CWSC 264

# THE EEL-GRASS SITUATION ON THE ATLANTIC COAST

BY

H.F. LEWIS

1932

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# The Eel-grass Situation on the Atlantic Coast

By Harrison F. Lewis,
Chief Federal Migratory Bird Officer
Ontario and Quebec,
National Parks of Canada,
Department of the Interior.

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Eel-grass (Zostera marina L.) is a flowering plant, belonging to the pond-weed family, that grows in salt or brackish water along most sheltered shores of the sea in the middle north temperate zone, from about half-tide to a depth of a few feet below low-tide mark. On the Atlantic coast of North America it ranges along the shore from southern Labrador to North Carolina, with outlying stations in Hudson Bay and on the west coast of Greenland. Where the inter-tidal zone includes extensive suitable flats, as it does in many shallow bays, harbours, and estuaries on the eastern coast of Canada and the United States, this plant is often found growing in dense masses over large areas. It is often two to four feet long above ground, with long narrow, ribbon-like leaves. Beneath the surface of the soil each plant has a rootstock, about 3/16 of an inch in diameter and several inches long, furnished with numerous short roots. Eel-grass reproduces both by seeds and by vegetative propagation, which involves the production of lateral buds that eventually become separated from the parent stem by death and abjointing of the older part of the rootstock. A plant grown from seed does not flower and produce seed until the second or third year.

The rootstocks or rhizomes of eel-grass form a very important food of Canada Geese and Brant, and the seeds are eaten to a large extent by Black Ducks and to some extent by other species of ducks. When in waters supplied with eel-grass, Brant feed upon it almost exclusively and Canada Geese rely upon it to a large extent. Eel-grass rootstocks constitute, under normal conditions, the essential food-supply of several thousand Canada Geese that customarily winter in southwestern Nova Scotia, as well as of large numbers of both Geese and Brant wintering on the eastern coast of the United States.

The leaves and stems of eel-grass, when thoroughly dried, are quite widely used in industry, especially for insulation and sound-proofing for buildings and for upholstering furniture. Under normal conditions thousands of tons of this plant are gathered annually in eastern Canada and United States for these industrial purposes. A great deal of eel-grass is also used locally by farmers near the shore for fertilizer and for banking the foundations of houses and other buildings in cold weather.

At the present time there is a notable and unprecedented scarcity of living eel-grass on the coasts of Nova Scotia, Prince Edward Island, and all of New Brunswick except the extreme north, and a similar scarcity is reported from the eastern sea-coast of the United States, from Maine southward at least to Virginia. Scarcity of this plant in areas where it is usually abundant is known to extend as far north on the eastern shore of New Brunswick as Tabusintac Lagoon, Northumberland County, which is north of the estuary of the Miramichi River. In September, 1932, I personally observed this scarcity at Tabusintac, but on the same day failed to find any evidence of unusual scarcity at Caraquet, which is a little farther north, on the southern side of the Baie de Chaleur. Such a scarcity of eel-grass has not yet been

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reported from any place in the Baie de Chaleur, nor in the estuary of the St. Lawrence River, nor on the north shore of the Gulf of St. Lawrence, nor along the coast of Newfoundland, so that the northern boundary of the area of scarcity would seem to have been situated, in September last, across the Gulf of St. Lawrence, with its western extremity just south of the Baie de Chaleur and its eastern extremity just north of Nova Scotia.

Tidal flats that I have recently examined in the affected areas on the Atlantic coast of North America, where eel-grass ordinarily grows in enormous quantities, now show in most cases only a few scattered plants, most of which are sickly and evidently dying. In some places great mats of interlaced dead rootstocks may yet be found, black and brittle, in the mud and sand of the bottom, in other places such rootstocks are not discoverable and have presumably decayed and disintegrated. The living plants that remain are chiefly to be found near the shore, although in some areas some also occur, scattered singly or in small groups, at some distance from dry land. At points, such as estuaries, or the immediate vicinity of the mouths of brooks in sheltered places, where the seawater is markedly diluted by fresh water, there still exist dense stands of eel-grass that is apparently normal and healthy, but such eel-grass beds are strictly limited in extent by the limits of the marked dilution of the seawater. The general character of the scarcity in an area such as Nova Scotia is indicated by the fact that a firm that usually ships 1500 tons of eel-grass annually from that province to Boston has not been able to obtain a single ton this year.

In some places, as at Buctouche, New Brunswick, a few small, scattered eel-grass plants that are apparently young and perfectly healthy are to be found on flats where all the original dense stand of eel-grass has died.

In south-western Nova Scotia, from Port Joli, Queens County, to Argyle, Yarmouth County, many extensive tidal flats, some of which are known to have been nearly bare of eel-grass about June 1st, 1932, showed in late September of this year large areas covered with a fairly dense growth of young eel-grass plants, with leaves five or six inches long. These plants look green and normal when viewed from a little distance, as from the shore, but on close examination show signs of an unhealthy condition similar to that found in older plants elsewhere. This makes it seem probable that this new growth of young plants, which has been the basis for popular reports that the eel-grass is "coming back" in this area, will soon, in its turn suffer severe reduction in numbers.

Eel-grass plants that are dying in the regions where this scarcity exists show black areas of considerable size on the leaves, at first near their tips, subsequently nearer the leaf-bases. Eventually each leaf affected dies, turns brown, and decays. Death of the leaf, with accompanying disintegration, is progressive from the tip to the base, so that leaves whose proximal portions are still green and living while their distal portions are entirely missing are frequently observed. The extreme base of the leaf may remain green for some time after loss of almost all the rest of the leaf. In a comparatively short time, however, a plant becomes entirely stripped of its leaves, while the rootstock dies and turns black; the death of the rootstock apparently coinciding with the loss of the leaves or following it very closely.

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According to information received this abnormal dying of the eel-grass has been observed for two years at least, and possibly as many as four years, on the coast of the United States, from Virginia to New Jersey. Its occurrence was so unexpected that observers in that region, as elsewhere, did not realize what was taking place and cannot now date with certainty their first observations that related, as they now believe, to this destruction. At the conclusion of 1931 the scarcity of eel-grass was present from the southern limit of the range of the plant on the coast of the United States northward to the extreme southern part of the Gulf of St. Lawrence, including Northumberland Strait as far as the vicinity of Cocagne, New Brunswick. The south coast of Prince Edward Island was included in the area of scarcity in 1931, but the eel-grass along the north shore of that island remained healthy during that year.

During 1932 the area of eel-grass scarcity has extended northward somewhat in the Gulf of St. Lawrence so as to include the north shore of Prince Edward Island and the east coast of New Brunswick from Cocagne north to Tabusintac or beyond.

Reports obtained from the Pacific Station of the Biological Board of Canada and from the Interior Department's chief bird protection officer for western Canada indicate that the growth of eel-grass is still normal on the coast of British Columbia. Inquiries concerning the condition of eel-grass on the west coast of Europe have resulted, up to the present time, in the receipt of three reports from European botanists. Mr. A. D. Cotton, of the Royal Botanic Gardens at Kew, England, wrote to me on October 24th of this year that he did not know of any reduction of the growth of Zostera in England, and Dr. Frederick C. E. Børgesen, of the Botanical Museum at Copenhagen, Denmark, writing on the 23th of October last, definitely stated that, apart from normal minor changes of a local character, there had been no alteration in the growth and abundance of Zostera in his country.

Professor C. Sauvageau of the Faculty of Sciences, Bordeaux, France, has sent me a copy of a letter dated October 26th, 1932, that he received, in response to enquiry, from Charles Pérez, Director of the Laboratory of Roscoff, on the west coast of France fronting on the English Channel, which is of quite a different tenor, and which, translated, reads as follows:

"We have noticed at Roscoff the same disappearance of "Zostera. From November, 1931, to January, 1932, all the "beds of it in this region diminished and about March "and at the time of the Easter vacation, all those that "we could see in front of the laboratory, at Callot, "Penpoull, etc., were entirely denuded; not a leaf, an "absolute desert.

"In the course of the summer they started to grow again, "but they were still very poor in September; there were

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"still large areas entirely bare or nearly so.

"Ed. Fischer has observed the same disappearance "in the region about St. Servan and Dr. Lefranc gave us "similar information concerning the southern coast of the "Department of Finisterre.

"No doubt it is a case of a general bacterial "infection; it is strange to observe that the epidemic "has had such an extensive geographic dispersal.

"Dr. Magrou, of the Pasteur Institute, gathered "at Roscoff some of the diseased leaves, with black areas "on them, in order to try to find bacteria in them. I "do not know whether he had any results.

"On the other hand, I think that Ed. Fischer in- "tends to mention this epidemic in a note that he will "publish in the 'Bulletin of the St. Servan Laboratory.'

"This is all I can tell you at present."

It would appear from this communication that a disappearance of Zostera plants, with symptoms resembling those observed on the eastern coast of this continent, took place last winter on the coast of extreme western France, around practically the entire Department of Finisterre, as well as westward on the coast bordering the English Channel at least as far as St. Servan. As it is believed to require about eight months for surface water to drift across the northern Atlantic from America to Europe, the time of this outbreak in Europe is in accord with a theory that, following the beginning of the destruction of Zostera on the American coast, the cause, whatever it may be, was borne across the Atlantic to Europe by drifting water.

Conceivable causes of eel-grass

Conceivable causes of an unusual scarcity of eel-grass are:

1. Winter killing, due to unusual ice conditions.
2. Too high a temperature in summer.
3. An increase in the salinity of the sea-water to a point at which the plant could not live
4. Destruction by waves in storms.
5. Consumption by Geese and Brant.
6. Destruction by competing plants.
7. Excessive commercial harvesting.
8. Destruction by oil pollution.
9. Alteration of one or more of the physicochemical factors involved in the relationship between this plant and the surrounding water, with its solutes.
10. Disease caused by a bacterium, a fungus, or other definite living organism.

Most of these conceivable causes have been advanced from one quarter or another to explain the existing scarcity, but while almost any one of them might be a plausible explanation of the scarcity in a particular limited locality, most of them are entirely inadequate as

explanations

explanations of the disappearance within two years of the greater part of the eel-grass growth over enormous areas, and under widely varying conditions, from Virginia to New Brunswick, as well as in western France.

Winter killing on an extensive scale would require an unusual combination of cold weather and low tides, which might possibly destroy much eel-grass in a few harbours in the northern part of its range, but which could not be seriously destructive in the southern part of the regions actually affected. During 1932 much eel-grass in New Brunswick and Prince Edward Island that appeared to be normal and healthy in spring and early summer has died during late summer and early fall and this could not be due to winter killing.

Eel-grass is affected adversely by water temperatures above 68° F., as Professor W. A. Setchell has shown in his admirable account of the morphology and phenology of this plant, and any increase of summer water temperatures in the southern part of its range might kill a good deal of it there. Available water temperature records of the U. S. Coast and Geodetic Survey do not, however, show any recent excessive summer water temperatures on the coasts of the Middle Atlantic States as compared to what have been recorded there in some previous years. Records of the Biological Board of Canada show a very slight increase of water temperatures at some places on the coasts of the Maritime Provinces in recent years, but in these northern waters the maximum attained is too low to be injurious to eel-grass. There is, in any event, no reason to believe that any possible increase in temperature would kill the rootstocks. Excessively high water temperatures cannot, therefore have caused the existing scarcity.

As for the salinity of the sea-water, the maximum salinity in which eel-grass will live and reproduce does not appear to be known, but it is believed that this plant is not subject to injury from the full normal salinity of Atlantic Ocean water along the eastern coast of the northern United States and Canada, which is about 31 parts in 1000. It will probably resist successfully a salinity markedly higher than this, for Professor Setchell informs me that it grows in ponds along the coast line of Rhode Island where the salinity must be raised considerably. Yet the plant has died over great areas where the maximum salinity is less than 31 parts in 1000. In Barnegat Bay and Great Bay, on the New Jersey coast, where disappearance of the eel-grass was very marked, the Biological Survey reports a maximum salinity of only 12.6 parts in 1000. In inlets around the Gulf of St. Lawrence where the destruction of the plant has been severe, records kept by the Biological Board of Canada over considerable periods of time in connection with studies of oyster culture show salinities ranging from 23 to 30 parts in 1000. Samples that I

collected

collected in September last from areas of eel-grass destruction show, for the Gulf of St. Lawrence, a maximum of 30.6 parts in 1000 from Buctouche, New Brunswick, and, for the outer Atlantic coast, a maximum of 31.6 parts in 1000 at Port Joli, Nova Scotia.

It is possible to argue that, although eel-grass, considering the species as a whole, withstands high salinities successfully in some parts of its range, yet this is because the individual plants concerned have become adjusted gradually to such salinities, and that these salinities, if applied rather suddenly to other individual plants that had never before experienced them, might prove fatal. When we consider, however, the unstable conditions under which eel-grass commonly grows, and which in many cases cause it to be subject, without observable injury, to marked changes of salinity with each ebb and flow of the tide, it is difficult to give much weight to any such argument. It seems inconceivable that a salinity of only 12.6 parts in 1000, as in the large coastal bays of New Jersey, should be the cause of any damage to the plant, even though, because of severe drought and decreased stream-discharge, this salinity may have been somewhat above the normal for the area in question. Salinities in Gulf of St. Lawrence areas where the plant has died extensively, and where there has been no marked drought in recent years, have not been abnormal. Therefore it seems impossible to credit the theory that the scarcity of eel-grass has been caused by increased salinity of the surrounding water.

During severe storms, waves undoubtedly destroy exposed eel-grass plants, and such destruction limits the plant to sheltered habitats. It is inconceivable, however, that destruction by this means should suddenly become so extensive as to cause the recorded scarcity. It is also to be noted that eel-grass in very sheltered beds, such as those in small coves, has died at the same time as eel-grass on large tidal flats.

Investigation by the writer in 1929 and 1930, as a result of complaints received by the Department of the Interior, showed that consumption of eel-grass rootstocks by Geese and Brant on the flats at Ile Verte, Quebec, where large numbers of these birds regularly gather and feed during their spring and fall migrations, was not seriously injurious to the stands of eel-grass. While Canada Geese and Brant are believed to have shown some increase in numbers on the Atlantic seaboard of North America during the time that they have been protected by the Migratory Birds Convention between Canada and the United States, it would be ridiculous to suppose that in the past two years they had suddenly increased to such an extent as to enable them to destroy nearly all the eel-grass over the extensive regions in which eel-grass scarcity is now present. The fact that in several places the disappearance of the eel-grass is known to have taken place in late summer, when no Canada Geese or Brant were present, also makes the theory of eel-grass destruction by these birds untenable.

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Flat from which the eel-grass has practically disappeared are in some cases now occupied by fairly dense growths of other salt water plants, such as sea lettuce (Ulva) and pigeon grass (Ruppia) and this condition led to the popular explanation that these plants had driven out and replaced the eel-grass. Such plants have always existed side by side with the eel-grass without harming it materially. No way in which they could seriously injure or destroy eel-grass is known, nor does there appear to be any reason why such plants should suddenly become highly efficient eel-grass destroyers. They are undoubtedly more conspicuous in places where the eel-grass has disappeared, and probably they are commonly more abundant in such places than they were when the eel-grass growth was normal there, but this presumably is due simply to their having and using now the opportunity to fill the space that the eel-grass has vacated.

Excessive commerical harvesting, by means of close annual mowing, is undoubtedly injurious to the stands of eel-grass, as was indicated by the investigations at Ile Verte, Quebec, previously referred to. However, such means of harvesting eel-grass are used only in very limited areas and could not possibly cause the extensive destruction of eel-grass that has recently taken place. In the Maritime Provinces and in the United States eel-grass is gathered for commercial and other uses by simply collecting loose material thrown on shore by the waves.

There is no proof that eel-grass has ever been destroyed on any noticeable scale by oil pollution, and it is not reasonable to suppose, nor is there any evidence to show, that oil pollution in the past two years has increased so generally and greatly from Virginia to New Brunswick as to cause extensive eel-grass destruction throughout most of the eel-grass beds in that region. In the summer of 1932 heavy crude oil pollution from an oil-tanker that had been wrecked on Anticosti was observed along a fifty-mile section of the north shore of the Gulf of St. Lawrence, but did not appear to injure eel-grass growing there.

It is a possibility that alteration of one or more of the physicochemical factors involved in the relationship between this plant and the surrounding water, with its solutes, has occurred and has caused the observed destruction, but no proof or independent indication of such an occurrence is known at present. Sea water, containing, as it does a great variety of solutes, is a very complex substance, with a very large number of variables, concerning which much fundamental knowledge is still lacking, and that some slight change in its constitution might be lethal to Zostera is certainly conceivable. On the other hand, if this is actually what has occasioned the death of this plant over such great areas in so brief a time, the geographical distribution of the destruction, from New Brunswick to Virginia and North Carolina, and also on the west coast of France, but not on adjoining coasts farther north nor on the coasts of the Pacific Ocean, is very surprising and difficult to account for.

The last of the suggested causes of the scarcity to be considered is destruction of the plant by a disease caused by some definite living organism, such as a bacterium, a fungus, or a filtrable virus. Consideration of all the data concerning the scarcity that are now available shows

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that they are in accord with such a theory of causation. The eel-grass has died quite suddenly over extensive areas and yet has not died everywhere at once, for the destruction apparently began at least two years ago in the southern part of the eel-grass range and spread northward, reaching the north shore of Prince Edward Island and part of eastern New Brunswick only in the summer of 1932. It is readily conceivable that a rapidly progressive destruction of this nature is the result of dissemination through the sea-water, which connects all living eel-grass plants, of minute disease-causing organisms, such as bacteria. The discoloration and disintegration shown by the unhealthy and dying eel-grass plants are readily interpreted as symptoms of a specific disease. The fact that eel-grass growing where the sea-water is greatly diluted, as in estuaries, is still normal and healthy may be considered to indicate that the disease-causing organism is not active in water in the lower ranges of salinity that eel-grass will tolerate. Here is where any slight drought-caused increase in salinity in recent summers of the waters of the great bays on the coast of New Jersey may have played a part, for it may have been just enough to have brought these waters within the salinity ranges in which the presumed destructive organism can be active. At just what degree of salinity below normal the eel-grass is preserved from attack has not yet been determined, but it may be noted that water from a healthy relict stand of eel-grass in a small cove into which a brook discharges at Cole Harbour, Nova Scotia, showed a salinity of 9.9 parts in 1000 on September 26, 1932, while the maximum salinity reported from the areas of eel-grass destruction in the New Jersey bays is, as previously stated, only 12.6 parts in 1000. The Cole Harbour specimen was taken when the tide was more than half up, so that the eel-grass in this bed was undoubtedly subjected at low tide to a degree of salinity even lower than that observed. The fact that young plants, as at Port Joli, N. S., may grow extensively in early summer and yet show symptoms of approaching destruction in September may indicate that the disease-causing organism is seasonal in its activity, and is relatively inactive in early summer and highly active in late summer and early autumn.

Of course, the idea of a disease-causing organism as the cause of the existing scarcity cannot be considered more than a highly probable theory until the organism can be found and the disease can be produced with it experimentally. Specimens of eel-grass in various stages of destruction, which I gathered at a number of places in the Maritime Provinces in September, 1932, were furnished as promptly as possible to the Laboratory of Plant Pathology, of the Canadian Department of Agriculture, at Ottawa, for examination. As a result of the examination made it can now be said only that no organism has yet been identified as the cause of the destruction, and that it is very unlikely that the causative organism is a fungus for, if it were a fungus, it would almost certainly have been discovered in the course of the examination. A coarse mycelium was found by Dr. E. Silver Dowding, of this Laboratory, in one section of a blackened portion of the cortex of a rhizome, but as it could not be found in any other samples examined, it was not considered to be a cause of the disease. Search for some other possible causative organism, whether it be a bacterium or an ultra-microscopic organism, must presumably be carried on in a suitable laboratory at the sea-shore, where sea-water and living eel-grass are immediately available. For the present we are entitled to consider only as an extremely probable working theory the idea that the present scarcity

of eel-grass is caused by a definite disease due to some highly contagious organism that is active only in water that is not below a certain degree of salinity.

Possible origin

The rapid and widespread destruction of eel-grass that has taken place within the past two years indicates that the destroying organism was either one that was new to the eel-grass attacked or was a new mutant from a strain previously present, else there is no apparent reason why it should not have destroyed the eel-grass before. If this is correct, where has the destroying organism come from? In this connection Dr. A. G. Huntsman of the Biological Board of Canada, has advanced a very interesting theory, based upon data collected by his organization in the course of its regular activities. It seems that in the past year or two certain tropical fishes and plankton forms previously unusual or unknown in Canadian waters, including Salpa Lepas, the Goose Barnacle, have been collected off the coast of Nova Scotia and even in the southern part of the Gulf of St. Lawrence and in Northumberland Strait. This is considered to indicate increased connection between tropical waters and those of the Maritime Provinces, due to an increased amount of water from the Gulf Stream entering the coastal basins around those provinces. It is possible that the minute organism that is believed to be destroying the eel-grass may be a native of the tropics, living there on some other host plant or plants long adjusted to its attacks, that has now been disseminated northward by the same movement that has brought the tropical fishes and plankton forms. Such an organism, finding in the eel-grass an abundant plant that was suited to its needs and that lacked resistance to its attacks, might cause the observed scarcity.

Future course

The future course of such an entirely new disease cannot be predicted with any certainty. During 1932 it has extended its range northward, though the extension has been much smaller than that made in 1931. It may extend its range still further in 1933 or it may meet a barrier of unfavourable conditions that will definitely limit its northward progress. Even should it extend to the north shore of the Gulf of St. Lawrence, it may not be able to enter the estuary of the St. Lawrence River because of lower salinity there and the existence of a continual outward movement of the water. It is possible that the eel-grass in regions where the disease flourishes may never be able to resist it and therefore may never recover to an extent that will permit it to become abundant again. The history of new disease invasions in general, however, makes it appear much more probable that there will be an eventual recovery, due either to development of a resistant strain of eel-grass or to decrease in the virulence of the attacking organism, or to both these causes together. The scattered young, apparently healthy plants that I found on the flats at Buctouche, N. B., on September 22, 1932, may possibly represent a resistant strain of eel-grass, but certainty concerning this is not possible at present. If the eel-grass recovers from the disease, the time that such recovery will require is unpredictable.

While the eel-grass is practically absent from great areas these are being modified in ways that will retard its possible return. As has been pointed out, the bottom materials are being shifted and other plants are occupying the space that the eel-grass formerly occupied. These occurrences are creating more or less adverse conditions against which an increasing population of eel-grass will have to contend. Incidentally, the shifting of bottom materials

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will probably cause more or less serious smothering of certain mollusks, such as clams and oysters, and the growth of such plants as sea lettuce and pigeon grass will supply a certain amount of food for water-fowl that may, to a slight extent, take the place of the food-supply that these birds formerly obtained from the eel-grass.

Conservation of birds

The chief immediate practical effect of the eel-grass scarcity in connection with the conservation of migratory birds, will be that, if Canada Geese and Brant come south along the Atlantic seaboard of North America in anything like their usual numbers this fall, a great many of them may be expected to die of starvation during fall, winter, and spring, especially, of course, during the winter, when shore ice will reduce the available supply of food to a minimum. There is evidence that some Geese died from this cause in Nova Scotia in late winter and early spring of this year, while others were greatly weakened. Close watch should be kept upon the actual situation relating to these birds, for if only a small stock is able to survive until the breeding season next year, they may then require additional measures of protection.

The Department of the Interior is observing carefully the actual effect of the scarcity of eel-grass on Brant, Canada Geese, and Black Ducks in Nova Scotia, New Brunswick, and Prince Edward Island this fall, and will continue to do so during the winter and spring wherever in these provinces these birds may be found. While maximum distress is not to be expected until ice, snow, and continued feeding have further restricted the supply of food available in the region, marked effects attributable to the lack of eel-grass have already been recorded in some areas. In reporting briefly concerning these, the three species of game birds referred to are here considered separately.

No adverse effect upon Black Ducks has been observed so far this fall. This species is present in the Maritime Provinces in normal numbers and in good condition.

Concerning Brant it may be said that, of fourteen recent reports from their regular haunts about the southern part of the Gulf of St. Lawrence, one states that they are more abundant this fall than formerly, two indicate their presence in normal numbers, and eleven speak of them as less abundant than usual, scarce, or very few. The condition of most of the Brant killed is said to range from fair to thin and poor, although some birds are said to be fat. In one instance it was noted that at least some of the Brant were fat when they arrived from the north, but those taken later were thin. A number of observers report that actions of the Brant this fall are abnormal, that they feed close in shore, or in other unusual places and that they seem restless and tame and respond more readily to decoys than was ever known before, so that they are being killed more easily than usual. One small flock in eastern Nova Scotia was seen to follow some Canada Geese inland, which is a very unusual thing for Brant to do.

Among 21 recent reports on the abundance of Canada Geese in the Maritime Provinces, 4 indicate an increase in numbers this fall, 5 indicate their presence in normal numbers, and 12 record a decrease. Some of the decreases in numbers reported are slight, others severe. The reports

concerning

concerning the condition of the Canada Geese in these provinces this fall show that most of them are decidedly under normal weight - so much so in several cases that they were condemned as unfit for human consumption. A few geese are reported as in good or even splendid condition. In their actions, the Canada Geese, like the Brant, show marked restlessness, moving about in small parties from one feeding-ground to another, visiting upland feeding-grounds to an abnormal extent, and passing through a given region on their migration more rapidly than usual. In some places they decoy more readily than is normal and fly very low over the land, so that more than usual are being taken by hunters. The following brief but informative report from Officer J. Spurgeon Jenkins, whose district includes Queens and Kings Counties, Prince Edward Island, gives a clear picture of conditions there on November twelfth:

"In this district geese are present in normal "numbers, although they appear to be more plentiful than "they really are on account of restlessness. Of a num-"ber personally examined and reported upon, approximately "30% were thin; 60% were fair; and 10% fat, though no "fat ones were personally examined. They are unusually "restless and, when they take wing, go over the land at "low altitudes, affording marvellous opportunities for "hunters. They have changed their habits almost entirely, "now feeding in grain and clover fields, and often resort-"ing to potato fields, where they feed on the refuse "potatoes that were left by the farmers. They are also "seen feeding on sedge grass, which grows on the marshes, "and on mud flats, where a species of small snail abounds. "A much larger number than usual are being killed. They "decoy very easily and occasionally alight in farmyards "with domestic Canada Geese near farm buildings."

Emergency demands to feed starving Geese and Brant may be expected during the coming winter and spring, and preparations should be made to meet these as far as may be thought advisable, although such artificial feeding measures will probably be only a minor palliative of the general situation.

Black Ducks, which are accustomed to eat large quantities of eel-grass seeds along the coast, and which are numerous this fall, will probably suffer to some extent from the eel-grass scarcity, but these birds have such a varied food-supply, other items of which are still available in abundance, that the adverse effect of the lack of eel-grass on them will probably be of a minor nature.