B.	Roller
868	27	54:41	132:04	0	22 VII 25	8	35	71.0	...	...	....
869	27	54:41	132:04	0	9 IX 25	57	..	66.5	...	...	....
870	27	54:41	132:04	0	23 IX 25	71	32	76.2	79.3	*	Cleaning
871	27	54:41	132:04	0	14 IX 25	62	32	71.0	74.9	*	....
872	27	54:41	132:04	0	9 IX 25	57	..	66.0	...	...	....
873	27	54:41	132:04	0	1 VII 26	352	40	77.6	81.4	N.F.	Cleaning
874	27	54:41	132:04	0	7 VIII 26	399	..	62.0	66.3	L.B.	Roller
876	27	54:41	132:04	0	21 V 26	311	32	67.4	73.0	*	Cleaning
877	27	54:41	132:04	0	31 VII 25	17	35	59.6	60.9	*	....
878	27	54:41	132:04	0	30 VII 26	381	45	75.0	82.7	L.B.	Roller
879	27	54:41	132:04	0	22 V 26	312	33	69.3	70.4	*	Cleaning
882	27	54:41	132:04	0	14 IX 25	62	32	73.8	74.9	*	....
883	27	54:41	132:04	0	10 IX 25	58	35	71.1	71.7	*	....
887	27	54:41	132:04	0	5 XI 25	114	45	62.9	66.0	*	....
888	27	....	.....	..	III–VIII 27	...	..	77.1	...	...	....[3]
889	27	54:41	132:04	0	4 VI 26	325	35	65.7	72.3	*	Cleaning
890	27	54:41	132:04	0	4 VIII 26	386	35	73.5	78.8	L.B.	Roller
893	27	54:41	132:04	0	24 VII 25	10	36	78.2	76.2	*	....
898	27	54:41	132:04	0	4 VIII 26	386	35	73.5	76.8	L.B.	Roller

APPENDIX B. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12
900	27	54:41	132:04	0	13 X 25	91	18	75.7	43.0	*	Trolling
902	27	54:41	132:04	0	28 X 25	106	37	67.0	67.3	*	Roller
903	27	54:41	132:04	0	7 IV 26	267	36	73.6	78.7	*	Deck
904	27	54:06	133:46	72	27 V 26	317	130	72.4	76.8	*	Cleaning
905	27	54:41	132:04	0	16 V 26	306	35	74.7	80.0	*	Roller
906	27	54:41	132:04	0	4 IV 26	264	36	71.1	76.2	*	Deck
907	27	54:41	132:04	0	5 VIII 26	387	45	60.0	62.3	L.B.	Deck
908	27	54:41	132:04	0	4 IV 26	264	36	76.2	80.0	*	Deck
909	27	54:41	132:04	0	5 VIII 26	387	45	70.9	75.7	L.B.	Roller
910	27	54:41	132:04	0	16 VI 26	337	40	64.5	72.0	R.B.	Cleaning
911	27	54:41	132:04	0	30 VII 25	16	35	69.5	69.8	*	....
912	27	54:41	132:04	0	.. V 26	...	35	76.2	...	...	L. S.
913	27	54:41	132:04	0	20 VIII 25	37	..	64.1	64.7	*	....
914	27	54:41	132:04	0	24 X 25	102	37	71.9	78.7	*	Roller
915	27	54:41	132:04	0	7 X 25	85	42	66.0	74.2	*	....
919	27	54:41	132:04	0	7 X 25	85	43	74.8	77.1	*	....
921	27	54:41	132:04	0	22 IV 26	282	35	64.5	74.9	*	Roller
922	27	54:41	132:04	0	17 V 26	307	32	73.6	...	...	L. S.
923	27	54:41	132:04	0	7 IV 26	267	36	73.7	81.3	*	Deck
924	27	54:41	132:04	0	15 VII 25	1	36	67.5	69.2	*	....
925	28	54:41	132:05	0	16 V 26	305	35	66.1	67.3	*	Roller
926	29	54:18	131:59	23	4 XI 25	111	90	70.9	76.2	*	....
928	29	54:41	132:05	1	4 VIII 27	749	30	74.8	83.8	*	Roller
929	29	54:41	132:01	0	9 IX 25	55	..	69.3	...	...	....
942	31	53:46	133:12	15	20 VI 26	335	70	64.5	67.7	R.B.	L. S.
945	31	54:03	133:19	3	12 V 27	661	50	69.1	79.3	N.F.	Cleaning
946	31	48:53	125:35	434	3 XI 27	836	..	68.5	...	...	....
948	31	54:35	131:12	83	18 VI 27	698	15	76.6	94.5	N.F.	Cleaning
951	31	54:10	132:49	18	15 VI 27	695	35	58.5	69.5	N.F.	L. S.
956	32	54:12	131:32	80	14 III 27	602	10	53.1	61.5	N.F.	Cleaning
966	32	54:39	132:11	.72	11 X 26	448	82	62.1	69.9	N.F.	Cleaning
972	32	54:41	132:00	76	17 VI 26	332	40	66.2	68.6	R.B.	Cleaning
974	32	53:46	133:07	0	26 VI 26	341	35	62.6	62.2	IFC.	Cleaning
976	34	53:45	133:07	0	28 IV 27	645	30	64.6	70.4	N.F.	Deck
977	34	53:46	133:08	2	16 VII 26	359	32	63.1	69.1	N.F.	Cleaning
980	34	53:46	133:07	1	25 V 26	307	30	63.3	65.5	R.B.	Cleaning
984	34	54:40	132:03	76	17 VIII 26	391	..	56.6	61.4	L.B.	Roller
985	34	50:56	128:42	241	14 III 26	235	35	64.3	67.3	*	....
989	34	53:46	133:07	1	24 V 26	306	30	61.3	62.8	R.B.	Cleaning
992	34	53:48	133:11	4	6 VI 26	319	30	62.0	56.6	R.B.	Roller
993	34	53:45	133:11	2	1 VII 26	344	68	68.6	69.8	*	Deck
994	34	53:46	133:08	2	17 VII 26	360	32	60.9	76.3	N.F.	Cleaning
995	34	53:44	133:11	3	24 VI 27	702	90	63.0	73.8	N.F.	Cleaning
999	34	53:46	133:07	2	19 IV 28	1002	35	56.7	72.5	N.F.	Deck
1000	34	52:56	130:35	160	22 VI 27	700	50	63.4	71.7	O.E.	Roller
1004	34	53:46	133:07	1	25 V 26	307	30	61.4	66.1	R.B.	Cleaning
1016	34	53:46	133:07	1	25 V 26	307	31	65.0	65.5	R.B.	Cleaning
1017	34	51:00	128:58	238	20 V 28	1033	45	63.2	101.3	O.E.	Cleaning
1020	34	53:46	133:08	2	19 IV 28	1002	35	58.7	76.0	N.F.	Deck
1021	34	53:46	133:08	2	7 VI 26	320	45	61.0	64.3	R.B.	Cleaning
1022	34	53:46	133:08	2	7 VI 26	320	45	67.5	72.1	R.B.	Cleaning
1024	34	53:45	133:05	0	17 V 27	664	40	63.5	69.3	N.F.	Cleaning
1025	34	53:46	133:07	1	25 V 26	307	30	66.7	69.8	R.B.	Cleaning
1029	34	53:46	133:08	2	14 VII 26	357	30	60.1	66.0	N.F.	Roller
1031	34	53:49	133:17	7	8 IV 28	991	75	60.7	71.5	N.F.	Cleaning
1035	34	55:38	133:56	115	1 VIII 26	375	64	59.6	65.4	N.F.	Roller
1040	34	56:06	134:59	163	15 IV 27	632	110	58.1	65.0	N.F.	Deck
1046	34	53:46	133:10	3	21 VII 26	364	76	63.7	64.7	*	Deck
1048	34	53:46	133:08	2	16 VII 26	359	32	59.8	61.0	N.F.	Cleaning
1051	34	54:09	133:39	30	26 IX 26	431	130	59.7	38.7	*	Roller
1054	34	53:45	133:07	0	20 V 26	302	45	62.8	63.5	N.F.	Cleaning
1059	34	53:46	133:10	3	13 VI 28	1057	75	64.2	76.5	N.F.	Cleaning
1061	34	53:46	133:10	3	22 VI 26	335	76	68.3	71.1	*	Deck
1065	34	54:40	132:03	75	3 VIII 26	377	35	67.5	72.3	L.B.	Roller
1067	34	54:16	133:34	37	14 X 25	84	140	66.5	69.8	*	....
1068	34	53:30	132:43	23	10 X 25	80	60	63.7	66.0	*	....
1069	34	53:45	133:08	1	20 V 27	667	30	68.1	78.9	N.F.	Deck
1070	34	53:45	133:10	0	1 VII 26	344	68	60.6	68.6	*	Deck
1071	34	53:46	133:07	1	25 V 26	307	30	64.0	67.3	R.B.	Cleaning
1073	34	54:08	133:45	32	11 X 26	446	135	62.5	72.0	N.F.	Cleaning
1075	34	54:41	132:01	76	4 IV 26	256	36	60.8	64.1	*	Deck
1077	34	53:48	133:11	3	6 VI 26	319	30	62.6	66.0	R.B.	Roller
1080	34	57:08	135:51	227	17 VI 27	695	..	65.2	...	...	Deck
1084	34	53:25	132:40	30	27 VII 25	5	65	64.0	76.2	*	....
1108	34	....	.....	...	III–VIII 27	...	..	61.0	...	...	.... [3]
1110	34	54:00	131:19	100	19 V 27	666	17	62.7	...	...	Deck
1112	34	53:46	133:08	2	18 IV 28	1001	35	55.6	77.0	N.F.	Deck
1119	34	53:45	133:07	0	7 IV 27	624	35	57.3	68.9	N.F.	Deck
1133	35	53:30	132:52	4	18 VII 26	360	50	60.0	63.5	*	Cleaning
1136	35	51:46	129:25	184	19 VI 26	331	44	56.9	...	...	Dory
1143	35	53:46	133:10	20	23 VI 26	335	76	58.7	64.1	*	Deck
1148	35	53:30	132:48	5	15 VI 26	327	55	68.5	73.7	R.B.	Roller
1151	36	51:30	129:30	172	27 V 26	308	30	65.6	73.6	*	Deck
1161	36	54:41	132:01	103	28 IX 26	432	40	...	61.0	*	Trolling
1167	40	53:08	132:30	0	28 VIII 28	1130	35	71.2	109.0	N.F.	Roller
1180	43	....	.....	..	11 IV 28	988	..	99.2	113.1	O.E.	Dock
1181	43	51:27	129:26	105	5 X 27	800	50	59.8	78.0	O.E.	Roller
1188	44	51:32	129:15	21	27 IX 26	426	45	65.8	78.7	*	Deck
1190	44	52:01	129:01	9	23 VII 26	360	55	67.7	71.7	*	Deck
1199	44	51:42	129:24	16	19 VIII 26	387	60	62.7	65.8	R.B.	Roller
1203	45	53:02	130:31	8	23 VI 27	693	50	65.8	67.9	O.E.	Cleaning
1212	45	52:58	130:40	3	12 V 26	286	42	61.2	64.3	F.B.	Deck

APPENDIX B. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12
1214	45	53:02	130:41	5	10 VI 26	315	44	55.1	58.4	*	Cleaning
1217	45	53:12	131:05	20	22 VI 27	692	55	59.2	70.0	O.E.	Cleaning
1220	45	52:47	130:34	13	8 VI 27	678	48	54.9	63.8	O.E.	Cleaning
1228	45	52:58	130:40	3	12 V 26	286	42	61.7	69.2	F.B.	Deck
1231	45	53:00	130:56	8	31 V 27	670	40	62.1	71.7	*	Cleaning
1232	45	52:20	129:58	47	7 IX 27	769	105	61.3	78.9	O.E.	Roller
1241	45	52:56	130:53	5	2 VII 28	1068	33	58.2	75.0	N.F.	L. S.
1247	45	52:58	130:40	3	12 V 26	286	43	65.5	66.7	F.B.	Deck
1251	45	53:41	131:05	45	1 VI 26	306	27	61.4	62.7	R.B.	Roller
1258	45	53:02	130:33	10	2 VIII 26	368	47	52.1	...	...	....
1259	45	52:58	130:40	3	12 V 26	286	42	64.5	72.0	F.B.	Deck
1262	45	52:50	130:44	7	11 VII 27	711	35	58.0	70.5	N.F.	Cleaning
1265	45	52:58	130:40	3	12 V 26	286	43	64.7	66.7	F.B.	Deck
1274	45	50:56	128:42	143	9 III 26	222	35	54.1	60.9	*	....
1280	45	....	.....	..	19 VI 28	1055	..	59.5	...	...	....
1286	48	51:45	129:03	9	11 V 26	279	32	64.2	71.0	*	....
1288	48	51:43	129:21	4	10 V 26	278	70	66.9	78.4	*	Roller
1291	48	51:54	129:22	13	16 VII 26	345	55	60.7	69.4	L.B.	Deck
1293	48	51:06	128:40	41	5 VI 28	1035	37	61.7	77.1	O.E.	Roller
1294	48	51:48	129:03	10	29 III 26	236	32	66.2	...	...	Roller
1297	50	52:57	130:42	208	1 VIII 26	357	45	65.1	66.0	*	Deck
1298	50	55:27	134:02	14	18 VI 27	678	61	67.8	73.8	N.F.	Roller
1299	50	55:38	133:56	3	23 VII 26	346	60	62.8	64.1	*	Deck
1304	50	55:38	133:56	3	25 VII 26	350	60	68.3	63.5	*	Deck
1311	50	55:43	133:52	3	18 III 26	221	90	70.6	74.9	*	Cleaning
1316	51	55:37	133:57	2	7 VI 26	301	56	63.7	65.7	*	....
1317	51	55:21	134:02	17	5 IX 26	391	64	69.8	73.0	*	Deck
1320	51	55:34	133:44	6	6 VI 28	1031	7	48.4	45.7	*	Cleaning
1321	51	55:34	133:44	6	22 V 28	1016	20	64.0	77.5	N.F.	Roller
1326	51	55:33	133:59	8	1 VII 27	690	50	70.3	75.9	R.B.	Deck
1327[7]	51	55:43	133:43	19	1 VIII 26	356	..	61.7	63.0	IFC.	Deck
1328	51	55:34	133:55	3	18 VIII 27	738	55	64.0	70.8	O.E.	Deck
1331	51	55:15	134:14	25	29 IV 28	993	95	62.9	69.5	O.E.	Roller
1337	51	55:38	133:56	2	19 VII 26	343	60	64.1	64.7	*	Deck
1338	51	....	.....	..	III–VIII 27	...	..	62.3	...	...	....[3]
1339	51	55:23	134:06	17	30 V 27	658	70	63.8	68.4	N.F.	Roller
1340	51	55:50	134:48	33	25 VII 27	714	83	62.1	67.9	*	....
1341	51	55:35	133:54	5	16 VI 27	675	56	65.9	71.0	N.F.	Roller
1344	51	55:38	133:57	2	18 VII 26	342	64	69.0	72.4	*	....
1349	51	55:31	133:48	6	30 III 26	232	40	66.9	66.0	*	....
1350	51	55:35	133:59	6	13 V 27	641	65	62.2	66.0	*	Cleaning
1357	51	....	.....	..	27	...	..	66.5	69.0	N.F.	....
1359	51	55:38	133:56	2	24 VII 26	348	60	63.1	66.0	*	Cleaning
1360	51	55:38	133:56	2	24 VII 26	348	60	62.8	64.1	*	Deck
1363	51	55:38	133:56	2	20 VII 26	344	60	67.6	66.0	*	Deck
1373	57	54:07	133:38	240	2 XI 26	150	135	97.6	99.2	N.F.	L. S.
1374	57	51:46	129:25	20	7 V 27	336	50	72.5	74.4	O.E.	Roller
1375	57	51:44	129:04	11	4 VII 26	29	35	90.0	88.9	H.L.	Deck
1376	58	51:53	128:56	2	2 VII 26	26	32	73.0	72.6	IFC.	Deck
1378	57	51:52	128:57	2	18 VI 27	378	30	65.0	70.7	O.E.	Cleaning
1380	57	51:41	128:53	12	6 V 28	701	30	73.2	87.5	O.E.	Deck
1381	57	51:54	130:22	54	19 X 27	501	160	65.0	84.5	H.L.	Deck
1383	57	51:40	129:07	15	28 III 27	296	30	77.9	79.0	O.E.	Roller
1384	57	51:53	128:52	1	3 VI 27	363	22	71.7	79.1	O.E.	Deck
1391	57	51:49	128:53	3	15 VII 26	40	32	70.5	71.1	*	Cleaning
1393	57	51:54	129:22	17	16 VII 26	41	55	80.0	80.1	L.B.	Deck
1396	57	51:51	128:52	2	21 V 27	350	31	77.1	81.4	O.E.	Roller
1399	57	51:47	129:23	19	19 VIII 26	75	51	74.3	75.8	R.B.	Deck
1400	57	51:45	129:25	20	12 V 27	341	70	86.9	90.3	O.E.	....
1402	57	51:54	128:54	2	21 V 27	350	31	79.8	87.6	O.E.	Roller
1403	57	51:57	128:55	5	21 IV 27	320	32	64.7	68.0	O.E.	Roller
1411	57	51:57	128:55	5	28 III 27	296	32	76.5	79.6	O.E.	Roller
1412	57	51:49	128:55	4	19 VII 26	44	32	65.9	66.0	*	Deck
1413	57	51:57	128:55	5	28 III 27	296	32	57.8	62.2	O.E.	Roller
1414	57	51:59	128:48	7	14 V 27	343	60	73.0	80.1	O.E.	Roller
1415	57	51:47	128:56	6	22 II 27	262	50	65.9	67.6	*	....
1417	57	51:59	128:48	7	14 V 27	343	60	75.0	81.8	O.E.	Roller
1422	57	51:53	128:52	1	24 IV 27	323	30	65.9	70.1	O.E.	Roller
1424	57	51:53	128:52	1	24 IV 27	323	30	66.5	72.1	O.E.	Roller
1427	57	51:45	129:14	15	30 IX 26	117	55	71.7	72.9	R.B.	Roller
1429	57	51:53	128:52	1	18 VI 27	378	25	61.3	66.7	O.E.	Roller
1431	57	51:53	128:56	2	2 VII 26	27	32	58.3	60.7	IFC.	Deck
1433	57	51:52	128:57	2	18 VI 27	378	30	63.7	74.2	O.E.	Cleaning
1435	57	51:41	129:21	20	30 VII 26	55	55	71.4	72.9	F.B.	Dory
1438	57	51:57	128:53	5	7 IV 27	306	30	58.0	64.4	O.E.	Roller
1443	58	51:39	128:44	14	15 V 27	343	30	91.9	92.1	O.E.	Deck
1446	58	51:50	129:03	6	17 VII 26	41	30	71.9	70.8	L.B.	Roller
1450	58	51:53	128:52	1	24 IV 27	322	30	60.4	69.1	O.E.	Roller
1452	58	51:56	128:55	3	18 VI 27	377	30	69.0	70.6	O.E.	Roller
1453	58	51:52	128:55	1	12 VI 28	737	30	73.8	81.8	H.L.	Cleaning
1455	58	51:42	129:24	21	19 VIII 26	74	60	84.1	87.2	R.B.	Roller
1456	58	51:53	128:53	0	16 V 27	344	28	68.1	40.6	*	Trolling
1461	58	51:53	128:56	2	2 VII 26	26	32	65.9	65.5	IFC.	Deck
1463	58	51:52	128:57	2	22 VI 28	747	30	68.3	77.9	H.L.	Cleaning
1467	58	51:49	128:55	3	17 VII 26	41	30	75.5	75.2	*	Deck
1468	58	51:56	128:55	3	18 VI 27	377	30	73.2	83.2	O.E.	Roller
1470	58	51:40	129:32	27	23 VIII 26	78	45	68.4	70.0	R.B.	Deck
1475	58	51:46	129:25	20	11 VIII 26	66	50	63.0	64.8	*	....
1476	58	51:49	128:53	3	15 VII 26	39	32	69.8	71.1	*	Deck
1478	58	51:47	128:56	6	22 II 27	261	50	69.8	72.4	*	...
1479	58	51:29	129:24	30	10 IX 28	827	50	69.8	85.1	E.P.	Deck
1480	58	51:53	128:53	0	23 IV 28	687	33	69.6	81.4	O.E.	Roller

[7]Recaptured during 1926 tagging operations and re-liberated.

APPENDIX B. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12
1481	58	51:38	128:54	14	27 IV 27	325	29	69.6	73.6	O.E.	Deck
1484	58	51:44	129:02	10	3 VII 26	27	35	68.0	68.6	H.L.	Deck
1485	58	52:05	130:07	46	5 VIII 27	425	70	65.7	81.5	O.E.	Roller
1486	58	51:43	129:02	19	7 IX 27	458	50	71.2	80.7	O.E.	Roller
1487	58	51:56	128:55	3	18 VI 27	377	30	64.4	70.3	O.E.	Roller
1488	58	51:51	129:00	4	26 IV 27	324	35	71.6	75.9	O.E.	Roller
1492	58	51:52	128:57	2	22 VI 28	747	30	69.9	81.0	H.L.	Cleaning
1493	58	51:42	129:36	28	2 VIII 26	57	55	70.0	70.7	N.F.	Cleaning
1494	58	51:56	128:55	3	19 VI 27	378	30	74.4	78.1	O.E.	Roller
1498	58	52:23	129:48	45	16 IX 26	102	75	77.8	80.0	*	....
1501	2	54:05	131:48	10	17 X 27	853	6	85.0	90.5	N.F.	Roller
1502	15	53:20	130:26	19	25 VII 27	755	30	84.0	119.0	N.F.	Roller
1507	2	54:10	131:51	8	25 VII 26	404	35	70.0	73.0	N.F.	Cleaning
1509	2	54:09	131:50	7	13 VIII 25	58	30	64.0	81.2	*	....
1510	2	54:13	132:10	6	8 VIII 27	783	65	73.0	76.5	N.F.	Cleaning
1512	2	54:10	131:51	7	21 VII 25	35	30	67.0	68.5	*	....
1516	2	....	.....	..	.. 26	...	..	73.0	...	...	L. S.
1520	2	54:10	132:06	3	6 VI 26	355	35	70.0	73.3	R.B.	Roller
1521	2	54:09	131:50	8	28 VIII 25	73	18	69.0	...	...	....
1522	2	54:10	131:51	7	6 VIII 25	51	30	...	68.6	*	....
1523	2	54:10	132:05	2	21 VII 26	400	25	70.0	71.1	*	Roller
1524	2	48:11	125:34	450	4 VI 27	718	85	71.0	80.0	H.L.	....
1526	2	54:08	132:00	3	23 IX 26	464	40	71.0	70.5	IFC.	Roller
1528	2	54:10	132:42	23	25 IX 26	466	40	77.0	82.6	*	....
1530	2	54:09	132:31	17	8 VII 26	387	36	72.0	76.2	*	Cleaning
1538	3	54:07	132:08	2	7 IX 25	,82	12	113.0	121.9	*	....
1539	3	54:07	132:12	0	30 IV 27	682	23	84.0	87.6	*	Deck
1540	3	54:11	132:04	5	8 IX 26	448	25	78.0	87.1	L.B.	Roller
1544	3	54:10	132:10	3	24 VII 25	37	30	70.0	69.8	*	....
1546	4	54:10	132:10	3	3 IX 25	78	30	79.0	78.7	*	....
1547	6	57:12	135:58	240	22 II 26	249	65	132.0	125.1	*	....
1550	6	55:31	134:20	118	1 III 26	256	105	87.5	91.4	*	....
1555	6	54:16	132:35	25	10 VII 26	387	65	89.0	98.0	N.F.	Deck
1557	6	54:14	132:01	7	26 III 28	1012	15	90.0	114.0	N.F,	Roller
1558	6	54:16	131:33	16	14 VIII 26	422	30	97.0	117.0	L.B.	Roller
1561	7	54:07	131:49	7	5 VII 27	746	18	78.5	90.8	N.F.	Roller
1562	7	54:10	131:47	7	2 IX 26	440	25	73.0	81.3	L.B.	Roller
1566	7	54:41	132:01	33	13 IX 25	86	32	85.6	86.3	*	....
1569	8	54:10	132:30	10	27 VIII 25	68	30	82.8	86.3	*	....
1573	8	54:07	133:38	31	22 X 25	124	150	86.3	137.1	*	Deck
1575	8	54:13	132:41	5	26 IX 25	98	60	93.6	96.8	*	....
1576	8	54:08	133:44	37	14 XI 26	512	150	95.7	101.5	N.F.	Deck
1578	8	54:10	132:44	2	30 VI 26	375	25	88.0	90.7	N.F.	Cleaning
1579	8	54:10	132:42	3	19 VII 27	759	25	97.4	105.0	*	Deck
1581	8	54:12	132:34	8	3 IX 26	440	70	108.4	119.4	*	Cleaning
1582	8	54:22	133:27	27	22 II 26	247	150	83.6	87.6	*	Roller
1585	8	54:12	132:49	3	14 VII 26	389	65	97.1	101.6	N.F.	Cleaning
1586	8	54:11	132:48	2	7 VIII 25	48	40	81.5	82.5	*	....
1587	8	54:10	132:44	1	29 VI 26	374	25	85.0	88.4	N.F.	Cleaning
1588	9	54:13	132:57	1	3 VII 25	12	20	82.7	85.0	*	....
1589	9	54:08	131:56	36	5 VII 28	1110	..	100.1	...	...	....
1591	10	54:09	132:29	6	15 VII 25	24	33	70.9	73.6	*	....
1594	11	54:12	132:36	7	5 VII 25	13	57	97.0	99.1	*	....
1596	11	54:12	132:43	11	27 IX 26	462	35	96.6	99.1	*	....
1597	13	54:18	131:58	12	28 X 26	492	90	99.6	115.5	N.F.	Cleaning
1598	13	54:07	131:49	2	27 IX 26	461	10	88.1	89.5	N.F.	Roller
1599	13	....	.....	...	III–IX 26	...	..	80.8	...	...	....[8]
1602	13	54:08	131:51	2	18 VI 26	360	60	82.7	76.2	*	....
1605	13	54:15	132:33	26	6 XI 28	1232	70	84.3	103.5	N.F.	Roller
1606	13	54:08	131:49	2	26 VI 26	368	19	86.8	83.2	N.F.	Roller
1609	16	52:57	130:37	5	25 VII 26	389	45	81.1	94.5	N.F.	Deck
1612	16	....	.....	..	VIII 28	...	..	93.6	...	...	Fish House
1613	16	....	.....	..	III–VIII 27	...	..	82.7	...	...	....[8]
1616	16	52:57	130:42	2	10 VIII 26	405	45	85.2	103.5	*	Deck
1620	16	52:54	130:37	6	14 VII 25	13	30	81.9	83.3	H.D.	....
1622	16	52:43	131:11	21	24 V 26	327	30	86.8	111.7	*	....
1624	16	52:59	130:37	5	14 V 27	682	57	91.1	97.6	O.E.	Deck
1625	17	52:54	130:55	7	7 VII 25	5	30	81.8	...	...	....
1626	17	52:54	130:49	4	17 V 26	319	32	85.0	91.4	*	Dory
1628	17	52:57	130:45	2	21 V 28	1054	50	93.2	101.9	O.E.	Deck
1629	17	52:49	130:31	12	23 VII 26	386	45	78.4	86.8	N.F.	L. S.
1633	19	52:22	131:08	7	25 V 28	1057	38	85.1	110.5	N.F.	Deck
1636	19	52:51	131:13	22	30 IV 26	300	17	101.0	111.7	*	Roller
1637	19	52:29	131:13	1	16 VI 26	348	70	104.3	114.4	R.B.	Cleaning
1639	20	52:31	130:47	12	19 VIII 25	46	65	105.9	108.5	*	....
1640	20	52:42	130:59	6	5 VIII 26	397	..	91.5	96.9	F.B.	....
1642	20	52:47	130:36	20	10 IX 25	68	72	81.6	86.3	*	....
1643	20	....	.....	..	1 IX 25	59	..	101.0	...	...	....
1646	20	52:35	130:57	5	16 IV 26	286	50	89.3	93.0	F.B.	Dory
1651	22	....	.....	..	28	...	..	108.7	...	...	Fish House
1654	24	54:21	130:54	21	8 VII 27	729	58	80.6	119.0	N.F.	Cleaning
1657	25	53:57	131:02	4	10 VII 26	365	48	92.1	107.8	N.F.	Cleaning
1659	26	54:41	132:04	0	16 VI 26	338	40	89.5	89.7	R.B.	Cleaning
1660	26	54:49	131:57	10	25 VII 26	377	20	84.0	107.3	*	Roller
1663	26	54:41	132:04	0	3 VIII 26	386	35	82.2	85.0	L.B.	Roller
1664	26	58:00	138:18	298	19 V 27	675	105	84.5	84.7	N.F.	L. S.
1666	26	54:21	130:59	44	5 V 27	661	40	81.5	85.0	N.F.	Deck
1667	26	54:41	132:04	0	26 X 25	105	37	76.6	84.4	*	Roller
1668	26	....	.....	..	X 26	...	..	80.1	...	...	Dock
1671	26	54:41	132:04	0	6 III 26	236	40	77.9	91.4	*	Cleaning
1672	26	54:16	131:28	35	3 III 26	233	18	80.0	86.3	*	Deck
1673	26	54:41	132:04	0	10 X 25	89	45	80.4	...	...	....

[8] In scow of salmon and halibut.

APPENDIX B. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12
1675	26	54:41	132:04	0	9 IX 25	58	30	78.6	...	...	Trolling
1676	26	54:35	132:07	5	7 VIII 28	1121	72	82.8	103.0	N.F.	Roller
1678	26	54:41	132:04	0	30 VIII 26	413	50	79.0	80.0	*	....
1682	27	54:41	132:04	0	9 IX 25	57	..	83.0	...	...	....
1684	27	54:41	132:04	0	8 IX 25	56	35	79.4	83.1	*	....
1686	27	54:41	132:04	0	5 VIII 26	387	45	79.1	83.5	L.B.	Deck
1687	27	54:41	132:04	0	27 VIII 25	44	..	79.1	81.2	*	....
1689	27	54:41	132:04	0	14 IX 25	62	32	86.6	87.6	*	....
1690	27	54:41	132:03	0	3 VIII 26	385	35	80.7	86.5	L.B.	Roller
1691	27	54:41	132:04	0	12 IX 25	60	32	78.8	72.4	*	....
1693	27	54:41	132:04	0	21 V 26	311	57	81.5	55.8	*	....
1694	27	54:41	132:04	0	5 VIII 26	387	45	85.8	88.3	L.B.	Roller
1698	32	53:46	133:10	5	22 VII 26	367	76	75.8	81.2	*	Deck
1699	34	....	.....	..	26	...	..	74.0	78.1	N.F.	....
1705	34	53:46	133:08	0	18 VI 26	331	27	69.2	79.2	R.B.	Roller
1707	34	53:49	133:08	4	16 VII 26	359	32	71.5	72.0	N.F.	Cleaning
1708	34	53:41	133:07	4	22 IV 27	639	50	72.8	82.3	N.F.	Cleaning
1711	34	53:30	132:44	26	24 V 26	306	50	104.2	110.0	N.F.	Cleaning
1714	34	53:46	133:08	3	5 VI 26	318	45	71.1	74.4	R.B.	Cleaning
1716	34	55:27	134:07	102	6 VIII 26	380	59	75.5	74.9	*	Deck
1718	34	53:45	133:08	1	20 V 27	667	30	71.0	77.7	N.F.	Deck
1719	35	53:34	133:00	5	26 VII 25	3	50	80.0	81.2	*	....
1720	35	48:29	125:00	430	20 V 26	301	..	75.4	77.5	F.B.	Roller
1721	35	53:30	132:52	1	12 VI 26	324	60	73.7	77.4	*	Deck
1722	35	54:06	133:25	38	18 VII 27	725	105	83.2	89.3	N.F.	Roller
1726	36	55:20	134:11	131	29 VIII 26	402	85	98.1	106.6	*	Deck
1728	36	53:27	132:50	5	4 IX 27	773	68	72.0	83.0	N.F.	Roller
1731	36	54:00	133:27	46	5 VII 27	712	45	74.7	85.5	N.F.	Cleaning
1732	36	....	.....	..	27	...	..	73.0	...	...	....
1736	37	53:24	132:40	4	27 VI 26	338	80	93.3	98.0	R.B.	Roller
1737	40	55:33	134:52	170	16 III 27	599	112	106.4	111.5	N.F.	Cleaning
1744	41	53:08	132:30	2	30 III 27	612	30	74.9	86.0	N.F.	Roller
1748	41	53:07	132:27	3	18 V 27	661	40	126.4	141.5	N.F.	Roller
1755	43	52:25	131:36	4	10 IV 26	257	40	86.1	91.4	*	....
1756	43	48:32	125:49	323	28 V 26	305	35	74.0	73.6	*	....
1757	43	52:28	131:42	0	14 X 25	79	40	76.4	78.7	*	Roller
1758	43	52:28	131:42	0	10 IV 26	257	40	87.4	88.9	*	....
1759	43	52:28	131:42	0	10 IV 26	257	40	73.9	73.7	*	....
1761	43	52:28	131:42	0	18 IX 26	418	87	71.5	76.2	*	Roller
1762	43	52:27	131:42	1	14 X 25	79	40	75.3	78.7	*	Roller
1764	43	52:25	131:42	5	3 V 27	645	55	76.5	83.6	N.F.	Cleaning
1765	43	52:28	131:42	0	10 IV 26	257	40	81.8	78.7	*	....
1767	43	52:28	131:42	0	10 IV 26	257	40	111.8	121.8	*	....
1770	44	51:53	128:49	10	31 VII 27	733	50	71.2	76.2	*	Deck
1773	44	51:54	129:17	8	27 IV 26	273	60	71.4	...	...	Dory
1775	44	51:53	128:56	6	2 VII 26	339	32	71.2	75.5	IFC.	Deck
1776	44	51:33	129:10	20	3 V 26	279	28	70.8	78.7	*	Roller
1777	44	51:55	129:01	4	17 IV 26	263	45	75.5	81.2	H.L.	Cleaning
1778	44	51:58	129:05	6	13 V 27	654	55	70.6	76.2	*	....
1780	45	52:57	130:45	1	18 V 26	292	45	72.0	73.0	*	Dory
1781	45	52:57	130:45	1	18 V 26	292	45	71.5	74.9	*	Dory
1782	45	52:58	130:42	2	1 VI 26	306	45	72.5	76.2	*	Deck
1784	45	52:58	130:42	2	1 VI 26	306	45	64.5	69.2	*	Deck
1785	45	52:58	130:42	2	1 VI 26	306	45	71.9	72.4	*	Deck
1790	45	53:04	130:47	7	28 VI 27	698	55	70.0	76.7	O.E.	Roller
1795	45	....	.....	..	III–VIII 27	...	..	82.2	...	...	....[3]
1798	45	52:49	130:31	13	19 VII 26	354	44	77.9	83.9	N.F.	Cleaning
1802	46	54:03	131:07	11	30 III 26	242	16	80.6	86.3	*	Deck
1808	47	51:51	129:00	6	31 III 26	238	..	71.8	76.8	*	Cleaning
1809	47	51:38	129:29	17	26 VIII 25	21	52	71.0	70.4	*	....
1810	48	52:01	129:56	32	22 VIII 25	17	65	85.2	85.1	*	....
1812	48	51:52	128:50	19	17 III 26	224	34	77.0	81.2	*	....
1814	48	51:50	129:08	10	16 IV 26	254	50	83.0	87.0	W.T.	Cleaning
1817	48	51:48	129:05	9	8 IV 27	611	..	79.5	105.2	O.E.	....
1818	48	51:41	128:46	18	27 III 26	234	22	99.8	106.6	W.T.	....
1819	48	51:33	129:15	9	28 III 26	235	30	72.8	73.6	*	....
1820	48	51:55	129:01	16	18 IV 26	256	45	71.2	78.7	W.T.	Cleaning
1823	48	51:12	129:04	31	15 VIII 27	740	70	94.5	101.7	O.E.	Roller
1826	50	50:38	133:56	3	20 VII 26	345	60	75.8	70.4	*	Deck
1827	50	55:40	133:50	1	21 VII 27	711	65	82.1	87.0	N.F.	Roller
1829	50	55:37	133:54	2	10 IX 28	1128	34	112.2	152.0	N.F.	Roller
1830	50	55:27	134:05	15	6 VIII 26	362	57	77.0	76.8	*	Dory
1838	51	55:38	133:56	2	21 VII 26	345	60	72.4	74.9	*	Deck
1839	51	55:36	133:56	4	31 VII 26	355	..	70.2	72.0	IFC.	Deck[7]
1841	51	55:31	133:48	6	30 III 26	232	40	71.7	71.1	*	....
1842	51	55:36	133:53	4	29 VII 26	353	..	75.5	77.9	IFC.	Deck[7]
1843	51	54:16	132:38	93	29 IX 25	50	65	71.9	77.4	*	....
1845	51	55:38	133:57	2	16 VII 26	340	64	70.2	73.6	*	....
1846	51	55:36	133:56	4	31 VII 26	355	..	71.9	73.8	IFC.	Deck[7]
1847	51	55:39	133:57	3	4 VIII 26	359	60	71.6	73.0	*	Dory
1848	51	55:23	134:06	17	30 V 27	658	70	71.1	77.0	N.F.	Roller
1850	51	55:44	134:31	22	24 III 26	226	110	74.8	76.2	*	....
1851	51	55:38	133:56	2	17 VII 26	341	60	71.9	74.3	*	Deck
1854	51	55:38	133:56	2	20 VII 26	344	60	83.1	85.7	*	Deck
1855	51	55:37	133:57	2	10 VI 26	304	56	76.1	79.6	*	....
1856	51	55:38	133:56	2	18 VII 26	342	60	83.9	89.5	*	Deck
1863	114	51:01	128:59	673	26 IV 28	525	35	78.5	82.4	O.E.	Roller
1866	114	58:27	139:10	73	7 V 27	170	120	106.9	106.7	*	Roller
1871	114	....	.....	..	27	...	..	123.4	...	...	....
1875	114	59:39	143:49	88	30 X 28	712	160	117.5	127.0	N.F.	Cleaning
1876	114	59:36	143:14	71	29 X 27	345	132	77.7	78.0	N.F.	Cleaning
1877	114	59:28	146:28	165	16 VII 28	606	40	78.4	83.9	E.P.	Roller

APPENDIX B. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12
1883	114	58:57	140:51	16	27 X 28	709	120	106.5	121.9	*	....
1899	114	59:02	140:42	21	20 VIII 28	641	90	77.1	82.5	N.F.	Deck
1902	114	59:01	141:07	8	11 XI 27	358	135	72.6	73.2	N.F.	Cleaning
1904	114	59:01	141:07	8	12 XI 27	359	135	77.8	77.4	N.F.	Cleaning
1909	114	59:01	141:07	8	9 XI 27	356	135	68.7	69.7	N.F.	Deck
1910	114	59:01	141:07	8	11 XI 27	358	135	75.4	75.7	N.F.	Cleaning
1912	114	59:36	143:14	71	30 X 27	346	132	91.9	95.2	N.F.	L. S.
1913	114	....	.....	..	III–VIII 27	...	..	82.8	...	...	....[3]
1926	115	58:49	153:16	381	26 VI 28	585	10	108.5	114.0	N.F.	L. S.
1933	115	59:31	146:22	162	25 VII 28	614	35	108.5	114.0	N.F.	L. S.
1952	115	57:41	149:35	305	23 II 27	96	230	88.4	...	...	Cleaning
1956	115	....	.....	..	III–VIII 27	...	..	75.2	...	...	....[3]
1957	115	58:36	138:55	78	9 III 27	110	91	79.5	84.5	*	Roller
1959	115	58:41	138:43	78	15 V 28	543	60	72.3	...	...	Deck
1961	115	59:46	151:56	370	27	...	20	79.9	81.3	N.F.	Dory
1964	115	51:40	129:20	620	28 VI 27	221	60	91.4	93.0	O.E.	Roller
1981	116	59:02	148:02	218	23 X 27	337	115	80.3	88.9	*	Deck
1987	116	55:10	156:30	582	10 IV 28	507	85	94.4	97.5	N.F.	Dory
1989	116	58:06	148:50	285	5 X 27	319	90	96.0	...	..	L. S.
1993	116	55:56	154:11	493	22 IX 27	306	80	102.0	103.1	O.E.	Roller
1995	116	....	.....	..	27	...	83	90.1	91.6	N.F.	Roller
2001	116	59:21	141:07	26	27 V 28	554	145	75.2	77.0	N.F.	Cleaning
2002	116	59:18	141:39	23	2 VI 28	560	110	91.5	193.7	*	....
2023	117	58:19	137:58	94	23 III 28	488	80	80.0	81.0	N.F.	Cleaning
2026	117	52:55	131:49	483	28 VII 27	249	40	78.9	82.7	O.E.	Roller
2038	117	59:01	141:07	22	9 XI 27	353	135	80.7	...	...	L. S.
2043	117	58:40	138:54	65	17 V 28	543	60	71.4	...	...	Deck
2045	117	56:57	134:30	266	9 VIII 28	627	60	92.3	111.8	N.F.	Deck
2047	117	58:36	138:55	64	9 III 27	108	91	88.2	94.0	*	Roller
2053	117	59:00	149:03	265	17 III 27	116	150	83.5	...	...	Cleaning
2058	117	56:53	153:22	450	9 VII 28	596	75	96.4	106.5	N.F.	Cleaning
2061	117	56:05	134:49	263	19 III 27	118	120	110.4	111.7	N.F.	L. S.
2070	117	58:12	138:41	75	18 III 27	117	122	86.4	85.5	N.F.	Cleaning
2082	118	58:33	139:11	71	26 III 27	124	90	78.3	88.3	*	Cleaning
2090	118	59:01	141:07	8	7 XI 27	350	135	87.0	88.5	N.F.	Cleaning
2097	118	58:33	139:11	71	26 III 27	124	90	81.5	80.0	*	Cleaning
2106	118	59:18	141:23	24	24 X 28	702	115	80.8	84.5	N.F.	Deck
2108	118	50:58	128:47	675	12 IV 28	507	45	87.8	99.1	O.E.	Roller
2113	118	54:40	159:24	700	20 V 27	179	..	91.0	93.2	N.F.	L. S.
2115	118	56:02	153:48	472	20 VIII 28	637	65	99.0	106.1	O.E.	L. S.
2131	118	58:50	148:57	240	5 IV 28	500	140	84.2	85.0	N.F.	Cleaning
2135	118	57:23	151:10	350	9 XI 28	718	40	69.8	71.0	N.F.	Cleaning
2141	118	55:36	134:03	314	4 VI 27	194	50	70.5	69.3	N.F.	Cleaning
2158	119	58:15	149:23	287	27 II 28	461	..	96.5	78.7	*	Cleaning
2164	119	58:50	140:09	34	14 IV 28	508	100	84.1	89.5	N.F.	Cleaning
2176	121	58:52	141:30	8	7 XI 27	348	180	95.4	97.8	H.L.	Roller
2181	121	56:36	155:18	488	27 V 28	550	35	80.0	83.2	*	Deck
2197	121	59:26	143:19	59	6 XI 27	347	153	79.9	82.0	N.F.	Cleaning
2213	121	58:34	138:17	107	7 VII 27	225	50	90.2	90.6	N.F.	L. S.
2226	121	59:43	143:05	62	12 XI 27	353	150	86.8	89.6	*	L. S.
2238	121	54:33	160:33	703	28 IV 27	155	60	98.1	94.0	*	Roller
2248	121	58:02	148:52	275	5 X 27	315	90	89.2	91.0	O.E.	L. S.
2258	122	59:43	144:16	93	12 V 27	168	80	96.2	98.0	N.F.	L. S.
2259	122	55:40	156:15	554	14 III 28	475	105	97.5	101.0	N.F.	L. S.
2277	122	59:37	142:29	48	7 XI 27	347	200	85.2	89.5	*	Cleaning
2289	122	59:02	140:42	26	8 VI 28	561	105	75.3	79.0	N.F.	Cleaning
2296	122	56:09	134:44	281	25 VII 28	608	45	81.5	...	...	L. S.
2309	122	59:02	149:00	225	2 III 27	97	120	83.1	83.0	N.F.	L. S.
2310	122	....	.....	..	27	...	..	82.2	...	...	Fish House
2314	122	56:59	152:38	395	23 VII 28	606	80	93.7	99.4	E.P.	Cleaning
2315	122	54:19	161:59	755	12 VI 28	565	45	96.0	97.8	*	Deck
2327	122	....	.....	..	20 XI 28	726	..	95.5	...	...	....
2333	122	48:29	125:32	865	4 VI 27	191	35	82.0	82.0	O.E.	Roller
2335	122	56:12	157:53	570	12 VI 28	565	70	97.2	97.9	O.E.	Deck
2339	122	57:27	151:40	354	10 X 28	685	47	100.3	...	...	L. S.
2346	122	58:32	148:44	243	10 IV 28	507	90	98.7	104.1	*	L. S.
2348	122	....	.....	..	III–VIII 27	...	..	89.3	...	...	....[3]
2349	122	59:27	144:50	105	26 VIII 27	274	110	118.1	122.5	N.F.	L. S.
2354	122	55:10	157:31	615	22 V 27	178	50	92.5	92.7	N.F.	Cleaning
2357	122	58:58	141:57	10	14 XI 27	354	170	102.5	108.5	N.F.	Cleaning
2369	122	57:55	149:23	274	19 X 28	694	80	77.8	83.8	*	Cleaning
2372	122	56:52	151:42	380	6 VIII 27	254	50	89.9	91.3	N.F.	Roller
2383	122	59:42	143:03	62	5 X 27	314	160	83.5	86.4	*	L. S.
2384	122	54:33	160:33	703	28 IV 27	154	60	93.6	96.8	*	Roller
2386	122	58:41	138:43	85	17 V 28	539	60	77.0	...	...	Deck
2407	123	60:13	146:41	183	22 IX 28	666	125	111.7	123.0	N.F.	Deck
2412	123	58:06	148:50	277	20 III 28	480	150	96.0	102.2	*	....
2420	123	59:11	147:16	182	18 V 27	173	95	89.5	91.4	*	Cleaning
2427	123	58:47	149:46	280	12 III 28	472	115	83.0	91.4	*	....
2430	123	59:36	143:42	83	8 XI 27	347	210	79.9	80.5	N.F.	Cleaning
2458	123	58:56	149:30	260	2 IV 28	493	125	94.0	100.0	N.F.	L. S.
2462	123	58:20	149:51	283	24 VIII 28	637	55	101.4	111.8	*	Cleaning
2473	123	57:58	153:01	400	8 VIII 27	255	55	79.2	78.7	*	Cleaning
2475	123	56:28	152:53	430	7 VI 27	193	35	84.8	84.9	N.F.	Deck
2476	123	58:29	139:15	70	24 IV 27	149	95	76.0	78.6	N.F.	Cleaning
2490	123	59:29	143:11	66	5 XI 27	344	180	90.9	92.9	H.D.	Roller
2512	124	58:32	148:44	240	23 IV 27	132	70	87.8	88.9	N.F.	Deck
2520	124	58:57	140:16	35	9 VIII 27	240	105	106.4	114.4	*	Roller
2527	124	54:19	133:30	383	17 III 27	95	160	110.8	110.4	N.F.	Deck
2538	125	59:29	143:29	64	12 X 27	304	165	81.7	82.9	N.F.	L. S.
2539	125	58:06	148:50	275	26 X 27	318	95	80.2	80.6	N.F.	Deck
2541	125	58:48	149:53	268	27 IX 27	289	85	75.9	77.3	N.F.	Cleaning

APPENDIX B. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12
2547	125	57:43	150:40	315	10 VI 27	180	53	75.0	...	...	L. S.
2554	125	59:17	147:48	197	23 IX 27	285	90	94.9	99.0	N.F.	Cleaning
2558	125	59:02	141:22	8	4 IX 28	632	122	114.6	...	...	Cleaning
2564	125	58:04	138:31	111	8 XI 27	331	180	75.9	...	...	Cleaning
2574	125	....	.....	..	28	...	..	85.6	90.5	O.E.	....
2603	125	....	.....	..	7 V 28	512	..	83.8	86.1	O.E.	Fish House
2609	125	55:32	159:25	645	16 VI 27	186	78	91.3	91.2	N.F.	L. S.
2610	125	57:01	152:39	400	18 VI 28	554	80	83.0	89.0	N.F.	Deck
2614	125	57:52	149:34	278	15 III 27	93	140	86.8	86.4	*	Deck
2616	125	56:40	156:29	535	28 VII 27	228	60	97.8	96.3	N.F.	Deck
2626	125	55:32	159:25	645	16 VI 27	186	78	82.0	81.9	N.F.	Cleaning
2644	126	58:53	141:25	8	15 XI 27	337	170	75.0	75.5	N.F.	L. S.
2646	126	56:45	153:36	445	2 IX 27	263	70	103.6	...	...	Roller
2654	126	58:21	149:28	264	20 VIII 28	616	45	93.6	99.1	*	....
2656	126	....	.....	..	III–VIII 27	...	..	93.9	...	...	....[3]
2672	126	56:09	153:52	480	9 IX 27	270	90	90.1	76.2	*	Deck
2685	126	54:45	158:52	670	21 IV 27	129	50	83.3	83.0	O.E.	Cleaning
2698	126	58:49	153:05	350	11 IX 27	272	97	92.0	93.5	N.F.	L. S.
2699	126	59:02	148:01	206	28 X 28	685	120	86.0	...	...	Dock
2704	126	58:28	150:00	300	III 27	...	..	95.7	97.3	N.F.	L. S.
2706	126	57:39	154:36	444	14 VII 28	579	125	94.2	...	...	Deck
2714	126	....	.....	..	27	...	..	98.8	100.3	*	Roller
2716	126	58:43	149:26	256	25 II 28	439	105	102.2	...	...	Deck
2719	126	58:16	149:28	285	29 II 28	443	42	79.2	79.5	N.F.	Deck
2721	126	54:39	159:06	660	18 V 27	156	55	84.9	84.9	N.F.	Roller
2734	126	56:04	154:24	479	15 V 28	519	90	93.0	101.6	*	....
2738	126	60:19	146:46	193	24 VI 27	193	120	106.2	...	...	....
2749	126	54:40	159:24	675	9 VI 28	544	45	95.3	98.0	O.E.	Cleaning
2755	126	58:04	149:17	270	13 III 27	90	..	98.5	97.5	N.F.	L. S.
2756	126	....	.....	..	28	...	..	100.2	...	...	....
2759	126	59:31	143:36	70	31 X 27	322	180	81.4	84.0	N.F.	L. S.
2769	127	59:12	148:00	204	23 IV 27	129	120	83.2	84.3	N.F.	Roller
2772	127	59:24	142:02	29	17 VIII 28	611	110	79.3	81.3	*	Roller
2786	127	56:26	156:35	542	25 VI 27	192	100	85.8	85.8	N.F.	Cleaning
2790	127	56:43	151:51	392	15 VII 27	212	30	84.4	88.9	*	Cleaning
2799	127	59:37	143:07	60	30 X 27	319	132	81.5	83.0	N.F.	Cleaning
2805	127	58:53	151:00	300	10 VI 28	543	69	92.3	99.5	N.F.	Cleaning
2817	127	58:24	149:31	259	20 II 28	432	..	80.0	...	...	L. S.
2824	127	56:31	152:00	414	11 X 27	300	135	94.2	...	...	Deck
2853	128	52:41	130:55	515	17 V 27	152	45	92.9	92.6	O.E.	Deck
2854	128	58:46	149:27	257	17 III 28	457	140	89.5	91.0	N.F.	Deck
2856	128	54:45	158:00	655	13 VII 27	209	65	91.0	94.9	*	Cleaning
2867	128	57:43	146:43	161	13 III 27	87	110	104.8	106.4	N.F.	Roller
2869	128	55:59	153:53	474	17 IV 28	488	210	98.2	106.7	*	....
2898	128	59:11	147:04	195	2 V 27	137	110	88.4	89.6	N.F.	Cleaning
2907	128	56:35	151:48	402	26 IV 28	497	130	91.8	80.5	*	Deck
2914	128	57:50	150:15	345	13 III 27	87	130	81.4	...	...	Cleaning
2926	129	57:59	149:33	291	27 IV 28	497	140	93.3	93.0	N.F.	Cleaning
2932	129	56:00	154:41	505	12 X 27	299	120	83.2	84.0	N.F.	L. S.
2940	130	59:05	139:24	55	19 VI 27	182	69	110.4	111.6	N.F.	Roller
2961	130	58:18	149:04	280	12 III 28	449	70	91.2	94.8	N.F.	Cleaning
2962	130	54:17	162:13	810	2 V 28	500	40	77.4	79.5	N.F.	Cleaning
2964	130	55:16	156:54	590	4 V 27	136	47	76.9	76.2	N.F.	Cleaning
2966	130	43:54	124:46	1090	11 VI 27	174	97	78.1	85.7	*	Cleaning
2973	130	55:00	156:50	635	6 VII 27	199	60	97.3	97.5	N.F.	Roller
2988	130	59:15	148:27	240	4 V 27	136	130	102.4	103.1	N.F.	L. S.
3453	28	54:41	132:04	0	14 X 25	91	45	71.0	58.4	*	....
3462	28	54:41	132:04	0	23 VII 25	8	36	78.6	60.9	*	....
3468	28	54:42	132:13	5	22 VIII 25	38	35	72.4	58.4	*	....
3481	28	54:41	132:04	0	25 VIII 25	41	36	75.0	78.7	*	....
3486	28	54:41	132:04	0	19 VIII 25	35	..	64.8	66.0	*	....
3496	28	54:41	132:04	0	21 VII 25	6	35	55.0	...	...	....
3503	28	54:41	132:04	0	21 VII 25	6	35	56.8	...	...	....
3510	28	54:41	132:04	4	21 VIII 25	37	35	71.9	58.4	*	....
3517	28	54:41	132:04	0	14 X 25	91	45	72.0	55.8	*	....
3524	29	54:41	132:04	0	9 X 25	85	32	76.6	83.8	*	Roller
3545	29	54:14	132:04	0	31 VII 25	15	35	74.0	73.6	*	....
3711	51	56:52	134:22	75	25 IX 25	46	40	72.8	...	...	....
3729	51	55:32	133:55	5	12 VIII 25	2	..	73.5	73.5	R.B.	....
3880	52	55:55	134:45	35	30 IX 25	50	85	72.5	73.6	*	....
3900	52	55:35	133:53	2	25 VIII 25	14	55	63.0	63.8	*	....
3901	58	51:50	129:02	6	23 IV 28	687	22	87.8	109.5	O.E.	Roller
3903	58	51:53	128:53	0	23 IV 28	687	32	78.5	84.0	O.E.	Roller
3905	58	51:53	128:53	0	23 IV 28	687	33	89.3	96.1	O.E.	Roller
3909	58	51:36	130:01	45	1 IV 28	665	180	103.4	109.0	O.E.	Deck
3910	58	51:56	128:55	3	18 VI 27	377	30	87.6	88.3	O.E.	Roller
3913	58	51:42	128:41	13	13 V 28	707	34	70.3	88.4	O.E.	Deck
3914	58	51:51	129:03	6	23 VIII 26	78	35	74.7	76.0	R.B.	Roller
3915	58	51:53	128:53	0	23 IV 28	687	32	56.8	73.6	O.E.	Roller
3916	58	52:10	129:06	18	11 IX 26	97	72	91.1	91.9	R.B.	Roller
3917	58	51:46	129:25	20	28 IX 26	114	45	83.5	84.1	R.B.	Roller
3919	58	51:52	128:55	1	12 VI 28	737	30	75.3	85.3	O.E.	Cleaning
3920	58	51:52	128:55	1	12 VI 28	737	30	68.1	77.8	O.E.	Cleaning
3922	58	51:53	128:53	0	8 V 27	336	28	81.8	43.2	*	Deck
3924	58	....	.....	..	VIII 28	...	..	91.0	...	...	Fish House
3925	58	51:43	129:21	19	4 IX 26	90	60	82.0	86.3	IFC.	Cleaning
3927	58	51:52	128:57	2	22 VI 28	747	30	96.2	103.2	W.H.	Cleaning
3931	58	51:50	129:04	7	20 VII 26	44	35	80.3	80.0	L.B.	Deck
3934	58	51:56	128:55	3	27 VI 27	386	31	77.2	82.0	O.E.	Roller
3938	58	51:43	128:49	10	11 IV 27	309	26	70.5	...	...	Cleaning
3941	58	52:00	129:49	35	14 VIII 26	69	70	75.1	75.3	R.B.	Roller
3944	58	51:44	128:51	8	7 VI 28	732	30	78.6	...	...	Cleaning

APPENDIX B. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12
3948	58	51:41	129:21	20	30 VII 26	54	55	67.4	68.1	F.B.	Dory
3949	58	51:41	129:21	20	30 VII 26	54	55	82.3	83.1	F.B.	Dory
3951	58	51:51	129:00	4	8 IV 27	306	50	69.4	71.2	O.E.	Deck
3952	58	51:50	129:04	7	20 VII 26	44	35	78.0	78.8	L.B.	Deck
3956	58	51:47	129:23	19	9 IV 28	673	40	68.3	85.7	O.E.	Roller
3958	58	51:44	129:20	18	18 VIII 26	73	60	70.5	71.4	R.B.	....
3961	58	53:04	130:42	98	28 VII 27	417	55	70.8	79.9	O.E.	Roller
3962	58	51:44	129:23	20	15 V 27	343	62	63.8	68.2	O.E.	Roller
3963	58	51:44	128:48	10	31 III 28	664	39	...	81.9	W.H.	....
3966	58	52:09	129:04	18	21 VIII 26	76	72	74.9	76.3	R.B.	Roller
3970	58	51:57	128:53	5	7 IV 27	305	30	92.3	93.0	O.E.	Roller
3971	58	51:44	129:51	8	7 VI 28	732	30	71.6	...	...	Cleaning
3972	58	51:53	128:56	2	2 VII 26	26	33	74.5	75.7	W.T.	Deck
3974	58	51:44	129:10	13	12 VIII 26	67	55	72.6	73.0	*	Deck
3977	58	51:42	128:41	13	13 V 28	707	34	94.1	98.7	O.E.	Cleaning
3978	58	51:49	128:55	4	17 VII 26	41	30	71.5	101.3	*	Deck
3980	58	52:00	129:17	17	20 VIII 26	75	65	77.2	76.8	N.F.	Deck
3981	58	51:56	128:55	3	19 VI 27	378	30	70.3	74.6	O.E.	Roller
3984	58	52:03	128:57	11	28 IV 27	326	40	93.7	94.7	O.E.	Roller
3986	58	51:42	128:41	13	13 V 28	707	34	79.0	78.3	O.E.	Cleaning
3988	58	51:49	129:16	14	27 V 28	721	70	84.5	100.4	O.E.	Roller
3989	58	51:42	129:21	20	28 VI 26	22	55	84.4	83.8	H.L.	Deck
3990	58	51:53	128:56	2	2 VII 26	26	32	71.0	71.1	IFC.	Deck
3992	58	51:49	128:53	3	15 VII 26	39	32	76.3	71.1	*	Deck
3993	58	51:51	129:03	6	23 VIII 26	78	35	76.8	78.7	R.B.	Roller
3994	58	51:53	128:56	2	2 VII 26	26	33	70.5	71.3	IFC.	Deck
3995	58	51:44	128:48	10	31 III 28	664	39	99.2	121.0	W.H.	....
3997	58	51:53	128:56	2	2 VII 26	26	33	68.4	68.4	IFC.	Deck
4003	58	51:49	128:55	4	17 VII 26	41	30	91.6	93.0	*	Deck
4004	58	51:42	128:41	13	13 V 28	707	34	81.6	100.6	O.E.	Cleaning
4006	58	52:20	129:37	38	29 IX 27	480	75	66.3	79.5	O.E.	Roller
4007	58	51:50	129:04	7	20 VII 26	44	35	82.8	82.5	L.B.	Deck
4011	58	51:53	128:52	1	24 IV 27	322	30	73.1	77.7	O.E.	Roller
4017	58	51:51	129:00	4	26 IV 27	324	35	75.6	79.1	O.E.	Roller
4019	58	51:45	129:15	15	13 V 27	341	70	79.1	84.3	O.E.	....
4026	58	51:56	128:55	3	18 VI 27	377	30	64.8	71.0	O.E.	Roller
4027	58	51:53	128:53	0	8 V 27	336	28	66.1	40.7	*	Deck
4028	58	51:52	128:57	2	22 VI 28	747	30	69.2	80.8	W.H.	Cleaning
4029	58	....	.....	..	III–V 28	...	..	87.7	...	...	Fish House
4031	58	51:46	129:25	20	11 VIII 26	66	50	81.3	85.0	*	....
4033	59	51:41	129:24	35	20 VII 28	774	..	60.1	...	...	....
4034	60	51:43	128:52	3	24 IV 27	320	30	69.9	70.8	O.E.	Roller
4041	60	51:44	129:23	18	19 V 27	345	62	67.0	72.6	O.E.	Roller
4042	60	51:56	128:55	3	13 VIII 27	431	45	68.1	76.2	O.E.	Cleaning
4045	60	51:51	129:01	5	24 VI 27	381	30	66.6	74.5	O.E.	Roller
4046	60	51:46	129:28	20	17 IX 27	466	55	81.5	93.3	O.E.	Deck
4047	60	51:56	128:55	3	18 VI 27	375	30	65.1	70.0	O.E.	Roller
4048	60	51:42	129:24	19	11 VIII 26	64	60	70.1	69.3	R.B.	Roller
4049	60	51:53	128:53	1	23 IV 28	685	32	68.9	80.1	O.E.	Roller
4050	60	51:53	128:56	7	2 VII 26	24	32	70.8	71.3	W.T.	Deck
4052	60	51:51	129:01	5	23 VI 27	380	30	69.1	72.0	O.E.	Roller
4054	60	51:29	129:23	28	12 V 27	338	38	80.0	85.1	*	Deck
4055	60	51:51	128:40	10	24 VI 28	747	50	67.6	73.9	O.E.	Deck
4062	60	51:30	129:33	31	4 X 27	483	65	77.4	89.8	O.E.	Deck
4064	60	51:42	129:13	14	28 VIII 28	812	55	84.5	102.4	O.E.	Roller
4065	60	51:45	129:10	11	10 IX 26	94	60	88.4	90.2	R.B.	Roller
4067	60	51:56	128:55	3	18 VI 27	375	30	69.0	72.7	O.E.	Roller
4068	60	51:54	129:20	14	22 IV 27	318	65	73.6	75.4	O.E.	Deck
4069	60	51:54	128:47	6	26 IV 27	322	30	67.9	79.3	*	Dory
4070	60	51:46	129:19	17	18 VII 27	405	53	73.4	78.0	O.E.	Roller
4077	60	51:50	129:04	5	20 VII 26	42	35	74.2	75.1	L.B.	Deck
4090	60	51:48	128:57	5	12 VI 27	369	20	85.1	...	...	Deck
4094	60	51:50	129:03	4	15 VII 26	37	30	81.0	83.3	L.B.	Roller
4096	60	51:51	129:03	4	23 VIII 26	76	34	70.5	72.8	R.B.	Roller
4098	60	51:55	129:01	4	5 IV 27	301	40	69.4	73.7	*	Cleaning
4100	61	51:54	129:14	9	8 IV 27	303	32	61.8	63.2	O.E.	Roller
4106	61	51:57	128:55	6	28 III 27	292	32	64.7	70.5	O.E.	Roller
4108	61	51:47	129:23	15	26 VIII 26	78	45	86.3	86.6	R.B.	Cleaning
4109	61	51:53	128:53	4	25 VI 28	747	30	59.0	68.0	H.L.	Cleaning
4110	61	51:42	128:41	15	15 V 28	706	34	74.7	82.6	O.E.	Cleaning
4112	61	51:50	129:04	3	20 VII 26	41	35	64.3	64.3	L.B.	Deck
4113	61	51:56	128:55	3	18 VI 27	374	30	62.9	68.5	O.E.	Roller
4116	62	51:42	129:24	5	19 VIII 26	71	55	63.8	64.0	R.B.	Roller
4117	62	51:35	129:15	9	23 V 28	714	35	75.4	78.3	O.E.	Roller
4119	62	51:50	129:07	17	26 IV 27	321	30	61.6	63.5	*	Deck
4120	62	51:55	129:11	20	26 VI 28	748	65	64.5	81.0	O.E.	Roller
4121	62	52:57	130:35	89	21 VIII 26	73	55	67.0	66.2	R.B.	Deck
4124	62	51:44	129:05	16	6 V 27	331	28	72.6	73.1	O.E.	Deck
4125	62	51:43	129:23	5	16 VII 27	402	..	70.1	73.0	R.B.	Roller
4126	62	52:00	129:17	23	2 VIII 26	54	65	67.0	67.6	N.F.	Roller
4127	62	51:57	129:26	19	10 IV 27	305	55	71.4	74.9	O.E.	Roller
4129	62	51:42	129:24	5	19 VIII 26	71	55	67.9	68.2	R.B.	Roller
4130	62	51 06	129 00	38	17 V 28	708	35	64.5	75.1	O.E.	Roller
4131	62	51:08	129:33	30	4 IX 28	818	55	57.6	77.5	*	L. S.
4133	62	51:45	129:31	7	2 VII 26	23	45	65.4	67.3	*	Dory
4136	62	51:53	128:56	25	5 VI 28	727	55	60.6	69.5	O.E.	Roller
4137	62	51:49	129:17	13	24 IV 27	319	35	62.4	64.3	O.E.	Deck
4138	62	52:23	129:48	46	31 VIII 26	83	75	73.8	74.9	*	....
4139	62	51:51	129:18	13	25 VI 26	16	53	66.8	66.6	IFC.	Dory
4145	62	51:22	129:24	16	25 IX 26	108	60	61.5	...	...	L. S.
4146	62	51:45	129:31	7	22 VI 27	378	65	70.2	77.5	O.E.	Roller
4148	62	51:57	129:31	18	8 VI 28	730	50	63.3	78.7	O.E.	Roller

APPENDIX B. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12
4149	62	51:43	129:21	7	4 IX 26	87	60	64.0	64.8	R.B.	Dory
4151	62	51:46	129:11	14	29 V 27	354	30	68.2	73.4	O.E.	Roller
4152	62	52:09	129:04	34	21 VIII 26	73	72	65.0	66.2	R.B.	Roller
4153	62	51:46	129:25	9	16 IX 27	464	50	64.1	71.5	O.E.	Roller
4154	62	51:54	129:20	17	22 IV 27	317	65	70.0	72.7	O.E.	Deck
4156	62	51:40	129:04	15	26 IV 27	321	35	65.0	65.7	H.L.	Deck
4158	62	51:46	129:25	9	16 IX 27	464	50	57.8	67.5	O.E.	Roller
4160	62	55:23	134:13	288	30 VII 27	416	60	60.2	65.2	N.F.	Dory
4162	62	51:43	129:25	5	18 VI 28	740	55	62.8	77.8	O.E.	Deck
4163	62	51:43	129:21	7	4 IX 26	87	60	74.7	74.7	R.B.	Dory
4164	62	51:53	129:34	15	20 IV 27	315	50	69.4	73.7	*	Dory
4165	62	51:48	129:15	13	25 IX 28	839	40	57.8	75.5	O.E.	Roller
4167	62	54:09	133:22	223	13 IV 28	674	200	57.9	75.8	O.E.	Deck
4168	62	51:46	129:25	9	28 IX 26	111	45	65.4	67.3	R.B.	Roller
4169	62	51:05	128:46	42	21 VIII 26	73	60	72.9	74.1	R.B.	Deck
4172	62	51:50	129:29	11	26 V 27	351	50	63.0	66.0	*	Dory
4174	62	51:45	129:34	7	30 IX 27	478	52	66.2	76.0	O.E.	Roller
4177	62	51:42	129:36	5	2 VIII 26	54	55	71.2	72.1	N.F.	Cleaning
4180	62	51:49	129:17	13	24 IV 27	319	35	63.2	73.4	O.E.	Deck
4181	62	51:45	129:21	8	15 VI 27	371	50	64.9	72.8	O.E.	Roller
4182	62	51:37	128:53	23	12 V 28	703	28	59.4	67.0	O.E.	Deck
4183	63	51:46	129:28	8	16 VII 26	36	55	73.0	76.2	*	Cleaning
4184	63	51:46	129:25	9	28 IX 26	110	45	69.4	70.5	R.B.	Roller
4188	63	51:42	129:24	5	12 VIII 26	63	60	66.1	67.4	R.B.	Roller
4190	63	51:46	129:28	7	30 VII 28	781	50	69.0	...	...	Deck
4191	63	51:45	129:34	7	2 X 27	479	52	66.4	76.5	O.E.	Roller
4193	63	51:43	129:23	5	15 VII 27	400	..	63.3	75.4	R.B.	Roller
4195	63	51:46	129:25	9	11 VIII 26	62	50	63.6	66.6	*	....
4196	63	51:48	129:15	13	11 VIII 28	793	45	63.9	71.4	O.E.	Roller
4198	63	51:40	129:02	17	15 V 27	339	30	67.5	71.3	O.E.	Roller
4199	63	51:54	129:27	16	11 VIII 27	427	50	64.1	69.5	O.E.	Deck
4200	63	51:43	129:23	5	15 VII 27	400	..	58.8	67.5	R.B.	Roller
4201	63	51:47	129:20	11	24 IV 27	318	55	66.0	67.2	O.E.	Deck
4202	63	51:41	129:21	9	30 VII 26	50	55	67.1	68.1	F.B.	Dory
4203	63	51:43	129:21	5	2 VI 27	357	55	66.5	73.2	O.E.	Roller
4204	63	....	.....	..	15 IV 27	309	..	59.6	...	...	Deck
4207	63	51:48	129:40	12	17 VIII 26	68	60	63.8	64.0	R.B.	Roller
4208	63	51:46	129:11	14	1 VI 27	356	35	57.0	62.5	O.E.	Roller
4209	63	51:46	129:25	9	11 VIII 26	62	50	74.7	75.6	*	....
4211	63	51:38	129:25	1	30 V 27	354	50	65.8	69.3	O.E.	Roller
4213	63	51:46	129:11	14	31 V 27	355	35	69.5	73.4	O.E.	Roller
4218	63	51:57	128:53	29	7 IV 27	301	30	66.0	73.0	O.E.	Roller
4223	63	51:55	129:35	16	17 IV 28	677	33	74.0	96.9	O.E.	Deck
4226	63	52:12	129:04	37	26 IV 27	320	70	71.2	73.2	O.E.	Roller
4228	63	51:46	129:25	9	28 IX 26	110	45	70.2	70.6	R.B.	Roller
4231	63	51:46	129:28	8	15 VII 26	35	55	70.6	74.3	*	Cleaning
4232	63	51:29	129:24	10	1 VII 27	386	35	64.0	67.3	R.B.	Deck
4233	63	51:43	129:21	7	4 IX 26	86	60	73.5	73.5	R.B.	Dory
4236	63	51:47	129:23	9	20 VIII 26	71	45	61.8	61.6	R.B.	Cleaning
4239	63	51:46	129:25	9	11 VIII 26	62	50	61.6	63.5	*	....
4241	63	51:43	129:21	7	4 IX 26	86	60	67.0	67.8	R.B.	Dory
4242	63	51:50	129:36	13	22 VII 26	42	65	78.0	78.7	*	Deck
4246	63	51:40	129:18	7	10 VI 28	731	60	79.8	86.0	O.E.	Roller
4251	63	51:49	129:33	11	19 VI 26	9	45	76.9	77.3	*	L. S.
4252	63	51:45	129:21	8	15 VI 27	370	50	79.9	81.0	O.E.	Roller
4253	63	51:51	129:18	13	25 VI 26	15	53	67.5	67.2	IFC	Dory
4254	63	51:49	129:12	15	10 III 27	273	50	67.9	72.5	O.E.	Roller
4256	63	51:45	129:25	7	12 V 27	336	70	86.0	88.0	O.E.	....
4258	63	51:43	129:25	6	10 IX 26	92	42	74.3	74.0	R.B.	Roller
4261	63	51:45	129:31	7	9 VIII 26	60	50	73.6	74.9	*	....
4263	63	51:39	129:38	5	20 IX 26	102	55	67.3	70.5	L.B.	Roller
4264	63	51:42	129:24	5	15 VIII 26	66	55	61.0	63.1	R.B.	Roller
4266	63	51:27	128:32	37	26 VII 28	777	45	68.2	83.2	E.P.	Dory
4269	63	51:51	130:31	40	28 III 28	657	190	70.2	...	...	Deck
4271	63	51:43	129:21	5	2 VI 27	357	55	64.8	67.1	O.E.	Roller
4274	63	51:12	128:42	41	25 IX 26	107	45	69.8	70.8	R.B.	Roller
4277	63	51:41	129:21	9	31 VII 26	51	55	71.1	71.2	F.B.	Dory
4278	63	51:38	129:25	1	26 V 27	350	50	79.4	84.9	O.E.	Roller
4280	63	51:43	129:29	4	24 IV 27	318	60	74.7	77.5	O.E.	Cleaning
4282	63	51:42	129:21	6	28 VI 26	18	55	79.5	78.7	H.L.	Deck
4287	63	51:50	129:25	12	7 VIII 26	58	52	76.1	78.7	N.F.	Cleaning
4289	63	51:40	129:00	18	27 III 28	656	35	63.6	73.1	O.E.	Deck
4295	63	51:45	129:34	7	21 IX 27	468	52	64.3	71.0	O.E.	Roller
4296	63	51:46	129:25	9	28 IX 26	110	45	68.1	68.8	R.B.	Roller
4297	63	51:47	129:23	9	30 VII 28	781	45	64.3	74.1	O.E.	Roller
4298	63	51:40	129:18	7	10 VI 28	731	60	65.3	68.5	O.E.	Roller
4299	63	51:47	129:23	9	23 VII 28	774	..	60.0	72.6	E.P.	L. S.
4300	63	51:45	129:31	7	9 VIII 26	60	50	68.2	94.6	*	....
4307	63	53:12	129:27	97	19 III 28	648	125	67.3	76.0	N.F.	Roller
4308	63	51:45	129:34	7	20 IX 27	467	52	54.2	66.5	O.E.	Roller
4310	63	51:48	129:15	13	11 VIII 28	793	45	63.1	74.2	O.E.	Roller
4311	63	51:42	129:47	11	1 X 27	478	55	67.6	75.8	O.E.	Roller
4312	63	52:16	129:27	37	22 V 27	346	50	57.7	67.9	O.E.	Cleaning
4314	63	51:26	129:16	14	2 XI 26	145	70	59.9	72.4	IFC.	Deck
4315	63	51:43	129:21	7	9 V 28	699	30	84.3	104.6	IFC.	Deck
4317	63	51:30	129:37	10	9 V 28	699	45	71.8	82.9	O.E.	Deck
4319	64	51:42	129:36	5	3 VIII 26	53	55	60.2	60.9	N.F.	Cleaning
4323	64	51:45	129:21	8	16 VI 27	370	50	60.7	69.7	O.E.	Roller
4325	64	51:42	129:24	5	19 VIII 26	69	55	64.1	66.4	R.B.	L. S.
4327	64	51:40	129:20	5	27 VI 27	381	60	63.4	71.1	O.E.	Roller
4328	64	51:48	129:15	13	25 VI 28	745	60	61.8	74.0	IFC.	Roller
4329	64	52:57	128:55	28	21 IV 27	314	32	71.2	75.4	O.E.	Roller

APPENDIX B. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12
4331	64	51:42	129:36	5	31 VII 26	50	55	62.9	64.8	N.F.	Cleaning
4333	64	51:46	129:25	9	28 IX 26	109	45	61.7	62.6	R.B.	Roller
4337	64	51:35	129:05	15	10 V 27	333	30	63.5	68.4	O.E.	....
4338	64	51:43	129:23	5	16 VII 27	400	..	65.6	74.9	R.B.	Roller
4341	64	51:43	129:25	5	21 VI 28	741	55	57.3	71.0	O.E.	Deck
4344	64	51:40	129:32	2	7 IX 26	88	45	68.8	68.5	R.B.	Deck
4346	64	51:42	129:21	6	27 VI 26	16	55	62.6	63.5	H.L.	Deck
4347	64	51:54	129:27	16	11 VIII 27	426	50	59.0	67.5	O.E.	Deck
4352	64	51:46	129:25	8	25 VI 28	745	60	68.7	80.9	IFC.	Roller
4353	64	51:43	129:23	6	13 V 27	336	62	66.7	68.7	O.E.	Roller
4355	64	51:48	129:12	14	19 VIII 26	69	55	73.3	71.8	R.B.	Cleaning
4358	64	51:40	129:33	2	10 X 28	852	..	68.7	82.1	O.E.	Roller
4359	64	51:47	129:22	10	14 VII 27	398	65	64.7	69.2	R.B.	Cleaning
4360	64	51:42	129:24	5	19 VIII 26	69	55	65.9	66.2	R.B.	Roller
4364	64	51:43	129:25	6	10 IX 26	91	42	71.8	72.8	R.B.	Roller
4366	64	51:57	129:11	22	24 III 27	286	30	62.0	67.5	O.E.	Roller
4369	64	51:43	129:23	6	30 VI 26	19	36	82.2	...		Cleaning
4370	64	51:42	129:24	5	19 VIII 26	69	60	61.9	62.3	R.B.	Roller
4371	64	51:45	129:14	12	30 IX 26	111	55	70.6	72.8	R.B.	Roller
4372	64	....	.....	..	V 27	...	..	70.2	...	...	Fish House
4373	64	51:43	129:29	2	26 IV 27	319	60	70.5	71.4	O.E.	Cleaning
4375	64	51:43	129:23	6	11 V 27	334	63	62.4	67.8	O.E.	Deck
4376	64	51:42	129:14	10	15 IV 28	674	45	64.5	75.0	O.E.	Roller
4377	64	51:45	129:34	7	3 VII 27	387	55	64.3	69.3	O.E.	Roller
4379	64	51:53	129:05	20	22 V 28	711	35	72.6	79.5	O.E.	Deck
4382	64	51:57	129:26	19	11 IV 27	304	55	64.3	66.5	O.E.	Roller
4385	64	51:39	129:38	5	20 IX 26	101	55	61.7	66.5	L.B.	Roller
4386	64	51:47	129:23	9	25 IV 28	684	55	63.2	76.4	O.E.	Roller
4387	64	52:00	129:17	23	2 VIII 26	52	65	60.2	61.4	N.F.	Roller
4390	64	51:45	129:31	6	1 VI 28	721	55	67.2	75.1	O.E.	Deck
4392	64	48:36	125:42	240	16 VI 27	370	33	57.4	63.6	O.E.	Cleaning
4393	64	51:53	129:34	15	20 IV 27	313	50	62.0	74.9	*	Dory
4395	64	51:40	129:20	5	28 VI 27	382	60	73.5	77.1	O.E.	Roller
4396	64	51:46	129:11	14	1 VI 27	355	35	67.2	...	...	Roller
4397	64	51:41	129:21	9	2 VIII 26	52	55	69.9	72.7	F.B.	Dory
4399	64	52:23	129:48	46	20 IX 26	101	80	67.2	68.6	*	....
4400	64	51:48	129:15	13	1 IX 28	813	40	65.3	79.5	O.E.	Roller
4402	64	52:02	129:58	29	24 V 28	713	60	60.5	75.5	O.E.	Roller
4405	64	51:46	129:25	9	28 IX 26	109	45	62.8	63.3	R.B.	Roller
4408	64	51:45	129:21	8	16 VI 27	370	50	70.4	75.6	O.E.	Roller
4409	64	51:38	129:25	1	26 V 27	349	50	74.1	76.5	O.E.	Roller
4411	64	51:44	129:23	7	15 V 27	338	62	65.8	75.9	O.E.	Deck
4412	64	51:42	129:24	5	19 VIII 26	69	55	66.5	67.9	R.B.	Roller
4413	64	51:54	129:27	16	11 VIII 27	426	50	70.5	76.0	O.E.	Deck
4415	64	51:47	129:23	9	14 VII 26	33	54	74.0	74.5	L.B.	Deck
4420	64	51:48	129:15	13	11 VIII 28	792	45	67.5	82.1	O.E.	Roller
4421	64	51:38	129:25	1	26 V 27	349	50	62.0	72.6	O.E.	Deck
4422	64	51:46	129:25	9	11 VIII 26	61	50	68.8	71.1	*	....
4423	64	51:54	129:22	16	18 VII 26	37	55	67.4	67.0	L.B.	Deck
4427	64	51:43	129:29	5	26 IV 27	319	65	59.6	64.8	O.E.	Cleaning
4428	64	52:02	129:58	29	24 V 28	713	60	64.5	76.5	O.E.	Roller
4431	64	51:41	129:21	9	31 VII 26	50	55	61.4	...	...	L. S.
4432	64	51:47	129:23	9	14 VII 26	33	54	72.4	73.2	L.B.	Deck
4435	64	51:47	129:23	9	8 IV 28	667	40	69.5	79.2	O.E.	Roller
4439	64	55:23	134:13	288	30 VII 27	414	60	70.4	74.5	N.F.	Dory
4441	64	51:45	129:25	7	12 V 27	335	70	64.8	66.5	O.E.	....
4442	64	51:46	128:59	20	26 V 28	715	37	64.2	75.6	O.E.	Roller
4446	64	51:57	129:31	18	8 VI 28	728	50	72.8	83.0	O.E.	Roller
4448	64	51:40	129:32	2	8 IX 26	89	45	63.9	65.1	R.B.	Deck
4450	64	51:43	129:29	5	26 IV 27	319	60	74.9	75.6	O.E.	Cleaning
4451	64	51:57	129:26	18	13 VI 27	367	55	64.9	68.6	O.E.	Roller
4452	64	51:39	129:37	4	24 VIII 28	805	50	66.1	77.5	O.E.	Deck
4453	64	51:47	129:23	9	19 VIII 26	69	51	69.6	69.5	R.B.	Deck
4454	64	51:46	129:25	8	25 VI 28	745	60	70.8	83.0	IFC.	Roller
4456	65	51:46	129:11	14	31 V 27	353	35	60.8	68.0	O.E.	Roller
4457	65	51:40	129:33	1	1 VIII 28	781	50	62.2	79.6	O.E.	Roller
4458	65	51:46	129:25	9	7 V 27	329	50	73.6	74.5	O.E.	Roller
4459	65	51:45	129:31	7	5 VII 27	388	50	64.3	71.0	O.E.	Roller
4460	65	52:09	129:04	34	21 VIII 26	70	72	69.1	68.6	R.B.	Deck
4462	65	51:45	129:31	7	2 VII 26	20	45	65.3	66.0	*	Dery
4466	65	51:44	129:23	7	11 V 27	333	62	62.3	68.5	O.E.	Roller
4467	65	51:46	129:11	14	29 V 27	351	30	65.4	70.6	O.E.	Roller
4469	65	51:43	129:25	5	22 VI 28	741	55	68.1	77.1	O.E.	Deck
4470	65	51:42	129:24	5	19 VIII 26	68	60	67.7	69.5	R.B.	Roller
4471	65	51:47	129:22	10	14 VII 27	397	65	65.5	69.8	R.B.	Cleaning
4478	66	51:05	128:40	10	8 V 27	330	55	66.7	62.2	*	Cleaning
4480	66	50:54	128:49	16	18 III 27	279	40	84.3	89.1	O.E.	Roller
4490	67	49:56	127:30	13	28 V 27	349	30	71.4	...	...	Deck
4496	67	49:54	127:31	10	5 IX 28	815	40	76.1	88.7	O.E.	Roller
4501	69	51:40	129:21	6	2 IV 28	653	60	56.6	73.4	O.E.	Deck
4503	69	51:40	129:20	5	28 VI 27	374	60	57.2	66.1	O.E.	Roller
4504	69	51:31	129:27	7	20 VI 27	366	40	69.0	71.1	H.L.	L. S.
4506	69	51:27	128:32	37	26 VII 28	768	45	65.4	...	...	Dory
4508	69	51:43	129:25	5	2 VI 28	714	65	59.1	73.2	O.E.	Deck
4509	69	51:45	129:31	6	31 V 28	712	55	63.3	71.0	O.E.	Roller
4511	69	51:38	129:25	1	26 V 27	341	50	60.1	...	...	Deck
4514	69	51:42	129:36	5	4 VIII 26	46	55	62.5	64.9	N.F.	Cleaning
4515	69	51:41	129:21	9	2 VIII 26	44	55	64.8	66.6	F.B.	Dory
4516	69	51:43	129:17	10	17 IV 27	302	50	70.0	73.7	*	Roller
4519	69	51:06	129:00	38	17 V 28	698	35	63.5	73.1	O.E.	Roller
4520	69	51:38	129:25	1	28 V 27	343	50	65.3	71.7	O.E.	Deck
4523	69	51:54	129:14	19	8 IV 27	293	32	64.5	67.6	O.E.	Roller

APPENDIX B. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12
4524	69	51.46	129:28	8	18 IX 27	456	55	66.9	76.8	O.E.	Roller
4528	69	51:44	129:35	7	15 VIII 26	57	55	71.0	75.6	*	....
4529	69	51:47	129:23	9	20 VI 28	732	50	68.5	78.7	O.E.	Deck
4530	69	51:38	129:25	1	30 V 27	345	50	64.4	67.8	O.E.	Roller
4536	69	51:39	129:38	5	20 IX 26	93	55	69.4	70.8	L.B.	Roller
4539	69	51:30	128:42	30	21 IV 27	306	22	62.1	74.9	O.E.	Cleaning
4540	69	51:46	129:25	9	28 IX 26	101	45	59.9	63.0	R.B.	Roller
4544	69	51:46	129:25	9	28 IX 26	101	45	67.9	69.9	R.B.	Roller
4545	69	51:45	129:34	7	18 IX 27	456	52	62.8	66.5	O.E.	Roller
4546	69	51:43	129:29	4	24 IV 27	309	60	60.0	63.5	O.E.	Cleaning
4547	69	51:38	129:25	1	26 V 27	341	50	70.6	75.2	O.E.	Deck
4551	69	51:41	129:21	9	2 VIII 26	44	55	71.9	71.5	F.B.	Dory
4552	69	51:48	129:15	13	3 VII 28	745	45	62.4	73.6	W.H.	Deck
4553	69	51:45	129:31	7	5 VII 27	381	50	60.3	67.0	O.E.	Roller
4554	69	51:39	129:38	5	20 IX 26	93	55	72.0	74.0	L.B.	Roller
4555	69	51:47	129:23	9	14 VIII 28	787	45	66.4	74.9	O.E.	Roller
4556	69	51:43	129:25	5	3 VI 28	715	65	60.3	64.4	O.E.	Roller
4557	69	51:12	128:42	39	25 IX 26	98	45	66.7	66.7	R.B.	Roller
4561	69	51:41	129:24	4	15 IX 28	819	..	74.8	...	...	....
4562	69	51:50	129:25	12	7 VIII 26	49	52	70.3	71.1	N.F.	....
4565	69	51:47	129:23	9	16 VIII 28	789	45	66.4	79.4	O.E.	Roller
4567	69	51:41	129:21	9	2 VIII 26	44	55	67.1	68.2	F.B.	Dory
4568	69	51:42	129:24	7	19 VIII 26	61	55	68.6	69.0	R.B.	Roller
4574	69	51:46	129:11	14	1 VI 27	347	35	63.3	69.1	O.E.	Roller
4575	69	51:40	129:20	5	28 VI 27	374	60	59.0	68.7	O.E.	Roller
4576	69	....	.....	..	26 X 26	...	..	63.3	65.5	O.E.	....[9]
4577	69	51:43	129:25	5	2 VI 28	714	65	67.4	77.2	O.E.	Deck
4578	69	51:50	129:28	12	17 VIII 26	59	60	67.7	67.3	R.B.	Roller
4579	69	51:48	129:15	13	25 IX 28	829	40	62.7	80.4	O.E.	Roller
4583	69	51:48	129:15	13	3 VII 28	745	45	57.2	71.6	W.H.	Deck
4585	69	52:05	129:13	29	16 VII 27	392	69	60.6	70.7	O.E.	Roller
4589	69	51:40	129:20	5	27 VI 27	373	60	58.1	64.1	O.E.	Roller
4590	69	51:52	129:07	20	10 IV 27	295	45	63.6	68.9	O.E.	Roller
4591	69	51:42	129:14	10	15 IV 28	666	45	64.5	74.3	O.E.	Roller
4594	69	51:58	129:05	26	14 V 27	329	55	67.4	71.1	*	....
4602	69	51:40	129:18	7	10 VI 28	722	60	59.6	92.1	O.E.	Roller
4605	69	51:35	129:27	4	20 IV 28	671	40	61.5	75.5	O.E.	Roller
4608	69	51:38	129:25	1	26 V 27	341	50	57.0	63.5	O.E.	Roller
4609	69	51:43	129:23	5	16 VII 27	392	..	67.9	72.4	R.B.	Roller
4610	69	52:09	129:04	34	21 VIII 26	63	72	76.4	76.2	R.B.	Deck
4611	69	51:38	129:25	1	26 V 27	341	50	66.5	69.0	O.E.	Deck
4612	69	51:43	129:25	5	21 VI 28	733	55	56.3	71.0	O.E.	Deck
4615	69	51:50	129:02	20	24 IV 28	675	22	62.4	48.3	*	Roller
4617	69	51:43	129:25	5	31 V 28	712	65	54.9	66.4	O.E.	Roller
4619	69	51:34	129:12	12	15 X 28	849	60	60.0	80.2	E.P.	Roller
4622	69	51:42	129:24	7	19 VIII 26	61	60	62.9	70.5	R.B.	Roller
4625	69	51:46	129:25	9	28 IX 26	101	45	66.0	67.1	R.B.	Roller
4626	69	51:45	129:34	7	7 VII 27	383	55	64.8	72.4	O.E.	Roller
4628	69	51:40	129:32	3	8 IX 26	81	45	67.7	69.3	R.B.	Deck
4630	69	51:43	129:25	5	20 VI 28	732	55	58.0	69.5	O.E.	Deck
4631	69	51:30	129:25	10	15 V 27	330	40	66.1	71.2	*	Cleaning
4633	69	51:57	129:26	19	10 IV 27	295	55	62.2	66.3	O.E.	Roller
4634	69	51:48	129:15	13	3 VII 28	745	45	58.4	70.7	W.H.	Deck
4636	69	51:45	129:34	7	1 VII 27	377	55	66.9	73.2	O.E.	Roller
4637	69	51:45	129:21	8	14 VI 27	360	50	56.6	63.9	O.E.	Roller
4639	69	51:41	129:21	9	1 VIII 26	43	55	64.8	65.5	F.B.	Dory
4643	69	51:45	129:34	7	19 IX 27	457	52	51.0	68.8	O.E.	Roller
4644	69	51:38	129:25	1	26 V 27	341	50	63.3	66.0	O.E.	Deck
4646	69	51:39	129:38	5	20 IX 26	93	55	60.6	64.6	L.B.	Roller
4649	69	51:47	129:08	14	26 VI 27	372	40	64.6	53.3	*	Cleaning
4651	69	51:48	129:15	13	29 VII 27	405	48	68.0	74.2	O.E.	Roller
4653	69	51:47	129:23	9	16 VIII 28	789	45	65.5	76.5	O.E.	Roller
4661	70	51:21	129:13	19	13 VIII 26	54	50	70.6	72.4	*	L. S.
4665	70	51:45	129:34	7	2 VII 27	377	55	66.1	70.4	O.E.	Roller
4666	70	51:40	129:20	5	27 VI 27	374	60	67.4	73.7	O.E.	Roller
4667	70	51:43	129:23	6	26 V 28	706	50	66.2	77.2	O.E.	Roller
4670	70	51:41	129:21	9	1 VIII 26	42	55	75.3	77.0	F.B.	Dory
4673	70	53:02	130:31	92	3 VI 27	348	50	73.0	76.1	O.E.	Cleaning
4676	70	51:48	129:15	13	3 VII 28	744	45	60.2	74.5	W.H.	Deck
4679	70	51:45	129:31	7	2 VII 26	12	45	58.2	58.1	*	Dory
4680	70	51:42	129:24	7	16 VIII 26	57	60	62.1	64.1	R.B.	Roller
4686	70	51:45	129:34	7	1 VII 27	376	55	62.5	65.8	O.E.	Roller
4688	70	51:53	128:53	26	29 VII 27	404	45	59.7	69.0	O.E.	Roller
4690	70	51:42	129:36	5	3 VIII 26	44	55	59.5	60.7	N.F.	Cleaning
4691	70	51:40	129:20	6	12 VIII 28	784	52	64.6	76.8	O.E.	Roller
4693	70	51:40	129:18	7	2 IX 27	439	50	56.7	67.3	O.E.	Roller
4694	70	51:40	129:18	7	1 IX 27	438	50	60.5	65.1	O.E.	Roller
4695	70	51:55	129:11	20	26 VI 28	737	65	74.2	...	...	Dory
4697	70	51:48	129:15	13	3 VII 28	744	45	66.8	77.3	W.H.	Deck
4700	70	51:41	129:21	9	1 VIII 26	42	55	79.4	79.1	F.B.	Dory
4703	70	51:47	129:22	10	14 VII 27	389	65	78.5	83.2	R.B.	Cleaning
4704	70	51:45	129:21	10	14 VI 27	359	50	81.0	94.1	O.E.	Roller
4708	70	51:49	129:12	15	10 III 27	263	50	58.9	62.0	O.E.	Roller
4709	70	51:42	129:24	7	17 VIII 26	58	55	71.8	72.9	R.B.	Roller
4710	70	51:35	129:18	8	12 VI 28	723	38	58.9	76.4	O.E.	Roller
4713	70	51:43	129:29	4	24 IV 27	308	60	67.1	69.5	O.E.	Cleaning
4714	70	51:47	129:23	9	20 VIII 26	61	50	66.2	68.2	R.B.	Roller
4715	70	51:47	129:23	9	9 IV 28	659	40	61.0	71.9	O.E.	Roller
4718	72	52:20	129:58	4	9 IX 27	445	105	66.2	68.0	O.E.	Roller
4720	72	51:41	130:52	53	18 IV 27	301	150	80.6	85.7	H.L.	Cleaning
4723	72	52:23	129:48	6	1 IX 26	72	75	85.4	86.3	*	....
4726	72	52:21	129:53	4	11 IX 27	447	75	67.0	72.7	O.E.	Roller

[9] Found among frozen fish at Cold Storage.

APPENDIX B. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12
4730	72	52:19	130:02	6	12 X 26	113	65	76.2	76.0	L.B.	Roller
4732	73	53:02	130:31	41	17 VI 27	361	50	70.6	75.8	O.E.	Roller
4734	73	51:27	129:26	62	1 X 27	467	50	75.1	78.8	O.E.	Roller
4735	73	52:19	130:38	21	29 IV 28	678	70	71.3	89.6	O.E.	Deck
4736	73	51:43	129:25	48	18 VI 28	728	55	70.5	78.3	O.E.	Deck
4740	73	52:23	129:48	10	20 IX 26	91	80	73.0	73.6	*	....
4741	73	52:19	130:02	6	11 X 26	112	65	70.7	71.0	L.B.	Roller
4746	73	52:22	129:45	12	8 VIII 27	413	75	77.0	81.3	*	Deck
4748	74	52:50	130:44	15	11 VII 27	384	35	97.6	99.6	N.F.	Cleaning
4750	74	52:23	129:48	38	30 VIII 26	69	75	75.6	78.7	*	....
4751	74	52:34	131:02	8	11 VII 26	19	58	95.5	94.0	*	Deck
4755	74	51:35	129:22	82	10 IX 27	445	48	68.2	72.0	O.E.	Roller
4756	74	53:02	130:31	29	2 VI 27	345	50	67.7	75.8	O.E.	Cleaning
4757	75	53:04	130:47	15	26 VI 27	369	55	75.0	82.2	O.E.	Roller
4777	76	....	.....	..	VII 27	...	..	74.7	...	...	Fish House
4778	76	51:40	129:18	20	2 IX 27	436	50	61.9	72.9	O.E.	Roller
4779	76	51:51	129:05	10	24 VIII 27	427	48	73.0	80.6	O.E.	Roller
4781	76	51:56	128:53	4	4 VIII 27	407	45	61.3	69.5	O.E.	Roller
4783	76	51:52	129:07	6	10 IV 27	291	45	72.5	76.6	O.E.	Roller
4789	76	51:47	128:54	10	28 IV 27	309	36	70.3	71.6	O.E.	Cleaning
4791	76	51:59	128:51	4	19 VII 27	391	45	59.4	66.4	O.E.	Roller
4793	76	51:59	128:51	4	20 VII 27	392	45	64.1	68.6	O.E.	Roller
4794	76	51:30	129:25	33	16 V 27	327	40	69.8	72.8	H.L.	Cleaning
4795	76	51:24	129:24	36	3 X 28	833	50	60.2	75.3	O.E.	Deck
4797	76	51:56	128:55	3	1 VIII 27	404	42	64.1	73.3	O.E.	Roller
4798	76	51:59	128:48	7	14 V 27	325	60	70.5	78.2	O.E.	Roller
4799	76	51:57	128:56	3	8 VIII 26	46	55	80.2	80.0	*	....
4802	76	48:29	125:32	270	5 VI 27	347	35	58.2	61.9	O.E.	Roller
4803	76	51:56	128:55	3	1 VIII 27	404	42	67.7	74.6	O.E.	Roller
4804	76	51:54	128:47	8	18 VI 28	726	40	70.2	78.5	O.E.	L. S.
4808	76	51:48	129:15	13	29 VII 27	401	48	68.6	78.5	O.E.	Roller
4809	76	51:49	128:54	8	7 IV 27	288	32	68.9	71.1	*	Cleaning
4812	76	51:59	128:48	7	14 V 27	325	60	70.0	81.9	O.E.	Roller
4813	76	51:53	128:53	5	19 VII 27	391	45	71.9	...	...	Roller
4816	76	51:46	129:07	11	16 VII 28	754	45	81.1	105.7	E.P.	Deck
4818	76	51:45	129:21	17	11 V 28	688	60	71.3	77.9	O.E.	Roller
4819	76	51:42	128:41	18	14 V 28	691	34	61.3	84.2	O.E.	Cleaning
4820	76	51:53	128:52	6	24 IV 27	305	30	63.1	69.0	O.E.	Roller
4821	76	51:59	128:51	4	19 VII 27	391	45	60.2	66.0	O.E.	Roller
4824	76	51:59	128:51	4	15 VII 27	387	45	59.4	66.2	O.E.	Roller
4828	76	51:59	128:52	6	14 III 28	630	50	51.9	59.5	O.E.	Roller
4829	76	51:59	128:48	7	14 V 27	325	60	58.1	59.7	O.E.	Roller
4830	76	51:59	128:48	6	18 VII 27	390	50	59.0	62.4	O.E.	Cleaning
4833	76	50:53	128:52	63	10 III 27	260	45	65.9	71.9	O.E.	Cleaning
4835	76	53:07	130:04	79	20 VIII 27	423	40	72.0	74.8	N.F.	L. S.
4836	76	51:49	128:37	14	11 VI 27	353	74	74.8	78.1	H.L.	Cleaning
4838	76	51:48	128:46	12	4 VII 27	376	50	53.7	59.9	O.E.	Roller
4840	76	51:30	129:25	32	5 VII 27	377	45	62.3	65.6	R.B.	Dory
4841	76	51:59	128:51	6	23 VIII 27	426	40	53.8	57.8	O.E.	Roller
4843	76	51:57	128:56	2	9 VIII 26	47	55	64.6	64.5	*	....
4847	76	51:56	128:53	4	4 VIII 27	407	45	68.8	74.2	O.E.	Roller
4849	76	51:46	129:25	18	25 VI 28	733	60	51.8	69.3	IFC.	Deck
4852	76	51:59	128:48	7	14 V 27	325	60	65.5	70.5	O.E.	....
4857	76	52:09	129:04	13	12 X 26	111	72	58.0	57.5	L.B.	Roller
4859	76	51:50	128:42	13	16 VIII 27	419	50	61.5	69.6	O.E.	Deck
4860	76	51:56	128:53	4	4 VIII 27	407	40	67.0	72.6	O.E.	Roller
4861	76	51:53	128:53	6	23 IV 28	670	32	62.5	75.4	O.E.	Roller
4862	76	51:59	128:48	7	14 V 27	325	60	63.5	70.8	O.E.	Roller
4863	76	51:53	128:53	5	19 VII 27	391	45	63.5	68.9	O.E.	Roller
4867	76	51:47	128:54	10	28 IV 27	309	36	70.5	73.6	O.E.	Cleaning
4868	76	51:26	128:54	30	17 VIII 28	786	35	57.2	75.8	O.E.	Roller
4870	76	51:50	128:42	13	16 VIII 27	419	50	68.7	74.9	O.E.	Deck
4873	76	51:59	128:48	7	14 V 27	325	60	64.3	67.5	O.E.	Roller
4875	76	51:06	129:00	51	29 V 28	706	35	58.8	69.9	O.E.	Roller
4877	76	51:53	128:53	5	1 VIII 27	404	42	66.3	79.6	O.E.	Roller
4878	76	51:59	128:48	7	14 V 27	325	60	73.5	75.6	O.E.	Roller
4879	77	51:53	128:53	3	21 VII 27	392	45	69.7	74.0	O.E.	Roller
4883	77	51:59	128:48	8	14 V 27	324	60	61.7	65.4	O.E.	Roller
4887	77	51:42	129:47	31	30 IX 27	463	55	60.0	67.1	O.E.	Roller
4888	77	51:50	129:07	7	12 IV 28	658	25	56.2	60.3	O.E.	Roller
4893	77	51:43	129:21	17	9 V 28	685	30	53.9	64.6	IFC.	Deck
4901	77	51:48	129:15	12	25 IX 28	824	40	61.0	75.0	O.E.	....
4906	77	51:56	128:50	5	27 IV 27	307	60	61.0	63.5	O.E.	Roller
4907	77	51:59	128:51	6	21 VIII 27	423	40	63.2	70.5	O.E.	Roller
4908	77	51:53	128:53	4	1 VIII 27	403	42	58.5	61.3	O.E.	Roller
4911	77	51:59	128:48	8	14 V 27	324	60	62.4	61.2	O.E.	Roller
4914	77	51:59	128:53	6	1 IV 28	647	60	60.2	77.5	O.E.	Deck
4920	77	51:59	128:51	5	15 VII 27	386	45	53.6	58.4	O.E.	Dory
4926	77	51:46	129:25	18	28 IX 26	96	45	64.4	64.6	R.B.	Roller
4933	77	51:56	128:50	6	27 IV 27	307	60	71.6	76.2	O.E.	Roller
4934	77	51:59	128:56	5	24 IV 28	670	62	71.0	73.6	O.E.	Roller
4935	77	51:58	129:05	5	14 V 27	324	55	61.6	66.0	*	....
4939	77	51:56	128:55	3	3 VIII 27	405	45	70.2	76.4	O.E.	Roller
4942	77	51:58	128:42	11	29 V 28	705	48	53.5	66.0	O.E.	Roller
4947	77	51:56	128:53	4	17 VIII 27	419	45	75.5	84.1	O.E.	Roller
4950	77	51:56	128:53	4	3 VIII 27	405	45	62.0	68.1	O.E.	Roller
4957	77	51:42	129:23	20	12 VIII 26	49	60	76.7	77.8	R.B.	Roller
4958	77	51:51	129:01	4	12 IV 28	658	55	52.1	...	...	Deck
4959	77	51:17	128:33	41	18 IV 28	664	25	64.5	74.9	O.E.	Roller
4960	77	51:50	128:42	11	16 VIII 27	418	50	66.2	71.6	O.E.	Deck
4963	77	51:47	128:54	8	28 IV 27	308	36	67.3	70.6	O.E.	Cleaning
4967	77	51:46	129:11	11	1 VI 27	342	35	64.5	67.9	O.E.	Roller

APPENDIX B. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12
4969	77	51:57	128:55	3	21 IV 27	301	32	54.5	56.2	O.E.	Roller
4971	77	51:56	128:50	6	27 IV 27	307	60	54.0	57.7	O.E.	Roller
4975	77	51:59	128:51	6	22 VIII 27	424	40	60.6	71.4	O.E.	Roller
4976	77	51:48	129:05	8	20 V 27	330	55	68.6	69.4	O.E.	Cleaning
4978	77	51:51	129:01	4	12 IV 28	658	55	51.9	73.6	O.E.	Deck
4979	77	51:54	128:47	7	13 IV 28	659	38	54.6	71.5	O.E.	Roller
4984	77	51:59	128:51	5	19 VII 27	390	45	70.0	76.0	O.E.	Roller
4985	77	51:54	128:35	15	20 V 28	696	..	71.9	79.5	O.E.	Deck
4989	77	51:59	128:51	5	20 VII 27	391	45	73.0	...	...	Roller
4992	77	51:53	128:52	5	24 IV 27	304	30	60.0	65.1	O.E.	Roller
4995	77	51:54	129:27	19	11 VIII 27	413	50	56.5	67.4	O.E.	Deck
4996	77	51:27	129:23	32	3 IX 28	802	45	51.9	73.2	O.E.	Roller
4999	77	51:59	128:56	5	24 IV 28	670	62	69.6	76.9	O.E.	Roller
5000	77	51:59	128:56	5	24 IV 28	670	63	65.1	76.7	O.E.	Roller
5003	77	51:53	128:49	6	3 VIII 27	405	50	68.7	71.1	*	Deck
5004	77	51:26	129:16	30	2 XI 26	131	70	64.5	63.0	H.L.	Deck
5005	77	51:53	128:52	5	24 IV 27	304	30	69.4	70.5	O.E.	Roller
5007	77	51:56	128:50	5	27 IV 27	307	60	67.5	70.0	O.E.	Roller
5008	77	50:24	128:06	95	11 VIII 28	779	45	67.2	...	...	....
5011	77	51:51	128:40	12	13 III 28	628	55	63.7	74.5	O.E.	Cleaning
5013	77	51.43	129:23	20	15 VII 27	386	..	63.6	68.4	R.B.	Roller
5014	77	51:56	128:55	3	5 VIII 27	407	50	56.6	57.8	O.E.	Roller
5020	78	51:53	128:53	4	1 VIII 27	402	42	55.2	60.8	O.E.	Roller
5021	78	51:59	128:48	3	14 V 27	323	60	59.3	61.9	O.E.	Roller
5023	78	51:45	129:34	29	6 X 27	468	52	53.9	66.2	O.E.	Roller
5024	78	51:59	128:48	3	14 V 27	323	60	65.0	69.3	O.E.	Roller
5026	78	51:59	128:56	4	24 IV 28	669	62	59.2	71.5	O.E.	....
5032	78	51:58	128:46	3	5 VII 27	375	55	51.2	56.3	R.B.	L. S.
5033	78	51:59	128:48	3	14 V 27	323	60	63.6	69.4	O.E.	Roller
5035	78	51:56	128:55	2	3 VIII 27	404	45	59.1	65.3	O.E.	Roller
5037	78	51:52	128:57	7	16 VII 27	386	34	52.8	56.7	O.E.	Roller
5038	78	51:53	128:49	3	30 VII 27	400	50	65.8	71.1	*	Deck
5039	78	48:34	125:39	246	15 VI 28	721	35	58.0	71.1	*	Cleaning
5043	78	51:41	129:21	24	1 VIII 26	37	55	67.8	67.5	F.B.	Dory
5045	78	51:43	129:25	23	10 IX 26	77	42	56.9	58.6	R.B.	Roller
5046	78	51:49	128:54	6	9 IV 27	288	32	60.2	64.5	O.E.	Cleaning
5049	78	51:48	128:52	9	28 VIII 27	429	45	74.7	80.8	O.E.	Cleaning
5053	78	51:23	129:21	37	25 X 28	853	70	55.8	74.9	E.P.	Roller
5062	78	51:48	128:52	9	28 VIII 27	429	45	64.0	69.5	O.E.	Cleaning
5064	78	51:53	128:49	3	31 VII 27	401	50	67.4	76.2	*	Deck
5066	78	51:47	129:23	22	4 IX 28	802	45	68.2	79.3	O.E.	Roller
5068	78	51:56	128:55	4	16 VIII 27	417	44	55.9	63.1	O.E.	Roller
5070	78	51:59	128:48	3	14 V 27	323	60	65.9	68.0	O.E.	Roller
5071	78	51:59	128:48	3	14 V 27	323	60	67.0	71.7	O.E.	Roller
5077	78	51:58	129:05	9	13 V 27	322	55	65.5	71.1	*	....
5078	78	51:39	129:38	33	20 IX 26	87	55	70.2	71.0	L.B.	Roller
5079	78	51:53	128:49	3	31 VII 27	401	50	69.6	76.2	*	Deck
5080	78	....	.....	..	 27	...	..	67.4	...	...	....
5083	78	51:53	128:56	4	5 VI 28	711	55	59.5	68.5	O.E.	Roller
5084	78	51:50	128:43	8	15 VIII 28	782	55	69.6	79.1	O.E.	Cleaning
5091	78	51:51	129:00	7	8 IV 27	287	50	56.0	60.2	O.E.	Deck
5099	78	51:58	129:05	9	13 V 27	322	48	65.1	68.5	*	....
5101	78	51:57	129:03	7	8 VI 28	714	42	73.2	82.6	O.E.	Roller
5102	78	51:43	128:40	15	11 IV 28	656	45	56.7	72.0	O.E.	Roller
5103	78	....	.....	..	20 VIII 27	421	..	56.2	61.0	*	Fish House
5105	78	51:59	128:51	3	21 VIII 27	422	40	64.5	77.9	O.E.	Roller
5107	78	51:56	128:53	1	4 VIII 27	405	45	67.8	72.3	O.E.	Roller
5119	78	51:05	128:40	52	9 V 27	318	55	74.6	74.3	*	Cleaning
5121	78	51:41	129:28	27	10 V 27	319	45	71.5	74.3	O.E.	Cleaning
5122	79	51:30	129:32	34	4 X 27	464	65	64.2	72.2	O.E.	Deck
5123	79	51:27	129:26	33	2 X 27	462	50	69.5	80.9	O.E.	Roller
5124	79	52:00	129:17	25	2 VIII 26	36	65	69.5	69.5	N.F.	Roller
5125	79	51:53	128:49	9	3 VIII 27	402	50	71.9	78.7	*	Deck
5127	79	51:53	128:49	9	30 VII 27	398	50	68.9	74.9	*	Deck
5131	79	51:45	128:50	4	24 IV 28	667	35	57.7	68.9	*	....
5134	79	51:51	129:00	12	26 IV 27	303	35	71.4	70.6	O.E.	Roller
5135	79	51:44	128:40	3	23 II 28	606	60	64.8	73.1	O.E.	Deck
5136	79	51:47	128:37	3	9 VII 27	377	50	74.0	81.5	R.B.	Cleaning
5139	79	51:41	128:41	3	7 V 27	314	30	58.0	61.3	O.E.	Cleaning
5140	79	51:46	128:41	1	17 VIII 28	782	40	65.3	82.9	O.E.	Roller
5142	79	51:02	128:32	46	14 III 27	260	55	66.3	67.3	H.L.	Roller
5144	80	51:36	128:46	11	24 IV 28	666	24	66.9	75.1	O.E.	Roller
5146	80	52:00	129:17	25	2 VIII 26	35	65	68.8	68.7	N.F.	Roller
5147	80	51:52	128:38	6	1 VI 28	704	50	60.0	77.8	O.E.	Deck
5150	80	51:59	128:51	14	25 VII 27	392	45	64.7	66.9	O.E.	Roller
5154	80	51:26	129:20	31	8 V 27	314	60	70.0	71.6	O.E.	Deck
5159	80	51:50	128:53	7	4 VII 28	737	40	67.5	73.9	O.E.	Roller
5160	80	51:51	128:40	5	24 VI 28	727	50	64.8	78.0	O.E.	Deck
5162	80	51:52	129:07	14	10 IV 27	286	45	62.2	69.1	O.E.	Roller
5166	80	51:56	128:50	10	27 IV 27	303	60	66.3	73.3	O.E.	Roller
5167	80	51:47	128:37	4	17 VII 27	384	30	63.8	70.6	O.E.	Cleaning
5170	80	51:51	128:40	5	24 VI 28	727	50	67.7	84.8	O.E.	Deck
5172	80	51:30	128:42	17	24 IV 27	300	..	54.7	...	...	L. S.
5182	80	51:53	128:49	8	3 VIII 27	401	50	67.9	71.8	*	Deck
5183	80	51:53	128:49	8	2 VIII 27	400	50	61.0	67.3	*	Deck
5184	80	51:45	129:34	31	5 X 27	464	52	59.6	68.3	O.E.	Roller
5185	80	51:41	129:24	25	15 IX 28	810	..	63.0	...	...	....
5188	81	51:48	129:15	19	1 IX 28	796	40	54.9	68.8	O.E.	Roller
5191	81	51:49	129:16	20	26 V 28	698	65	70.0	88.4	O.E.	Roller
5192	81	51:44	128:53	6	10 IV 27	286	38	66.0	77.0	O.E.	Deck
5193	81	51:52	128:38	6	1 VI 28	704	50	67.6	81.1	O.E.	Deck
5194	81	51:53	128:49	6	1 VIII 27	399	50	67.5	72.4	*	Deck

Appendix B. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12
5198	81	51:53	128:53	6	1 VIII 27	399	42	68.0	76.8	O.E.	Roller
5199	81	51:40	129:18	22	2 IX 27	431	50	58.0	67.3	O.E.	Roller
5200	81	51:53	128:49	6	2 VIII 27	400	50	65.3	71.1	*	Deck
5201	81	51:53	128:49	6	4 VIII 27	402	..	63.2	69.8	*	Deck
5202	81	....	.....	..	VIII 27	...	..	70.3	87.2	O.E.	Fish House
5205	81	51:51	128:40	5	6 VII 28	739	45	65.1	76.8	O.E.	Deck
5207	81	51:47	128:54	5	28 IV 27	304	36	71.8	73.5	O.E.	Cleaning
5212	81	51:53	128:49	6	3 VIII 27	401	50	70.5	78.7	*	Deck
5213	81	51:46	129:25	25	28 IX 26	92	45	69.6	69.7	R.B.	Roller
5219	82	51:59	128:48	10	18 VII 27	384	50	68.9	77.1	O.E.	Cleaning
5220	82	51:42	129:14	19	15 IV 28	656	45	61.0	67.1	O.E.	Roller
5224	82	51:32	128:34	19	24 IV 28	665	22	65.2	86.3	O.E.	Roller
5225	82	51:52	128:38	5	31 V 28	702	48	68.6	86.8	O.E.	Cleaning
5226	82	....	.....	..	3 VIII 27	400	..	61.2	74.9	*	....
5228	82	51:54	128:47	5	7 III 28	617	50	60.2	76.5	O.E.	Roller
5229	82	51:47	129:23	23	14 VIII 28	777	45	68.5	76.8	O.E.	Roller
5235	82	51:50	128:42	2	16 VIII 27	413	50	73.7	83.4	O.E.	Deck
5237	82	51:44	128:53	5	24 IV 27	299	25	68.3	68.6	*	Deck
5241	82	51:47	129:23	23	4 IX 28	798	45	70.6	78.9	O.E.	Roller
5248	82	51:56	128:46	7	14 III 27	258	45	64.0	66.0	O.E.	Cleaning
5249	82	51:59	128:51	10	20 VII 27	386	45	62.2	69.3	O.E.	Roller
5250	82	51:58	129:05	15	13 V 27	318	55	68.0	68.6	*	....
5251	82	51:30	129:10	24	V 27	...	30	67.2	91.4	*	Cleaning
5254	82	51:52	128:57	7	22 VI 28	724	30	60.2	71.0	W.H.	Cleaning
5260	82	51:53	128:52	5	16 IV 27	291	55	60.6	69.5	F.B.	Cleaning
5270	82	51:51	128:40	4	4 VIII 28	767	45	67.8	77.8	O.E.	Roller
5274	82	51:54	128:35	8	20 V 28	691	48	62.3	72.5	O.E.	Deck
5275	82	51:59	128:53	11	1 IV 28	642	60	70.2	70.0	O.E.	Deck
5277	82	51:50	128:42	2	16 VIII 27	413	50	66.4	70.5	O.E.	Deck
5278	82	51:51	128:40	4	24 VI 28	726	50	71.4	79.4	O.E.	Roller
5279	82	51:53	128:49	5	3 VIII 27	400	50	69.6	78.1	*	Deck
5284	82	51:42	129:47	38	29 IX 27	457	55	62.8	71.6	O.E.	Deck
5287	82	51:33	129:26	28	23 VIII 26	55	65	67.7	67.4	R.B.	Cleaning
5294	82	52:48	131:01	100	15 VI 28	717	40	61.3	71.3	O.E.	Roller
5306	82	51:54	128:35	8	20 V 28	691	48	63.2	71.6	O.E.	Deck
5310	82	51:50	128:42	2	16 VIII 27	413	50	67.7	75.4	O.E.	Deck
5319	82	51:56	128:53	9	19 VII 27	385	30	73.4	81.0	O.E.	Cleaning
5321	82	51:32	128:38	18	3 IV 28	644	23	70.0	77.0	O.E.	L. S.
5324	82	51:30	129:25	31	6 VII 27	372	44	58.4	66.3	R.B.	Dory
5327	82	51:53	128:49	5	1 VIII 27	398	50	70.0	80.0	*	Deck
5328	82	51:50	128:42	2	16 VIII 27	413	50	56.0	64.6	O.E.	Deck
5332	82	51:51	128:40	4	3 VIII 28	766	45	58.6	68.3	O.E.	Roller
5334	82	51:56	128:46	7	14 III 27	258	45	67.0	67.9	O.E.	Cleaning
5349	84	52:40	130:59	5	22 VII 28	743	35	58.8	74.9	IFC.	Deck
5363	85	52:47	130:34	8	19 VII 27	373	50	58.8	65.5	O.E.	Cleaning
5372	88	54:12	132:07	2	24 IX 27	437	75	68.4	70.2	N.F.	L. S.
5377	88	54:07	132:08	4	19 X 28	828	8	61.8	83.0	N.F.	Cleaning
5378	88	54:11	132:12	1	7 IX 26	55	20	60.8	60.2	L.B.	Roller
5381	89	....	.....	..	27	...	..	67.9	...	...	....
5388	89	54:08	132:15	7	10 VIII 28	757	35	64.8	71.5	N.F.	L. S.
5392	89	54:12	132:10	5	1 VIII 26	17	50	62.6	61.5	L.B.	Roller
5393	89	54:12	132:07	4	23 IX 27	435	75	65.5	69.0	N.F.	Roller
5395	89	54:11	132:04	3	20 VII 27	270	37	61.6	63.5	N.F.	Roller
5397	89	54:11	132:06	3	14 VII 28	730	35	72.1	79.0	N.F.	Deck
5398	89	54:12	132:41	23	23 VIII 27	404	55	62.3	63.9	N.F.	Deck
5399	89	54:11	132:04	3	20 VII 27	370	38	67.0	68.3	N.F.	Roller
5400	89	54:13	132:09	6	23 VII 26	8	57	70.0	69.8	N.F.	Roller
5454	52	55:35	133:54	2	27 VIII 25	16	55	65.2	67.3	*	....
5554	53	56:29	135:16	74	27 X 25	76	85	73.0	76.2	*	Deck
5603	53	55:40	133:47	7	30 VIII 25	18	40	69.2	71.2	*	....
5709	20	52:03	129:48	58	29 IX 25	87	60	79.0	81.2	*	....
5742	21	52:31	130:47	14	16 VIII 25	42	65	88.1	88.9	*	....
5752	23	54:41	132:01	55	9 X 25	95	32	86.7	85.0	*	Roller
5767	23	54:17	131:11	21	10 VIII 25	35	28	70.8	72.4	*	....
5770	23	54:19	131:10	23	27 VII 25	21	27	84.5	95.2	*	....
5792	28	54:41	132:04	0	22 X 25	99	32	76.4	78.7	*	Deck
5795	28	54:41	132:04	0	13 IX 25	60	32	70.0	61.6	*	....
5798	28	54:42	132:13	5	25 VIII 25	41	35	80.5	73.6	*	....
5801	28	54:41	132:04	0	27 VII 25	12	35	68.8	60.9	*	....
5808	28	54:41	132:04	0	9 IX 25	56	35	77.0	76.2	*	....
5809	28	54:41	132:04	0	16 VIII 25	32	35	71.5	72.4	*	....
5811	28	54:41	132:04	0	11 VIII 25	27	36	68.2	71.1	*	....
5816	28	54:41	132:04	0	10 IX 25	57	35	68.9	70.1	*	....
5828	28	54:41	132:04	0	21 VIII 25	37	45	79.9	84.4	*	....
5829	28	54:41	132:04	0	16 VI 26	336	35	70.2	70.5	N.F.	Cleaning
5834	28	54:41	132:04	0	9 IX 25	56	35	71.8	73.3	*	....
5837	28	54:41	132:04	0	8 IX 25	55	35	71.5	72.4	*	....
5840	28	54:41	132:04	0	26 VIII 25	42	..	71.4	...	...	L. S.
5845	28	54:41	132:04	0	27 VII 25	12	35	74.4	74.3	*	....
5847	28	54:41	132:04	0	20 X 25	97	45	73.1	...	...	....
5851	28	54:41	132:04	0	15 IX 25	62	36	68.4	72.4	*	....
5853	28	54:41	132:04	0	14 X 25	91	45	69.7	58.4	*	....
5855	28	54:41	132:04	0	12 IX 25	59	50	75.9	45.5	*	....
5859	28	54:41	132:04	0	23 X 25	100	..	71.1	...	...	L. S.
5862	28	54:41	132:04	0	27 VII 25	12	35	74.1	74.9	*	....
5864	28	54:41	132:04	0	19 VIII 25	35	..	71.7	73.0	*	....
5867	28	54:41	132:04	0	9 X 26	451	36	80.2	83.7	N.F.	Cleaning
5868	28	54:41	132:04	0	25 X 25	102	37	65.8	69.8	*	Roller
5872	28	54:41	132:04	0	10 VIII 25	26	38	76.7	76.2	*	....
5874	28	54:41	132:04	0	21 V 26	310	57	62.2	66.0	*	....
5876	28	54:41	132:04	0	25 VIII 25	41	36	66.7	66.0	*	....
5879	28	54:41	132:04	0	25 VIII 25	41	36	79.0	80.0	*	....

APPENDIX B. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12
5880	28	54:41	132:04	0	1 VII 26	351	50	69.2	72.4	N.F.	Cleaning
5881	28	54:41	132:04	0	17 IX 25	64	36	65.7	71.1	*	....
5892	29	54:41	132:04	0	14 IX 25	60	32	83.9	83.8	*	....
5895	29	54:41	132:04	0	26 VIII 25	41	..	70.4	...	...	L. S.
5896	29	54:41	132:04	0	10 VIII 25	25	40	65.1	71.1	*	....
5899	29	54:41	132:04	0	7 X 25	83	42	74.2	74.9	*	....
5904	29	54:41	132:04	0	9 IX 25	55	35	69.0	69.8	*	....
5910	29	54:41	132:04	0	23 VII 25	7	36	82.1	81.2	*	....
5914	29	54:41	132:04	0	27 VIII 25	42	..	64.5	...	...	L. S.
5917	29	54:41	132:04	0	25 VIII 25	40	36	81.2	83.8	*	....
5918	29	54:41	132:04	0	30 VII 25	14	35	70.1	69.8	*	....
5919	29	54:41	132:04	0	25 VIII 25	40	36	71.5	76.2	*	....
5920	29	54:41	132:04	0	21 VIII 25	36	45	68.1	73.6	*	....
5921	29	54:41	132:04	0	25 X 25	101	37	70.5	74.9	*	Roller
5925	29	54:41	132:04	0	7 X 25	83	42	60.1	62.2	*	....
5927	29	54:41	132:04	0	27 VIII 25	42	36	71.7	74.9	*	....
5928	29	54:41	132:04	0	25	...	..	64.6	...	...	....
5932	29	54:20	131:11	38	20 VIII 25	35	30	70.3	71.1	*	....
5934	29	54:41	132:04	0	24 VIII 25	39	36	83.5	81.3	*	....
5939	29	54:41	132:04	0	30 VIII 25	45	36	64.8	43.2	*	....
5941	29	54:41	132:04	0	10 VII 26	359	45	78.0	86.3	*	Roller
5943	29	54:41	132:04	0	25 VIII 25	40	36	68.2	68.5	*	....
5951	29	54:41	132:04	0	21 VII 25	5	35	62.1	...	...	....
5954	29	54:41	132:04	0	17 IX 25	63	36	78.0	78.7	*	....
5955	29	54:41	132:04	0	13 IX 25	59	32	74.8	76.2	*	....
5966	30	54:35	130:58	20	26 VIII 25	40	35	72.5	74.9	*	....
6096	54	56:35	134:19	65	12 IX 25	30	15	66.5	...	...	Trolling
6200	54	55:35	133:54	1	25 VIII 25	12	55	71.0	71.2	*	....
6325	56	54:05	133:39	46	3 X 25	49	130	65.1	81.2	*	....
6426	56	54:22	133:44	30	11 X 25	57	125	69.0	73.0	*	....
7202	89	54:20	131:18	29	10 III 27	238	18	67.3	62.7	N.F.	Cleaning
7211	89	....	.....	..	III–VIII 27	...	..	66.1	...	...	....[3]
7212	89	54:13	132:10	6	28 IX 28	806	50	66.0	70.0	N.F.	Cleaning
7222	89	54:11	132:07	4	22 IX 27	436	75	63.3	67.2	N.F.	L. S.
7223	89	54:11	132:04	3	20 VII 27	370	37	71.5	73.4	N.F.	Roller
7224	89	54:15	131:05	35	7 VII 27	357	32	67.8	...	...	L. S.
7225	89	54:23	131:37	20	12 X 26	89	92	59.4	60.3	N.F.	Cleaning
7227	89	....	.....	..	III–VIII 27	...	..	58.0	...	...	....[3]
7241	89	53:48	130:39	57	28 IV 27	287	..	63.5	74.0	N.F.	....
7250	89	56:09	134:58	157	1 III 28	595	115	62.8	66.0	*	L. S.
7253	89	....	.....	..	III–VIII 27	...	..	65.1	...	...	....[3]
7254	89	54:19	131:20	27	4 X 27	446	35	69.9	...	...	L. S.
7261	89	54:11	132:07	4	22 IX 27	434	75	61.5	63.2	N.F.	Roller
7263	89	54:10	132:06	2	9 VI 27	329	30	67.0	67.3	*	Roller
7266	89	54:15	131:35	16	3 III 27	231	40	63.2	62.5	N.F.	Roller
7271	89	54:11	132:01	2	1 VIII 26	17	50	70.5	69.9	L.B.	Roller
7272	90	54:10	132:21	11	5 IX 26	51	20	66.6	66.6	L.B.	Roller
7277	89	54:10	132:06	2	24 VI 27	344	30	64.5	66.0	*	Roller
7281	89	54:06	132:05	3	13 V 27	302	18	59.3	60.3	N.F.	L. S.
7287	89	54:11	132:07	4	21 IX 27	433	75	50.3	53.1	N.F.	Roller
7289	89	51:19	128:17	233	12 VI 27	332	20	62.9	...	...	Roller
7294	90	54:11	132:04	3	16 VIII 28	762	35	51.1	61.5	N.F.	Roller
7300	90	54:11	132:07	4	23 X 27	464	75	62.2	66.4	N.F.	Roller
7308	90	54:20	132:10	12	16 VIII 26	31	..	69.5	72.4	*	Deck
7309	90	54:13	132:10	6	3 VIII 26	18	62	68.8	69.0	L.B.	Roller
7311	90	54:09	131:57	3	1 VIII 28	747	25	59.6	71.5	N.F.	Roller
7314	90	54:15	132:09	8	1 IX 27	412	48	60.0	62.9	N.F.	Cleaning
7324	90	50:59	127:55	249	12 III 28	605	40	62.0	76.2	*	....
7337	90	51:30	129:29	201	16 IV 28	640	40	52.5	61.0	O.E.	Roller
7341	90	54:13	132:10	6	2 VIII 26	17	62	67.8	67.4	L.B.	L. S.
7342	90	54:10	132:21	12	18 VII 27	367	50	61.5	67.3	*	L. S.
7343	90	52:54	130:37	110	17 V 27	305	60	69.9	72.6	N.F.	Roller
7347	90	52:57	130:37	102	1 VI 28	686	45	54.6	66.2	O.E.	Cleaning
7350	90	54:11	132:04	3	24 IX 26	70	40	73.6	74.5	N.F.	Roller
7351	90	54:08	131:58	2	15 VI 28	700	30	59.1	63.5	N.F.	L. S.
7356	90	....	.....	..	III–VIII 27	...	..	70.8	...	...	....[3]
7363	90	....	.....	..	III–VIII 27	...	..	68.9	...	...	....[3]
7364	90	54:13	132:07	6	29 IX 28	806	65	55.7	67.0	N.F.	Roller
7367	90	54:10	131:51	6	13 VIII 28	759	30	67.5	71.5	N.F.	Roller
7372	90	....	.....	..	III–VIII 27	...	..	59.1	...	...	....[3]
7374	90	51:47	129:23	187	8 IV 28	632	40	54.8	68.9	O.E.	Roller
7380	90	48:34	125:48	419	16 V 28	670	..	67.3	76.6	O.E.	....
7381	90	54:13	132:10	6	10 IX 28	787	50	67.2	...	...	Cleaning
7382	90	54:11	132:07	4	24 IX 27	435	75	60.9	63.0	N.F.	Roller
7386	90	54:25	133:36	57	20 X 28	827	120	61.2	69.0	N.F.	L. S.
7387	90	54:10	132:10	5	10 X 26	86	40	64.8	64.0	N.F.	Roller
7396	90	54:10	132:06	4	8 VIII 27	388	30	64.8	67.3	*	....
7399	90	54:10	132:31	18	8 X 27	449	40	65.3	66.2	N.F.	Cleaning
7402	90	54:18	131:19	27	5 IX 28	782	40	63.9	74.5	N.F.	Cleaning
7406	90	54:10	132:06	3	23 VI 27	342	30	63.5	64.8	*	Roller
7407	90	51:27	128:33	219	24 III 27	251	24	65.9	66.8	O.E.	Deck
7408	90	54:11	132:07	4	21 IX 27	432	75	65.3	67.6	N.F.	Roller
7417	90	54:12	132:41	22	6 XI 26	113	50	71.2	71.9	N.F.	....
7420	90	54:11	132:04	3	20 VII 27	369	37	63.9	65.9	N.F.	Roller
7421	94	51:54	131:04	1	26 IV 27	274	50	87.5	89.5	*	Roller
7423	94	52:05	130:05	39	3 VIII 27	373	70	68.0	71.6	O.E.	Roller
7427	95	55:09	133:48	20	29 VI 27	337	70	60.7	62.3	O.E.	Roller
7429	95	54:02	133:17	50	5 V 27	282	38	67.5	66.0	*	Deck
7430	95	51:42	129:15	255	14 VI 27	322	40	70.9	72.4	H.L.	Deck
7432	95	54:46	133:33	4	31 VIII 26	35	50	62.0	62.3	L.B.	Cleaning
7445	95	54:47	133:37	2	14 IX 27	414	60	76.9	80.0	N.F.	L. S.
7448	95	55:24	134:03	37	2 VIII 27	371	50	73.5	71.1	*	Deck

APPENDIX B. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12
7449	95	54:45	133:34	5	14 IX 26	49	58	77.9	78.7	*	Cleaning
7457	95	54:25	133:36	24	22 VI 27	330	110	89.5	91.0	O.E.	Deck
7464	95	55:06	134:09	25	4 VIII 28	739	95	94.0	95.5	N.F.	Roller
7465	95	54:49	133:34	3	16 IX 26	51	88	88.5	71.1	*	Cleaning
7470	95	54:46	133:37	4	4 VIII 26	8	75	82.2	88.2	*	Roller
7478	95	54:49	133:34	3	16 IX 26	51	87	75.6	76.2	*	Cleaning
7488	95	54:46	133:37	4	4 VIII 26	8	75	80.3	79.8	N.F.	Roller
7491	95	54:08	133:35	40	2 XI 26	98	142	79.9	91.4	*	L. S.
7494	96	55:40	133:57	7	11 VIII 26	13	45	69.5	70.9	N.F.	Deck
7496	96	55:28	134:38	26	13 V 27	288	110	66.5	66.0	*	Cleaning
7500	96	55:36	134:02	7	19 VI 27	325	50	67.6	69.8	N.F.	Roller
7508	96	55:45	134:05	11	9 VIII 28	742	100	67.9	75.0	N.F.	Cleaning
7509	96	55:38	133:57	2	11 VIII 26	13	64	67.5	66.3	N.F.	Deck
7519	96	55:32	134:09	10	23 V 27	298	50	69.5	...	...	....
7527	96	53:42	133:00	120	12 VI 28	684	70	59.5	64.0	N.F.	Deck
7530	96	55:35	133:55	2	18 VIII 27	385	55	65.2	67.9	O.E.	Deck
7537	96	55:35	133:55	2	18 VIII 27	385	55	62.8	68.2	O.E.	Deck
7538	96	53:33	133:59	5	1 VII 27	337	50	67.0	68.6	R.B.	Deck
7540	96	55:35	133:54	1	16 VI 27	322	56	60.2	63.1	N.F.	Roller
7541	96	55:38	133:57	2	11 VIII 26	13	64	58.9	59.8	N.F.	Deck
7545	96	55:36	133:41	7	17 VII 27	353	25	63.4	63.5	N.F.	Roller
7549	96	55:39	133:57	4	3 VIII 26	5	60	66.7	66.0	*	Dory
7558	96	55:27	134:03	11	24 V 28	665	65	58.8	64.9	O.E.	Roller
7559	96	54:07	133:30	91	14 IV 28	625	210	65.2	69.6	N.F.	Cleaning
7563	96	55:39	133:57	4	5 VIII 26	7	60	73.2	72.4	*	....
7570	96	55:32	134:09	10	23 V 27	298	50	71.8	...	...	....
7574	96	56:18	135:05	58	18 X 26	81	80	72.1	73.4	N.F.	Roller
7578	96	55:36	134:02	7	20 VI 27	326	50	58.8	57.2	N.F.	Roller
7581	96	56:00	134:20	31	10 VII 27	346	43	69.1	74.2	N.F.	Cleaning
7593	96	55:36	134:02	7	9 VI 27	315	50	62.8	62.4	N.F.	Roller
7597	96	55:35	133:55	2	18 VIII 27	385	55	59.6	63.3	O.E.	Deck
7615	96	55:17	134:10	22	22 V 27	297	50	64.0	...	...	....
7620	96	56:17	134:39	48	8 VIII 28	741	15	69.3	72.5	N.F.	Deck
7626	96	55:33	133:59	5	1 VII 27	337	50	64.0	67.7	R.B.	Deck
7628	96	55:30	134:03	9	17 IX 27	415	69	69.3	78.1	O.E.	Roller
7644	96	55:30	134:03	9	17 IX 27	415	69	56.6	62.0	O.E.	Roller
7645	96	55:35	134:54	35	27 III 27	241	107	66.7	77.8	N.F.	Deck
7646	96	55:45	134:05	11	13 VIII 28	746	100	70.3	86.0	N.F.	Cleaning
7649	96	55:33	133:59	5	1 VII 27	337	50	68.5	72.0	R.B.	Deck
7652	96	55:17	133:58	19	21 V 28	662	67	65.0	70.9	O.E.	Deck
7659	96	55:23	134:08	16	16 V 28	657	70	64.8	71.4	O.E.	Roller
7661	96	55:48	134:46	31	19 IV 27	264	106	67.8	68.9	N.F.	Roller
7669	96	55:33	133:59	5	1 VII 27	337	50	71.3	72.9	R.B.	Deck
7670	96	55:39	133:59	3	31 VII 26	2	64	59.5	58.1	N.F.	Roller
7671	96	55:32	133:57	5	1 IX 26	34	55	62.3	64.8	*	Deck
7679	96	55:34	133:55	3	5 VI 27	311	55	64.8	67.8	N.F.	....
7687	96	....	.....	..	27	...	..	66.9	68.9	N.F.	....
7688	96	55:30	133:50	7	18 VI 27	324	45	68.9	74.9	*	Deck
7689	96	55:30	134:03	9	17 IX 27	415	69	64.8	72.4	O.E.	Roller
7696	96	55:33	133:59	5	1 VII 27	337	50	63.0	66.0	R.B.	Deck
7699	96	58:06	148:50	620	17 III 28	597	140	64.0	...	...	Deck
7704	96	55:37	133:59	3	25 V 27	300	58	59.6	58.3	N.F.	Roller
7724	96	55:31	134:04	8	19 VII 27	355	58	77.9	80.0	N.F.	Cleaning
7738	96	55:38	134:48	30	27 III 27	241	107	75.2	78.5	N.F.	Deck
7749	96	....	.....	..	VIII–XI 28	...	..	66.8	77.5	*	Fish House
7759	96	....	.....	..	27	...	..	58.5	60.5	N.F.	....
7760	96	53:57	131:07	141	27 VI 28	699	48	64.0	68.5	N.F.	Cleaning
7764	96	55:32	133:57	5	31 VIII 26	33	55	63.0	63.5	*	Deck
7776	96	55:36	134:02	7	18 VI 27	324	50	62.2	61.0	N.F.	Roller
7778	96	55:33	133:59	5	1 VII 27	337	50	60.2	62.9	R.B.	Deck
7780	96	55:33	133:59	5	1 VII 27	337	50	67.9	69.4	R.B.	Deck
7784	96	55:37	134:03	6	2 V 28	643	120	64.7	68.6	*	Cleaning
7786	96	55:46	134:03	12	31 X 27	459	100	63.7	...	...	Cleaning
7788	96	55:41	134:41	27	5 III 28	585	95	62.5	69.8	*	....
7790	96	55:32	133:48	5	29 VI 27	335	35	66.5	73.7	*	Cleaning
7795	96	55:21	134:02	17	2 IX 26	35	64	68.8	74.9	*	Dory
7799	96	55:36	133:02	7	6 VI 27	312	50	65.5	65.7	N.F.	Cleaning
7811	96	55:36	133:53	0	5 VIII 26	7	55	69.2	69.8	*	....
7812	96	55:29	133:57	8	17 V 27	292	55	61.8	62.4	N.F.	L. S.
7818	96	48:44	125:54	519	16 V 28	657	32	59.5	70.8	O.E.	Cleaning
7823	96	55:36	133:02	7	4 VI 27	310	50	75.1	74.8	N.F.	Roller
7826	96	....	.....	..	27	...	..	75.8	73.8	N.F.	....
7828	96	55:35	133:55	2	18 VIII 27	385	55	80.4	85.6	O.E.	Deck
7829	96	55:49	134:52	36	8 V 28	649	90	68.1	73.7	*	Cleaning
7836	96	55:36	133:02	7	7 VI 27	313	50	68.1	67.2	N.F.	Roller
7840	96	55:38	133:56	2	10 VI 27	316	64	76.2	78.8	N.F.	Cleaning
7851	96	55:48	134:05	13	16 VIII 27	383	120	83.6	71.2	*	Deck
7855	97	55:23	134:04	16	6 V 27	280	69	70.2	...	...	L. S.
7858	97	55:35	133:55	4	18 VIII 27	384	55	65.1	68.3	O.E.	Deck
7861	97	55:21	134:02	18	4 IX 26	36	64	71.5	65.4	*	Deck
7864	97	55:30	134:04	9	17 IX 27	414	69	78.4	79.9	O.E.	Roller
7865	97	55:31	133:48	9	6 VI 28	677	..	63.2	...	...	....
7868	97	55:36	134:02	4	20 VI 27	325	50	70.4	62.8	N.F.	Roller
7869	97	55:39	133:59	1	31 VII 26	1	64	72.0	72.4	*	Roller
7872	97	55:31	134:48	30	20 IV 27	264	110	87.2	87.8	N.F.	L. S.
7876	97	55:31	133:55	8	19 VI 27	324	50	69.2	75.6	*	Deck
7877	97	49:54	127:31	430	5 IX 28	768	40	63.7	76.0	O.E.	Roller
7880	97	55:37	133:59	1	25 V 27	299	58	71.5	76.3	N.F.	Roller
7882	97	55:52	135:19	47	8 X 28	801	105	66.1	77.0	N.F.	Roller
7891	97	55:35	133:54	4	16 VI 27	321	56	55.3	58.8	N.F.	Roller
7902	97	55:31	133:55	8	19 VI 27	324	50	68.1	77.5	*	Deck
7904	97	55:36	133:59	4	13 V 27	287	65	63.2	67.3	*	Cleaning

APPENDIX B. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12
7905	97	55:36	133:53	3	5 VIII 26	6	55	70.9	71.1	*	....
7909	97	55:23	134:04	16	6 V 27	280	68	63.0	63.3	N.F.	....
7921	97	50:53	128:39	359	1 V 28	641	35	61.2	71.0	O.E.	Roller
7923	97	55:34	133:55	5	5 VI 27	310	55	63.8	64.3	N.F.	....
7928	97	53:48	130:58	164	18 V 28	658	35	63.9	78.0	N.F.	Cleaning
7931	97	55:30	134:04	9	17 IX 27	414	69	62.2	66.4	O.E.	Roller
7933	97	55:36	134:02	4	23 VI 27	328	50	65.7	65.2	N.F.	Roller
7935	97	55:30	133:52	10	18 VI 27	323	50	71.5	80.0	*	Deck
7942	97	53:40	130:52	166	17 VII 27	352	27	56.6	63.0	N.F.	Cleaning
7944	97	55:35	133:54	4	16 VI 27	321	56	63.2	60.9	N.F.	Roller
7946	97	55:39	133:59	1	1 VIII 26	2	64	70.8	70.1	*	Roller
7947	97	55:23	134:04	16	6 V 27	280	68	62.4	73.4	N.F.	....
7948	97	55:39	133:57	0	5 VIII 26	6	60	68.3	67.3	*	Dory
7949	97	55:40	133:52	3	1 VIII 26	2	..	61.7	61.6	IFC.	Deck
7950	97	55:25	134:06	15	18 VII 27	353	60	65.4	65.8	N.F.	Dory
7953	97	55:31	133:55	8	19 VI 27	324	50	62.7	67.3	*	Deck
7958	97	55:33	134:00	3	9 VII 27	344	45	64.0	64.2	N.F.	Roller
7960	97	55:36	134:02	4	21 VI 27	326	50	64.5	66.1	N.F.	Roller
7964	97	55:17	134 21	26	14 X 28	807	85	66.7	81.0	N.F.	L. S.
7972	97	55:36	133:59	4	13 V 27	287	65	62.9	66.6	*	Cleaning
7974	97	55:30	134:04	9	17 IX 27	414	69	73.2	78.0	O.E.	Roller
7980	97	55:46	134:03	8	31 X 27	458	100	70.0	...	...	Cleaning
7993	97	55:36	134:02	4	7 VI 27	312	50	62.1	63.5	N.F.	Roller
7995	97	55:23	134:04	16	6 V 27	280	69	60.1	65.0	N.F.	....
8006	97	54:18	131:15	134	8 VII 27	343	20	57.8	63.2	N.F.	Cleaning
8010	97	55:33	134:00	6	9 VII 27	344	45	70.1	71.1	N.F.	Roller
8011	97	55:35	133:54	4	28 VI 27	333	55	64.0	67.7	N.F.	Cleaning
8016	97	55:36	134:02	4	24 VI 27	329	50	78.8	76.0	N.F.	Roller
8021	97	55:36	134:02	4	9 VI 27	314	50	69.2	69.5	N.F.	Roller
8022	97	55:31	134:04	9	17 VII 27	352	58	71.7	74.5	N.F.	Roller
8026	97	55:38	133:56	1	10 VI 27	315	64	65.8	65.8	N.F.	Cleaning
8028	97	55:36	134:02	4	3 VI 27	308	50	71.2	71.4	N.F.	Roller
8030	97	55:36	134:02	4	10 VI 27	315	50	70.8	71.0	N.F.	Roller
8031	97	55:48	135:00	38	14 IV 28	624	105	60.7	67.8	N.F.	Deck
8037	97	55:33	133:59	5	1 VII 27	336	50	49.5	52.6	R.B.	Deck
8038	97	55:34	133:55	4	18 VIII 27	384	55	70.4	72.0	O.E.	Deck
8039	97	55:32	133:57	6	31 VIII 26	32	55	64.9	66.0	*	Deck
8043	97	53:36	130:52	167	13 V 27	287	35	59.0	60.8	N.F.	Roller
8050	97	55:39	133:59	1	31 VII 26	1	64	67.3	67.3	*	Roller
8053	97	56:31	133:44	78	26 III 27	239	50	71.6	71.1	*	....
8063	97	55:36	134:02	4	22 VI 27	327	50	57.5	56.0	N.F.	Roller
8067	97	55:25	133:56	14	1 IX 28	764	55	63.5	70.8	O.E.	Roller
8072	97	55:24	134:05	16	27 IX 27	424	65	64.4	68.5	O.E.	Roller
8074	97	55:38	134:00	2	24 V 27	298	70	65.9	69.2	O.E.	Cleaning
8076	97	55:36	133:53	3	5 VIII 26	6	55	64.6	63.5	*	....
8078	97	55:39	133:59	1	2 VIII 26	3	64	60.2	...	...	Dory
8091	97	55:34	133:55	4	18 VIII 27	384	55	59.4	...	...	Deck
8092	97	55:17	134:10	23	23 V 27	297	50	56.7	...	...	....
8094	97	55:39	133:59	1	1 VIII 26	2	64	60.4	60.3	*	Roller
8099	97	55:36	134:02	4	3 VI 27	308	50	65.3	65.6	N.F.	Roller
8100	97	55:30	134:13	13	2 VIII 26	3	73	70.4	74.0	W.T.	Dory
8103	97	55:29	133:57	10	29 V 27	303	54	59.3	58.6	N.F.	Cleaning
8105	97	55:36	134:02	4	5 VI 27	310	50	64.0	63.3	N.F.	Roller
8107	97	55:33	133:59	6	2 VI 27	307	45	78.8	80.3	N.F.	Roller
8111	97	55:35	133:54	4	12 IX 27	409	50	65.1	71.0	N.F.	Roller
8128	97	55:29	133:57	10	26 IV 27	270	50	69.1	69.8	*	Cleaning
8132	97	55:33	134:27	18	2 V 27	276	110	76.8	77.4	N.F.	Cleaning
8144	98	55:30	134:08	10	15 V 27	288	65	62.7	69.8	*	Cleaning
8145	98	55:39	133:59	2	1 VIII 26	1	64	61.7	61.0	*	Roller
8147	98	55:27	134:03	11	17 V 27	290	60	59.5	60.1	H.D.	L. S.
8155	98	55:26	131:52	140	15 VI 27	319	30	59.6	74.3	*	Roller
8156	98	55:37	133:59	1	25 V 27	298	58	60.0	61.2	N.F.	Roller
8159	98	55:28	133:54	10	25 V 27	298	35	69.2	70.3	N.F.	L. S.
8161	98	55:34	133:55	3	18 VIII 27	383	55	64.8	69.9	O.E.	Deck
8167	98	55:21	134:02	17	3 IX 26	34	64	75.3	66.6	*	Dory
8173	98	55:33	134:52	31	16 III 27	228	112	64.6	...	...	Cleaning
8175	98	55:29	133:57	9	18 V 27	291	55	63.1	65.8	N.F.	L. S.
8176	98	51:27	129:26	316	3 X 27	429	50	64.2	78.0	O.E.	Roller
8181	98	55:33	133:59	4	1 VII 27	335	50	69.9	71.3	R.B.	Deck
8185	98	55:34	133:55	3	18 VIII 27	383	55	57.8	63.7	O.E.	Deck
8204	98	55:34	133:55	3	18 VIII 27	383	55	56.5	64.2	O.E.	Deck
8205	98	55:17	134:10	22	22 V 27	295	50	61.7	...	...	....
8215	98	55:31	134:04	7	17 VII 27	351	58	68.6	70.3	N.F.	Roller
8222	98	55:27	134:07	11	7 VIII 26	7	59	62.2	65.4	*	Deck
8223	98	55:35	133:54	3	16 VI 27	320	56	62.4	62.5	N.F.	Roller
8235	98	55:21	134:02	17	1 IX 26	32	64	64.3	64.4	*	Dory
8240	98	54:09	132:06	110	2 VIII 28	733	35	55.0	...	...	Cleaning
8242	98	55:29	133:57	9	18 V 27	291	55	74.9	75.4	N.F.	L. S.
8243	98	55:34	133:55	4	5 VI 27	309	55	68.5	73.7	N.F.	....
8273	98	55:30	134:03	8	17 IX 27	413	69	66.4	69.2	O.E.	Roller
8282	98	55:27	133:53	11	22 V 27	295	35	64.5	66.0	N.F.	Roller
8283	98	56:15	135:16	56	11 IV 27	254	105	72.2	74.3	N.F.	Cleaning
8289	98	55:54	134:55	37	3 X 27	429	95	63.8	71.0	N.F.	Deck
8293	98	55:38	134:00	2	24 V 27	297	70	63.4	66.4	O.E.	Cleaning
8294	98	55:36	134:02	3	24 VI 27	328	50	62.5	73.2	N.F.	Roller
8296	98	55:23	134:08	15	17 V 28	656	70	69.1	73.6	O.E.	Roller
8300	98	55:34	133:44	8	11 VI 27	315	20	63.5	...	...	Trolling
8309	98	....	.....	..	II-VI 27	...	..	70.6	...	...	....[10]
8315	98	55:33	133:59	4	1 VII 27	335	50	57.2	59.9	R.B.	Deck
8316	98	55:24	134:03	14	2 VIII 27	367	50	65.5	67.3	*	Deck
8321	98	55:17	134:10	22	22 V 27	295	50	70.5	...	...	....
8323	98	55:38	133:57	1	11 VIII 26	11	64	59.0	59.5	N.F.	Deck

[10] Found on fish at Fisheries Experimental Station; Prince Rupert.

Appendix B. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12
8326	98	55:31	134:04	7	18 VII 27	352	58	61.0	64.5	N.F.	Cleaning
8328	98	55:36	134:02	3	23 VI 27	327	50	63.4	65.0	N.F.	Roller
8334	98	55:27	134:03	11	21 V 28	660	65	62.4	67.0	O.E.	Roller
8339	98	55:35	133:54	3	16 VI 27	320	56	77.8	80.5	N.F.	Roller
8346	98	55:36	134:02	3	4 VI 27	308	50	59.8	60.0	N.F.	Roller
8353	98	56:10	135:00	47	21 IV 28	630	135	64.8	67.5	N.F.	Roller
8358	98	55:27	134:03	11	24 V 28	663	65	60.5	60.3	O.E.	Roller
8361	98	55:33	133:59	4	1 VII 27	335	50	59.8	60.5	R.B.	Deck
8364	98	55:33	133:59	4	1 VII 27	335	50	63.6	66.6	R.B.	Deck
8368	98	55:36	134:02	3	18 VI 27	322	50	57.1	59.4	N.F.	Roller
8377	99	55:23	134:04	18	6 V 27	278	68	77.0	77.9	N.F.	....
8379	99	55:34	133:55	6	18 VIII 27	382	55	49.9	60.8	O.E.	Deck
8386	99	51:10	129:54	316	1 IV 27	243	185	69.3	72.4	*	Deck
8388	99	55:15	133:56	25	23 V 27	295	70	78.0	81.5	O.E.	Cleaning
8396	99	....	.....	..	V 28	...	..	72.5	...	...	L. S.
8397	99	55:35	133:59	6	13 V 27	285	65	63.5	68.5	*	Cleaning
8401	99	55:24	134:03	17	2 VIII 27	366	50	62.1	60.3	*	Deck
8405	99	55:23	134:04	18	6 V 27	278	69	64.3	65.1	N.F.	....
8407	99	55:32	134:09	12	2 X 27	427	70	68.9	73.5	O.E.	Roller
8412	99	55:38	134:00	5	22 V 27	294	70	63.8	66.3	O.E.	Cleaning
8415	99	55:33	133:59	8	1 VII 27	334	50	65.7	67.6	R.B.	Deck
8417	99	55:36	134:03	7	8 VI 27	311	50	60.8	62.4	N.F.	Roller
8422	99	55:36	134:03	7	24 VI 27	327	50	61.0	63.6	N.F.	Roller
8423	99	55:40	134:12	13	6 VIII 26	5	73	61.8	62.8	W.T.	Dory
8425	99	55:59	135:26	55	13 IV 28	621	155	69.8	...	...	Roller
8426	99	55:36	134:03	7	21 VI 27	324	50	68.6	70.1	N.F.	Roller
8427	99	55:37	133:57	4	19 V 28	656	58	68.7	72.1	O.E.	Roller
8442	99	55:38	134:00	5	22 V 27	294	70	77.5	79.1	O.E.	Roller
8445	99	56:10	134:49	42	11 X 28	801	90	62.5	74.0	N.F.	Cleaning
8447	99	55:32	133:50	8	20 VI 27	323	30	72.5	61.0	*	Deck
8449	99	55:38	134:00	5	25 V 27	297	70	80.8	82.3	O.E.	Cleaning
8451	99	55:40	133:49	2	4 VI 27	307	55	72.2	73.3	N.F.	L. S.
8459	99	55:32	134:09	12	2 X 27	427	70	63.6	70.2	O.E.	Roller
8462	99	55:24	134:03	17	2 VIII 27	366	50	79.3	78.7	*	Deck
8465	99	55:37	133:57	4	19 V 28	657	58	76.6	81.0	O.E.	Roller
8475	99	55:35	133:55	5	18 VIII 27	382	55	62.4	64.3	O.E.	Deck
8477	99	55:33	133:59	8	1 VII 27	334	50	76.3	78.6	R.B.	Deck
8479	99	55:35	133:55	5	18 VIII 27	382	55	68.1	69.3	O.E.	Deck
8480	99	55:35	133:55	5	18 VIII 27	382	55	63.1	64.3	O.E.	Deck
8491	99	51:27	129:23	307	17 VII 28	716	45	61.4	73.6	E.P.	Dory
8497	99	55:26	134:03	15	18 VII 27	351	60	70.8	75.7	N.F.	Dory
8500	99	....	.....	..	27	...	..	71.4	...	...	....
8505	99	55:27	134:03	14	17 V 27	289	60	68.5	69.7	O.E.	Roller
8506	99	49:35	127:25	446	3 VIII 27	367	85	66.0	72.4	*	Roller
8511	99	53:58	130:50	155	9 VI 28	678	35	56.7	60.5	N.F.	Roller
8517	99	55:35	133:55	5	18 VIII 27	382	55	61.0	64.5	O.E.	Deck
8534	99	55:29	133:57	12	18 V 27	290	55	64.5	65.0	N.F.	L. S.
8538	99	55:23	134:08	19	17 V 28	655	70	66.1	67.5	O.E.	Roller
8539	99	55:31	134:48	33	15 IV 27	263	110	71.4	70.8	N.F.	L. S.
8544	99	54:18	131:28	126	21 IV 28	629	45	67.8	68.7	W.H.	Deck
8562	100	55:33	133:59	6	1 VII 27	333	50	67.5	68.8	R.B.	Deck
8569	100	55:31	134:04	9	20 VII 27	352	58	64.7	66.5	N.F.	Cleaning
8570	100	55:23	134:13	13	30 VII 27	362	60	59.5	65.8	N.F.	Dory
8571	100	55:27	134:03	5	17 V 27	288	60	65.0	64.5	H.D.	L. S.
8580	100	55:33	133:59	6	1 VII 27	333	50	60.7	62.2	R.B.	Deck
8581	100	54:12	133:42	74	5 XI 28	826	130	55.3	67.0	N.F.	Roller
8589	100	55:33	133:59	6	1 VII 27	333	50	69.9	72.7	R.B.	Deck
8597	100	55:31	134:04	9	18 VII 27	350	58	62.8	67.4	N.F.	Cleaning
8598	100	55:27	134:07	6	30 IX 26	59	50	70.8	70.1	*	....
8614	100	55:29	133:57	5	18 V 27	289	55	74.5	77.9	N.F.	L. S.
8616	100	....	.....	..	27	...	..	78.3	...	...	....
8626	100	55:28	133:50	3	11 IV 27	252	35	60.4	60.6	*	Cleaning
8628	100	55:24	133:54	2	26 IV 28	633	60	76.7	90.6	O.E.	Cleaning
8649	100	56:05	132:28	110	6 III 27	216	..	64.5	...	...	....
8658	100	55:21	134:03	7	27 IX 26	56	50	65.0	64.1	*	....
8667	100	55:27	134:03	6	17 V 27	288	60	61.1	63.0	O.E.	Roller
8686	100	55:21	134:02	7	6 IX 26	35	64	59.7	59.7	*	Deck
8687	100	55:15	134:14	17	29 IV 28	636	95	60.0	67.5	O.E.	Roller
8706	100	55:33	134:52	34	16 III 27	226	112	68.1	68.7	N.F.	Cleaning
8711	100	55:25	134:06	9	18 VII 27	350	60	63.5	68.0	N.F.	Dory
8712	100	52:10	131:21	218	23 VII 28	721	25	63.4	75.5	N.F.	Cleaning
8720	100	....	.....	..	28	...	..	68.4	66.0	*	Fish House
8726	100	55:35	133:55	9	22 VIII 27	385	55	59.6	64.5	O.E.	Deck
8733	100	55:23	134:08	10	16 V 28	653	70	66.8	77.5	O.E.	Roller
8745	101	53:04	130:47	153	26 VI 27	327	55	60.5	66.4	O.E.	Roller
8749	101	54:49	133:34	3	16 IX 26	44	87	66.1	68.5	*	Cleaning
8751	101	54:49	133:37	1	4 IX 26	32	50	71.7	71.6	R.B.	L. S.
8753	101	54:47	133:38	2	28 IX 26	56	90	66.0	65.0	N.F.	Cleaning
8755	101	52:41	130:50	176	6 VII 27	337	30	77.2	79.4	R.B.	Cleaning
8756	101	54:49	133:34	3	16 IX 26	44	88	82.1	83.8	*	Cleaning
8762	101	54:45	133:34	4	15 IX 26	43	58	61.8	63.5	*	Cleaning
8764	101	54:49	133:34	3	16 IX 26	44	87	79.5	80.6	*	Cleaning
8765	101	55:37	133:59	51	25 V 27	295	58	70.4	73.1	N.F.	Roller
8769	101	55:23	134:06	38	8 VI 27	309	70	62.1	70.8	N.F.	Roller
8772	101	54:45	133:34	4	15 IX 26	43	58	80.2	80.0	*	Cleaning
8773	101	53:53	133:19	57	19 V 27	289	87	78.4	78.6	O.E.	Cleaning
8774	101	54:48	133:34	3	16 IX 26	44	88	79.7	81.2	*	Cleaning
8778	101	55:33	133:59	47	1 VII 27	332	50	67.5	70.1	R.B.	Deck
8780	101	55:24	134:06	40	29 V 27	299	60	66.1	71.3	O.E.	Cleaning
8798	113	55:53	154:03	494	26 III 27	129	90	108.4	110.9	N.F.	Cleaning
8799	113	59:15	140:11	38	6 VI 27	201	68	75.1	76.2	*	Roller
8800	113	59:36	143:14	74	29 X 27	346	132	72.7	72.5	N.F.	L. S.

APPENDIX B. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12
8802	114	59:02	141:46	15	9 XI 28	722	160	73.6	81.8	E.P.	Cleaning
8803	114	55:33	133:59	322	1 VII 27	225	50	72.3	74.2	R.B.	Deck
8804	114	59:01	141:07	8	23 X 27	339	135	74.2	77.5	*	Cleaning
8812	114	59:34	143:24	74	10 XI 28	723	235	64.0	70.1	E.P.	L. S.
8815	114	58:29	139:16	69	16 V 27	179	105	76.5	...	...	Cleaning
8820	115	58:44	140:01	45	2 V 27	164	105	65.2	64.2	N.F.	Cleaning
8826	115	56:25	152:07	424	1 X 27	316	130	93.7	97.5	N.F.	Cleaning
8852	117	59:18	141:26	41	26 VII 28	613	95	73.7	74.0	N.F.	Cleaning
8857	117	58:25	138:50	68	11 IV 28	507	67	72.8	73.7	N.F.	Cleaning
8878	118	58:28	139:58	50	23 III 28	487	120	79.2	82.0	N.F.	Deck
8880	118	59:30	143:44	82	22 X 28	700	155	60.9	63.5	N.F.	Cleaning
8885	118	....	.....	..	XI 27	...	..	70.7	72.3	IFC.	....
8886	118	58:25	138:50	83	11 IV 28	506	67	68.8	71.1	N.F.	Cleaning
8900	119	59:34	144:36	112	12 XI 27	354	180	76.0	77.9	N.F.	Cleaning
8906	121	58:32	148:44	253	24 III 27	120	70	71.8	...	...	L. S.
8922	121	58:58	140:13	43	13 V 27	170	92	71.2	70.8	N.F.	Cleaning
8924	121	58:31	139:32	69	29 IV 27	156	135	77.5	76.0	N.F.	Cleaning
8933	122	58:38	139:14	76	1 VI 28	554	130	71.3	...	...	Deck
8942	122	59:37	143:05	60	13 X 27	322	180	75.1	77.0	N.F.	Cleaning
8946	122	58:37	140:43	34	20 II 28	452	108	72.2	71.6	N.F.	Roller
8962	122	58:32	139:19	75	28 II 28	460	105	73.3	72.7	*	L. S.
8963	122	58:52	149:25	252	12 III 27	107	110	75.7	...	...	Deck
8964	122	59:22	146:44	162	29 X 27	338	140	76.0	78.0	N.F.	Cleaning
8979	122	59:02	141:22	8	13 XI 28	719	135	73.7	78.5	N.F.	Deck
8994	123	59:28	141:14	34	11 VI 28	563	110	76.8	82.0	N.F.	Cleaning
9028	123	....	.....	..	III–VIII 27	...	..	68.0	...	...	....[3]
9039	124	....	.....	..	28	...	..	74.3	...	...	....
9040	124	59:16	140:18	45	14 VI 27	184	68	76.4	76.2	N.F.	Cleaning
9044	125	59:36	143:09	60	12 XI 27	335	180	64.6	...	...	Deck
9080	125	58:20	150:20	296	24 VI 27	194	32	70.5	71.7	*	Roller
9105	125	59:01	141:07	15	23 X 27	315	135	76.8	81.3	*	Cleaning
9106	125	59:01	141:07	15	19 X 27	311	135	77.9	83.8	*	Cleaning
9122	125	58:44	138:37	92	17 V 27	156	55	69.9	79.4	N.F.	Roller
9134	125	59:06	147:49	200	8 X 27	300	130	72.3	76.5	N.F.	L. S.
9151	126	59:09	151:53	334	22 V 27	160	15	67.6	88.9	*	....
9159	126	56:31	151:54	395	26 X 28	683	136	75.2	79.0	N.F.	Roller
9162	126	58:44	148:55	239	25 III 28	468	145	74.6	...	...	Deck
9166	126	56:34	151:57	427	8 IX 27	269	120	72.0	74.3	*	Cleaning
9179	126	59:01	141:07	15	7 XI 27	329	135	73.2	76.0	N.F.	Cleaning
9192	126	59:02	141:13	11	30 IV 28	504	135	76.8	76.5	N.F.	....
9208	126	58:16	150:18	290	24 VII 27	223	45	68.9	68.8	N.F.	Cleaning
9226	127	59:35	141:29	36	13 XI 28	699	180	77.9	83.0	N.F.	Roller
9231	127	59:01	140:43	27	30 X 27	319	112	78.2	79.4	*	Roller
9250	127	58:44	138:37	92	15 V 27	151	55	73.9	74.2	N.F.	Roller
9268	128	60:11	146:39	173	22 VIII 27	249	127	76.5	84.5	*	....
9270	128	....	.....	..	III–VIII 27	...	..	79.1	...	...	....[3]
9279	128	57:49	150:52	317	28 IV 27	133	47	69.8	68.6	*	Roller
9283	128	59:01	141:07	15	7 XI 27	326	135	70.8	68.5	N.F.	Cleaning
9289	128	58:31	139:27	72	12 III 28	452	100	76.4	76.8	N.F.	Roller
9292	128	57:36	150:57	350	6 VII 27	202	40	67.4	68.2	N.F.	Deck
9298	128	53:58	130:50	486	15 VI 28	547	35	66.5	73.0	N.F.	Cleaning
9309	128	60:27	147:23	203	2 VII 27	198	35	69.2	...	...	....
9314	128	58:38	140:14	47	2 XI 28	687	115	70.9	73.0	N.F.	Cleaning
9321	128	58:32	148:44	255	3 III 27	77	150	69.4	65.0	N.F.	L. S.
9322	128	59:36	143:43	75	9 XI 27	328	210	78.0	81.0	N.F.	Cleaning
9323	128	59:14	141:36	15	30 IX 27	288	139	76.4	78.0	N.F.	Cleaning
9335	128	59:43	142:39	58	7 XI 28	692	180	78.4	87.0	N.F.	Cleaning
9346	129	58:21	148:42	255	16 XI 27	334	110	68.0	67.9	W.H.	Deck
9349	129	58:14	137:05	139	18 III 28	457	60	70.5	73.7	*	Cleaning
9353	130	55 19	134 32	302	3 VII 27	198	95	77.6	79.5	N.F.	Cleaning
9376	130	....	.....	..	27	...	..	69.1	...	...	L. S.
9378	130	59:13	140:00	44	23 VII 27	216	65	69.6	71.8	N.F.	Cleaning
9380	130	58:41	138:54	65	15 V 28	513	60	76.8	...	...	Deck
9386	130	57:37	150:56	358	11 VIII 28	601	45	71.8	75.0	N.F.	Cleaning
9399	131	59:19	152:04	110	15 VI 28	490	30	66.3	70.0	O.E.	Deck
9410	131	56:31	152:40	176	27 VII 27	166	45	65.1	64.1	N.F.	Cleaning
9424	132	59:19	152:04	115	14 VI 28	488	30	68.9	72.0	O.E.	Deck
9425	132	58:31	148:36	0	21 II 27	9	103	61.8	62.0	N.F.	L. S.
10227	133	58:50	148:57	13	10 IX 28	308	120	69.5	71.0	N.F.	Cleaning
10240	136	58:32	148:37	31	11 IX 28	307	85	74.0	84.1	*	....
10267	138	56:19	153:43	177	19 VII 28	251	15	60.1	61.0	N.F.	Cleaning
10274	138	57:33	150:52	69	27 VI 28	229	45	60.9	...	...	Cleaning
10324	140	58:18	148:44	7	22 X 28	344	68	65.5	69.5	N.F.	Cleaning
10372	142	59:40	152:07	145	29 VI 28	227	25	56.4	103.5	N.F.	Cleaning
10385	142	57:50	149:43	44	3 III 28	109	95	71.6	...	...	Cleaning
10403	143	58:18	149:17	19	22 II 28	98	68	78.0	77.5	W.H.	Cleaning
10427	145	58:49	149:44	197	25 II 28	82	87	71.4	70.9	N.F.	Deck
10428	145	58:25	148:40	180	19 VIII 28	258	75	72.8	74.0	N.F.	L. S.
10429	145	59:15	140:57	78	16 V 28	163	110	72.2	72.1	N.F.	Cleaning
10451	146	59:28	147:00	108	7 V 28	153	105	79.5	79.5	N.F.	Cleaning
10475	146	59:37	148:34	155	1 IX 28	270	55	71.4	78.7	*	....
10480	146	57:19	151:01	280	5 XI 28	335	80	67.3	68.0	N.F.	L. S.
10482	146	57:23	150:41	268	26 X 28	325	200	70.1	71.5	N.F.	Deck
10493	146	56:16	152:56	371	16 IX 28	285	70	68.7	70.0	N.F.	Deck
10546	147	58:09	150:15	231	22 VII 28	228	35	71.1	72.0	N.F.	Cleaning
10554	148	59:35	151:27	305	29 VIII 28	265	31	66.3	66.5	N.F.	Cleaning
10572	148	57:13	152:45	329	25 VII 28	230	50	76.9	79.6	E.P.	....
10579	149	....	.....	..	28	...	..	70.1	...	...	....
10581	149	58:15	149:00	194	8 VIII 28	243	76	76.5	81.0	N.F.	Deck
10595	149	60:06	145:42	77	5 X 28	301	153	64.7	66.0	N.F.	Cleaning
10619	149	59:19	152:04	278	15 VI 28	189	30	70.2	70.6	O.E.	Deck
10629	149	56:56	153:01	347	15 VIII 28	250	70	80.8	84.0	N.F.	Roller

Appendix B. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12
10651	150	57:42	150:56	266	9 IV 28	121	47	65.4	67.3	*	Deck
10665	150	....	.....	..	7 V 28	149	..	73.0	...	...	Fish House
10666	150	....	.....	..	II–VI 28	...	..	74.0	...	...	Fish House
10691	150	58:19	149:17	197	5 IV 28	117	87	71.5	71.5	N.F.	Deck
10699	150	58:32	148:44	176	15 X 28	310	70	74.2	76.0	N.F.	Cleaning
10708	151	57:52	149:34	223	21 II 28	72	140	75.1	74.3	*	Deck
10710	151	56:30	154:50	410	21 VII 28	223	7	76.4	77.0	N.F.	Roller
10716	151	57:49	149:26	226	23 II 28	74	140	73.5	...	...	Deck
10746	151	58:32	148:25	162	2 III 28	82	165	86.0	85.5	W.H.	Deck
10750	151	57:01	151:45	308	27 IX 28	291	45	69.6	...	...	Cleaning
10760	151	59:04	151:34	254	25 IX 28	289	35	67.6	...	...	Cleaning
10793	152	56:59	152:43	339	22 VI 28	193	85	76.0	76.3	O.E.	Deck
10809	152	59:30	142:37	25	4 IV 28	114	120	82.5	83.0	N.F.	Hold
10811	152	58:49	153:16	306	25 VI 28	196	10	72.7	73.0	N.F.	Deck
10827	152	59:35	151:27	305	29 VIII 28	261	31	68.0	67.5	N.F.	Cleaning
10832	152	....	.....	..	IV 28	...	..	80.8	...	...	Fish House
10850	153	58:16	149:58	223	1 III 28	79	42	86.7	86.0	N.F.	Deck
10867	153	59:33	141:43	50	10 XI 28	333	170	68.5	71.5	N.F.	Roller
12221	133	58:50	148:57	13	10 IX 28	308	120	69.5	71.0	N.F.	Cleaning
12227	133	58:45	149:15	6	18 II 28	103	90	80.7	80.9	O.E.	Deck
12231	133	58:16	149:58	35	1 III 28	115	42	77.1	76.0	N.F.	Deck
12256	134	58:23	150:16	5	22 III 28	135	38	75.9	77.2	N.F.	Deck
12272	134	58:32	148:44	50	4 VII 28	239	73	75.3	75.5	N.F.	Roller
12276	134	58:41	148:29	61	19 II 28	103	150	75.9	74.6	O.E.	Deck
12291	136	58:07	149:18	9	10 VIII 28	275	60	76.9	77.5	N.F.	Cleaning
12298	136	58:00	148:43	10	12 IV 28	155	95	67.6	67.5	N.F.	Cleaning
12308	136	59:28	141:21	268	23 VI 28	227	120	92.8	96.0	N.F.	Cleaning
12309	136	57:37	150:02	42	28 II 28	111	105	114.8	116.0	N.F.	Cleaning
12310	136	58:15	149:00	12	4 VIII 28	269	76	67.3	67.5	N.F.	Deck
12366	136	58:04	148:51	5	17 VII 28	251	62	85.3	88.0	N.F.	Deck
12375	136	58:10	149:20	12	14 VIII 28	279	85	65.1	67.0	N.F.	Deck
12376	136	58:32	148:44	29	20 II 28	103	75	77.8	99.1	*	Cleaning
12379	136	58:20	150:19	44	10 VI 28	214	35	83.3	83.3	O.E.	Deck
12380	136	58:14	153:35	160	11 VIII 28	276	100	75.5	77.0	N.F.	Cleaning
12388	137	58:18	149:08	14	3 III 28	114	70	67.9	68.5	N.F.	Cleaning
12393	137	57:58	148:45	10	20 V 28	192	95	83.1	...	...	L. S.
12401	137	58:15	149:00	9	8 VIII 28	272	76	62.5	66.0	N.F.	Deck
12403	137	58:10	150:51	64	29 V 28	201	45	63.5	63.5	N.F.	Deck
12404	137	54:46	159:10	402	15 VI 28	218	40	68.1	68.5	O.E.	Deck
12414	137	57:25	151:54	108	9 X 28	334	70	73.3	74.0	N.F.	Cleaning
12417	137	56:44	152:16	141	4 VII 28	237	65	68.5	70.5	N.F.	Cleaning
12422	137	58:22	148:46	13	26 VIII 28	290	72	66.2	67.0	N.F.	Cleaning
12427	137	55:55	156:06	278	28 II 28	110	125	79.6	81.3	*	Cleaning
12434	137	58:16	150:00	39	21 VII 28	254	36	72.9	73.6	E.P.	Roller
12440	138	....	.....	..	28	...	..	77.4	...	...	....
12454	138	....	.....	..	II 28	...	..	72.2	...	...	Fish House
12471	138	58:04	148:52	11	30 IV 28	171	70	67.7	68.5	N.F.	Roller
12480	138	58:16	150:00	29	21 VII 28	253	36	74.1	77.0	E.P.	Roller
12485	138	57:59	148:57	15	12 X 28	336	..	83.9	89.5	*	....
12489	138	58:16	150:00	29	21 VII 28	253	36	70.2	75.1	E.P.	Roller
12501	138	57:59	152:03	94	9 VIII 28	272	97	93.1	94.0	N.F.	Deck
12523	138	58:23	150:15	37	22 III 28	132	38	78.6	80.0	N.F.	Deck
12524	138	58:32	148:44	23	28 II 28	109	68	87.3	87.6	*	Cleaning
12531	138	58:19	150:12	36	14 VI 28	216	40	85.8	87.5	N.F.	Cleaning
12541	138	58:22	148:46	15	24 VIII 28	287	72	66.3	67.5	N.F.	Cleaning
12542	138	56:48	153:27	165	12 VII 28	244	50	78.8	80.0	N.F.	Cleaning
12565	138	58:22	148:46	15	26 VIII 28	289	72	66.4	67.0	N.F.	L. S.
12567	138	58:01	148:48	15	29 V 28	200	75	70.0	72.3	N.F.	Cleaning
12569	138	58:22	149:52	26	16 VI 28	218	35	66.3	69.0	N.F.	Roller
12576	138	58:20	149:38	19	28 VI 28	230	50	67.5	69.0	N.F.	Deck
12580	138	57:58	149:13	15	27 II 28	108	70	63.3	...	...	Roller
12587	138	59:08	151:27	90	5 VIII 28	268	26	71.6	73.0	N.F.	Deck
12588	138	58:15	149:00	5	11 VIII 28	274	76	75.0	76.0	N.F.	Deck
12599	139	57:32	150:28	69	5 VI 28	206	50	61.2	62.5	N.F.	Cleaning
12605	139	58:32	148:44	17	20 II 28	100	75	74.8	75.0	*	Cleaning
12610	139	58:29	148:59	16	12 IX 28	305	80	69.1	70.0	N.F.	Roller
12616	139	58:25	150:14	48	27 VII 28	258	30	80.0	77.5	*	...
12618	139	55:29	156:13	295	14 III 28	123	110	95.1	95.0	N.F.	Roller
12642	139	58:35	148:28	22	4 IX 28	297	70	72.7	72.5	N.F.	Cleaning
12656	139	58:14	153:35	165	11 VIII 28	273	100	72.6	77.0	N.F.	Cleaning
12657	139	57:59	149:31	29	30 VIII 28	292	65	81.9	85.1	*	Cleaning
12662	139	58:32	148:44	17	5 III 28	114	70	87.4	86.0	N.F.	L. S.
12678	139	58:32	148:48	17	18 II 28	98	65	74.3	73.0	O.E.	Cleaning
12701	139	58:18	148:43	3	21 X 28	344	68	89.8	96.0	N.F.	Cleaning
12735	140	56:29	153:04	172	9 VI 28	209	35	89.1	91.0	N.F.	Deck
12743	140	57:13	152:20	129	10 X 28	332	..	100.8	108.0	*	Deck
12746	140	59:35	143:20	180	11 IX 28	303	86	67.1	...	...	Deck
12753	140	57:24	151:20	96	18 IX 28	310	65	65.1	66.0	N.F.	Cleaning
12755	140	58:32	148:44	20	3 VII 28	233	73	66.0	65.0	N.F.	Roller
12759	140	57:40	150:20	59	29 II 28	108	120	66.9	67.3	O.E.	Cleaning
12779	140	57:52	149:34	31	13 III 28	121	140	70.6	70.2	*	Deck
12792	140	....	.....	..	X 28	...	..	84.0	...	...	Fish House
12793	140	58:07	148:50	4	7 XI 28	360	75	85.9	87.5	N.F.	Roller
12800	140	56:44	152:40	155	10 VII 28	240	50	70.6	72.5	O.E.	Deck
12809	140	58:32	148:44	20	2 VII 28	232	72	70.7	...	...	Roller
12812	140	58:37	148:43	26	10 VIII 28	271	64	69.6	72.4	*	Cleaning
12815	140	58:46	149:41	45	23 X 28	345	65	71.0	76.0	N.F.	Cleaning
12833	141	56:35	151:48	144	26 IV 28	164	130	82.3	94.0	N.F.	Deck
12834	141	58:28	150:00	41	18 IV 28	156	65	82.5	84.0	N.F.	Cleaning
12840	141	58:37	148:43	18	10 VIII 28	270	64	72.9	74.9	*	Cleaning
12845	141	57:11	151:43	119	9 VI 28	208	38	77.7	79.0	N.F.	Roller

APPENDIX B. *(continued)*

1	2	3	4	5	6	7	8	9	10	11	12
12878	141	57:51	154:48	220	19 VI 28	218	150	96.1	97.5	N.F.	Deck
12891	141	56:44	152:16	149	4 VII 28	233	65	85.9	86.0	N.F.	Cleaning
12897	141	56:06	154:20	226	4 IV 28	142	100	102.5	103.5	N.F.	Cleaning
12935	141	57:50	149:43	43	3 III 28	110	95	73.4	...	...	Cleaning
12973	141	58:04	148:41	15	20 II 28	98	90	83.1	86.4	*	Cleaning
12991	141	59:19	152:04	125	14 VI 28	213	30	71.5	72.2	O.E.	Deck
13012	142	57:19	136:14	465	19 II 28	96	110	115.2	116.5	N.F.	Deck
13046	142	58:06	149:03	18	7 III 28	113	65	80.2	80.0	N.F.	Cleaning
13069	142	54:46	163:17	547	15 VIII 28	274	..	85.6	...	...	Deck
13079	142	57:46	149:43	47	8 III 28	114	140	80.5	80.5	N.F.	L. S.
13103	142	54:39	159:49	434	27 V 28	194	52	83.5	86.1	O.E.	Cleaning
13130	143	55:36	156:31	310	3 V 28	169	120	84.7	88.9	*	....
13139	143	58:06	149:16	23	27 II 28	103	70	84.5	86.4	*	L. S.
13146	143	54:37	159:33	428	12 V 28	178	44	85.0	86.5	O.E.	Deck
13166	143	59:40	152:07	145	29 VI 28	226	25	74.8	76.0	N.F.	Cleaning
13167	143	58:18	149:17	19	20 II 28	96	68	74.0	72.6	W.H.	Cleaning
13189	143	57:36	150:15	68	6 III 28	111	80	73.6	71.8	N.F.	Cleaning
16203	145	57:53	149:42	220	10 III 28	96	140	93.6	92.5	N.F.	L. S.
16219	145	58:43	149:26	190	5 II 28	62	90	104.8	115.3	O.E.	L. S.
16226	145	58:15	153:58	338	18 IV 28	135	132	104.2	104.3	O.E.	Dock
16257	145	59:04	139:26	126	4 IX 28	274	75	94.2	94.0	*	Cleaning
16261	145	58:45	149:15	184	19 II 28	76	90	105.8	106.0	O.E.	Deck
16304	146	58:07	148:50	193	9 XI 28	339	82	107.0	112.0	N.F.	Roller
16364	147	59.00	150:45	225	3 VI 28	179	80	108.3	109.5	N.F.	Cleaning
16367	147	59:37	143:31	6	13 XI 28	342	..	100.8	100.0	N.F.	Roller
16382	147	59:37	143:00	14	12 XI 28	341	190	86.5	88.7	W.H.	Cleaning
16409	147	56:46	152:50	346	11 V 28	156	40	99.3	...	...	Deck
16432	147	59:28	141:21	64	23 VI 28	199	120	97.6	96.5	N.F.	Cleaning
16452	147	....	.....	..	28	...	..	114.4	...	...	....
16455	148	56:58	133:00	400	12 VIII 28	248	70	104.8	109.2	*	Cleaning
16458	148	59:14	147:36	128	26 II 28	80	110	83.4	137.2	*	Roller
16488	148	54:36	159:33	612	4 IX 28	271	80	86.1	87.8	IFC.	Cleaning
16495	148	58:05	149:19	202	11 III 28	94	65	110.5	113.0	N.F.	Cleaning
16501	148	56:14	135:04	343	12 IV 28	126	85	102.3	102.0	N.F.	Cleaning
16517	149	54:19	161:59	694	11 VI 28	185	45	96.2	97.1	O.E.	Deck
16520	149	....	.....	..	28	...	..	90.8	...	...	Fish House
16526	149	59:00	150:18	212	27 X 28	323	80	101.6	...	...	Roller
16533	149	59:34	150:03	200	19 IX 28	285	70	84.2	89.0	N.F.	Cleaning
16537	149	57:48	150:08	241	27 IV 28	140	105	88.8	88.5	N.F.	Cleaning
16550	149	58:49	139:27	130	6 IX 28	272	110	94.8	95.2	*	Cleaning
16567	149	....	.....	..	28	...	..	106.2	...	...	Fish House
16570	149	56:22	157:20	496	8 VII 28	212	100	95.8	96.4	W.H.	Hold
16576	149	59:23	146:20	90	31 X 28	327	..	84.0	90.8	*	....
16589	149	57:45	151:00	262	8 IX 28	274	45	118.4	122.0	N.F.	Roller
16597	149	58:42	147:13	128	29 II 28	82	195	78.4	78.7	*	L. S.
16601	149	55:49	156:32	484	25 VII 28	229	135	99.2	99.1	*	Roller
16603	149	56:45	152:50	349	8 V 28	151	40	75.6	75.0	N.F.	L. S.
16604	149	58:40	150:57	237	15 VIII 28	250	50	71.6	104.1	*	Cleaning
16612	149	56:13	156:10	460	6 V 28	149	80	107.9	110.5	N.F.	L. S.
16613	149	....	.....	..	28	...	..	84.1	...	...	Fish House
16659	149	56:30	152:34	352	4 VII 28	208	37	97.6	97.8	*	Deck
16670	149	58:58	148:37	162	27 III 28	109	135	96.4	97.5	N.F.	Roller
16674	150	54:34	159:49	624	25 V 28	167	48	98.1	100.0	N.F.	Cleaning
16681	150	57:44	150:10	244	31 III 28	112	58	77.1	72.5	N.F.	Roller
16698	150	59:26	153:39	319	2 VIII 28	236	9	78.2	80.0	N.F.	Cleaning
16706	150	58:01	150:29	237	4 IV 28	116	80	77.2	82.6	*	Cleaning
16736	150	58:37	148:44	174	11 VIII 28	245	64	97.7	101.6	*	Cleaning
16744	150	59:40	152:07	295	29 VI 28	202	25	101.9	...	...	Cleaning
16746	150	59:42	143:10	12	23 III 28	104	150	91.7	92.5	N.F.	Deck
16776	150	58:15	153:58	338	18 IV 28	130	132	78.0	78.2	O.E.	L. S.
16797	150	58:03	152:20	300	15 VIII 28	249	110	83.9	86.4	*	Cleaning
16813	150	58:32	148:44	176	4 IV 28	116	90	93.1	96.9	*	....
16821	150	58:31	148:41	175	27 IV 28	139	68	102.9	105.0	N.F.	Roller
16838	151	55:10	157:41	553	11 IV 28	122	130	91.6	93.0	N.F.	Roller
16842	151	58:26	149:52	212	4 IX 28	268	75	102.2	104.0	N.F.	Cleaning
16886	151	59:43	143:10	13	18 II 28	69	175	85.8	87.6	*	Roller
16892	151	58:07	153:09	320	7 VII 28	209	35	97.5	100.6	O.E.	Deck
16901	151	42:57	124:43	1280	3 VI 28	175	70	88.0	88.9	*	....
16906	151	58:19	153:53	332	26 VIII 28	259	40	82.6	86.4	*	Cleaning
16916	151	58:55	148:10	152	6 III 28	86	153	85.3	88.6	*	Cleaning
16930	152	59:21	148:11	146	20 VI 28	191	67	86.7	89.0	N.F.	Roller
16932	152	59:29	147:44	128	8 IX 28	271	75	87.5	...	...	Roller
16990	152	54:10	133:39	475	8 IV 28	118	150	105.4	106.7	O.E.	Deck
16991	152	58:43	149:26	187	25 II 28	75	105	79.5	80.9	O.E.	Cleaning
16993	152	58:18	149:11	193	30 III 28	109	63	90.1	90.0	N.F.	L. S.
17003	152	57:55	150:43	252	6 IX 28	269	47	106.3	110.0	N.F.	L. S.
17014	153	59:05	147:37	134	13 IV 28	122	117	90.5	92.0	N.F.	Cleaning
17026	153	58:32	148:44	180	20 II 28	69	75	91.6	91.4	N.F.	Cleaning
17056	153	56:35	151:48	331	26 IV 28	135	130	81.0	82.5	*	Deck
17069	153	59:19	152:04	282	14 VI 28	184	30	78.0	80.2	O.E.	Deck
17077	153	59:46	151:56	315	1 VII 28	201	5	83.8	....	...	Cleaning