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PROBLEMS CONNECTED WITH THE PILCHARD FISHERY IN
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PROBLEMS CONNECTED WITH THE PILCHARD FISHERY

IN BRITISH COLUMBIA WATERS.

by

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There does not appear to be authentic records of the pilchards in British Columbia waters over 30 or 40 years ago. The Indians knew these fish, which they called "seetons": they did not find them palatable. So far as one can learn, the appearance of the pilchards in the inlets were spasmodic. Whether on these occasions when they were not observed, or at least, recognized in the inlets, they were in the sea inside is not known. The pilchard may have always been a habitant of these waters, or maybe only a periodical visitor.

Since 1925 the pilchards have been reduced for the sake of their oil and meal. In 1928, 80,000 tons of pilchards were captured. This appeared to some to be a large quantity of fish and fear was expressed as to the possibility of depletion of the fishery. The question of the advisability of restricting the catch arose.

This is an unusual case. The fishery at present shows no sign of depletion and still the question is asked--"How can depletion be prevented?" That is a difficult proposition. How can we proceed in such a matter? May one argue from analogy? Other fisheries have been depleted--through overfishing, it is thought--and it is inferred that it must happen in the case of the pilchard. There is no fear of the pilchard being exterminated by fishing, and if the fishing become non-productive it will cease. Is it wise, or necessary, to take precautions against possible depletion before decline is indicated? A decline in the return of a fishery may be due to natural fluctuations and other causes. Even if the catch began to decline would we be justified in asserting that it indicated de-

pletion, and that depletion is due to the work of the fishermen? How can one differentiate between a decline due to natural fluctuations from one due to fishing? Many years' statistics are necessary before one can claim that a depletion of the fishery is indicated. One cannot tell that a decline in the catch is due to a decrease in the stock of fish until one knows the distribution of the fish. One gets only glimpses of the pilchards in the sea; how can one tell their abundance? Until one has a knowledge of the distribution of the fish one cannot estimate what proportion of the stock of fish is being captured. Assuming that a rough estimate of the quantity of fish were available what would be a safe percentage quantity to take? These are the problems.

The fishery consists in the capture of adult fish, many of which have already spawned, and if a fishery is to be conducted at all the capture of the fish after they have spawned is the least harmful attack which can be made on the stock. In fact, there are great fisheries which consist in the capture of the fish before they have spawned, and the fisheries are not exhausted.

Up till this year the majority of the pilchards caught were spent fish. This year, however, in June and July, some shoals of pilchards were captured which had developing reproductive organs; that is, were preparing to spawn. But there were other shoals which had a majority of spents, as in previous years. It might be asked, is this appearance of spawning fish merely a delayed spawning this year. One cannot tell at present whether these fish have already spawned last year or are first spawners. It may be that they are or include surviving spents of last year. The writer has observed pilchards in a resting, spent condition in February. It may be that in such spents, by June or July, the reproductive organs have reached the stage inhibited by the spawning fish of the summer. It seems likely that they could have ripened and spawned out before

July. But as nothing is known at present about this phase of the pilchard's life one may keep an open mind on the question.

There seems reason for inferring that the pilchards, or some of them, spawn in the vicinity of the British Columbia coast. If now, as one may suggest as a possibility, these fish that were preparing to spawn and which were captured this year in greater numbers, and which were always represented in the early part of the season in previous years by some pilchards in a similar reproductive condition, are fish that are preparing to spawn for the second (or later) time, it might be taken as indicating that a larger number of spents survived last year's fishing. But that inference would not be arrived at by neglecting other principle factors; such as, change in the movements of the spawning fish, or of fish migrating into the district. Its validity gains some standing only through our ignorance of the whereabouts and movements of the pilchards during the winter months.

In the hope of finding the eggs of the pilchard, a series of townet collections were made both inside and outside the inlets of the West coast of Vancouver during May and July. These collections have not yet been examined in this connection.

At different times, but not every year, small-sized pilchards (3 inches long) have been reported, for example, in Clayoquot sound, Hesquiat and Malksope inlet, and they are recorded as having been taken at Nootka this year.

It may be that while the fishery may not be threatened with depletion, a case may be made out for the restriction of further extension of the fishery with a view to preventing undue competition between the fishermen on the assumption that there is only a fixed quantity of fish available and that, quite irrespective of the effect of the fishing upon the stock supplied by nature. Such a restriction will do no harm to the stock of fish. These and fishing activities may not result

in an increased catch: they may have the effect of disturbing the fish and rendering capture more difficult.

To advise restriction of a fishery really amounts to a claim of ability to forecast the catch of next year. With no present evidence of decline, to answer the question whether depletion is likely to occur in the future, if the fishing maintains its present intensity, is to say the least extraordinarily difficult. What data and evidence will be required? One will require to know the ecology of the pilchard. Is the stock of pilchards a local one or is it spasmodically or regularly added to by migrants from the south? One of the first problems to be studied is the spawning of the pilchard and the rearing grounds of the young. If the race is a local one, one must consider the possibility of its departing. Pilchards are pre-eminently migratory and one must contemplate the possibility of their changing their habitation quite irrespective of man's attacks. One cannot tell, for example, whether the location of the race here is dependent upon hydrographical and plankton conditions which may be liable to change. When a race of fishes is not fished there should be an accumulation of post-spawners. If now the fishery consist in the capture of spents the number of post-spawners may decrease from year to year and the catch eventually be composed of fish that had spawned for the first time. Man's efforts should not have any effect on the number of first spawners which will depend on the natural environment.

Before it is possible to estimate the amount of the stock and determine what proportion of it is being taken, one must know the distribution of the pilchards. It is not at all likely that at present all the pilchards come under the notice of the fishermen. The fleet of boats cannot effectively survey the 160 miles of coast and the ramifications of the inlets. For the fishermen it is important that the fish, or a proportion of them, should come inshore, or better, into the inlets. But they are found offshore also, and one cannot tell in what

proportions. Why do the pilchards come inshore, and why do they enter the inlets? Can one correlate their movements with hydrographic and plankton conditions? That in itself is a large and important problem.

We do not at present have evidence of the pilchards being in these waters during the winter, although the writer has found a pilchard in the stomach of a salmon in February. The salmon was captured at the mouth of Nootka sound, so that the pilchard may have wintered in the sound. Pilchards have been captured in small quantities for bait inside the sound in March, April and May. The presence of the pilchards in the coastal waters may be detected in May, through their being found in the stomachs of salmon. In June, as a rule, some pilchards are caught. They are usually difficult to catch at the beginning of the season, they are said to be wild, probably hungry. They are then usually poor in oil. Some fish caught early in June have yielded only 8 gallons of oil per ton, but they rapidly improved in quality and by July were giving 30 gallons of oil. That would indicate that this region was sought on account of the richness of the food supply. The pilchards become richer in oil as the season advances; some shoals may yield over sixty gallons per ton. In July some pilchards have yielded only 16 gallons per ton. One may infer that there were later arrivals in the region. In other words they had not been throughout the Spring in these waters; that some shoals arrive early and fatten up quickly, others are delayed in their arrival and for a time may be poorer in oil than the first comers. The principal food in British Columbia waters consists of diatoms and other minute forms, but they feed also on Crustacea (Copepods and Schizopods), and on small fishes (lance and clupeids, probably herring, have been observed in the stomachs of pilchards). The first fish caught in 1929 (June 28th) had been feeding on schizopods, but soon thereafter diatoms became their main food. While the fish are being got close to the shore, other shoals may be found well offshore so that apparently it is not always necessary

for the pilchards to come close inshore. Occasional catches of pilchards have been made up to 25 miles offshore. This must be kept in mind when one attempts to estimate the intensity of the fishing.

The pilchards, when they enter an inlet, sometimes select certain arms of the inlet. Again, after entering the inlet for a short distance, they turn back to sea. Their presence in the inlet renders the fishing very much easier. Complaints are made that the fishermen set upon them at that time, and by their action drive them out to sea. But it is doubtful whether this reason is the true one. We have no reason to infer that all the pilchards enter the inlets at any time. Is it by chance that the pilchards enter? Can it be that the hydrographical conditions, temperature and specific gravity of the water or the plankton food available, either as to quantity or quality, attract the pilchards? As a basis for the study of the life-history of the pilchard, a knowledge of these conditions should be available, and a survey of the waters of the west coast of Vancouver island has been carried out over a period covering part of 1927, the whole of 1928, and part of 1929. These data of the temperature and specific gravity of the seawater at different levels, with plankton collections made at different levels, were taken during every month of the year in 1928. A total of 190 visitations were made to stations inside and outside the inlets during the 24 months. It is intended to try to correlate these observations and collections with the appearances and migrations of the pilchards and they will be useful for comparison with these conditions in future years. The collections and observations were made on as extensive a scale as the facilities permitted of.

While the appearance of the pilchards on the coast occurs at approximately the same time of year, the locality of first appearance varies. Very often the first pilchards appear between Cape Beale and Sidney Inlet. According to fishermen they first appear on the banks of Barkley sound and then work their

way inshore. In May, there are great quantities of schizopods (whale feed) to be seen at the surface. The presence of whale birds often indicates whale feed or lance fish. An experienced whale fisherman said that the whale feed appears in March off Cape Flattery; he believed it was brought there by a current from the South. Pilchards eat schizopods and it is probably the schizopods which attract them to these waters in the first place. While observers are confident of their ability to recognize the pilchards when they show themselves at the surface, the reports of pilchards seen at sea may not always be accurate. Even experienced pilchard fishermen have mistaken a shoal of herrings or lance fish for pilchards and have set upon them.

The first run may last for a few days and then the fish may disappear, going out to sea again, it is thought.

The first pilchards in 1926 were got at Barkley sound on June 1st; in 1927 at Mosquito harbour, Clayoquot, in 1928, on June 21st; at Village Island, Barkley sound, on June 12th, and in 1929 off Lennard point, Clayoquot, on June 28th. There then appear to be two routes of approach, each, more or less, direct to an inlet. The pilchards seem to be a little later in appearing at places farther west. In 1927, the first pilchards were obtained inside Clayoquot sound. Pilchards had remained in Deer creek, Clayoquot sound, during the winter. Those that were caught on June 21 were fat fish, yielding 25 gallons per ton. The question was asked whether they could be the fish that had been in the sound during the winter. It was thought that they were in too good a condition to have been fish that had wintered there, as fish got inside the inlets in Spring are said to be thin and in poor condition. There was, moreover, a considerable quantity of the fish and the fishing continued in the sound throughout the season. On July 6th pilchards were caught in the S.E. arm, Quatsino. They yielded 30

gallons per ton. Some pilchards had been in the arm all winter. Later in the month a small quantity of pilchards was taken in the arm and thereafter during the season no pilchards were taken inside. The pilchards appeared at the mouth of the sound and a few catches were made 8 miles within the entrance. But the fishing in the inlet was a failure. The first fish got at Barkley sound in July yielded only 16 gallons per ton of fish. By July 11th the fish were got at Nootka and at cape Cook on July 12th. In the examination of the water at Mosquito harbour, Clayoquot and the S.E. arm, Quatsino, a comparative richness of diatoms was found, whereas in Nootka and Kyuquot sound the quantity of diatoms was less. It seems more likely that the fish caught early in Clayoquot and Quatsino sounds were fish that had wintered in these places. But while other shoals of pilchards came into Clayoquot sound, practically none entered Quatsino sound. In September plankton collection made in Clayoquot sound, at a point 8 1/2 miles inside Quatsino sound, showed a great poverty of diatoms at Quatsino compared to Clayoquot sound. This points to the conclusion that it was probably a dearth of diatoms, which had succeeded the earlier abundance, which had kept the pilchards out of the sound. But the other Kyuquot sound, which provided poor fishing that season, contained a good quantity of diatoms. The inlets on either side of cape Cook furnished good fishing that season. In the summer it was remarked by the fishermen that with a N.W. wind the pilchards were found in the inlets on the east side of cape Cook, and with a S.W. wind they were got on the west side of the inlets.

How far can we estimate the stock, and what proportion of the stock is caught? Is there at present evidence of a large destruction of the accessible stock? One may postulate that the fishermen do not see the stock of pilchards. While the fleet works actively it cannot effectively cover all the ground, neither

the coastal waters nor the inlets, and less so offshore. If the pilchards were a fish that showed themselves continuously at the surface it would be possible to estimate the quantity of fish in the region, but they only show themselves occasionally and for a short time and of course no boat may be present when they do appear. Again, the pilchards may not be seen for a whole day. No estimate of the size of the stock seems possible. But does the fisherman take a big toll of the fish he sees? It is said that with favourable conditions of sea and lighting, fish may be spotted half a mile off, but very often only a few flips will be seen and the boat requires to be near them before they will be detected. When the fish are observed the boat is stopped and the fish watched until their movements are made out. The boat may move slowly round the fish until it comes into a suitable position for intercepting the fish. The set is made slowly at first, then at full speed. The operation of making the circle takes two minutes. Even as the net encircles the body of fish they may escape. They may get out past the end of the net before the circle is completed, or swim under the boat, or dive right down under the net, going down 16 to 20 fathoms and come up on the outside of the net. At another time the pilchards, when discovered, may be travelling along the surface so fast that the seine boat cannot keep up with them. Any attempt to encircle them is practically useless. A school of pilchards may be too widespread to be completely encircled; if the net divides the school, one may lose the lot. The intercepted fish will seek to join those that escaped. The great attraction of association that exists among the pilchards is seen when individual fish succeed in jumping over the cork line. They will sometimes come back to the net and try to bore their way in to join their imprisoned companions. Some fishermen think that the pilchard-school acts under a leader and that he must be captured or the shoal will make its escape. Mackerels are not infrequently taken among the pilchards and if the mackerels are

numerous the pilchards seem to be very wild. That may be due to the mackerel setting the pace for the school. The capture of the pilchards is not by any means a simple and easy matter. A boat with an experienced skipper has been known to work for over a month and get only one haul during that time; but that was an exceptional case in 1927. It is the misfortune of all boats to make what are known as "skunk hauls"; they miss the fish they have the labour of setting and hauling the long, heavy net for nothing. "Skunk hauls" are frequently numerous. Sometimes the fish only show themselves once and do not appear again. The boat may wait about for their reappearance and be disappointed. The boats have to travel long distances and the fish, even when discovered, may not be captured. The fish play more often in the early morning and evening and at slack water. The seiners do not find all the schools. The writer has been behind schools of pilchards when no seiner was near. The fish do not, when feeding, require to come within sight of the fisherman and whatever it is that now and then brings a few fish to the surface is not known. The fishermen look for the brown water (discoloured with abundant plancton) and expect to get pilchards in it.

When they get them in the brown water they are more easily caught, as they do not seem to notice the net so readily. The school of pilchards may be detected from the masthead as a dark mass floating down to three fathoms below the surface.

Bad weather accounts for much loss of time and the wandering habits of the fish entail much searching. A decline in the catch of the fishery may not be due to a smaller stock of fish but merely that the fishermen did not succeed in securing them. Thus the decline in catch may really be an advantage to the stock of fish, and merely indicate that there are so many difficulties that the efforts of the fishermen are rendered from time to time less effective.

There seems, then, ground for asserting that the fishermen do not take a big majority of the fish, but it is impossible to tell what that toll is. The

pilchards are exposed to capture for four months only. In October they begin to disappear. Whither they go, whether they hide themselves in the ocean not far away, or whether many of them take a long journey south is one of the problems. It does not seem that they need to depart on account of lack of food. Will the survivors return to British Columbia waters next year?

The question of the possible depletion of the stock of fish is bound up with the whole ecology of the pilchard. Such a question cannot be solved without an extended study and investigation. There are many factors, some known, others which will reveal themselves during the progress of the work which must be studied. A knowledge of the hydrographical and plankton conditions is necessary, not only for the discussion of the movements of the pilchards but also for comparison with these conditions in future years.