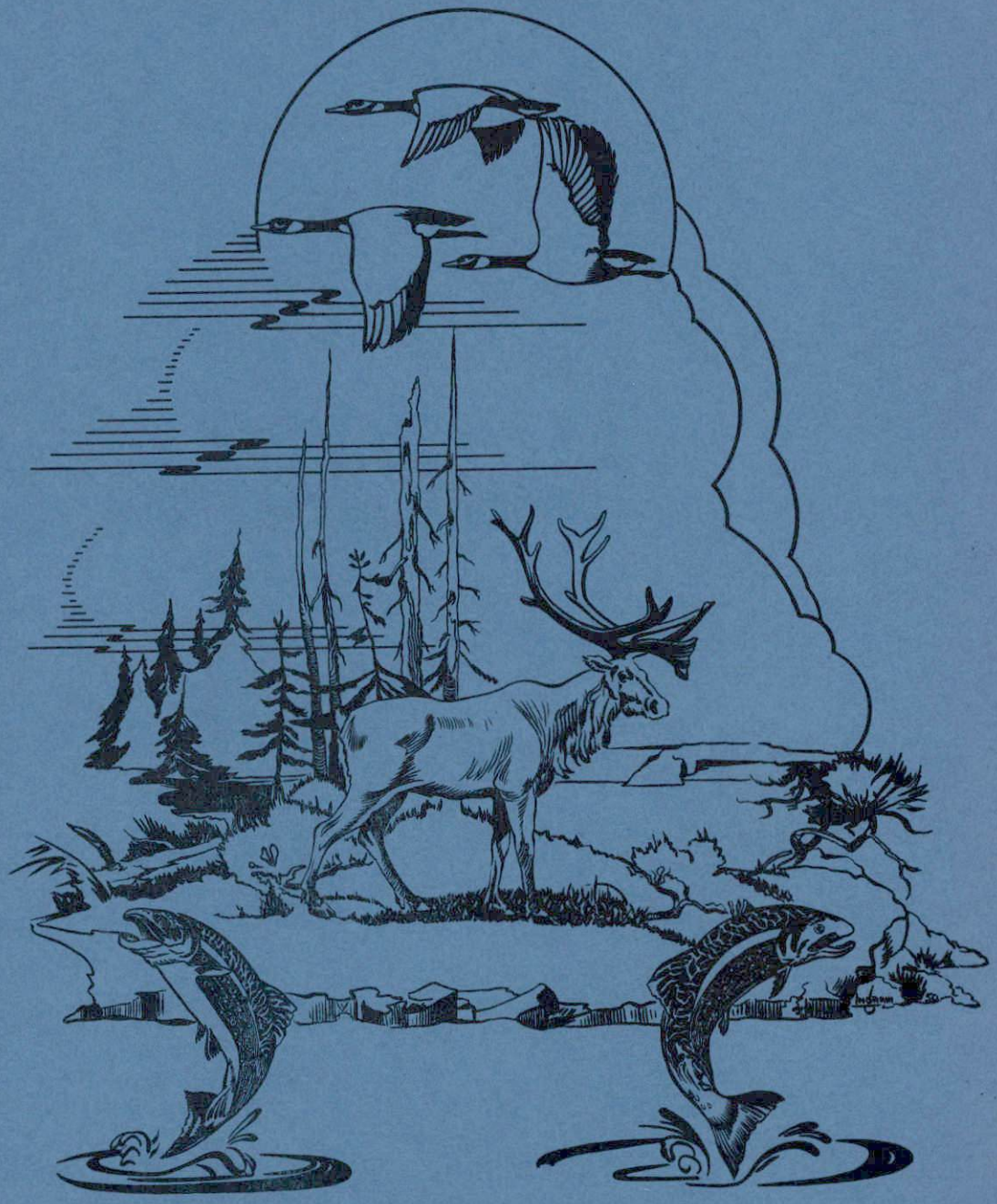
# WILDLIFE MANAGEMENT BULLETIN



DEPARTMENT OF RESOURCES AND DEVELOPMENT
DEVELOPMENT SERVICES BRANCH
CANADIAN WILDLIFE SERVICE

SERIES 2 OTTAWA NUMBER 5

JUNE 1952

CANADA

DEPARTMENT OF RESOURCES AND DEVELOPMENT

NATIONAL PARKS BRANCH

# THE ECONOMIC STATUS OF THE HERRING GULLS OF THE GRAND MANAN ARCHIPELAGO, NEW BRUNSWICK, 1949

by

D. H. Pimlott

WILDLIFE MANAGEMENT BULLETIN

SERIES 2 NUMBER 5

ISSUED UNDER THE AUTHORITY OF
THE MINISTER OF RESOURCES AND DEVELOPMENT

OTTAWA

1952

Table of Contents




Wildlife Management Bulletins are produced to make available to wildlife administrators the information contained in reports which are submitted by officers of the Canadian Wildlife Service.

The reports do not, in most cases, cover extensive studies and are not written primarily for publication. Recommendations arising from the studies are not included.

## Introduction

The second investigation into the economic status and population dynamics of the herring gull of the Grand Manan Islands was carried out during the period May 26, to September 4, 1949.*

In the presentation of this report, it is intended to utilize and compare the findings of all previous studies conducted on the islands by the Canadian Wildlife Service, (Cameron 1945, Boyer 1948, Pimlott, 1948), and studies which have been conducted by the Bowdoin College Scientific Station on Kent Island.

The first investigation by the Canadian Wildlife Service was conducted by Austin Cameron, during a two-week period in June, 1945. The period of study was too short to allow actual investigation into every phase which is covered in his report, but he succeeded in outlining the situation extremely well. His report proved to be of great value, providing a general understanding of the situation that alone would have taken many days to acquire and serving as a guide in planning further investigations. His comments and conclusions were borne out in a number of instances by the results of the work done in 1949, and this report follows an outline similar to his.

The principal object of the 1949 investigation was to determine as closely as possible the amount of economic loss caused by the gulls. Accordingly most of the summer was spent in investigating their economic status. When possible, information concerning changes in population numbers and the reasons for such changes was

* During this period the writer was employed by the Canadian Wildlife Service.

to be secured; but as this was a minor phase, no attempt to determine the exact number of the gulls was made, and the available time was devoted to finding answers to the following questions:

1. Had there been an increase in the Kent Island population as estimated by Cameron following census in 1945?
2. Did the 1948 estimate for Outer Wood Island (Boyer 1948, Pimlott, 1948) still appear to be reasonable?
3. Had the Outer Wood Island population decreased in recent years?
4. Exactly what islands had herring gull populations?

Transportation to the outer islands of the archipelago where the herring gulls nest was hard to secure. During the first month the Fisheries Patrol boat, the Department of Transport life boat, and local fishing craft were of much assistance. In late June a dinghy and a 5 H.P. Johnson outboard motor was secured and they provided a more certain and independent means of transportation in favourable weather.

The residents of the archipelago were found to be very co-operative and helpful. The kindness of those who permitted the use of their fields in the fish offal experiments is gratefully acknowledged, as is also the assistance of the following: Dr. A. O. Gross, Director, and Mr. A. Barnes, Field

Director, Bowdoin Scientific Station; Mr. Allan Moses of North Head; Mr. Ernest Joy, Warden of Kent Island; and Captain Coleman Green and Captain Howard Zwicker, both of Seal Cove.

## SECTION I - HISTORY OF THE COLONIES

In view of the ornithological and economic importance which the sea bird, particularly the herring gull, colonies of the archipelago have assumed for more than 100 years, it would seem to be of interest and of some importance to trace the development and the fluctuation of the herring gull population. The following history is derived mainly from published papers of the Grand Manan Historical Society.

The first reference to the presence of the herring gull on the Grand Manan Islands is found in the journal of Captain William Owens who visited Grand Manan in August 1770, nine years before the first settlement. Under date of August 10, is the following:

"At ten we landed on the point of the marsh on the south shore, where we pitched the tent, made a fire and boiled the pot: we caught some young gulls, shelldrakes and dippers....."

Accompanying notes by Professor W. F. Ganong identify the spot visited as the southern end of Cheney Island.

Audubon visited Grand Manan in 1833, on the first leg of his Labrador journey aboard the cutter "Swiftsure". In his Ornithological Biography he referred to the colony at White Head Island. He was particularly interested to find some of the

gulls nesting in trees.

Dr. Gesner mentioned the same colony in The Geology of Grand Manan, 1839. He says:

"This island abounds in gulls and other sea-birds. The young broods are so numerous in July that thousands may be taken by hand, and the swamps are shadowed by the grey and white gulls floating in the air."

The first reference to the colony at Southern Head is found in a work by B.F. Decosta, a noted clergyman and writer of the times, who visited Grand Manan in 1868. He describes that colony and mentions seeing at Point Pleasant, Maine, young gulls taken alive on Grand Manan by Indians and being fattened on porpoise meat for future feasting.

It seems probable that until 1850 the main herring gull colonies were located on Southern Head, and on Ross, Cheney, Kent and White Head Islands. Here were found grassy regions and stunted, scattered spruce adjoining heaths and salt ponds, providing ideal nesting sites. The other large islands of the Archipelago were settled by that time, and clearings among the heavy woods were gradually permitting the spread of the gulls to those islands.

After 1850, numerous ornithologists visited the islands to study their bird life.

The success of the larger colonies did not continue. In 1874 foxes were introduced at Southern Head by Indians of the Passamaquoddy tribe, and by 1883 the gull colony there had disappeared. By 1890, according to Ed. Manchester, an elderly

resident of White Head Island, the gull colonies of Cheney, Ross and White Head apparently had disappeared. The foxes were undoubtedly one of the main causes of the disappearance, as these islands are accessible by land from Grand Manan at low tide. It now seems improbable that the gulls will ever return to nest on any of these islands, as they are frequented by raccoons, introduced to the Archipelago in 1905.

By 1900, the combined effect of foxes, plumage hunters and egging was so great that the herring gull had become very scarce. Ernest Joy described the camps of plumage hunters on the shore at Long Pond, now a Migratory Bird Sanctuary, where dead gulls lay rotting in large piles, and long lines of waving white wings and other plumage stretched between the trees. After plumage-hunting ceased, the colonies of Two and Three Islands began slowly to build up and egging again became common. The islands were rented by the day to parties who made a picnic of the occasion and often gathered gulls' eggs by the barrel. The Migratory Bird Treaty in 1916 prohibited the collection of the eggs, but enforcement in an area where egging was fun and dodging the game warden only added to the sport, was very difficult.

In the mid-twenties raccoons were introduced to Kent Island, presumably through malice on the part of people to whom permission to visit the island was refused. Little other natural food was available, and the raccoons soon attacked the nesting populations of gulls, eiders and other sea birds. Allan Moses of North Head, while on scientific expeditions with J. Sterling

Rockefeller, acquainted him with the story of Kent Island, and the danger of extinction faced by the American eider in the region. In 1930 the island was purchased by Rockefeller and set aside as a bird sanctuary. Moses and Ralph Griffin, the local game warden, hunted the raccoons until the fourteenth, and last, was finally destroyed in 1931. When only one raccoon remained on the island, nine three-egg gulls' nests were found destroyed in a single night's predation.

In 1935 Kent Island was given to Bowdoin College of Brunswick, Maine, after a number of students had impressed Rockefeller with their enthusiasm and with the high quality of the ornithological research which they were conducting on the island.

No reliable estimates of the herring gull population in those early days of protection are available, but local residents state that they have at least doubled in number during the past 18 years. By the time Kent Island was purchased by Rockefeller, the gulls had begun nesting on the islands north of Cheney Passage, (Nantucket, the three Duck Islands, and Long Island), possibly to escape persecution on Kent Island.

In 1937 the National Parks Bureau of the Department of Mines and Resources began permitting control of the gulls by the removal of their eggs. Permits to collect eggs were obtainable at first on application to the Chief Migratory Bird Officer for the Maritime Provinces. After 1947 they could be obtained from the local detachment of the Royal Canadian Mounted Police.

In 1948 control measures were extended to include spraying of the eggs, and a team headed by G.F. Boyer conducted this operation in all the larger colonies except on Kent Island.

In 1948 a pair of gulls was reported to have returned to nest on Grand Manan Island, in a raven's nest on Fish Head promontory on the side of a cliff 150 feet from the water and 100 feet below the closest approach for raccoons or egg-collecting humans. Not many gulls may be expected to return to the main island, as raccoons are now present in sufficient numbers for effective control.

In 1949 the gulls occupied nesting sites on every island, and on most of the islets, of the Archipelago, having spread from the two or three main nesting sites that they occupied 150 years ago.

## SECTION II - POPULATION ESTIMATES

### A. GENERAL

Before 1940 no real attempt was made to estimate the population of any of the herring gull colonies of the Archipelago. In 1940 F.R. Crystal (1941) conducted a nest count on the south part of Kent Island. He estimated a population of 30,000 for this part and 2,000 for the northern part, a total of 32,000 for the whole island.

In 1945, A.W. Cameron estimated the population of Kent Island to be 50,000; Outer Wood Island, 30,000; and the total for the Archipelago, 86,500.

Three years later, in 1948, G.F. Boyer conducted gull control measures in the main colonies other than on Kent, and estimated the total population for the Archipelago at 50,000. He estimated a decrease from 1945 of 9,000 on Kent Island and 25,000 on Wood Island. He assumed that the difference was due, in part at least, to over-estimation by Cameron.

During 1949, population studies were conducted on the colonies of Outer Wood and Kent Islands. Boyer's 1948 estimates agreed quite closely with those made in 1949. The Kent Island estimate was 7,000 lower in 1949, but this difference was partly made up by the inclusion of certain colonies not previously considered, where the population figures were derived from general visual estimates, thought to be reasonably accurate. The estimate for Long Island was made by Moses. The figures for some of the other islands were taken from Boyer's report.

Table I Herring Gull Population Estimates for the Grand Manan Archipelago, 1940-49.

| Island | 1940 | 1945 | 1948 | 1949 |
|---|---|---|---|---|
| Kent | 32,000 | 50,000 | 41,000 | 34,000 |
| Outer Wood | ------ | 30,000 | 5,700 | 5,000 |
| Inner Wood (south end) | ------ | 2,000 | 1,500 | 1,500 |
| Inner Wood (north end) | ------ | ------ | ------ | 2,000 |
| Green Island and White Horse | ------ | 1,000 | 650 | 650 |
| Duck Islands | ------ | 1,000 | 500 | 500 |
| Hay and Sheep | ------ | 2,500 | 1,500 | 1,500 |

Table I (cont'd)

| Island | 1940 | 1945 | 1948 | 1949 |
|---|---|---|---|---|
| Nantucket | | ----- | ----- | 1,000 |
| Long | ----- | ----- | ----- | 1,000 |
| Gull Rock | ----- | ----- | ----- | 50 |
| Gull Islet | ----- | ----- | ----- | 200 |
| TOTALS | | 86,500 | 50,850 | 47,400 |

## B. OUTER WOOD ISLAND

The population of Outer Wood Island was determined by essentially the same method in 1948 and in 1949. In 1948 a total egg count was taken and the population determined by the formula devised by Dr. Gross, (Gross, 1946; Boyer, 1948), and used on the Atlantic Coast in the United States Herring Gull-Cormorant Control Project.

In the 1949 investigations this method was again used, but in addition a complete nest count was made. Dr. Gross added 10 per cent for nests missed but in 1948 and 1949 it was considered desirable to increase this to 20 per cent as it is difficult for a single investigator to get complete coverage of an island.

The 1948 study was conducted during the period from July 12 to 14. The period July 22 to 26 was chosen for the 1949 study, but unfortunately circumstances prevented starting the work until August 4. By that date some young gulls had begun to leave the nest. This is a factor causing the 1949 results to show a higher proportion of unoccupied nests.

Table 2. Nest Census Data for Outer Wood Island (non-wooded areas only), 1948 and 1949.

| | 1948 (formula) | 1949 (actual) | 1949 (formula) |
|---|---|---|---|
| Total eggs and young | 1,294 | 943 | |
| Number of occupied nests | 684 | 540 | |
| Total nests | 1,848 | 1,587 | 1,570 |
| Per cent of nests with eggs | 37 | 34 | |
| Per cent of nests unoccupied (old) | 37 | 59 | |
| Per cent of nests unoccupied (new) | 26 | 7 | |

Table 3. Population Estimates for Outer Wood Island, 1948 and 1949.

| | 1948 | 1949 |
|---|---|---|
| Total nests observed | 1,848 | 1,570 |
| Plus 20 per cent nests missed | 370 | 314 |
| Total nests | 2,218 | 1,884 |
| Nesting population of gulls | 4,436 | 3,768 |
| Plus 20 per cent not nesting | 887 | 754 |
| | 5,323 | 4,522 |
| Estimate for wooded area | 400 | 400 |
| | 5,723 | 4,922 |

Table 2 shows an estimated nest total for 1948 greater by 261 than for 1949. This is reflected in the final population estimates by a difference of 800 gulls between the two years (Table 3). The apparent decrease in population may have been due to the fact that in 1949 the census was conducted approximately

three weeks later than the 1948.

New nests made up 26 per cent of the total in 1948 and 7 per cent in 1949. This difference may also have been due to the lateness of the investigation in 1949. It was found in conducting the work on a reproduction success plot that no eggs were laid after July 12, and that nests which appeared new at that time were of such flimsy construction that only the presence of a marker permitted their identification after two weeks had passed. Many nests of this nature would be unrecognizable by early August, and so would not be included in the 1949 nest count.

The estimates obtained for egged colonies by the Gross formula were probably high, due to the large number of destroyed nests and play nests found. However they appear to be more reliable than estimates obtained by the simple expedient of multiplying the number of occupied nests by two. This conclusion is based on counts of gulls made on Outer Wood Island just before dusk on August 4. From the vantage point of two of the higher hills on the island, approximately 2,000 gulls were counted. Many areas were not visible from these points, and so many gulls were not counted. If the population for 1948 had been estimated by considering only the occupied nests it would not have been found much greater than 1,400, obviously much less than actual numbers present.

From this it was obvious that after the egging season a considerable proportion of the gulls was not nesting. The

practice of egging seemed to be the causal factor. However, Dr. Gross (1949) stated that on certain islands visited by the egg-spraying teams, extremely large numbers of gulls were present but very few nests were found. In view of this occurrence on islands in the same general region, it would be unwise to attribute the presence of so many non-breeding gulls solely to the effect of egg-collecting.

An attempt was made to determine the population trend on Outer Wood Island over the past 20 or 30 years. No effort was made to obtain estimates from residents of the numbers of gulls present at given times, but rather to obtain estimates of the number of gulls' eggs collected in various past years, and from this to make relative population estimates. It was the practice some years ago to rent the various islands to egg-collecting parties by the day. Two of the five men who jointly own Outer Wood Island stated that it was not uncommon to collect a 30-gallon pork barrel full of eggs in a day. The number of eggs which can be contained in a gallon can is approximately 30. It is possible that 600 to 1,000 eggs were gathered daily, since the owners themselves often egged at night.

The crew of the Department of Transport Life-saving Station stated that as late as the early 1940's they commonly preserved a small barrel of the eggs in water glass for winter use. No such large quantities of eggs had been gathered recently. On the days spent by the writer on the island, members of the station were out egging in the early morning, but on no day did they collect more than 60 eggs, and generally they collected

fewer. They were always able to gather what they required for daily use, and generally a small quantity to take home on weekends, but none for preserving.

The evidence of large collections of eggs did not, of course, make it possible to give even an approximate estimate of the population in any given year. However such evidence was more reliable than population estimates made years after the ocular observations on which they were based. It did appear that the herring gull population of Outer Wood Island was much lower in 1949 than 20 or 30 years before. This may have come about through a considerable number of birds not re-nesting after the egging season, as happened in 1949. It could also have been caused by movement of the gulls to other colonies within the archipelago, such as Kent, which has been a refuge since 1935, or even to colonies along the Maine or Massachusetts coasts. A decrease in population on Outer Wood Island did not necessarily imply a decrease in the population of the archipelago.

## C. KENT ISLAND

Even before the investigations began it was apparent that it would not be wise to attempt a complete nest census of Kent Island in the limited time available. It was decided to base population estimates on samples taken within distinct vegetative type areas which were plotted on aerial photographs with the aid of a stereoscope. It was believed that nesting density would be fairly constant for each vegetative type.

Unfortunately the work was planned for mid-July when

it should have been conducted during the second and third weeks of June. By mid-July the very dense vegetation was an almost insurmountable handicap. In addition, most of the young gulls had left the nest, so that it was necessary to use apparent nesting sites rather than occupied nests as a basis for the population estimates.

The theory of equal nesting density within major vegetative types appeared to be sound. Six samples taken in the ragweed type at the south end of the island showed a nest density which varied from 230 to 300 nesting sites per acre; while in an area of dead trees it varied from 375 to 450.

A total of 19 circular fifth-acre plots were taken. Based on these samples, the population for the southern end (60 acres) of Kent was estimated at approximately 32,000 and for the northern end of the island at approximately 2,000.

Table 4. Population of Southern Kent Island

| Sample No. | Area in Acres | Nest count (1/5 acre) | Birds/Acre | Estimated Population |
|---|---|---|---|---|
| 1. | 6 | 40 | 400 | 2,400 |
| 2. | 10 | 50 | 500 | 5,000 |
| 3. | 10 | 35 | 350 | 3,500 |
| 4. | 10 | 81 | 810 | 8,100 |
| 5. | 24 | 54 | 540 | 12,960 |
| TOTALS | 60 | | | 31,960 |

No further discussion of the census is attempted since the factors previously mentioned and the smallness of the number of samples taken do not permit statistical analysis of the data.

## D. SUMMARY AND CONCLUSIONS - SECTION II

1. No population estimates for any of the gull colonies were made prior to 1940.
2. The Kent Island population was estimated in 1940 at 32,000.
3. An estimate in 1945 placed the population for the archipelago at approximately 87,000; estimates in 1948 and 1949 at approximately 50,000.
4. The 1948 and 1949 estimates for Outer Wood Island, and the 1940 and 1949 estimates for Kent Island, closely agreed.
5. The Gross formula appears to give a better estimate of the population of an egged colony than does a count of occupied nests.
6. The herring gull population of the archipelago may have passed a peak about 1940. This is suggested by the apparent decrease in the Outer Wood Island population, and by the apparent maintenance of a constant population on Kent Island.

# SECTION III - REPRODUCTIVE SUCCESS STUDIES

## A. GENERAL

Information on reproductive success is important in a study which attempts to evaluate the economic status of a species. A census gives the population level and investigations may show that no extensive economic loss is attributable to the species, but results so obtained refer only to a limited period of time and tell

little about future status. The possibility of great population changes in the future is important, and reproductive success studies are needed to supply data on which to base predictions of such changes. A recent development in the calculation of composite life tables for herring gulls combines reproductive data with data obtained from banding returns.

Reproductive success will inevitably differ in colonies that exist under entirely different conditions. Among the colonies of the Grand Manan Archipelago this difference is probably greatest between Outer Wood and Kent Islands. The two islands have the same approximate area, 160 acres, but, as far as nesting gulls are concerned, all resemblance ends there. Outer Wood is closely grazed by a large flock of sheep and is intensively egged, and the colony there is frequently disturbed by visitors. Kent has not been grazed since 1930 and has luxuriant vegetation. The main colony there is a sanctuary, so the gulls are not molested, and there are relatively few visitors.

During the summers of 1947 and 1948 comprehensive studies of reproductive success of the herring gulls on Kent Island were carried out by R. Paynter, Jr., then Field Director of Bowdoin Scientific Station. A paper on the results of the first season's work was published in 1949. Observation of a group of 100 nests was commenced on June 12 and terminated August 15. The nests were checked daily throughout the study period. The site chosen was the southernmost tip of the island where it was not

believed possible for the young birds to wander from the study area and so be incorrectly classed as having died.

Reproductive success data gathered by Paynter in 1947 on Kent Island and data gathered by the writer on Outer Wood Island in 1949 are summarized and compared on the following pages.

## B. KENT ISLAND

### 1. Clutch Size

In conducting a census of the herring gull population, Crystal (1941) found that the mean clutch size was 1.93. However his study was conducted in July or August, after nesting activity had passed its peak. Presumably by that time many nests had been robbed of at least part of their contents and other nests had their clutch size reduced by hatching and disappearance of the young gulls.

In a random sample of 100 nests on Kent Island examined by the writer on June 3, 1949, 38 nests contained one egg each, 38 contained two eggs each, and 24 contained three eggs each, a total of 186 eggs and a mean clutch size of 1.86. In this case the sample was taken almost two weeks before the date when, according to Paynter, the maximum number of eggs are present in the nests.

Paynter obtained a much larger mean clutch size by making a complete record of eggs laid in study nests during a two-month period. He also took a random sample of more than 1,000

nests in the colony proper in a six-day period at the peak of the nesting season and a repetitive random sample of the study nests during a six-day period, also at the peak of the nesting season. The mean clutch sizes obtained varied from 2.38 to 2.47 and he pointed out that as some eggs may have been lost in the pre-study period the results may be slightly low. He was confident that the number of eggs per occupied nest on Kent Island in the summer of 1947 was between two and three, with a mean extremely close to 2.5.

2. Egg Survival

Of 247 eggs in the 100 nests studied by Paynter, 176 eggs hatched, giving approximately 71 per cent hatching success. He pointed out that in nests that never contained more than one egg, 71 per cent of the eggs failed to hatch; in two-eggs nests, 44 per cent; and in three-egg nests, 20 per cent. He concluded that three eggs is the optimum number for hatching and that two-egg and one-egg nests are disproportionally unsuccessful.

Three causes were given for failure of eggs to hatch: (1) they disappeared (were lost) from the nest during incubation; (2) they remained in the nest but failed to hatch (dying); and (3) they were pipped but the embryo died before hatching was complete. The number of failures from the three causes was 51, 13, and seven, respectively.

The loss of 51 eggs from the nests was attributed almost wholly to predation by herring gulls and great black-backed gulls.

3. Hatching Dates

Paynter found that hatching within the study area began on June 19 and continued until July 14. Nearly half the birds were hatched by June 27.

4. Post-hatching Mortality

Paynter found that there was heavy mortality in the first week of life and only scattered deaths of young over a week old. The youngest possible age of any birds on August 15, when the study was terminated, was 44 days. He concluded that at that age it was reasonably certain that most of even the very retarded birds had flown.

It was determined that 51.5 per cent of those that hatched survived to fledgling age. Calculating from this and from the 71 per cent hatching success it was shown that about 36 birds fledged from every 100 eggs laid. Although three-egg nests had greater hatching success than two-egg or one-egg nests, survival of the young until the thirtieth day was apparently independent of brood size.

A point which seemed to merit consideration in judging the effect of egging practices on control of herring gulls was brought out by Paynter. As previously mentioned, nearly half the birds were hatched by June 27 when egging had ceased. It was found that 67 per cent of young hatched before June 28 survived to the thirtieth day. Only 48.5 per cent of those hatched later lived to this age.

5. Causes of Death

The total number of recovered dead young birds was 37, of which 17 appeared to have been killed by adult gulls. Paynter

suggested that the actual number dying from this cause was probably several times larger, since numerous missing birds may have been killed by gulls.

Regarding the tendency of herring gulls to eat the young of their own species, Paynter stated that it was not uncommon to see adults flying overhead with chicks in their beaks which they ate on the rocks near the shore.

The great black-backed gull was described as the killer of many young herring gulls. Paynter found the regurgitated bands of 10 young herring gulls at the base of a rock used by a pair of black-backs as a roosting site. He referred also to a case on Kent Island described by Dr. Gross (1945), when three 10-day old herring gulls were seen killed within the space of a few minutes.

No other predators on the eggs or young of the herring gulls were listed. Crows and ravens may sometimes cause loss of the eggs, but on Kent Island they were thought to be preying almost exclusively on the eggs of the eider.

From a composite life table prepared by Paynter it appeared that the Kent Island colony was not maintaining itself. He suggested three chief possible sources of error: (1) the study covered too short a period; (2) certain year classes - 1936 and 1947 - may have suffered abnormally heavy mortality; (3) a number of bands are lost by older birds.

Paynter tended to discount the third possibility, but Dr. J.J. Hickey of the University of Wisconsin has conducted extensive research on banding returns at Washington and has evidence

leading him to conclude that band loss at present constitutes an almost insurmountable obstacle in the compilation of life tables for sea birds.

A fourth possible source of error apparently unconsidered by Paynter, is that herring gulls will re-nest if the clutch is lost.

When the obstacles to the compilation of accurate life tables are overcome they should prove invaluable in considering present and future status.

## C. OUTER WOOD ISLAND

A much less comprehensive study than that conducted by Paynter on Kent Island in 1947 was carried out in 1949 on Outer Wood Island after the conclusion of the egging season, June 25. The chief aim was to obtain comparative data on the number of young gulls which approach fledgling age. As this was only one phase of the summer's investigation, it was planned to check the plot at least weekly and oftener during the hatching period, and to make additional checks whenever time permitted.

### 1. Location and Description of the Plot

A section of the north-east end of the island was chosen for the plot (Fig.3). This section was a completely separate nesting area with natural features which helped to limit the wandering of the young gulls. Checks of adjacent areas were, however, regularly made to make certain that the young gulls were not wandering from the study area. Within the plot topographic and vegetative features varied greatly. Nests were located on a section of rocky

shore line; in an area of dead spruce; on a high, closely-grazed hill; and in a section where the vegetation was as luxuriant as it was anywhere on this heavily grazed island.

2. New Nest Building

In an attempt to obtain information on the number of new nests being built, a sample of 100 nests was classified under three headings:

O - old - unoccupied nest, with no sign of nesting activity. (Two of these nests were later rebuilt, as shown in Table 5.)

OB - old but rebuilding; an old nest but with new nesting materials present, and signs of recent building activity.

N - new nest, a nest in which all materials and the site appeared to be fresh and new.

Table 5. Classification of Nests After Egging Season.

| O | | OB | | N | |
|---|---|---|---|---|---|
| Occupied | 2 | Occupied | 19 | Occupied | 27 |
| Unoccupied | 25 | Unoccupied | 11 | Unoccupied | 16 |

It appeared evident that a large number of the birds were building new nests after the consistent robbing undergone during the egging season. Of the nests which were occupied 56 per cent were new. Most of the new nests that were unoccupied may have been play nests built by the males.

3. Clutch-size

For a period which extended from the end of the egging season until July 12 all nesting sites in the area were marked,

regardless of whether or not the nests contained eggs. A total of 202 nests was marked. Ninety-five nests in the plot were occupied and contained a known total of 186 eggs. As several days elapsed between successive checks, it is probable that some eggs were laid and removed from the nests in the periods between checks.

Table 6. Known Mean Clutch-size in Study Plot

| No. eggs per nest | No. of nests | No. of eggs | % of eggs |
|---|---|---|---|
| 1 | 28 | 28 | 15.0 |
| 2 | 43 | 86 | 46.0 |
| 3 | 24 | 72 | 39.0 |
| Total | 95 | 186 | 100.0 |

Mean 1.96 or 2.0.

As shown in Table 6 the mean clutch-size for the nests was approximately 2.0.

In a previous study by the writer during the period from July 8 to July 14, 1948, a total of 213 nests in two plots contained 400 eggs, a mean clutch-size of approximately 1.9. These mean clutch-sizes for Outer Wood Island are considerably lower than the mean of approximately 2.5 obtained by Paynter in 1947 on Kent Island. Whether the difference was due to reduction of clutch-size through egging, or to more intensive nest-robbing, was not definitely ascertained.

Paynter (1947) conducted a census of the 65 most conspicuous nests on the northern section of Kent Island, 20 days after the end of the egging season. Twelve of the nests contained

3 eggs each, 18 nests contained 2 eggs each, 7 nests contained 1 egg each, and 28 nests contained no eggs. The total number of eggs in the 65 nests was 79, an average of 1.2 eggs per nest. From this Paynter concluded tentatively that egging would reduce the herring gull population if carried on over an extended area as intensively as on northern Kent Island.

It is obvious that many gulls desert their old nests and build new ones under pressure of intensive egging. Therefore, it does not seem logical to conclude as Paynter did that a deserted nest means a cessation of nesting activity for a pair of birds. It may well be that one pair of birds was responsible for one or more deserted nests as well as an occupied one.

It is the writer's belief that the mean clutch is smaller in an egged colony. However, the only proof was obtained as explained in Section II, by counting the birds present on Wood Island in the late evening and comparing the result with the population total obtained by census.

4. Failure of Eggs to Hatch and Mortality of Young

Of the 186 eggs in the plot, 63 are known to have failed to hatch. Of these, 43 disappeared from the nest during incubation; 18 remained in the nest but did not hatch; two were pipped but did not hatch.

During the hatching period 21 eggs or young birds were lost and were classed as missing, stage unknown, as they may have been lost before hatching or after. Such losses are considered both in the discussion of hatching failure and in the discussion of mortality of young.

Due to uncertainty in ascertaining mean clutch size, comparison of hatching failure and mortality of young on Outer Wood Island with that on Kent Island is made on the basis of mean loss per nest.

Table 7. Comparison of Causes of Failure to Hatch - Outer Wood and Kent Islands

(Figures underlined indicate maximum failure, including loss of nest contents which may have occurred before or after hatching.)

| | Not Hatched | | Lost from Nest | | Dying in Egg | | Pipped only | |
|---|---|---|---|---|---|---|---|---|
| Island | Total | Av. per Nest | Total | Av. per Nest | Total | Av. per Nest | Total | Av. per Nest |
| Outer Wood | 63 | .66 | 43 | .45 | 18 | .19 | 2 | .02 |
| | <u>84</u> | <u>.87</u> | <u>64</u> | <u>.67</u> | | | | |
| Kent | 71 | .71 | 51 | .51 | 13 | .13 | 7 | .07 |

If the mean clutch-size is presumed to be the same on both islands, the total number of unhatched eggs on Outer Wood Island was 112 or <u>133</u>. On this basis between 1.2 and 1.4 eggs fail to hatch in the average nest on that island. This would indicate extremely high loss by predation.

Survival of the young on Outer Wood Island is based on a time when the young were approximately 20 days old (August 22). The exact date when hatching commenced was not known but hatching was at its peak about August 2. The last egg was hatched in the plot on August 9. The survival data for Kent Island was based on a time when the young gulls were 30 days old, but as only scattered deaths seems to occur after the twentieth day (four per cent according to Paynter), comparison with only minor adjustment for the difference

in time length is possible.

Of the 186 eggs, 102 are known to have hatched. On August 22 when the average age was approximately 20 days, 81 young survived. The total loss of 21 young birds was classed as missing, as no dead gulls were found before August 22.

Table 8. Comparison of Survival of Young - Kent and Outer Wood Islands.

(Underlined figures indicate maximum mortality, including losses that may have occurred before or after hatching.)

| Island | Days Old | No. Nests | No. Young | % Hatch | Av.Hatch Per nest | Survival No. | Survival % | Survival Av. per Nest |
|---|---|---|---|---|---|---|---|---|
| Outer Wood - Known | 20 | 95 | 102 | 55 | 1.1 | 81 | 79 | 0.85 |
| - Possible | 20 | 95 | <u>123</u> | <u>66</u> | <u>1.3</u> | <u>81</u> | <u>66</u> | 0.85 |
| - Theoretical for 30 days | 30 | 95 | 102 | 55 | 1.1 | 78 | 76 | 0.82 |
| Kent | 30 | 100 | 176 | 71 | 1.8 | 106 | 60 | 1.06 |

From the data in Table 8 it can be shown that for every 100 nests on Outer Wood Island, 85 young survived until 20 days old; on Kent for every 100 nests 106 young survived until 30 days old. Correcting the Outer Wood estimate by four per cent (the loss between 20 and 30 days observed by Paynter) a 30-day survival figure of approximately .82 young per nest is obtained. There was a difference of .50 in mean clutch sizes, but the difference in nest survival averages is only .24.

Two young from the same nest were found dead on August 29. The cause of death was unknown. These are not considered in the tables as they were alive on August 22.

Throughout the entire season on Outer Wood Island only 10 young were found dead. None had the pecked appearance seen commonly in dead birds on Kent Island where nesting density is much greater. Egg predation by herring gulls was occasionally observed, but no cases of actual predation on the young. Adult gulls were sometimes seen swooping at and hitting the young gulls but as no deaths were observed it is not known whether these were cases of predation or merely of parental reproof.

One half-grown young gull found dead was completely torn apart and its bones picked clean. Ernest Joy stated that it was probably a case of gull predation as he had often seen gulls picking at the bodies of young too large to be swallowed.

A flock of crows and a pair of ravens were frequently observed over the island. Although considerable time was spent watching these birds, no acts of predation by them were observed. The many destroyed eggs found in wooded areas seemed to indicate predation from this source, but except for the absence of other predators, proof was lacking.

Both observation and experimental results suggested that predation by gulls was considerably lighter on Outer Wood Island than on Kent Island. Quite possibly further study would show a distinct correlation between nesting density and predation by gulls on the young of their species.

It should be pointed out that although the data

compared were gathered in different years, both seasons were free from climatic extremes, and it does not seem likely that any important variables were introduced by this treatment.

## D. SUMMARY AND CONCLUSIONS - SECTION III

1. The estimated mean clutch-size on Kent Island was approximately 2.5; on Outer Wood a much smaller sample gave an estimated mean clutch size of 2.0.

2. On Kent Island 71 per cent of the eggs hatched; on Outer Wood Island between 55 per cent and 66 per cent hatched (perhaps less, due to unaccounted for predation).

3. On Kent Island nearly 20 per cent of the birds died within the first 7 days, and about 51 per cent of the birds survived to fledgling age.

4. There appeared to be a considerably lower mortality of young on Outer Wood Island where the nesting density is much lower.

5. The loss of eggs and mortality of young on Kent Island was attributed mainly to herring and great black-backed gulls.

6. The average survival of young per nest at 30 days was approximately .82 for Outer Wood and approximately 1.06 for Kent Island.

7. Life tables may eventually throw considerably light on the status of the Kent Island colony, if band loss and other factors do not prove to be unsurmountable obstacles.

## SECTION IV - FOODS AND FEEDING HABITS

### A. GENERAL

It is generally considered that the herring gull obtains most of its food from scavenger activities around harbours and along shores. Undoubtedly this is true in many regions in which the birds are found; however, observation during two summers does not indicate that it is true in the Grand Manan Archipelago. In this region there appears to be a division of the season into two very marked phases of food abundance.

Before the appearance of the herring schools in the waters of the archipelago the gulls give much more evidence of hunger than at any other time. They are extremely active around the fishing coves and in any locality where fish offal of any description can be obtained. Residents report that in the early spring it is not uncommon to have the gulls light in the vicinity of houses and feed on scraps of meat, bread, and even potato peelings.

The herring run generally begins in late June in the waters of the archipelago. From then until autumn, herring is the staple food of the gulls, and they are much less active as scavengers.

### B. UTILIZATION OF HERRING

Evidence showing the effect of the presence of herring schools on the feeding habits of the gulls was obtained in experiments conducted to determine gull activity on fields where fish offal was used for fertilizer. The case histories of two fields

on which offal was spread before and after the time when the herring first appeared in Grand Manan waters (approximately June 20 to June 25) are as follows:

Castalia: During the first week of May a farmer in this locality used offal as fertilizer on a field which was being ploughed. When he began to spread the offal the gulls immediately appeared on the scene, and it was found necessary to spread the offal not more than two or three furrow-widths away from the plough. If it was placed farther away the gulls immediately carried it off.

On July 5 the same type of offal was spread in an adjoining field as a top-dressing fertilizer. Although it was completely exposed, no gulls were observed in the vicinity of the field for more than two weeks.

Seal Cove: On June 18 a fisherman in this locality spread fish offal over an area of pasture land which adjoined his house. The following morning the gulls arrived, and only by constant vigilance could they be kept from the field. By the end of the third day they had removed almost all the offal from the field.

On July 5 and again three weeks later, the same part of the field was spread with offal, but it was not visited by the gulls.

This division of the season into two parts does not mean that herring gulls' feeding behaviour was constant either before or after the period of herring abundance. Variations occurred which appeared to be related to periods of unfavourable

weather, such as fog or rain, or to inactivity at fish factories. On some occasions no positive indications were present to show why the gulls showed strong interest in fish offal fertilizer after long periods of disinterest.

A few cases in which herring gull activity began on fields which had remained, apparently, unnoticed for periods of varying length may be considered as follows:

Castalia: As previously stated, this field was spread with fish offal on July 5. A heavy fog settled over this region on July 16 and did not clear off until July 22. On July 19, the gulls came in large numbers and began feeding. By the end of the day they had removed all the offal.

Mark Hill: Offal was spread on this field on July 5. By evening of the same day approximately 100 Herring Gulls were circling over the area but none was observed alighting. They did not appear again over the area until July 16, one day after fog settled in. They then came in large numbers and succeeded in removing all offal within two hours.

Two other fields remained untouched during this period. Both of these were close to occupied dwellings, a factor which appeared to restrict gull activity after the first appearance of the herring schools.

On July 29 the fish offal experiment was repeated on certain locations and was begun on some new sites. In some cases the greatest activity appeared to be correlated with poor weather conditions, or periods of shut-down at the local sardine factories and fish stands. The one thing which continued constant was that the gulls would not feed on fields which adjoined occupied dwellings.

Further discussion of the results of fish offal experiments is contained in Section V.

The first observation of herring gulls feeding on the herring schools was made in early July. On a number of occasions flocks of several thousand gulls which were active around the heavy tidal areas of the outer shoals and ledges were observed from Kent Island. Analysis of the stomach contents of a number of birds collected on their flight back to the island indicated that the gulls were feeding on herring.

It was quite common throughout the summer to see large flocks of gulls in shoal water areas, very actively feeding.

## C. UTILIZATION OF FOODS OTHER THAN HERRING

### 1. Shrimp

Stomach content analysis during the course of the summer did not indicate that large numbers of shrimp are taken by the gulls in the Grand Manan region. It may be that shrimp is utilized more by some colonies than by others. Unfortunately no birds were collected before the time when herring became abundant; it is possible that at that time the shrimp is an important food for gulls.

In certain areas where the current is very strong it was always possible to observe flocks of several hundred gulls feeding on what was believed to be shrimp. It was not possible to collect any of them for a check on their feeding, but shrimp was very commonly found washed up on the shore. The main site of these observations on Grand Manan was at Long Eddy Point on the

north end of the island.

On July 26 the writer visited fishing centres of the Campobello, Deer Island and Eastport area. At the south end of Deer Island a flock of herring gulls, estimated to number approximately 4,000, was feeding in the open water and along the shore. A local fisherman confirmed the theory that they were feeding on the shrimp which at this point are brought to the surface by the tides. On the Eastport shore large numbers of shrimp left stranded by the ebbing tide were observed. It is stated (Battle et al., 1936) that in this area the shrimp are sometimes cast up on the beach in windrows and that at times they have been hauled away for fertilizer. It would seem that in this region at least, shrimp are a very important food for the gulls and possibly a more reliable source of supply than the herring.

2. Wild Berries

During the month of August flocks of several hundred gulls feed on the berries which grow on the heaths of White Head Island. Observations indicated that the species mainly utilized by the gulls was the crowberry (Empetrum nigrum). Cameron (1945) refers to instances where he has seen the gulls feeding on these berries on Cape Breton Island.

3. Other Forms of Gull Food

On Nantucket Island gulls were not uncommonly seen dropping sea urchins on the rocks and swooping down to feed on the contents spilling from the broken shells.

At low tide many gulls feed on the tidal flats and bars which teem with invertebrate forms.

In the various fishing coves where the salt-fish industries are located, large quantities of fish offal are disposed of simply by dumping into the harbours. This provides a dependable source of food for several hundred gulls.

## D. HERRING GULL FEEDING BEHAVIOUR

It was observed that the behaviour pattern of the gulls varied, depending on whether they were feeding on herring or shrimp. While feeding on herring the gulls were constantly active, hovering, dropping into the water, dipping, and taking off again. From a distance the flock appeared almost as a white cloud close to the surface of the water.

When shrimp were being taken the gulls were much less active, appearing rather to be sitting on the water. Seldom did they appear to hover and flights appeared to be more purposeful, as if to seek out a new spot on which to sit and fish.

## E. FOOD HABIT STUDIES

No gulls were collected for food habit studies prior to July 7. Between this date and the end of the summer a number of stomachs of adults were examined. Regurgitation samples of young birds were also taken during this period, as it was possible to induce the young to regurgitate simply by picking them up and holding them for a time.

From the samples obtained by both methods it appeared that the diet of the gulls was mainly herring.

Table 9. Food of the Herring Gull

Adults - stomach contents by examination
Juveniles - regurgitation samples

| Food | Adults | Juveniles |
|---|---|---|
| Herring | 9 | 34 |
| Mackerel | 1 | 2 |
| Shrimp | 1 | 0 |
| Pollock | 1 | 2 |
| Insects | 0 | 1 |
| Rock Eel | 0 | 1 |
| Empty | 6 | 0 |
| Total | 18 | 40 |

The 18 gulls collected, were all in a very fat condition. This certainly did not indicate that the gulls were threatened with starvation, as some residents had stated.

## SECTION V - ECONOMIC STATUS

### A. DESTRUCTIVE TENDENCIES

1. General

By 1949 a marked change in the views of the people of Grand Manan regarding the destructive tendencies of the herring gulls seemed to have taken place. Complaints against the gulls had formerly been common, but now there were few.

Charges that the gulls were destructive were not necessarily without foundation, however, and evidence was found to support some of them.

The original charges against the gulls are repeated

in this section in a form essentially the same as that used by Cameron. Repetition of some material already covered in Section IV will be found in the subsection dealing with loss to the farming industry. This was felt to be necessary in order to present a complete account of gull activity on fields where fish offal was used as fertilizer.

2. Loss to the Farming Industry

The charge against the gulls is that they remove offal from the land when it is applied as a fertilizer. As a result, land which was formerly fertile and capable of yielding worthwhile crops has "run out". Because of the gulls, Grand Manan must import many agricultural products formerly raised on the island.

Fish offal as used for fertilizer is mainly of two forms: (1) scoots, or fresh herring sorted as undersize in the smoked herring industry, and (2) smoked herring cuttings, the by-product from the packing of boneless, smoked herring. Scoots had been very difficult to obtain in recent years for use as fertilizer. In spring they were in great demand for lobster bait, later they were used for lobster food in the pounds. Smoked herring cuttings were the most common and most popular form of offal used for fertilizer. They were often available free of charge from small packers and could generally be obtained whenever required. This is the form of fish offal which is referred to in all cases throughout this report.

Since the 1949 investigation was primarily concerned

with economic status, and as the charge that gulls remove fish offal is of the greatest importance to agriculture, more time was spent on this phase of the work than on any other.

(a) Causes of Decline of Agriculture

An appreciation of the inter-relationship of agriculture and fishing gradually assumed form as the result of interviews with residents and personal observation of the two industries throughout the archipelago.

From the days of the early settlers fishing has been a primary industry and agriculture a secondary one. In 1949 the number of residents who earned their living solely from farming was only five. Reliable authorities stated that it had never been much greater. Farming had the status of a spare-time pursuit for a people who were primarily fishermen. Where such inter-relation of two industries exists, it is common to find that the secondary industry is neglected, especially in periods of prosperity. On a number of occasions, residents pointed out that the peak seasons for farming and fishing coincide - e.g. spring planting with the lobster season, weir building with haying.

The small labour group preferred employment in fishing rather than in farming. These various facts made a resident's statement, "When times are good it hardly pays to farm", sound quite reasonable.

Besides being relegated to a secondary place in the economy, agriculture had suffered from other causes. Since spring fishing activities were so heavy that little spare time was found for farming, grain crops had never been raised to any extent. It was therefore necessary to bring in, at high transportation cost,

grain required for the feeding of livestock.

Since little grain was raised, many fields were permanently in hay, with very little periodic re-seeding or crop rotation to maintain the fertility of the soil and the quality of the hay produced. Here the herring gulls had played a part in the gradual decline of the fertility of the fields. When the herring gull population was much lower; it was possible to spread fish offal as a top-dressing fertilizer on hay fields and pasture, and so increase fertility. As the gull population built up, it was found increasingly difficult to use offal for fertilizer without having it removed almost immediately. Apparently the farmer, being accustomed to such a direct, easy method of use, did little to utilize the offal in more effort-expending ways by making a compost with sea weed, or by the use of scarecrows in the fields where the offal was spread. The comparatively high cost of commercial fertilizer was a deterrent against its use.

Another reason for the decline of agriculture on Grand Manan was pointed out by a number of older residents. This was the tendency of young people to stop farming. In many cases where mixed fishing and farming had been carried on, the younger generation fished almost exclusively, very often without having even a small garden. This, they said was due not only to reasons already discussed, but also to augmentation of family incomes by employment of women in the fishing industry, and to the desire for increased freedom obtained when there are no cows to milk and pigs to feed.

Proof that farming can be profitable was presented by the few men who still carried on this pursuit exclusively. The quantities of farm produce imported indicates that many more farmers

would be required before supply of agricultural products exceeded the demand on the local market.

Considering the factors discussed, the conclusion was reached that the gulls were only a minor factor, which could be overcome, in the decline of agriculture on Grand Manan.

(b) Investigation of the Use of Fish Offal

Before investigations were actually begun on Grand Manan, it was decided that in order to be useful they should yield factual data on the removal of offal from the fields by the herring gulls.

Between May 26 and June 30 many days were spent interviewing residents of the archipelago. The use of offal as a fertilizer was always discussed, and actual instances of its use, or intended use, in 1949 were sought. The results of many interviews showed that for various reasons the people were not persevering in their attempts to use offal for fertilizer. Most stated that it was waste effort, since the gulls always removed it as soon as it was spread. In some cases other reasons were advanced. Residents of Inner Wood and White Head Islands, where the smoking of herring has practically ceased in recent years, thought that offal was too difficult to obtain. Residents using fertilizer for gardens, preferred commercial fertilizer. Two people thought that cuttings are too strong and burn the grass.

Before June 21 only three instances of the use of fish offal for fertilizer were obtained. In two of the cases the use was for gardens (ploughing under) and in the other case for a top-dressing fertilizer. (These cases are discussed in detail on

succeeding pages). Realizing that too many factors were involved to permit sound conclusions to be reached from observations made on only one field and during one part of the season, authorization to conduct experiments on various selected sites on the main island was obtained.

The experiments were to be correlated, if possible, with periods in which herring were scarce and abundant. With this in mind, an attempt was made to keep a close check on the presence of the herring schools in Grand Manan waters. Scattered reports of schools were first discussed by local fishermen in the latter part of the week ending June 25. On June 24 the Machias Seal lighthouse keeper came to Grand Manan. He stated that schools of brit (immature herring too small for sardines) had been observed off the island during that week and that it had become common to find these small herring on the rocks where they had been dropped by the arctic terns. The Gannet Rock lighthouse keeper reported that the herring gulls first appeared in large numbers between June 20 and 25. At that time he observed them feeding on herring caught in the rock-weed and left stranded by the ebbing tide.

The first herring were caught in a weir near the southern end of the main island on June 29. From that time until the end of the investigations herring were always present in the waters of the archipelago, although the quantities taken were much smaller than in 1948.

In two of the three cases where fish offal was used as fertilizer before June 21, the gulls appeared within 24 hours of the time when the offal was applied, in the third case (early

May) their appearance coincided with the arrival of the wagon carrying the offal. It was found to be very difficult to keep the birds from carrying off the offal; where it was ploughed under they removed every piece that was in the least exposed; where it was used as a top-dressing, they succeeded finally in removing almost all of it. It is noteworthy that in the latter instance the offal was spread within 30 feet of the owner's house, and that five young children kept watch during most of the day.

The remainder of the cases to be reported were part of the experiment previously mentioned. Offal was spread on four fields in the period from June 25 to July 5, after herring had become abundant.

Table 10. Behaviour of Herring Gulls with Regard to Offal Spread on Fields, June 25 to July 19.

| Site No. | Locality | Date | Distance from House | Date Offal removed by Gulls | Remarks |
|---|---|---|---|---|---|
| 1 | Near Seal Cove | July 5 | 25-150 ft. | Untouched | The identical site from which the gulls had removed all offal less than three weeks before. No scarecrows used. |
| 2 | Mark Hill | June 25 | 50-100 ft. | Untouched | A few gulls lit on June 26 but did not feed. No scarecrows used. |
| 3 | Mark Hill | July 5 | 300-400 ft. | July 17 | Gulls circled field July 5. Did not again appear until July 17 when they removed all offal within a few hours. Scarecrows set up on July 12 by owner. |
| 4 | Near Castalia | July 5 | 200-300 ft. | July 19 | Gulls made first appearance July 19. Removed all offal in a few hours. No scarecrows used. |

In analysing the results of this group of experiments the following points stood out:

1. The gulls did not always remove the fish offal as soon as it was spread as residents had claimed in every interview.

2. Fields on which the offal was untouched were very close to occupied dwellings. This now appeared to be an effective deterrent, though it had been ineffective in the single case observed in the period before herring were abundant.

3. Removal of the offal from Sites 3 and 4 coincided with a period of very heavy fog. It was considered possible that the gulls could not easily locate the herring schools in unfavourable weather, and so sought the readily available offal.

4. Days on which the offal was taken also coincided with days of inactivity at the fishing coves (July 17 was Sunday, and on July 19 the sardine factory at North Head was not operating).

As the season progressed it became increasingly difficult to state whether herring were abundant or scarce. According to the fishermen, the signs which generally indicate herring could always be observed in the outer waters. The catches in the numerous weirs were sporadic. The southernmost weir on the island was the only one in which herring were being taken consistently, this in part substantiated the fishermen's theory that herring were present, but were not moving, to any extent, into the shallower waters. Various reasons for this were given; some said the weather was too fine, that it took a storm to get the food supply of the herring into shoal waters. Whatever the reason the herring season was not a good one.

Under such conditions, a group of five fields was spread with fish offal on July 29. Three of them had been spread in the previous experiments which started June 25 and July 5. Site 3 was not utilized this time as the owner stated that he required the area for pasture, and that if offal were spread the cows would eat it and the butter would have a very unsavoury flavour.

Of the two new sites, one was located in Seal Cove itself, and the other adjoined the beach at Long Pond Bay. The latter site was chosen so that it would be possible to observe closely gull behaviour over a field for an extended period of time, and also to observe the effect of Donaxe "Scare Away" devices on the feeding behaviour of the gulls.

Table 11. Behaviour of Herring Gulls with Regard to Offal Spread on Fields, July 29 to August 5.

| Site No. | Locality | Date | Distance from House | Date Offal removed by Gulls | Remarks |
|---|---|---|---|---|---|
| 1<br>1a * | Near Seal Cove | July 29 | 25-150 ft.<br>300-400 ft. | Untouched<br>Aug.14-15 | Fresh offal added to site adjoining house, and additional site covered approx. 300 ft. away. Aug.14 the gulls began to alight on second site, completely removing all offal by next day. Original site remained untouched. No scarecrows used. |

Table 11 (cont'd)

| Site No. | Locality | Date | Distance from House | Date Offal removed by Gulls | Remarks |
|---|---|---|---|---|---|
| 2a * | Mark Hill | July 29 | 300-400 ft. | Jul.30-Aug.1 | Offal spread on same field as on June 25, but farther from house. Gulls appeared in numbers, for short periods next day. Had removed almost all offal by end of second day. No scarecrows used. |
| 4 | Near Castalia | July 29 | 200-300 ft. | Aug. 1-3 | Gulls first came Sunday, July 31, but did not feed. On succeeding three days came in numbers (200-400) for short periods and removed all offal. No scarecrows used. |
| 5 | Seal Cove | July 29 | 50-75 ft | Untouched | No gulls ever reported in vicinity of this field. No scarecrows used. |
| 6 | Long Pond Beach | July 29 | 300-400 ft. | Aug. 1-5 | Area of very heavy gull concentration. Several hundred observed daily using Sanctuary Ponds. Gulls began alighting on field on day offal first spread but not observed to light on section covered by offal until Aug. 3. Several days before all offal removed. Scare devices used. |

* The addition of a letter indicates a different site in the same field.

Removal of the offal could not be associated with foggy conditions, as the weather was generally very clear. High southwest winds were the rule, and made sea conditions much too rough for safe travelling by dory. That the gulls were adversely affected by the high winds in their search for food was possible, but could not be proved.

It was not clear why the gulls removed the offal on three fields almost immediately after it was spread, but left it on a fourth field until two weeks later. At Sites 1 and 6, nearby occupied dwellings again appeared to be the reason why the offal was untouched.

The final experiment on the use of fish offal was conducted on Site 2a at Mark Hill beginning on August 13. The gulls began to alight on the field on August 14; however, no great quantity of offal was removed, as two gulls were shot and used as scarecrows.

(c) Use of Scarecrows

Many residents interviewed during the season stated that the use of ordinary scarecrows on fields where fish offal was spread was completely ineffective when large numbers of gulls had gathered. A smaller number stated that they had found the only effective scarecrow device to be to shoot some of the gulls and to stake them down on the fields, ventral-side up, with wings outstretched. During the course of the fish-offal experiments three different types of scarecrow devices were used. The results obtained agreed with the reported experiences of residents. The only scare device effective in keeping the gulls from the field was to shoot some of the birds and use them as scarecrows.

A brief discussion of the three experiments in which scarecrows were used follows:

July 5. Site 3 - Mark Hill - When this site was first spread with fish offal a number of scarecrow devices were present, having been placed to scare the deer away from adjoining vegetable gardens. When the offal was spread, the scare devices were removed in order to determine whether the gulls would feed under undisturbed conditions. Approximately 50 gulls circled over the field on the same day, but none was observed to alight. On July 12 the gulls had not returned to the site, and the farmer replaced the scarecrows, as the deer were again causing damage to his garden. On July 17 several hundred gulls re-appeared and within two hours all offal was gone, the gulls paying no heed whatsoever to the scarecrows. The devices used at this site included a human form type scarecrow, three aeroplane type wind wheels, several tin noise rattlers, and strips of long white rag, hanging from lines.

July 29. Site 6 - Long Pond Beach - The exact area covered by the offal was marked by stakes driven into the ground at the four corners. From July 29 until August 2 the gulls were observed around the offal several times a day, but, peculiarly, did not light where it was spread. They alighted in most instances just off to one side, but occasionally on a field on the opposite side of the road or in the adjoining trees. On August 3 they became bolder and began to feed on the offal for short periods. That evening 10 special scarecrow devices, called "Scare-away", were hung on a line forming a wide V with 12-foot sides, at one end of the plot. These devices are strips of thin aluminum foil which move and crackle in the

slightest breeze, and reflect light brilliantly. In spite of the scare devices the gulls continued to feed on the offal, and by August 5 had removed all of it from the site except directly within the inner portion of the V formed by the scare-away. For several days they continued to alight on the field and by August 10 they had become so accustomed to the scare-aways that the offal within the V was also taken.

It was found that these devices were easily broken by a heavy wind, and that after such winds there was a considerable reduction of light reflection and noise-making. This may have been a factor in allowing the final removal of the offal, as by August 10 a number of the devices were much less effective.

Obviously it would not be practical to use these devices on any large area since the gulls did not appear to be unduly disturbed by them, except at very short distances, and since they are so delicate that they are broken after short periods of use and would not last from year to year, or even for a complete season.

August 13. Site 2a - Mark Hill - Offal was first spread on this site on July 29 and was entirely eaten by the gulls within two days. The next experiment was conducted on the site beginning August 13. The gulls began to gather in the area on the following day. At my request the owner used his collie dog to keep them from feeding on the offal. This method was effective for only short periods. The gulls generally returned within an hour.

On August 15 a blind was constructed in a clump of trees near the field. The gulls began early to circle over the area and to build up in numbers. When the flock was sufficiently large,

500 to 1,000, they alighted and began to feed voraciously. At that time two of the birds were shot and staked down as previously described. The gulls immediately left the area and did not return.

3. Loss to the Fishing Industry

(a) Loss of Commercial Fish and Fish Foods

The charges against the gulls are: firstly, that they eat large quantities of economically valuable fish, and as a result, fish are growing progressively scarce; and secondly, that they eat large quantities of crustaceans which are valuable as a fish food.

An attempt to evaluate the part played by the gulls in losses of this nature is not a simple task. To obtain a representative sample of the food taken by an omnivorous species such as the gull, it would be necessary to examine a very large number of stomachs collected at regularly spaced intervals from the time the gulls first arrive in March until autumn migration. After these food data were collected, they would be comparatively useless for economic study unless some method could be devised to estimate percentages taken as a scavenger and also as a predator. It was pointed out in Section IV that flocks of gulls were observed feeding on shrimp and herring in areas where it appeared that they were predators and not scavengers. These observations show that the gull population of the archipelago certainly does not rely solely on food obtained from scavenger activities, but do not indicate the relative quantities of valuable and nonvaluable fish and fish foods taken.

(i) Loss of Valuable Fish - Analyses of food data presented by Cameron (1945), by Harrington and Pillsbury (1938), and in this report, show that of the stomachs of a total of 67 adult gulls, only 3 contained commercial fish other than herring. Food samples of a total of 55 juveniles show that only 4 contained commercial fish other than herring. This is to be expected since these fish are mainly bottom feeders and very few healthy ones would ever come within reach of the gulls. It can be safely stated that the only commercial food fish taken in any quantity by the gulls is herring.

Some evidence of the abundance of herring in the Bay of Fundy may be considered.

Dr. A. G. Huntsman, of the Fisheries Research Board, in a letter to the Chief of the Canadian Wildlife Service (1949) stated:

"Capture of the herring without restriction of the season, spawning, or size, and chiefly of the immature, has failed to give evidence of any effect on renewal of the stock by breeding; although there is definite evidence of reduction of the quantity of the larger fish, not in total poundage."

When the writer visited the Atlantic Biological Station in July, 1949, he was shown a chart on which was plotted the seasonal sardine catches in the Passamaquoddy Bay. The chart showed a steady upward trend in the quantity of herring taken in recent years. The average level of the previous two or three years was greater than at any time since the early 1930's when the catches dropped very low due to herring disease and a depression market.

In a letter written on June 22, 1949, Dr. A.W.H. Needler, Director of the Station, referring to the effect of the gull population on fisheries in general, stated:

"We do not believe that gulls could affect fish populations sufficiently to damage the fisheries. It is doubtful whether they take enough economically valuable fish to have any serious effect, as only a very small proportion of the population of any valuable fish would come within reach of the gulls. Although they do doubtless consume large quantities of shrimps and other fish food organisms, it seems unlikely that the abundance of fish would be affected enough to cause damage to the fisheries.

"Changes in the abundance or in the distribution of fish are of common occurrence and might be caused by a great variety of physical or biological factors. Changes in cod and pollock fisheries could not be safely ascribed to the action of the gulls in the absence of any definite evidence."

(ii) Loss of Fish Foods - In 1933, examination of 32 samples of herring taken in the Passamaquoddy area of the Bay of Fundy showed that the Eupausiid shrimp, Meganyctiphanes norvegica, and copepods of three different species formed practically the entire food of the herring in this area. Figures available at the Atlantic Biological Station show that the average annual herring catch for the Charlotte County area of the Bay of Fundy for the last ten years has been approximately 60,000,000 pounds. A gull weighs on an average, 2.5 pounds; a population of 80,000 gulls would weigh approximately 200,000 pounds. This gives a proportionate weight

of 60,000,000 to 200,000 or 300 to 1.

Perhaps this is a rather peculiar comparison to make, and it is needless to point out that innumerable other factors are present. The two things that are common are: that the herring and herring gulls are in the same general area during six months of the year; and that the figures represent body weight, which must be maintained by consumption of food in one form or other if the species is to survive. It seems likely that even if the whole population of herring gulls in the Bay of Fundy lived on crustaceans during the entire season, the quantity taken would not constitute an important part of the total predation on crustaceans in the region.

(b) Loss of Fish from Boats and Wharves

It is said that if large quantities of fish are left exposed on boats or wharves, the gulls remove them.

Interviews and personal observation indicated that the period of the year in which this was most likely to occur was during the late summer and autumn when net fishing for herring was at its peak. The boat used in this type of fishing is the open-type lobster boat in which the fish are taken to the smokehouses. The reports of loss, and these were not frequently obtained, spoke of gulls removing the herring when the boats were left untended in harbour. The solution seems to lie in providing a tarpaulin with which to cover the fish. As the boats are small, this would not cause any great expense or effort.

Cod, pollock, haddock and halibut are too large to be carried away bodily and were generally kept in large boxes

while on board the fishing boats, so they were not disturbed by the gulls.

On May 31, 1949, at McLaughlin's wharf in Seal Cove, six large fish, cod and pollock, were seen lying out in the open. Three of the six had their eyes pecked out and a fourth had a small hole in the ventral region. The other two were untouched. McLaughlin stated that they had been on the wharf since 6 a.m. when a boatload of herring was unloaded. It would seem that in this case the gulls had been more considerate of the fish than the person who had left them on the wharf in the hot sun.

A number of persons interviewed stated that in stringing herring the gulls sometimes constituted a menace in that they would rob the horses (devices used in carrying herring from stringing table to smokehouse) when they were left in the yards prior to being carried into the smokehouses. Two smokehouse owners stated that this was not important as the horses were seldom left outside untended for periods of longer than an hour or so at lunch time. Personal observations showed that damage of this kind was the exception rather than the rule, during the summer of 1949. Two examples illustrate this.

On May 31, two horses left outside a smokehouse at Seal Cove for more than six hours, with no person in the vicinity, were untouched.

On June 2, 30 to 40 horses loaded with herring were left in the yard at a smokehouse during the lunch period but were undisturbed by gulls.

It is worthy of note that on the same day approximately 40 fresh herring lay on the beach untouched, in this

vicinity, for more than four hours. An attempt to arouse the interest of approximately 40 gulls perched on a nearby rock, by throwing herring out into the water, was unsuccessful. The herring along the shore were finally covered by the tide.

During the summer of 1949 no instance of fish being lost overboard in unloading, was observed. A considerable time was spent discussing the various aspects of the habits of the herring gull with the owners of local fishhouses. They were generally well disposed towards the gulls and seemed to be well aware that there was a credit balance in favour of them because they removed large quantities of offal at little cost.

It may be concluded that little economic loss occurred in 1949 because of the activity of the gulls in removing fish from sheds, wharves or boats, and that in most cases loss which did occur was occasioned by the failure to take very simple precautions.

(c) Weir-fishing Losses

The charges against the gulls are: (1) that when herring are being held over in a weir or pound, the gulls feed on the herring and drive them out of the weir; and (2) that large quantities of herring are removed from the weirs by the gulls at low tide.

(i) Loss of Herring from Weirs - The complaint that gulls drive herring from weirs was made by a resident of White Head Island. When closely questioned he said that the weirs in which this occurred were located in the shoal waters of Cow Passage, between White Head and Cheney Islands. These weirs had, however,

fallen into disrepair and were no longer in use. Many fishermen were questioned. Without exception they stated that cormorants and seals definitely will drive the herring out of a brushed weir but they had never known gulls to do so.

Weirs of the archipelago are of two types, brushed and twined. The twined outnumbered the brushed by at least three to one, and the ratio was likely to become even greater, tending to minimize loss of herring.

(ii) Loss of Herring at Low Tide - Herring were sometimes held over in the weirs for periods that varied from one tide to three days, because of the lack of buyers, or the presence of undesirable stomach contents, or because it was too late in the week for the fish to be utilized at once. Some weirs are located in shoal water and have only a few feet of water in them at low tide. The herring are then literally on the surface of the water, and it was not uncommon to see from one to several hundreds of gulls feeding on them. In a letter, Dr. Gross stated that the same thing occurred along the coast of Maine, causing serious loss.

The fishermen themselves did not seem to consider the loss of herring from the weirs of any great consequence. This is evidenced by the fact that not one of them mentioned it until some reference was made to it by the investigator. A typical attitude was, "Well, what can you do about it?"

The question is difficult to answer. Herring are the natural food of the gulls. The fact that they feed on them where they are easiest to obtain does not indicate an unnatural condition or severe food competition. It may be asked to what level

the herring gull population must be reduced so that they would not utilize this readily available food supply. The answer is not known.

4. Damage to Vegetation

(a) General

The charges against the gulls are three in number: (1) many islands on which the gulls breed formerly were valuable for pasturing sheep, but the acidic guano tended to kill the vegetation; (2) available pasture is reduced through large areas being covered with gull nests; and (3) the gulls have killed off forest growth.

Observation during 1945, 1948 and 1949 indicated that there is little truth in any of these charges. Concerning the first charge Cameron (1945) remarked that sheep pastured on Wood Island, where the second largest colony of nesting gulls is located, appeared to be thriving on the vegetation there. He did attribute the stunting of trees to the gulls.

Gleason (1937) noted an instance where the gull colony had very completely destroyed the original vegetation and effectively prevented the growth of any species except those which can grow on broken and disturbed land.

Paynter (1949) emphasised the effect of grazing by sheep as the cause of the damage to vegetation.

Gross (1936) noted the condition of the spruce and remarked that the gulls had killed off forest growth in one section.

Residents interviewed in 1949 failed to point out any islands on which it was not possible to pasture sheep where it was formerly possible. Kent, the two Wood Islands, and White Head have

always been the main sheep-grazing areas. Kent is the only one of these islands on which sheep were not being pastured in 1949 and this because it was the policy of the new owners, Bowdoin College, not to allow it, and not because a flock could not be maintained.

Allan Moses said that sheep were pastured for a number of years on Northern Green Island, a small island between Three Islands and White Head, though none were pastured there in 1949. In spite of an increasing colony of gulls that had been there for 30 years, this island had the richest growth of vegetation (mainly timothy, Phleum pratense L. ) seen anywhere in the archipelago except in the central part of Kent Island.

(b) Soil Deficiency and Over-grazing

Luxuriant vegetation was not found on every island on which the herring gulls breed. On large tracts of Outer Wood Island the grass was dying off and degenerate types of vegetation were taking over. Even late in the season when the vegetation was several feet high on the ungrazed islands, here it was rarely found to be more than a few inches high, and in hilly regions it was very short indeed (Figures 1 and 2). There are two possible reasons.

The first reason was that on the sections of Outer Wood Island utilized for grazing (80 to 100 acres), and on the southern portion of Kent Island (Figure 5), a very peculiar soil condition was found. The surface was a humus layer of unincorporated organic material which varied from a few inches to as much as four feet in depth. Soil study in these areas revealed that the humus

layer in most cases ended in hard pan or on bed-rock. This meant that minerals and nutrients were almost unavailable in the natural soil.

Samples sent to the Soil Survey Laboratory of the University of New Brunswick could not be analysed due to laboratory work being at a standstill during the summer months. However, a few elementary tests were conducted by Mr. R.E. Wicklund, who wrote as follows:

"I have taken the pH of the samples and find them extremely acid. The pH ranges from 3.5 to 4.5 with most of them at the lowest figure. Judging from the numerous analyses which we have carried out on the soils of this province it is questionable whether any further analysis would be of any value. In soils with such a low pH the elements of plant food are present in such small amounts that it is difficult to draw any conclusion as to their comparative fertility status."

It would seem that elements of plant food necessary to support the growth of grass would have to come from sources other than the soil. Apparently they were supplied mainly by sheep manure and gull guano. A comparative chemical analysis of gull guano and fish meal taken from Henry's Feeds and Feeding, shows the following:

| | Gull Guano (Oven Dry) | Fish Meal (10% Moisture) |
|---|---|---|
| Total Nitrogen | 8.2% | 8.2 |
| Water-Soluble Nitrogen | 3.6 | --- |
| Total Phosphoric Acid | 7.7 | 14.0 |
| Available " " | 7.4 | --- |
| Water-Soluble Potash | 0.8 | 0.3 |

No reason was apparent why gull guano should kill the vegetation unless applied in extremely large quantities. That this did not occur was well demonstrated by the luxuriant vegetation of the islands not pastured by sheep, and on a roosting area on Outer Wood Island where 500 to 1,000 gulls roosted regularly.

Over-grazing was the second reason for the dearth of vegetation. On Outer Wood Island a flock of approximately 175 sheep and 125 lambs, a herd of 10 beef cattle, and an unestimated rabbit population were found in the spring. By autumn the rams were removed and a flock of approximately 250 sheep started the winter. During the winter the animals were left to forage for themselves. Winter kill losses were so great that the flock barely maintained its numbers during the few years previous to 1949.

According to a booklet published by the Canadian Department of Agriculture in 1948, a nursing ewe with a lamb constitutes 0.2 animal units and a dairy heifer 0.5 animal units, in the calculation of pasture-carrying capacity. The calculation for Outer Wood Island showed that during the ordinary grazing season at least 40 animal units were present. The same booklet also showed that on the average 3.9 acres of pasture are required in New Brunswick per animal unit. On Outer Wood Island, 156 acres of <u>average</u> land should be available for pasture, without considering the rabbit population. This, however, was not the case. Only 90 acres of the island provide pasture and this land was certainly below average, and might be classed as submarginal. Over-grazing was indicated by large bare patches completely devoid of vegetation (Figure 2), by large patches of apparently dead grass, and by the extremely close-grazed condition which existed particularly on the hills where the sheep appeared to feed

much of the time.

Dying out of the coniferous forest was attributed to three main causes: (1) starvation due to lack of necessary mineral nutrients; (2) pasturing, which prevented the establishment of any regeneration and broke up the forest floor so as to permit excessive drying out; and (3) the approach to maturity of the trees, some of which had ring counts showing them to be nearly 100 years of age.

On the north end of Kent and in a portion of Outer Wood Island where coniferous vegetation was still alive, soil studies showed a more normal forest soil. Here the humus layer did not exceed 12 inches and a mineral soil from 6 to 12 inches in depth was present over the rocks or hardpan. On this portion of Kent Island, dense balsam and spruce regeneration from 10 to 17 years old was found. This age showed that regeneration of the forest coincided with the removal of the sheep from the island.

In certain areas of Outer and Inner Wood and Kent Islands, stunting of the trees had undoubtedly been brought about by perching gulls breaking the leader shoots (Figure 4). It was believed, however, that the gull-nesting population had moved into in area of coniferous vegetation which was dying because of the other conditions previously mentioned in this section.

The reduction of available pasture by occupation by nests was inconsequential. There were approximately 2,000 nests on Outer Wood Island. If each nest were 12 inches in diameter, one nest would cover an area of less than one square foot. The 2,000 nests would cover less than 2,000 square feet, or approximately one-twentieth of an acre. At least half of the nests were in locations which did not provide pasture, (i.e. on rocks, under trees, stumps, etc.),

so that the reduction of available pasture would not exceed one-fortieth of an acre.

5. Damage to Wild Berry Crops

It is charged that the gulls throughout the archipelago, but especially on White Head Island, eat large quantities of baked-apple berries (Rubus Chamaemorus), blueberries, and rock cranberries (Vaccinium Vitis-Idaea var.minus and Vaccinium Oxycoccos).

Only scattered instances of any of the fruits listed above being picked commercially on Grand Manan were found. Moses stated that there was little berry-picking even in depression years when a few families were found selling the berries.

No berries were found in quantities large enough to encourage commercial picking, although there were scattered small patches along roadsides, on cut-over areas, on the heaths north of the Sanctuary Ponds and on White Head Island.

The season when berries are ripe was a most busy one. For the men, weir-building and weir tending activities were at their peak. For the women, the sardine factories or the smoked herring industry provided several days of employment each week. If time for berry-picking was found, no more than could be used for home needs were picked.

The berries provided fresh fruit when other fruit was expensive and difficult to obtain in good condition, and, if sufficient quantities were picked and preserved, they had a small influence on the cost of living for the family throughout the rest of the year. But even a complete failure of the berry crop, whether through natural conditions or removal by the gulls, would have had little effect on

the general economy of the people of the islands.

During the summer of 1949 many people were interviewed regarding their opinion on the removal of berries by herring gulls. Some were of the opinion that the gulls did eat berries, but not enough to make the situation serious. In a year of great yield their effect could not be noticed; in a year of poor yield no one bothered picking anyway. Others (a very few) blamed the gulls for the scarcity of berries. When questioned closely they generally disclosed either that they had not been out to the berry fields and were going by reports, or that they had seen gulls on the heath and took it for granted that they were eating desirable species of berries.

Personal observation supported numerous opinions that in 1949 the baked-apple berry crop was almost a complete failure. Theory attributed the failure to a late frost and this was supported by the presence of scattered patches of berries in protected locations along the edge of the heath.

Blueberries and rock cranberries were plentiful in 1949 on the archipelago, and particularly on White Head. Bog cranberries observed on White Head Heath were very scattered and still completely green. Unless there were better patches which were not located, it would seem that they would not be worth picking. It was unlikely that they would be eaten by gulls in the green state and there was no sign that this had occurred.

August 18 was spent in observing the herring gulls and interviewing pickers on White Head Heath. A number of gulls (400 to 600) was observed feeding in an area where the only berry that was

plentiful was the crowberry (Empetrum nigrum), which is not utilized locally by humans. Throughout the entire heath, gull feathers were frequently found, and they were most abundant in the area where the crowberries were plentiful. Feathers were found only once in the blueberry and rock cranberry patch. These berries grew in association on a ridge that divided the heath into two sections.

The nine pickers interviewed believed that the gulls were not feeding to any extent on the blueberries. All the pickers stated that they had been making regular excursions to the patch and had never flushed gulls from the ridge, though it was common to see them in large flocks on the heath. The evidence may not always be so favourable to the gulls. In some years the quantity of crowberries may not be large enough to satisfy the gulls, and in that case the blueberry and rock cranberry crops might suffer great inroads.

It was concluded that wild berries did not play an appreciable part in the economy of Grand Manan and that the herring gulls did not exert an appreciable effect on the abundance of these wild fruits (or berries). The consumption by the gulls of berries useful to humans could vary considerably from year to year, depending on the availability of other food such as crowberries or herring.

6. Damage to Roofs and Boats

It is said that the acidic guano left by the gulls destroys the roofing of fishing-sheds and other buildings. It is also charged that boats are soiled by the guano to an extreme degree.

Both these charges were kept constantly in mind, and

were given consideration on all field expeditions during the course of the investigations.

(a) Damage to Roofs

In only two of the seven small centres on Grand Manan (Seal Cove and North Head), could the first charge be substantiated. Little evidence of this "malicious tendency" of the gulls was found in Castalia, Woodward's Cove, Grand Harbour, Ingall's Head or on White Head Island.

The Seal Cove waterfront (Figure 6) is a close cluster of fishstands, smokehouses and a sardine factory. Of 36 buildings, the roofs of only six showed marked visible evidences of the deposit of guano.

Close observation revealed that the buildings soiled with the guano were those around which fish offal was carelessly disposed of. The six buildings concerned were in three clusters of two, spaced at about equal intervals around the cove. The method used in disposing of fish offal in one of these units and, with some minor variations, in the two others, was to throw it into a small open barge to be towed out to sea and dumped. Frequently the fish offal was thrown over the side of the wharf with little or no regard as to whether it went into the barge or not. Intestines were always thrown well clear of the barge. When large fish were cleaned the heads and spinal columns were placed in it. This made it possible to dump the barge only once or twice a month instead of every few days.

The owner of one of the buildings soiled by guano felt strongly about the matter. However, he attributed it to the careless handling of offal by his neighbour, and felt that laws should be

enacted by the local health authorities to remedy the situation. He stated that the shed had been built ten years before. Although its appearance was not pleasing, he did not feel that the roof was damaged to any great extent.

Cameron (1945) observed that often the entire roof of a building may be covered with perching birds. However it was apparent that this could happen on only a very few buildings in Seal Cove. The pitch of most fish-house roofs was so steep that the gulls could perch only on the ridgepole. In one case the roof of a building was rigged with No. 6 telephone wire, and as the gulls cannot balance on a single strand, this successfully prevented perching.

In North Head the only buildings soiled by guano were two adjacent factories, one of which was not operating. The gulls were attracted by the open scoot bins and conveyor belts, as well as by large numbers of oversize herrings thrown to them for sport by the male employees of the factory in operation.

In Grand Harbour the most active smoked-herring business on the island disposed of its scoots by sale to lobster pounds. The smoked-herring cuttings were carefully placed in a closed shed where they were kept until shipped to a fertilizer factory. Only very small quantities of food were available to the gulls. Few gulls congregated and the roofs of the buildings were unspotted.

(b) Damage to Boats

The charge that fishing boats are soiled was almost completely unsubstantiated. On many herring and lobster boats, only scattered guano marks were found. In no instance did boat owners

claim that gulls soiled their boats, even when they were questioned in such a way as to give them every opportunity to do so, short of putting the words into their mouths.

One of the few soiled boats observed was the Department of Transport life boat moored in Two Island Harbour, between two of the larger gull colonies on Outer and Inner Wood Islands. To prevent the gulls from perching on the life boat the crew set mouse traps secured by a string on the roof of the cabin. After a few gulls had their toes pinched all perching ceased. This device was used each year for a short period in the spring after the gulls returned to the island. The crew stated that it was very effective. The trap did not hold the bird, but merely rapped its toes.

## B. PREDATION ON OTHER WILDLIFE

It seems necessary to consider as one the predatory activities of great black-backed gulls and herring gulls. In the colony at Kent Island they live in such close relationship that unless actual instances of predation were observed it would not be possible to state which species was responsible for the damage. The nests and eggs are so similar that it would not be possible to control one species and not the other.

### 1. Predation on American Eiders

Little evidence that gulls prey on the eggs or nests of American eiders was found. During the season a total of 99 eider nests was observed. Only one showed definite evidence of destruction, and in the absence of evidence, it was not possible to attribute the damage to gulls.

Table 12. Nesting Success of American Eiders

| Island | Nests with Eggs | Nests with Young | Nests where Young Flown * | Nests Empty | Nests Destroyed | Nests Deserted | Total |
|---|---|---|---|---|---|---|---|
| Kent | 44 | 3 | 8 | 4 | 1 | 2 | 62 |
| Northern Green | | | 1 | | | | 1 |
| Gull Rock | | | 1 | | | | 1 |
| White Horse | 4 | 1 | 25 | 5 | | | 35 |
| Total | 38 | 4 | 35 | 9 | 1 | 2 | 99 |

* That young had flown was determined by presence of egg membranes covered with down.

Presuming that the eggs in the empty nests were destroyed, which is by no means certain, destruction of nests from all sources was 10 per cent. It is possible, of course, that some nests with eggs were later robbed, but as the date of observation was very close to that of the main hatch, (approximately July 15), there could not have been many.

Ernest Joy, Kent Island caretaker, stated that Paynter made a check of 100 eider nests during the 1948 season, and that the eggs in 75 of these were destroyed by gulls. Unfortunately it was not possible to contact Paynter regarding the matter, as he was absent from the United States. Joy's statement was commented on in a letter to Dr. Gross but no confirmation or denial was made in his reply. A. Barnes, Field Director of the Station, had no information on the incident other than Joy's report.

It would appear that the story cannot be accepted at face value. It does not seem reasonable that actual evidence that gulls were the predators could be obtained in so many cases, and if

it had been obtained, Paynter would surely have reported it. The predation was certainly more serious than in a case in Penobscot Bay in 1943 reported by Dr. Gross (1944), when 22 nests out of 40 were destroyed and doubt for the future of the colony was expressed. In his report Paynter stated that crows and ravens appear to prey almost exclusively on the eggs of the American eider, but made no reference to herring gull predation on eiders.

On July 20th an eider nest with five eggs was found three feet from a herring gull's nest in which two downy young were present. According to Gross (1938) this is a common occurrence.

Cameron (1945) made an interesting observation of predation on young eiders by a herring gull. He attributed it to his presence, which caused the female eider to desert her young. From personal observation it is believed that such instances are very rare even when humans are present. The broods are almost always capable of keeping up with the parent, unless a deliberate attempt is made to separate them, or unless water conditions are very unfavourable. Then, too, there is a noticeable tendency for a number of females to raft their broods so that even if some of the old birds get panic-stricken there is always at least one adult to protect the young.

The presence of humans is much more likely to be a serious mortality factor when the birds are incubating. It was noticed that when the ducks were frightened from the nests the eggs very seldom had the protection of the downy cover, which is the case under normal conditions. It is not inconceivable that if the eiders were constantly being frightened from their nests (e.g. by activities of students or eggers) many nests might be robbed by the gulls.

The comparative isolation of Kent Island in 1949 may have been a big factor in what appeared to be a successful year for the eiders.

That an adult eider would be incapable of warding off a herring gull, as Cameron concluded, does not seem to be borne out by an incident related by Dr. Gross (1938). A female eider attacked and drove off a herring gull when she returned to her nest and found the gull within her nesting territory, and then pulled another gull from its own nest and took possession of it. It was Dr. Gross's experience that gulls will attack the eggs and young of eiders only when they are unprotected, although they may do a great deal of damage in this way at times.

In a letter to Dr. Gross during the course of the investigation, the apparent increase of the black-backed gull population was remarked on and he was asked whether he thought it might be necessary in the future to control this species on Kent to safeguard the eiders. Dr. Gross replied that he did not favour control on Kent Island which should be kept as a natural laboratory. He hoped it would not be necessary to control the black-backed gulls there since the eiders had done well so far in spite of competition with the gulls, which had not been the case off the coast of Maine.

In another paragraph Dr. Gross stated that in Penobscot Bay whole colonies of eiders had been virtually destroyed by black-backed gulls.

Apparently no such destruction had taken place in the archipelago. This appears to be clearly shown by Dr. Gross (1938, 1945) and also by the Ninth Annual Report of the Bowdoin Scientific Station (1949). According to the latter the estimated number of

nesting pairs of American eiders had increased from 20 in 1930 to 300 in 1937 and 2,000 in 1947.

2. Predation on Leach's Petrel

W. A. Gross investigated Leach's petrel in 1935 on Kent Island. He found evidence of predation on them by gulls. No evidence of such predation was obtained in 1949. Moonlight nights were spent on both Kent and Outer Wood Islands and the shores were searched the following mornings without finding any gull regurgitation containing remains of petrels, such as Gross saw frequently.

In the Ninth Annual Report of the Bowdoin Scientific Station it is stated that the Leach's petrel, while not increasing, was maintaining its large numbers on Kent Island.

3. Predation on Double-Crested Cormorants

Cormorants had recently started nesting on White Horse Island. On July 6, two nests were present but contained no eggs. On August 12 seven nests were present, but again no eggs were found. At first the absence of eggs was attributed to eggers, but when numerous young fledged herring gulls were found on August 12, it was felt that the cormorant egg loss must be due to herring gull, crow, or raven predation. The nests were in the most exposed section of the island, and certainly ideally located for avian predation.

4. Predation on Terns (Arctic and Common)

(a) Present Colonies

Numerous gulls were regularly found in the vicinity of Machias Seal Island, but, according to O. Benson, the lighthouse keeper, they did not noticeably disturb the nesting terns.

Apparently this was not always the case, for Mr. R.W. Tufts, in a letter, writes of the tern colony:

"When I was there last the herring gulls seemed to be encroaching on them and it looked as though human interference would be necessary to protect the terns if they were to remain."

As far as could be ascertained no steps had been taken to remove this danger; apparently it had been removed by natural conditions.

(b) Former Colonies

Ernest Joy and Allan Moses spoke of colonies of arctic terns on the three Green Islands in the late years of the nineteenth century. Western Green is the only one of the three on which they attributed the disappearance of the terns to the coming of the gulls. The terns apparently left the other islands before the gulls were known to nest there.

5. Predation on Mammals

Within recent years the populations of muskrats had increased on all the islands of the archipelago. That the gulls did not disturb these mammals to any extent was evidenced by the trapping record for Kent Island which showed a steady increase in the number of muskrats trapped from 13 in 1943 to 720 in 1949.

On Outer Wood Island domestic rabbits (Oryctolagus cuniculus) were very numerous in the early summer. Rabbits less than half-grown were observed to approach within two feet of gulls that sometimes chased them, but did not molest them in any other way.

## C. ECONOMIC VALUE

Cameron (1945) listed and commented on a number of ways in which the herring gulls are beneficial to the economy and

life of Grand Manan. They were: (1) they remove fish offal from the fishing coves; (2) they provide a large number of eggs annually; (3) they warn fishermen of reefs at low tide; (4) they eat rodents; (5) they have aesthetic value.

No evidence that gulls eat rodents to any great extent was obtained in 1949. It is well established that rats and mice were once common on Outer Wood and Kent Islands, but the cause of their disappearance is not known. Ernest Joy stated that he knew of cases of immature muskrats being eaten by gulls, so it is conceivable that the gulls played a part in the disappearance of the rodents; however it must be recognized that a multitude of ecological factors could have been responsible.

In 1949 gulls were noted to be beneficial in other ways.

1. Removal of Dead Fish from Weirs

It was frequently observed that considerable numbers of herring were caught in the mesh of the twined weirs commonly used throughout the archipelago. A number of fishermen remarked that if these were not removed they would decompose and cause the twine to rot. These herring were quickly and efficiently removed by gulls.

Numbers of weakened and dead herring were often observed outside of the seine, but within the weir these were always quickly taken by the gulls, which thus removed a possible source of objectionable odour.

2. Value of Guano as Fertilizer

It was observed that guano is seldom, if ever, deposited in quantities large enough to cause the death of vegetation. On

the islands on which the gulls nest the guano appeared to be beneficial.

A. A. MacLean, Soil Specialist of the Experimental Farm at Fredericton, stated that he considered guano worth $20.00 to $25.00 per ton as fertilizer, on a dry weight basis, an evaluation reached by considering the nitrogen and potash content in the water soluble form and phosphorus in the so-called available form. He further stated that in comparison with commercial fertilizer it is low in content of the three chief plant food elements, but it might be expected to have high organic matter content which would enhance its value as it would supply plant nutrients and also organic matter, often a limiting factor in plant growth. If so, it would have commercial value for use on gardens and lawns and could compete with lower grade garden fertilizers. For commercial sale it would be wise to supplement the potassium content to the four per cent level with crude potash salts or muriate of potash. The plant food content would then compare quite favourably with existing commercial garden fertilizers.

3. Assistance in Location of Herring

Many fishermen were able to predict the first appearance of herring in the spring from what they called "the signs of herring". The most reliable of these signs was the presence of large flocks of gulls over the herring schools. This was true throughout the herring season. One fisherman stated that he could always tell whether he could expect to have herring in his weir, simply by the behaviour of the gulls around the creek at Seal Cove. Another stated that he often set his herring nets in the late summer and autumn

in locations indicated by the presence of the gulls.

4. Attraction to Tourist Trade

Many bird-lovers come to the archipelago to study the sea-bird life. An important attraction for them and for tourists was a trip to Kent Island to see the gull colony. Local fishermen who provided the means of transportation to the island benefited by the income received.

D. SUMMARY AND CONCLUSIONS - SECTION V

1. Herring gulls appear to have played only a minor part in the decline of agriculture on the Grand Manan Islands.

2. Loss due to removal by gulls of fish offal used as fertilizer is greatest before the season of herring abundance and seems to depend to some extent on weather conditions after the herring run commences.

3. Herring gulls probably have little effect on the supply of economically valuable fish.

4. Only small loss occurs owing to the gulls removing fish from boats and wharves, driving them from weirs, or feeding on them in the weirs.

5. Scantiness of vegetation on the islands may be attributed rather to soil conditions and overgrazing than to nesting activities of the gulls or the effect of gull guano.

6. Wild berries are not economically important to the people of the islands and in 1949 consumption of the berries by gulls did not greatly affect their abundance.

7. Damage due to soiling of roofs and boats by gulls is slight and could be largely avoided by suitable precautionary and preventative measures.

8. In 1949 the population of herring gulls and great black-backed gulls appeared to be causing no serious damage by preying on other wildlife.

9. Gulls were beneficial to the economy of the islands as scavengers, by producing eggs for human food and guano for fertilization of the soil, and in other ways.

## CONTROL MEASURES

The method in use in 1949 of controlling the herring gull by permitting collection of the eggs appeared to be adequate, seeing that extensive damage was not being caused at that time by the gulls. Yet it seems necessary to keep in mind that such a large population could, by a change in feeding habits, constitute a menace. Extremely unfavourable weather conditions or a change in the distribution of the herring schools during a long period might prevent the gulls from utilizing natural food sources and cause them to become destructive.

Very large unutilized areas suitable for nesting sites were available on various islands. Movement to these sites has been traced. In 1949 the archipelago as a whole was sparsely populated, but if unimpeded increase took place and a nesting density comparable with that of Kent Island were attained generally, the population of the islands would be tripled at least.

It was not proved conclusively that egging acted as a control; it was, however, shown that a decrease in population had taken place on Outer Wood Island, where there was consistent egging. It was logical to conclude that egging was at least partially instrumental in bringing about the decrease.

## ABSTRACT

The growth and fluctuations of the herring gull colonies are discussed, population estimates for the various islands are given, and the conclusion is reached that a peak in the population may have been passed about 1940. Reproductive success data for Kent and Outer Wood Islands are compared, and tend to show that, in 1949, on the average, a pair of nesting gulls succeeded in raising less than one young to fledging age. The results of food-habit investigations indicated that herring was a staple food for the gulls, and that their utilization of other foods depended on the abundance of herring in adjacent waters. The various economic aspects of the gull population are discussed, and it is concluded that they were not doing very serious damage to agricultural or other interests in 1949.


## LITERATURE CITED


| | | |
|---|---|---|
| 1. Anonymous | 1948 | Better Pastures in Eastern Canada. Farmer's Bul. 150, Dept. Agr., Ottawa. |
| 2. Battle, H.I., et al | 1936 | Fatness, Digestion, and Food of Passamaquoddy Young Herring. Jour. Biol. Bd. Can., 2(4) : 401-429. |
| 3. Boyer, G.F. | 1948 | Report on the Gull Control Project, the Grand Manan Archipelago, N.B. Unpub. Rep. to Can. Wlife. Serv. |
| 4. Cameron, A.W. | 1945 | Report on the Economic Status of the Herring Gull in the Grand Manan (N.B.) Archipelago. Unpub. Rep. to Can. Wlife. Serv. |
| 5. Crystal, F.R. | 1941 | Herring Gull Census. Fifth An. Rep. Bowdoin Sc. Sta., Bul. No. 7 : 38-39. |

6. Gleason, H.A. Jr. 1937 A Botanical Report on Kent's Island. Second An. Rep. Bowdoin Sc. Sta., Bul. No. 3 : 27-29.

7. Gross, A.O. 1938 Eider Ducks of Kent Island. Auk, 55(3) : 387-400.

1940 The Migration of Kent Island Herring Gulls. Bird Banding, XI (4) : 129-155.

1944 The Present Status of the American Eider on the Maine Coast. Wilson Bul., 56(1): 16-26.

1945 The Present Status of the Great Black-backed Gull on the Coast of Maine. Auk, 62(2) : 241-256.

1946 The Herring Gull Cormorant Control Project, 1946. Joint Bul. State of Maine Sea and Shore Fish. Dept. and U.S. Fish and Wlife. Serv.

1949 The Herring Gull Cormorant Control Project, 1949. Joint Bul. State of Maine Sea and Shore Fish. Dept. and U.S. Fish and Wlife. Serv.

8. Gross, William A.O. 1935 The Life History of Leach's Petrel (Oceanodroma leucorhoa) on the Outer Sea Islands of the Bay of Fundy. Auk, 52(4) : 382-399.

1936 Kent Island - Outpost of Science. Nat. Hist. Mag., 37(4) : 195-210.

9. Harrington, R.W. Jr. and Pillsbury, N.R.Jr. 1938 Parasitology. Third An. Rep. Bowdoin Sc. Sta., Bul. No. 4 : 8-9.

10. Paynter, R.A. Jr. 1947 Preliminary Report on the Effects on Egging on the Clutch Size of Kent Island Herring Gulls. Eighth An. Rep. Bowdoin Sc. Sta., Bul. No. 10 : 11.

1949 Clutch Size and Egg and Chick Mortality of Kent Island Herring Gulls. Ecol. 30(2) : 146-166.

11. Pimlott, D.H. 1948 A Follow-up Report on the Gull Control Project. Unpub. Rep. to Can. Wlife. Serv.

Fig. 1. Outer Wood Island. Signs of over-grazing and large amount of exposed rock.

Fig. 2. Outer Wood Island. Grass completely killed by over-grazing. Shallow peaty soil.

Fig. 3. Outer Wood Island. Reproduction plot centred around hill in background.

Fig. 4. Kent Island. Tree-stunting presumably caused by gulls. Tree in foreground is probably close to maturity.

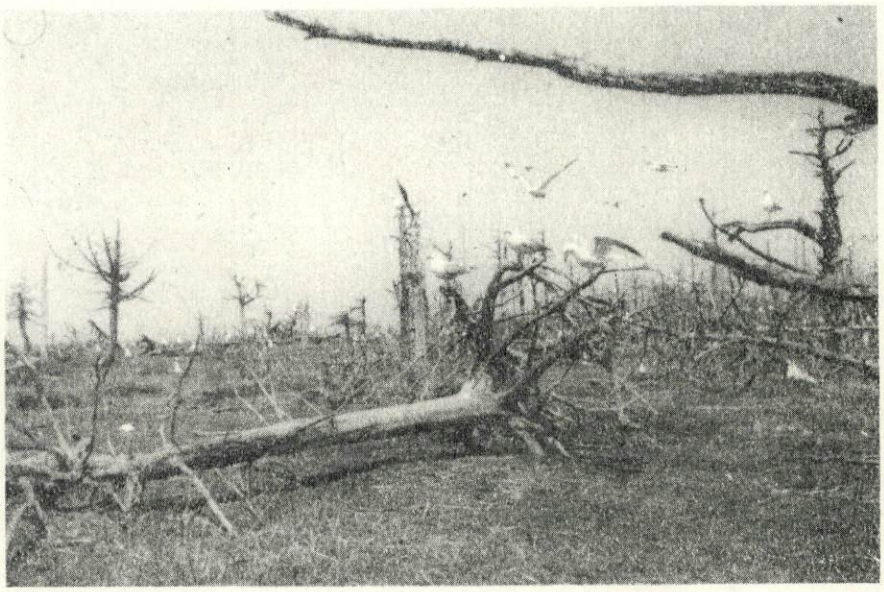


Fig. 5. Southern Kent Island. Marginal area of dead spruce. June 9, 1949.

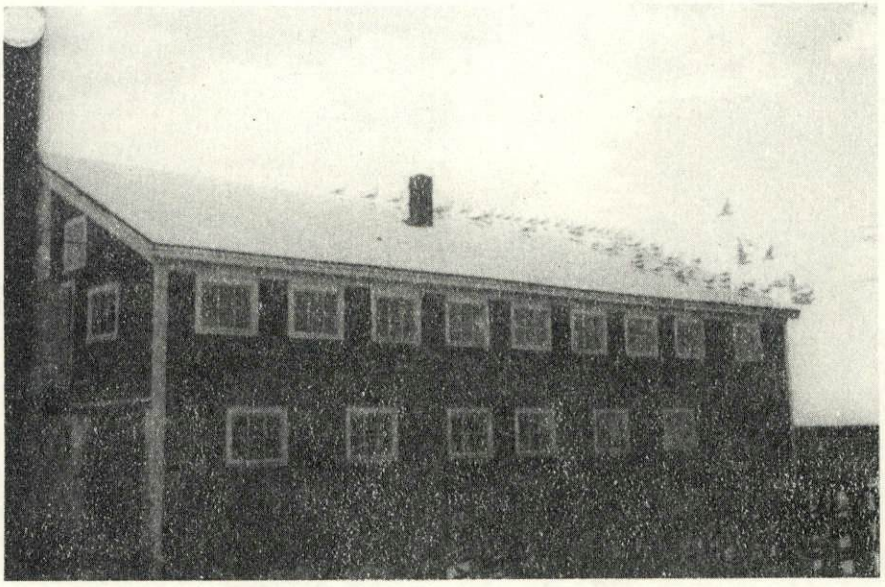
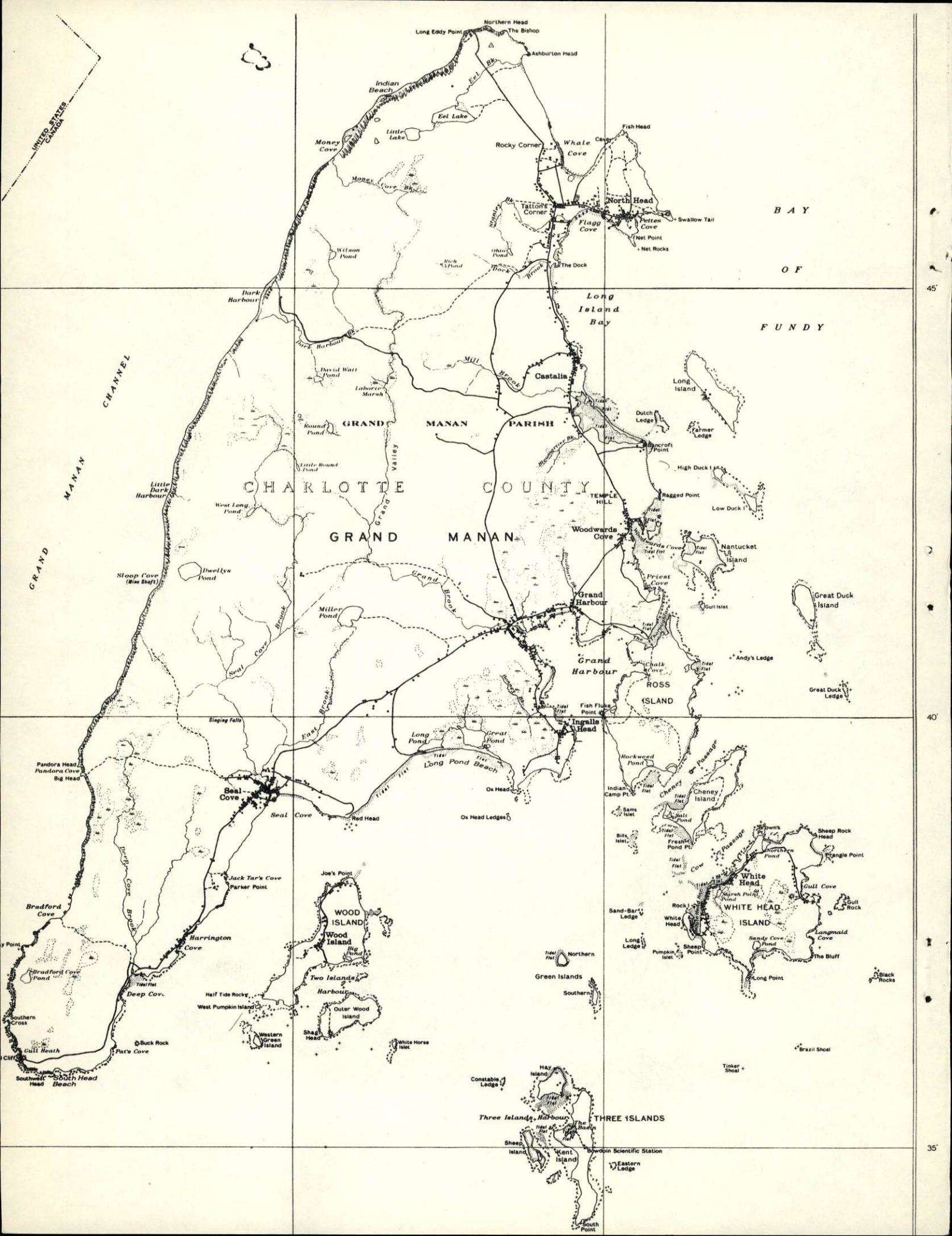


Fig. 6. Seal Cove. Herring gulls perching on roof of fish shed.


UNITED STATES
CANADA
Northern Head
Long Eddy Point
The Bishop
Ashburton Head
Indian Beach
Eel Lake
Little Lake
Money Cove
Rocky Corner
Whale Cove
Fish Head
Tattons Corner
North Head
Flagg Cove
Petten Cove
Swallow Tail
Net Point
Net Rocks
The Dock
BAY
OF
FUNDY
Long Island Bay
Wilson Pond
Dark Harbour
David Watt Pond
Laborie Marsh
Mill Brook
Castalia
Long Island
Dutch Ledge
Farmer Ledge
Bancroft Point
High Duck I.
Ragged Point
Low Duck I.
GRAND MANAN PARISH
CHARLOTTE COUNTY
GRAND MANAN
GRAND MANAN CHANNEL
Little Dark Harbour
West Long Pond
Grand Valley
TEMPLE HILL
Woodwards Cove
Nantucket Island
Sloop Cove (Mine Shaft)
Dwellys Pond
Grand Brook
Miller Pond
Priest Cove
Grand Harbour
Gull Islet
Great Duck Island
Andy's Ledge
Great Duck Ledge
Seal Cove Brook
Chalk Cove
ROSS ISLAND
Fish Flume Point
Ingalls Head
Singing Falls
East Brook
Long Pond
Great Pond
Long Pond Beach
Rockweed Pond
Passage
Pandora Head
Pandora Cove
Big Head
Seal Cove
Red Head
Ox Head
Ox Head Ledges
Indian Camp Pt.
Cheney
Cheney Island
Sams Islet
Salt Pond
Bills Islet
Fresh Pond Pt.
Brown's
Sheep Rock Head
Northern Pond
Triangle Point
Cow Passage
White Head
Gull Cove
Marsh Point Pond
Gull Rock
WHITE HEAD ISLAND
Rock I.
Sand-Bar Ledge
White Head
Long Ledge
Pumpkin Islet
Sheep Point
Sandy Cove Pond
Langmaid Cove
The Bluff
Long Point
Black Rocks
Joe's Point
WOOD ISLAND
Wood Island
Big Pond
Two Islands Harbour
Outer Wood Island
Half Tide Rocks
West Pumpkin Island
Shag Head
Western Green Island
White Horse Islet
Northern Green Islands
Southern
Brazil Shoal
Tinker Shoal
Jack Tar's Cove
Parker Point
Bradford Cove
Bradford Cove Pond
Harrington Cove
Deep Cove
Deep Cove Brook
Southern Cross
Gull Heath
Buck Rock
Pat's Cove
Southwest Head
South Head Beach
Constable Ledge
Hay Island
Three Islands Harbour
THREE ISLANDS
The Basin
Sheep Island
Kent Island
Bowdoin Scientific Station
Eastern Ledge
South Point
45'
40'
35'

The economic status of the herring gulls of the Grand Manan Archipelago, New Brunswick, 1949.

SK
471
.C347
ser.2
No.5

The economic status of the herring gulls of the Grand Manan Archipelago, New Brunswick, 1949.