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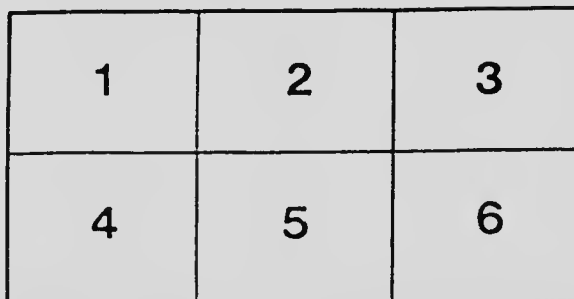
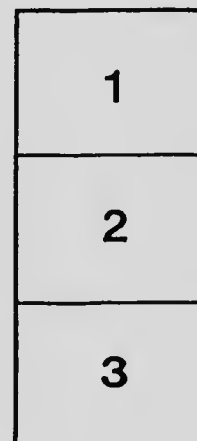
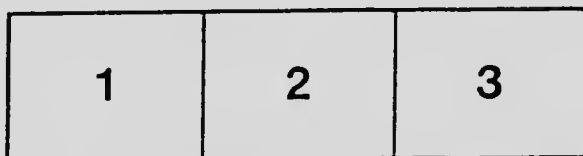
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BRITISH COLUMBIA FISHERIES DEPARTMENT, 1916.

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REGULATION OF THE HALIBUT FISHERY OF THE PACIFIC

BY  
WILLIAM F. THOMPSON,  
Stanford University.

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## THE REGULATION OF THE HALIBUT FISHERY OF THE PACIFIC.

By WILLIAM F. THOMPSON.

### THE CONDITION OF THE BANKS.

It was made evident in a previous paper (B.C. Fishery Report for 1915) that intense fishing on the halibut banks of the coast of British Columbia and the United States has resulted in not only serious depletion, but has made its influence felt throughout the whole biological appearance of the species, and in doing so has rendered precarious the future of the banks, particularly the older or longer known. The numbers still found on them are so small, and the percentage of mature fish in this population has fallen so low, that it appears imminent that the halibut will drop to a minor position among the food-fishes of the Pacific. It may recede northward, as it did from the shores of Massachusetts and from the coast of England, until it exists only in the more remote and difficult to reach of the banks. It is very difficult to see wherein more proof than is at hand may be adduced to emphasize this tendency, save the final one of the catastrophe of commercial extinction itself.

The rate of decrease shown—over 70 per cent.—for each decade is surprisingly large. Yet it must be remembered that the constant shifting to new banks has stayed off a portion of the effects of impoverishment. This extension is, in its way, a measure of depletion. Just as a mine may be exhausted and its owners reduced to working over the discarded low-grade ore, so may the halibut fleet be compelled to rely on depleted banks. The progress from Cape Battery to Hecate Strait, and from there to Yakutat and beyond, has been at a constantly accelerated rate as the total catch has grown from year to year. When the end will be reached, perhaps in the Southern Bering Sea, perhaps on the Siberian coast, is, of course, difficult to forecast. In the meantime the expenses of long voyages are gradually growing, and the necessity for vessels of large steaming radius is becoming greater, so that it is a question whether the final reserves of halibut shall be exploited by vessels from our coasts. When expansion is at an end, as will inevitably be, the vessels must return to fishing on the older banks, which will then be depleted beyond their present condition unless measures are taken to allow them to recuperate. They cannot support the fishery now existent, it is very plain, or anything comparable with it.

There are many reasons why this depletion does not evince itself in the prosperity of the fishing business in direct proportion. The rising prices demanded of the consumer and the extension to new banks require no comment on their effects. More important than these, however, is the fact that the time and effort required by the boats to catch the fish is only a portion of that necessary to carry the fish from the ocean to the consumer, and a seemingly overwhelming increase in the fishing-time of the boats is but a moderate increase in the total. The length of the voyage, as has been shown, does not increase in the same proportion as the actual fishing-time, and the length of the voyage is but a part of the whole journey over ocean and land. In other words, the increased expense of obtaining the fish is distributed between that of transporting and selling, and is felt correspondingly less.

It is evident, therefore, that an automatic abatement of the fishery in direct proportion to the rate of depletion is far from what is to be expected, and those who rest content in the belief that it will not pay commercially to deplete the banks beyond the limit of recuperation are on unsafe grounds.

### REMEDIAL MEASURES.

The reason for the existence of halibut-fishing on the older banks when they are apparently partly depleted is seen also in the great seasonal variation in the yield obtained. It is evident from almost all of the data presented that during the winter months the yield falls greatly, but rises to its maximum in summer, during June and July. It is during these best months that it is possible to do profitable fishing on these banks, and that fact keeps a certain number of vessels in the impoverished areas. Notwithstanding this, it is common knowledge that even during the best season it now pays to go to the Far North. It has also been proved that there is an alarming lack of mature fish on the older banks. It must be borne in mind, then, that the vital need of the southern banks, with the exception of those off the coast of Oregon, is protection during that portion of the year when they are yielding their largest proportion of small and



immature fish. As the main fishery has shifted to a position farther north, there should be no great obstacle to the application of adequate measures to the older banks.

In addition to propositions discussed privately, there has been a strong effort to pass a measure designed to meet the urgent need for the protection of the banks. This has resulted in the introduction into the Congress of the United States, and its passage by the Senate, but not by the House, of a Bill (S. 4586), establishing a close season for halibut during the months of December and January, and a nursery of approximately 200 square miles near Hecate and Noyes Islands, Alaska. The enforcement of this was to be dependent on the enactment of similar regulations by the Canadian Government. It was the present author's opinion, as expressed in a previous communication to the Provincial Fisheries Department, that the remedy for the depleted condition of the banks "would be to materially restrict the fishery (1) by stopping fishing entirely over large areas, such as Hecate Strait; (2) by making a close season of, at the very least, twice the length suggested; or (3) by limiting the number of boats and men employed."

The provisions of the Bill and the above alternatives are here discussed in greater detail, with the exception of the question of limiting the "number of boats and men employed," which cannot be seriously considered in view of the necessarily international aspect of the proposed remedies. Brief comment on an additional means of combating depletion—namely, artificial propagation—is also given.

#### ARTIFICIAL PROPAGATION.

The contemplation of experiments in hatching the halibut must lead simply to ill-founded optimism on the part of the fishermen. The hatching of cod and plaice has been carried on by several Governments with results which are local and limited, and have been disputed. These species are much smaller, more easily handled, come to maturity at a smaller size, and the near-ripe fish are obtainable in greater numbers than is the case with the halibut. The latter's ova are shed gradually, so that to get quantities of ripe ova it would be necessary to keep fish in breeding enclosures, and, as they reach maturity at a considerable size, this would be difficult and expensive. It is also very doubtful whether, on the long sea voyages of the fishing-boats, enough ripe spawn could be captured to make the attempt profitable. As the number of eggs produced by a female during its lifetime is supposed to be proportional to the difficulties encountered in survival after being laid, the value of such ripe eggs as are obtained from this species would be less than that of those from less "prolific" forms. The number of ova laid in each of the spawning periods of a halibut is about 300,000 when 35 inches long, and 1,000,000 when 50 inches, and there must be about ten such periods in the normal life of a twenty-year-old fish. So the value of hatched eggs cannot be great unless the resultant young are carried through more of the precarious stages than is usual, or possible without great expense. Hence, in the face of the wholesale reduction in numbers of halibut on the banks, the establishment of hatcheries cannot be regarded as anything but exceedingly expensive experimental work. Its results, unlikely as they are to be of value, could not be known for many years, and those years might mean the ruin of the industry if action were delayed pending the arrival at a conclusion.

#### CLOSE SEASON.

Recognizing the urgency of the situation, there has been, among fishermen and dealers, a strong sentiment in favour of the imposition of a close season of two months, December and January. This has been perhaps the most widely approved measure of any proposed, and in view of the widespread adoption of closed seasons in conserving other species is worthy of careful consideration.

To be worthy of adoption, however, it is imperative that a measure be shown capable of conserving the numbers of the species as a whole or in threatened areas, or adequate to increase the number of spawning fish where it has fallen below the margin of safety. The question in any case is simply one of ensuring the existence of a sufficient number of breeding males and females in those large areas now lacking them.

It is a serious question whether the closed season would not simply result in a more intense fishery during the open portions of the year. It must be remembered that the cold-storage facilities now available render it possible to deliver a supply of halibut all the year round, with or without a close season. There is no question, then, of an interruption of the demand from



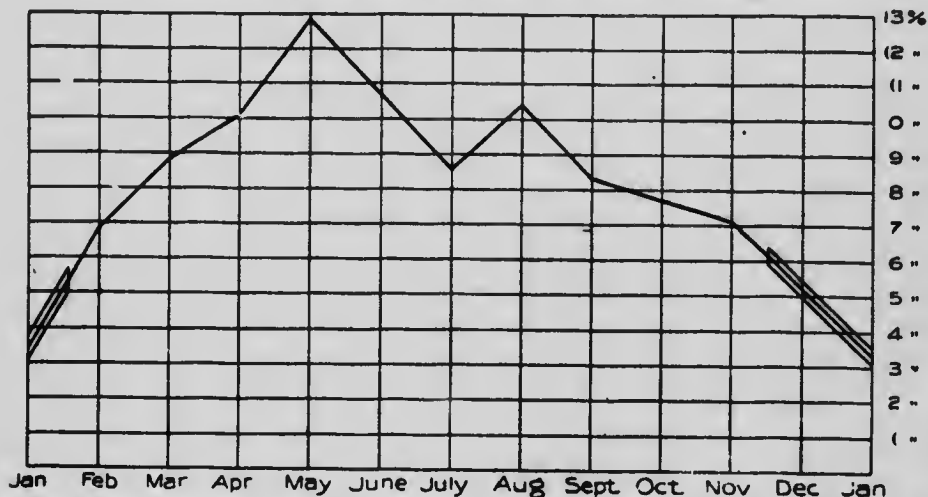
the consumer, with a consequent lessening of the total called for; and there is, as we shall see, every reason to believe that this demand will be satisfied, whether there is a close season or not.

*Catches of the Puget Sound Halibut Fleet.*

|               | 1912.     | 1913.     | 1914.     | 1915.     | Total.      | Per Cent. |
|---------------|-----------|-----------|-----------|-----------|-------------|-----------|
| January ...   | 1,310,250 | 927,500   | 1,080,500 | 1,228,150 | 4,852,400   | 3.20      |
| February ...  | 1,845,000 | 2,240,750 | 3,325,250 | 2,824,300 | 10,251,000  | 6.04      |
| March .....   | 3,034,450 | 3,000,750 | 3,407,850 | 2,721,400 | 13,161,450  | 8.80      |
| April .....   | 4,270,400 | 2,028,500 | 4,080,550 | 3,803,050 | 14,908,100  | 10.00     |
| May .....     | 3,001,000 | 3,040,850 | 4,585,050 | 4,530,500 | 10,008,400  | 12.91     |
| June .....    | 3,740,000 | 4,280,000 | 4,728,000 | 3,151,500 | 15,908,500  | 10.76     |
| July .....    | 2,844,000 | 3,510,000 | 3,255,000 | 3,058,100 | 12,673,100  | 8.58      |
| August .....  | 3,021,000 | 4,731,000 | 4,300,050 | 2,200,400 | 15,300,350  | 10.30     |
| September ... | 3,000,400 | 2,830,000 | 3,752,425 | 2,500,011 | 12,287,736  | 8.31      |
| October ....  | 2,050,250 | 3,012,000 | 3,052,500 | 2,104,325 | 11,518,075  | 7.70      |
| November ..   | 2,440,700 | 2,747,000 | 3,051,000 | 2,147,007 | 10,805,207  | 7.03      |
| December ..   | 1,071,050 | 1,470,500 | 2,512,000 | 2,487,140 | 7,550,500   | 5.11      |
|               | ...       | ...       | ...       | ...       | 147,771,838 | 100.00    |

*Table and Chart showing the Percentage of the Total Catch which is landed during the Several Months.*

(Compiled from the years 1912 to 1915, inclusive. Those parts included in the "close season" indicated by a triple line. Data taken from *Pacific Fisherman*.)



The cost of catching is but a small part of the cost of transporting, preserving, and marketing. It could increase manifold before being felt greatly. If the fish may be purchased on the docks in Seattle at 5 cents per pound, as has been done, and sold by the retailers at 25 cents, then an increase of 2½ cents, or 50 per cent. of the original cost, would be but 10 per cent. of the retail price. Something essentially similar to this has taken place in the fishery, the length of a voyage, and with that the expense of obtaining a cargo, having increased by about 100 per cent. In the ten years between 1904 and 1914. That means that the yield per vessel has fallen to a half, yet the total catch landed by the fleet has steadily increased in response to the demand. Such being the case, it is hardly to be expected that the reduction of the fishing-time by a sixth would have much effect even if it were capable of being accepted at its face value.

The apparent value of the close season during the winter is greatly modified by certain considerations. One of the most prominent of these is the fact that during the two months of December and January the catch is but half that prevailing during the summer months, as is shown on the foregoing chart. That is, the effectiveness of such a close season would be half that of a similar one in the summer. Furthermore, the decrease in total catch is in accordance with the diminished catch per unit of gear, and indicates with it the fact that the two proposed months are the most expensive. Providing the far greater consideration of the future of the banks were not in question, there would be no possible objection to legislating away the unprofitable part of a business year. But, aside from the fact that it is not the *bona-fide* object of the proposed legislation to increase the immediate prosperity of the industry, it can be shown to have a really detrimental effect on the condition of the banks. The proposed close season would surely put vessels on a better financial basis, encouraging the building of more and rendering them capable of profitable operation on smaller summer catches than is now the case. This would mean the enlargement of the fleet and the closer fishing of the banks, including those considered the least profitable.

Fishing on these more depleted southern banks off the coast of British Columbia is prevalent, mostly in summer, because the catch per unit of gear is at that time highest, and the reliance is on young fish almost entirely. It has been shown that it is these banks which need protection, and if they are to have it, it must come while fishing is being done on them. Instead of that, as has been pointed out above, a winter close season will intensify the fishery, the more so as the most depleted banks are nearer to market than the less depleted.

Cold-storage plants play an important part in intensifying this result of the closure. They not merely maintain the demand, but tend to counteract the extensive natural increase in price in winter and the decrease during the summer. This results from the absorption of surplus fish in summer for freezing and its sale during seasons of scarcity. There is in the winter, nevertheless, a considerable catch of fresh fish with which the frozen product must compete. The elimination of this catch during several months would without the cold-storage plants apparently stop the consumption, but with them could simply force the buying by of more extensive stocks of fish frozen during the summer. It is obvious that this has a tendency to impel still better prices in summer and poorer in winter. In other words, there would ensue a more profitable summer fishery, hence a more intensive one. It should be observed in this connection that the near-by banks off the coast of British Columbia yield a medium of small-sized immature fish ("chicken halibut") very suitable for freezing. These banks are those fished most intensively in summer and need better, not poorer, protection. A certain measure of the harm that it is evident, be averted by forbidding the sale of cold-storage halibut during the close season.

The most generally held reason for supporting a winter close season is that it is designed to protect the halibut during its spawning period. The assumption is that the fleet resorts to "spawning-grounds" in which are to be found spawning fish congregated from other localities, and that the catch consists to an unusual degree of such fish. However reasonable this may sound, it is impossible to find any basis of scientific fact behind it. On the contrary, so-called spawning-banks are those less depleted than others because less accessible, or because it pays to resort to them only during the winter seasons. It has been demonstrated that at one time the banks now characterized by small immature fish had a population of large, undoubtedly mature, fish, and that their absence is due to the effects of commercial fishing. We therefore come to the anomalous conclusion that protection is proposed for banks which show exhaustion least, as they have a more nearly adequate supply of breeding fish.

If, however, the claim had been that within the confines of each bank winter fishing was carried on in areas characterized by spawning fish, more weight might be given it. As a matter of fact, however, no proof of such congregation has been found, and observation has not yet disclosed any annual change in average size in one portion of a bank which did not take place in another. The shift in the fishing-grounds, according to season, is something entirely different from this, being a removal of the fleet to other banks far distant. It is a fact worthy of every emphasis that no such extensive movement on the part of the fish is to be found, whether there is some possibility of a limited and local movement or not.

It would seem certain that the closure would not protect spawning fish especially, and there would be little utility in extending protection to halibut spawning and immature alike at the cost of more intensive fishing during other seasons. As has been indicated, the depleted banks

are characterized by a lack of mature fish and a predominance of immature. If the latter are caught, it is a matter of indifference at which season it is done, as all succeeding spawning periods are eliminated, anyway. This is also true of the mature halibut. There is no reason why capture a week before spawning-time should be more disastrous than capture six months previously, all the remaining periods of spawning being eliminated, anyway. If the number of fish caught by the fleet remains the same, prohibition of fishing during such a season would mean naturally that of those fish usually caught during spawning the more intense fishery would cause just as many to be captured before the season as would be caught later because of the protection. As a result the number of fish present each spawning-time would be unaltered. As a matter of fact, the areas now needing protection are those in which halibut rarely have a chance to reach maturity, and to allow them to do so the only method available is to give them a better chance of escaping capture. It is not sufficient merely to alter the time of year at which they are caught.

Among other reasons advanced is one implying that fish caught during winter are of poorer quality, with larger heads and leaner bodies, than those taken during summer. Regarding this it should suffice to state that the observed difference is due rather to the fact that in summer immature fish from banks with rapidly growing fish are utilized, while in winter mature slow-growing fish are obtained. These immature poor-quality fish come from undepleted northern, or outside, banks naturally characterized by large-headed fish, and it is extremely improbable that they change their appearance greatly with the season. It is just as well that these fish are utilized to some extent at least. The difference between banks in so far as quality is concerned is far greater than can be assigned to seasonal differences. It is not to be denied that there is such a seasonal difference, but it cannot be assigned the importance given it. This is the more true as it has no immediate bearing on the all-important objective of preservation of the banks.

#### AN EXTENSION OF THE CLOSE SEASON.

Despite the fact that there are cogent reasons against the adoption of a close season during two winter months, it is possible that certain modifications of it might be feasible; for instance, an extension to four months. But if not disastrous to the fishery and to the fishermen because of its length, the objection previously held that the already depleted banks would be subject to a still greater strain would apply to an even greater degree. The restraint on the fishery would be accomplished principally, perhaps, by forcing vessels and men to lose a third of their time. It is possible that some other fishery could be developed to supplement that for the halibut during that season, but at present none offers itself; and even if such were the case, the objection to the changed concentration of the fishery still remains. So it is hardly conceivable that such a measure could meet with unqualified approval.

#### A SUMMER CLOSE SEASON.

A course, on the other hand, which might obviate the most dangerous features of the close season would be to place it in the summer. One summer month would be the equivalent of two winter months. Such action would result in discouraging the capture of small immature fish, of which spring and summer catches mainly consist on the older banks, and would encourage winter fishing. The influence of cold-storage firms would not in such a case be adverse. But the serious question would still remain as to whether the total catch from any bank would be sufficiently decreased. If the demand overcame the handicap of an increase of the voyage length of 200 per cent. within ten years, would it not overcome one of a decrease in available fishing-time of even 30 per cent.? Although it is probable that what the banks need is a total cessation of fishing in view of the great rate of depletion, yet such a measure as closure during summer months would be certainly effective in its nature, in contrast to the winter close season.

#### A NURSERY.

Supplementing the proposed close season, the Bill mentioned above for the conservation of the fisheries defined a nursery of about 200 square miles to be withdrawn from use. There are very decisive reasons for regarding the measure as totally inadequate. There are no considerable migrations between banks, as has been shown, and it is not probable that any but the zones nearest to such a permanently closed region would profit by it at all. The area of the continental shelf within the 140-fathom line off the coasts of Alaska and British Columbia, between Bering

Sea and the Strait of San Juan de Fuca, is certainly in excess of 80,000 square miles, of which about  $\frac{1}{4}$  of 1 per cent. was to be made this nursery. The nursery itself, the region to benefit principally, would never be opened to the fishery. Behind the idea of such a nursery there is seemingly the conviction that the small fish characteristic of this region are young, but it is far more probable that they are simply a slow-growing population, from which, in addition, the larger mature fish may have been caught off. Added to this is the fact that there is no reason to believe that the reserve in question has been bearing even its proportionate amount of fishing. So regarding this proposal it is safe to say that it would protect only the region closed. However, the idea involved in this plan, that of extending protection to an area by totally eliminating fishing on it, is a suggestive one.

#### CLOSURE OF LARGE AREAS.

Before considering the last of the proposals designed to protect the banks, it would be well to observe those conditions which are not met by the others. It is obvious that the winter closed season would fail to protect the depleted banks during the proper season and appears inadequate even if changed to summer. In fact, there is doubt whether a season short enough to allow the vessels and fishermen a business in any way continuous would be adequate. The nursery, on the other hand, does not benefit an adequate area outside its own limits, and is not intended to be reopened. It is hence obvious that any measure must protect a large area for a sufficient time and during the proper season. This would be possible, considering the welfare of the fishery, only by applying it to portions of the banks alternately, making it adequate without doubt by covering all seasons of the year. We come then, logically, to a consideration of the closure of large areas for periods of years.\*

There are certain general considerations which it would seem must be borne in mind in formulating such regulations. The areas must be so balanced as to add and subtract nearly identical reserves of halibut when closed or opened. Otherwise the fleet would be subject alternately to failure of supply and abundance. This would be the more so, the larger these areas are made, and the embarrassment would reach its maximum with a division into two alternately closed or opened areas. Since the depletion of the banks is unequal, it is also obvious that fixed regulations suitable for one year might become unsuitable on the replenishment of the areas. In fact, some flexibility must be given to any regulation applied for the preservation of favourable conditions in the fleet and the trade. A prerequisite for the passage of fixed regulations which would not become dangerous would be the possession of data as to the exact location and extent of the fishery and the condition of the banks. It would seem necessary, then, to make a careful collection and survey of the logs of the fishing-vessels preceding definite regulation.

A tentative outline of legislation for the regulation of the halibut fishery may be made, taking into account the aforesaid general considerations.

I. The banks should be divided into districts of such areas as: (1) Those off the Oregon and outer Washington coasts; (2) the coast of British Columbia; (3) between Icy Strait and Dixon's Entrance; (4) between Icy Strait and Cape Cleare; (5) between Cape Cleare and the entrance to Bering Sea; (6) any subsequently discovered banks not properly attached to the foregoing, including Bering Sea.

Areas 1, 5, and 6 are those least depleted; Area 2 has been shown to be badly exhausted; Areas 3 and 4 are presumably also depleted, the latter less so.

II. Areas 2 and 3 could be alternately closed and opened, 2 closed for five years, then 3 for the next five, and so on alternately. Areas 1, 4, 5, and 6 could be closed at the same time as either 2 or 3, their closure being subject to the discretion of conferees appointed by the two Governments; provided that, unless otherwise agreed upon by these conferees, Areas 1, 3, and 5 would be closed together, and Areas 2, 4, and 6. Each area would thus be closed five out of every ten years.

This arrangement would allow sufficient latitude of time to overcome any differences in the productive power of the areas, and at the same time make the closures automatic if the times of their inauguration were not agreed upon. It would also obviate any danger of placing any particular port under a disadvantage.

\* On February 26th, 1917, G. J. Desbarrats, Esq., Deputy Minister of Naval Service, Ottawa, advised the writer that, "In all the circumstances, and in the light of your reports, the most feasible course that appeals to the Department is to divide the ocean into three areas, and allow no halibut-fishing, as such, in a given area during a term of years."

III. To cover the period of adjustment and to render protection immediately available to the most badly depleted regions, a special programme for the first ten years might be formulated. Thus Area 2 could be closed for five years, its opening to be simultaneous with the closure of Areas 4 and 3. Subsequent to the first ten years, the provisions of section 11. could apply. This programme would be felt very slightly during the first five years, more in the second, and fully in the third, allowing in the meantime the exploitation of the least-depleted banks and protecting those in the worst condition. It would be advisable to close Area 2 for more than the five years during this first decade.

IV. There should be an emergency clause enabling a further closure of any area upon mutual consent of the conferees, a closure solely in addition to the prescribed minimum.

V. Provision could be made for the collection by each Government of data from the official log-books of the fishing-vessels, it being made compulsory for the masters of such vessels to supply in these books, over their signatures, the following information:—

(a.) Place and date of each fishing operation.

(b.) Amount of gear utilized and its nature (size of net, or space between hooks on long line).

(c.) Number and approximate dressed weight of halibut taken in each place. This should be collected by each Government and placed at the disposal of the other at the conclusion of each year, it being expressly stipulated that such data be placed in the hands of the scientific departments of both Governments, and that it be formulated by them, and in a way mutually agreed upon by the conferees. This should be the case in order that the latter could utilize the information obtained in making their decisions regarding the times of closure.

The discretionary power vested in the officers designated as conferees should lead the fishermen to furnish this information willingly, in the interests of their trade.

It appears to the writer that the principal objection which will arise will be one of inadequate amount of protection, but it is difficult to see how any other precaution than the granting of discretionary powers to the appointed officials could be taken. The objection is one which would apply to any measure.

There may be some injury worked to vessels unable to fish outside the three-mile limit, or those with limited cruising radius. This might be greatly magnified by opponents of the measure, but does not seem important in looking over the list of vessels. It must follow on the exhaustion of the banks in any case, or on the imposition of any other regulations.

*Stanford University, April 4th, 1917.*



