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SEASONAL POPULATION FLUCTUATIONS OF HERRING GULLS IN CENTRAL MAINE

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INTRODUCTION

The daily routine of gulls away from their breeding colonies has received little attention. The present work was carried out from December 1964 through February 1966 to obtain a better understanding of gull behavior in the upper tidal reaches of the Penobscot River near Bangor, Maine. Fluctuations in the population size and its age-class composition were recorded. Through tagging individual gulls for field identification some indication of the daily and seasonal movements was obtained.

The Herring Gull (*Larus argentatus smithsonicus* Coues) is the most common gull in this region, while the Great Black-backed Gull (*L. marinus* L.) comprises one to three percent of the population, with an occasional Glaucous Gull (*L. hyperboreus* Gullerup) and Iceland Gull (*L. glaucoides* Meyer) present during the winter. Unless otherwise stated, the term "gull" refers to the Herring Gull.

METHODS

I visited dumps and other concentration points of gulls periodically from December 1964 through February 1966. When possible, I made the trip from the University of Maine campus to the dumps in Old Town, Orono, and Bangor, and to the Bangor Salmon Pool, with intermediate stops, at least every other day. The round trip covered approximately 32 miles and during the year I travelled over 6500 miles. Preliminary observations showed the most consistent number of birds present in the study area between ten and two o'clock, E.S.T. (and D.S.T. during the summer), so I planned my schedule to be at and between the dumps during this time. I spot-checked at other periods of the day to obtain data on the behavior and movements of the gulls during the time of less concentrated flocking. On several occasions I travelled between Belfast and Bar Harbor, Maine, (about 41 miles, airline) stopping at known concentration areas of the gulls and talking with fishermen in the area.

In each area where gulls were congregated I counted the birds present, using a tally counter. I grouped the birds into age-classes following Drury's (1965) analysis of plumage and soft-part changes,

using age groupings for my convenience. I found it convenient to group birds as adults, intermediates, six- to fourteen-month olds, and chicks. Chicks are birds up to six months old. They are entirely dark brown, with black bills showing almost no lightening at the base, and the eye is very dark. After the first of the year I grouped these birds into the six- to fourteen-month age group. Through August they remain dark and are easily distinguishable from the intermediates. The chicks first were seen in the study area in August and are readily distinguishable from the birds 13 months old. By the beginning of September, however, I found it impractical to separate the 14 to 15 month old birds from the intermediates. An intermediate gull is 15 to 35 months old. As long as a gull showed appreciable brown on its mantle, breast and belly, tail and rump, had a dark eye or noticeable dark in the bill I called it an intermediate. Adults are birds 35 months old and older with all-yellow bills, light eyes, white tail, gray mantle, breast and belly white with little streaking, and head and neck white in the summer but with light to heavy mottling in the colder months.

This classification may be somewhat subjective but I believe I have been as consistent as is possible when counting 150 to 1000 birds in one flock. I think it better to group all birds seen during a day into one of these categories than to be more precise and omit portions of the population. The total number of birds was always counted as accurately as possible and I did not try to estimate any flock size. The data were averaged over two-week intervals for analysis. The arc sine transformation was used in all mathematical procedures.

With a cannon net I caught and banded 810 birds in the Bangor city dump. The operation of a cannon net differs with each situation and the operator must adapt its use to his locality and the type of birds he desires to catch.

The most satisfactory and convenient bait was meat scraps. My net was 50 by 80 feet, of knotless nylon, square mesh size 1.5, twine size number 147. Four cannon were used to throw the net; the angle and direction of their aiming are critical for proper operation. The angle must be raised during windy weather to compensate for the quicker take-off of the birds on a windy than a calm day. Placing the net upwind of the bait also was helpful on windy days. Proper seating on the cannon was important, for if they recoiled excessively, the net did not spread properly. Five-pound projectiles fired by cartridges (Net Trap Cartridges UNG 1024, produced by Unidynamics, a Division of Universal Match Corporation of St. Louis, Missouri.) connected in series and fired from a six-volt car battery propelled the net. I parked the car approximately 50 yards from the bait, which is sufficient distance to allow the birds to approach readily without undue "fear." After the proper techniques are worked out, a cannon net is a satisfactory way of catching gulls away from the nesting colonies.

The use of a telescope for reading band numbers of free gulls is limited in the distance that all eight digits can be read. Since I wished to identify in the field a high percentage of the individual

gulls banded, I devised a numbered leg tag which enabled me to identify gulls at over 200 yards under ideal conditions. I made the six- by one-inch tags from "Saflag" material (produced by Vogue Textiles Inc. of Pawtucket, R.I.), a plasticized nylon, with a noose-type arrangement for attachment around the tibia. I painted numbers on both sides of the tags with "Marks-a-Lot" (produced by the Carter's Ink Company, Cambridge, Mass.) If thoroughly dried prior to release, the numbers are legible after seven months on some birds. I first placed both numbers on the tag near the attachment noose. Later I found it easier to read the numbers if the number on one side was placed at the end of the tag and on the other side near the noose.

This tag had no apparent adverse social effect on the bird's behavior or on other gulls' behavior toward the tagged bird. However, the gulls did preen the tag in a fashion similar to the preening of the primary feathers, i.e., by grasping the tag near the leg and biting the tag as the bill was moved distally. Whether the tag affected the pair bond or other social behavior could not be determined by this study.

I read tags and bands with a Bausch and Lomb spotting scope with four-hole Bushnell turret and 20X wide-angle, 30X, and 40X eyepieces. The 20X lens was the most useful eyepiece, but the 40X was often necessary.

During the summer months approximately 300 birds were dyed with picric acid, which turned the bird pale yellow. The gulls were dyed by holding them in a dissecting pan filled with saturated aqueous picric acid solution. It was necessary to rub the acid on the feathers by hand to get penetration. If this was not done, the feathers easily shed the solution and the color did not penetrate. No apparent behavior changes by or toward dyed gulls were noticed. The yellow color plus the bright tags made the birds easy to spot and identify. The dyeing was originally intended for my own observations but it turned out to be useful in finding the range of the gulls away from the study area. Notices in the Maine newspapers brought numerous reports of the dyed and tagged gulls.

OBSERVATIONS

The gull population present in this region varies widely throughout the year. Figures 1, 2, and 3 show the daily population size and the age-class breakdowns during the study period. Each point represents the average number or percentage observed during the preceding two-week period. The points are connected only to show the pattern of change and are not meant to represent the true fluctuations. Periods not sampled were the last two weeks of December 1964, the first two weeks of January 1965, the last two weeks of March, the first ten days of September and the last two weeks of December 1965. However, a general pattern for the population of the gulls spending the day in this region is readily distinguishable.

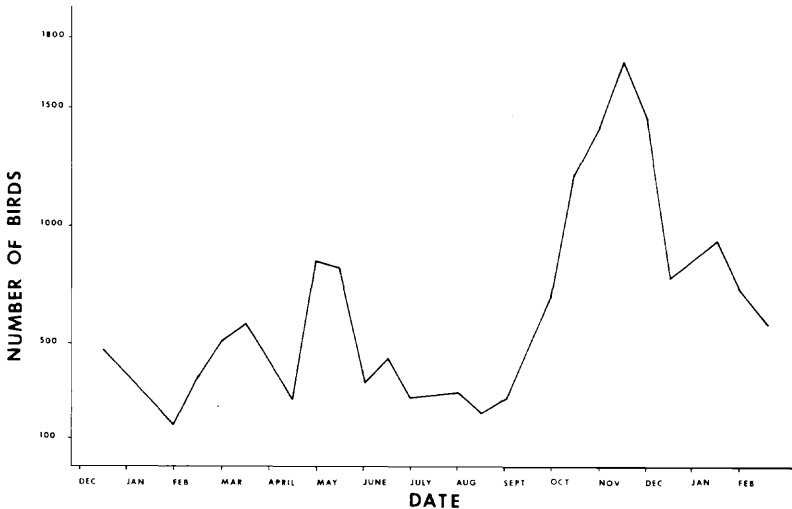


Figure 1. Seasonal fluctuations in the total gull population of the Bangor region from 1 December 1964 through 13 February 1966.

Total Gulls Present

Figure 1 shows the average number of birds seen during two-week periods throughout the seasons studied. From December 1964 through the first two weeks of April 1965, the average number of gulls fluctuated between 160 and 550 birds. During the last weeks of April and through the middle of May there was a peak of approximately 900 birds. However, by the first of June and through the first of September the population in the area dropped to a rather consistent minimum of about 200 to 300 birds. During the first week of September and continuing into November the population rose to an average peak of 1600 to 1700 birds. During December there was a rapid drop to near 750 birds and through the middle of February 1966 the average population stayed near this number.

Age-Class Percentages

Figure 2 shows the percentage of the age-classes of the gulls making up the population. From December 1964 through the end of April 1965 the adults averaged from 87 to 93 percent. During May the adults dropped to 13 percent and then a gradual rise throughout the summer and fall, until during late December 1965 and January 1966 the adults were back to nearly 90 percent of the population.

From the end of December 1964, until the first week of May 1965 the percentages of intermediates and six- to ten-month old birds were consistently low, intermediates comprising between seven and 13 percent and six- to ten-month-olds one to three percent of the population. During May the intermediates increased

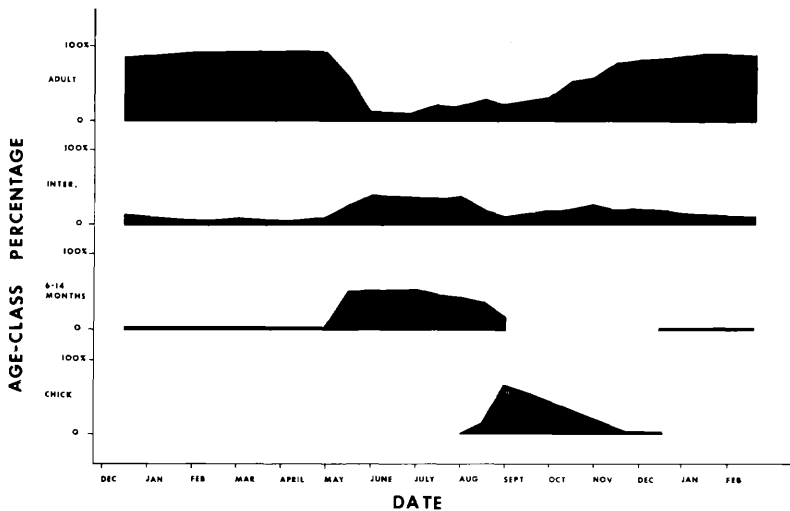


Figure 2. Seasonal fluctuations in the age-class percentages of the Herring Gull population near Bangor from 1 December 1964 through 15 February 1966.

to nearly 40 percent where they remained throughout the summer. During August there was a drop in the intermediates to approximately ten percent. Through September and October the intermediates became slightly more numerous but after October there was a slow drop to near ten percent during January 1966.

The six- to ten-month-old birds showed a sudden increase during the final two weeks of May to above 50 percent, followed by a gradual decrease throughout the summer until the end of August when these birds were grouped with the intermediates. The chicks first appeared in this area during the first week of August and rapidly reached about 65 percent of the population by the first of September, followed by a consistent rapid drop to one to three percent of the population during December 1965.

Actual Numbers of the Age-Classes

Figure 3 shows the average actual numbers of birds in each age-class throughout the period of observation, which correspond in their fluctuations to the percentages shown in Figure 2. The adults varied from between 150 and 400 birds during the winter of 1964-65 to a peak of just over 700 in the end of April and then dropped to under 100 birds throughout the summer. During October and November the number reached over 1100 birds per day on the average and then dropped off to between 500 and 800 birds in December 1965 and January 1966.

The six- to ten-month-old birds and intermediates were consistently under 30 birds from December 1964 through April 1965; then both increased to nearly 100 birds in May. These numbers dropped off gradually through July and August. Through Septem-

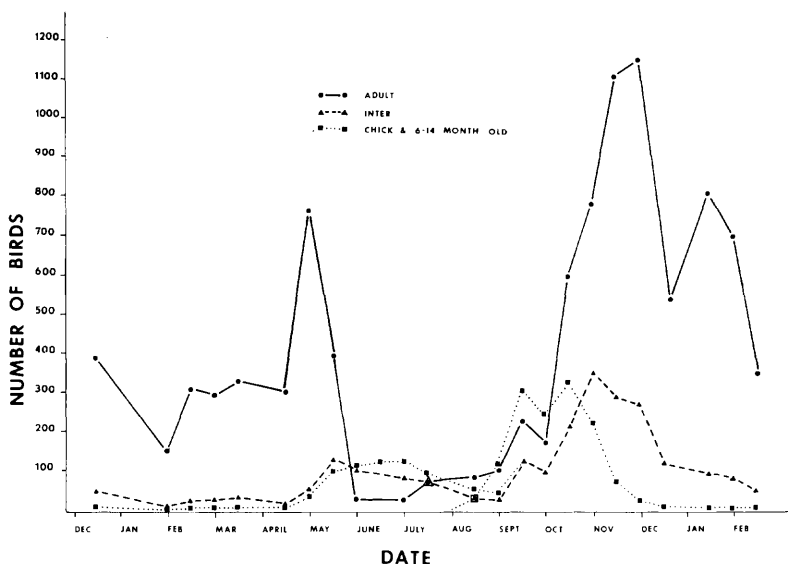


Figure 3. Seasonal fluctuations in the total numbers of the various age-classes of the Herring Gull population near Bangor from 1 December 1964 through 15 February 1966.

ber and October their combined numbers increased, reaching a peak at the end of October of close to 400 birds. Then a fairly rapid drop to below 100 birds occurred through January 1966.

Chicks appeared at the beginning of August, rapidly peaked to average approximately 300 birds from the first of September to the middle of October and rapidly dropped to under ten birds a day in December 1965 through February 1966.

Daily Fluctuations in Population

Superimposed on the seasonal fluctuations in population size of the gulls in this region is a day-to-day fluctuation. Figure 4 represents the actual number of birds seen in the study area between 23 September and 25 November, 1965. The graph line does not represent the true population changes but is probably indicative of the fluctuations that occur between the days when the birds were counted. The irregular line at the bottom of the figure represents the cloud conditions on the day of observation. A solid line indicates a cloudy day, a broken line partly cloudy, and the absence of a line a clear day. With exceptions on 8, 10, 15, 16 November (when a major population shift began), a cloudy-day population showed an increase over the previous day counted. Without exception, on clear days the population has always decreased from the preceding count. In this area a clear day is usually accompanied by winds from the northwest. During the period shown on this graph the birds were roosting at Pushaw Lake so the potential day population is within easy range during the night.

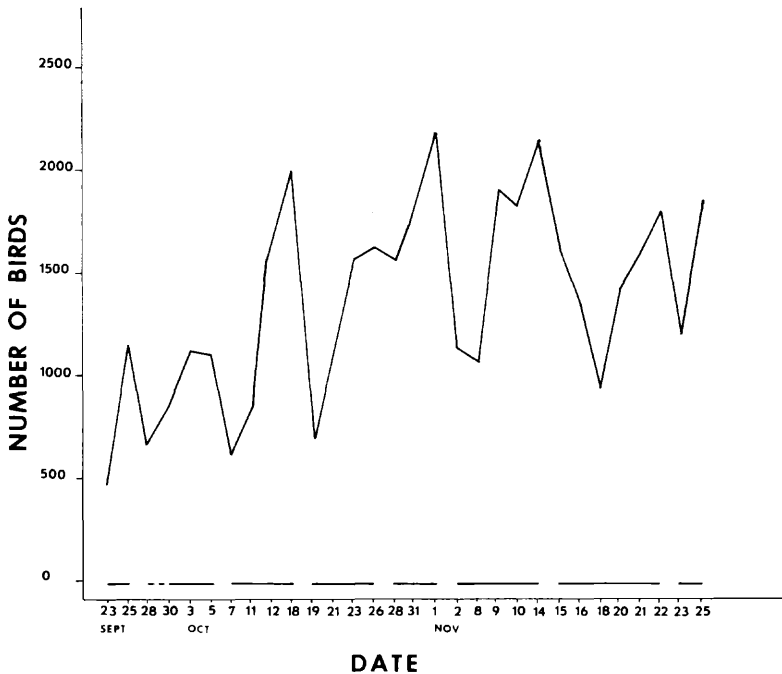


Figure 4. Daily fluctuations in the Herring Gull population in the Bangor region 23 September 1965 through 25 November 1965. The irregular line at the bottom represents the cloud conditions.

It is my feeling that on days when it is clear and windy from the northwest the birds tend to move toward the coast rather than remaining here. On days when it is cloudy and usually with little wind, the gulls remain and feed in this region and gulls from the coast tend to move inland to these dumps. Storms along the coast also tend to push the gulls inland.

I do not feel that there is a significant variation in the amount of food available in the dumps from one day to the next but if there is, this could play a role in the number of gulls present. The food supply available on the coast may be important, but how the gulls know when a food source becomes available is not known. Another factor affecting the number of gulls is the fresh-water supply. During July and August there were consistently 150 to 300 gulls in this area. However, the summer of 1965 was very dry and during the first week of August the water seepage pools in the Bangor dump disappeared and for three days when no water was available no gulls came to feed in the dump. After a rain, pools reappeared and gulls returned and fed in the dump.

Another factor which may affect the number of gulls is the amount of disturbance while feeding. Normal dumping activity does not appear to frighten the gulls but if shooting occurs nearby, if a dog

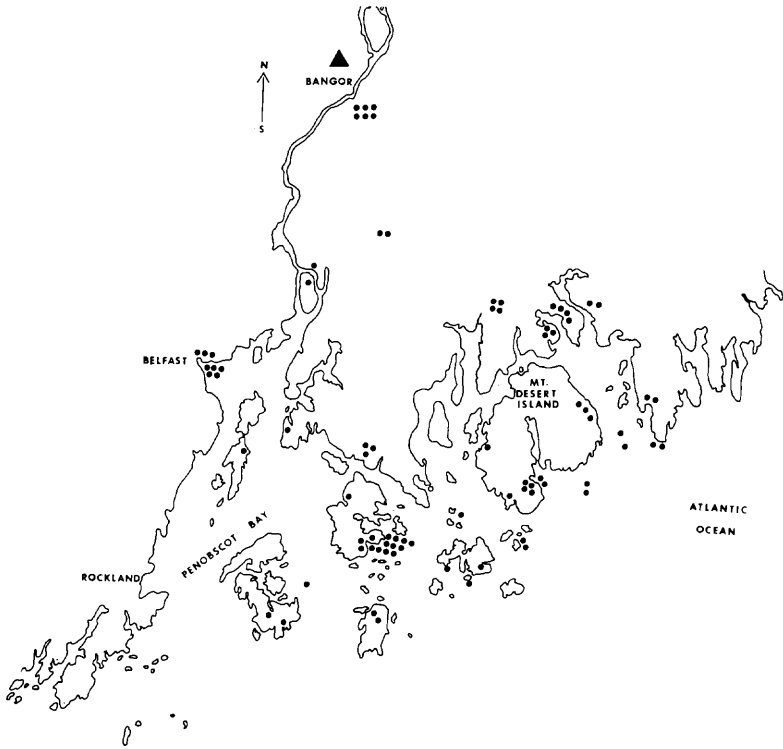


Figure 5. Outline map of the Penobscot Bay region of Maine, showing the approximate location of dyed gull sightings by the public during the summer of 1965. Each circle represents one report.

is present, or if other fright stimuli occur, the birds stop feeding and leave. Possibly an intense disturbance will cause the gulls to move out of the region entirely for a period of time.

Banding and Tagging Reports

In view of the fluctuations in the numbers of gulls it would be expected that birds found in the study area are moving widely throughout the region. Reports from the public of banded and dyed gulls provide an indication of the extent of this movement. However, three factors must be weighed in interpreting these reports: 1) the concentration of the marked birds when they disperse; 2) the concentration of people in the region where the birds are found; and 3) the reliability of the reports received. People may be sighting birds but not reporting them, because of lack of either interest or information about the project, thereby introducing bias into the reports. In view of the paucity of reports, I have not attempted a statistical analysis of my marked gull reports by the public. As far as possible I checked the validity of reports

and have not included any that could be duplications of the same bird on the same day. Several of the reports may, however, be of the same bird on succeeding days.

Reports of Marked Gulls

Figure 5 is a map of the Penobscot Bay region. Each black circle represents one report of a marked gull sighting by the public. None of the marked gulls I spotted in the Bangor region are included. All of these sightings are in response to the newspaper articles about my project or reports from personal acquaintances. The majority came from "summer people" vacationing in the region and a few were supplied by permanent residents.

Sherwood Cook, a lobsterman fishing out of Tenants Harbor, was specifically looking for my birds during the marking period but failed to see one. No other fisherman in that region reported seeing any either. Jerry Choate, a graduate student at the University of Maine studying eiders on Islesboro, failed to see a marked gull on or in the vicinity of that island. I talked with fishermen east of Schoodic Point (just east of Mt. Desert Island) to Grand Manan Island but none of these men had seen a dyed or leg-tagged gull. Ray Potter, observing the Enfield region about 30 miles up the Penobscot River, reported widely scattered marked gull sightings throughout the year.

It appears then that the birds banded in Bangor from 9 May to 26 August are remaining within a funnel extending from the upper tidal reaches of the Penobscot Bay to Belfast and Schoodic Point and through the bay islands. The gulls are apparently concentrating at food sources in the region, such as the chicken-processing plants at Belfast that dump refuse directly into the bay; the commercial and sport-fishing fleets at Stonington, Northeast Harbor, and Bar Harbor; and the dumps in Ellsworth, Brewer, and Hancock. Other reports are from widely scattered regions.

Professor Clara Dixon, on Kent Island in May, reported a gull with a green leg tag and "orange" tail. This is the only report of marked gulls from the Bowdoin College Research Station at any season even though Dr. Charles Huntington and his staff were looking for them. Dr. William H. Drury, Jr. reported two tagged gulls in the Boston region on 28 October. One of these was a two-year-old banded 26 August and the other an adult banded 12 July. On 8 November at Tybee Island, Georgia, Ivan Tomkins (pers. comm.) saw a gull I had banded either 9 or 30 October in Bangor. Undoubtedly these three reports were of migrating or dispersing birds. I have no other distant reports from my marking.

Band-Reading Results

Throughout the study period I read the Fish and Wildlife Service band numbers of gulls whenever possible. Through the courtesy of Earl B. Baysinger of the Bird Banding Laboratory I have received the date and place of banding of these birds. Table 1

TABLE 1. HERRING GULLS BANDED AS CHICKS IN 1965 WHOSE BANDS WERE READ WITH TELESCOPE IN THE BANGOR REGION IN SEPTEMBER AND OCTOBER 1965

Band Number	Date Banded	Place Banded	Date Band Read
526-45749	7-6-65	Lobsterville, Mass.	8-29-65
616-03858	7-10-65	Bluff Island, Ont.	9-13-65
656-29509	7-24-65	Western Is., Penobscot Bay, Me.	8-29-65
656-29592	7-24-65	" " "	9-13-65
666-59264	7-17-65	Nantucket, Mass.	8-20-65
666-77105	6-29-65	Bremen, Me.	9-13-65
666-77274	6-30-65	Owls Head, Me.	9-19-65
666-77296	6-30-65	Knox, Me.	9-25-65
666-77394	6-30-65	Hancock, Me.	9-25-65
666-77595	6-30-65	Hancock, Me.	9-21-65
666-77647	6-30-65	Deer Isle, Me.	9-19-65
666-77661	6-30-65	Deer Isle, Me.	8-29-65
666-77939	7-5-65	Boothbay, Me.	9-13-65
676-98893	6-30-65	Sister Island, Wis.	9-28-65
686-46625	7-2-65	Goose Nest Island, Me.	9-16-65
696-20648	6-5-65	Southampton, Ont.	8-29-65
706-00384	6-28-65	Edgartown, Mass.	8-10-65
706-06570	6-12-65	Sandy Point, R. I.	9-13-65
706-06890	6-20-65	Sandy Point, R. I.	8-28-65
706-10662	7-8-65	Marblehead, Mass.	9-16-65
706-10906	7-9-65	Boston, Mass.	8-27-65
726-00354	6-25-65	Westerly, R. I.	8-17-65
726-00768	6-25-65	Westerly, R. I.	8-19-65
726-01581	7-9-65	Little Compton, R. I.	8-24-65
726-02204	7-5-65	Boothbay, Me.	9-19-65
726-02340	7-5-65	Phippsburg, Me.	8-17-65
726-02353	7-5-65	Phippsburg, Me.	9-13-65
726-02766	7-6-65	Harpswell, Me.	8-24-65
726-02834	7-6-65	Harpswell, Me.	8-28-65
726-02906	7-6-65	Harpswell, Me.	9-19-65
726-02949	7-6-65	Harpswell, Me.	8-25-65, 8-29-65 9-19-65, 9-25-65
726-03073	7-6-65	Harpswell, Me.	8-20-65
726-03397	7-9-65	St. George, Me.	8-29-65
726-03486	7-7-65	Portland, Me.	8-29-65
726-03542	7-7-65	Cumberland, Me.	8-20-65
726-04194	7-9-65	Deer Isle, Me.	8-18-65
726-04237	7-11-65	Vinalhaven, Me.	9-16-65
726-04294	7-12-65	Cumberland, Me.	8-19-65
726-06703	7-10-65	Chatham, Mass.	8-24-65
726-06770	7-10-65	Chatham, Mass.	8-29-65
757-98159	7-1-65	Vinalhaven, Me.	8-29-65

gives the number, the date identified in the Bangor region, and the date and place of banding for all birds banded in the summer of 1965. Table 2 presents gulls banded in other years than 1965 but sighted in Bangor in 1965. Figure 6 is a map of the East Coast from Long Island through Maine with each circle representing the approximate place of banding of all gulls presented in Tables 1 and 2. It is readily seen that birds from almost the entire breeding range of the Herring Gull, from southern Rhode Island to the Great Lakes, may move through Bangor. Also, the wide dispersal of the first-year gulls as they leave the nesting colony is recog-

TABLE 2. HERRING GULLS BANDED AS CHICKS BETWEEN 1961 AND 1964 WHOSE BANDS WERE READ WITH TELESCOPE IN THE BANGOR REGION DURING 1965

Band Number	Date Banded	Place Banded	Date Band Read
566-94931	7-14-64	Magawagonish Is., N. B.	10-26-65
566-95728	7-12-63	St. Johns, N. B.	6-25-65
597-18245	7-1-61	Muscongus Bay, Me.	6-28-65
597-18245	7-1-61	Muscongus Bay, Me.	7-7-65
606-86915	7-4-62	Trois Pistoles, Que.	11-2-65
646-26549	7-22-63	Bristol, Me.	8-14-65
666-44579	6-30-63	Apple Island, Que.	11-18-65
676-71462	6-8-64	Sandy Point, R. I.	5-23-65
676-89838	7-9-64	Edgartown, Mass.	8-26-65
716-19214	7-17-64	Milk Island, Mass.	5-23-65
716-19535	7-17-64	Rockport, Mass.	6-25-65

nizable. The absence of band readings of first-year birds after the last week of September points to their migration by this time and also the lack of concentrated banding to the north and east of Bangor.

The results of banding and reading tag numbers on gulls in this region give some idea of the amount of daily movement and dispersion of gulls feeding away from the nesting colony. Table 3 presents the numbers of birds banded in the Bangor dump during

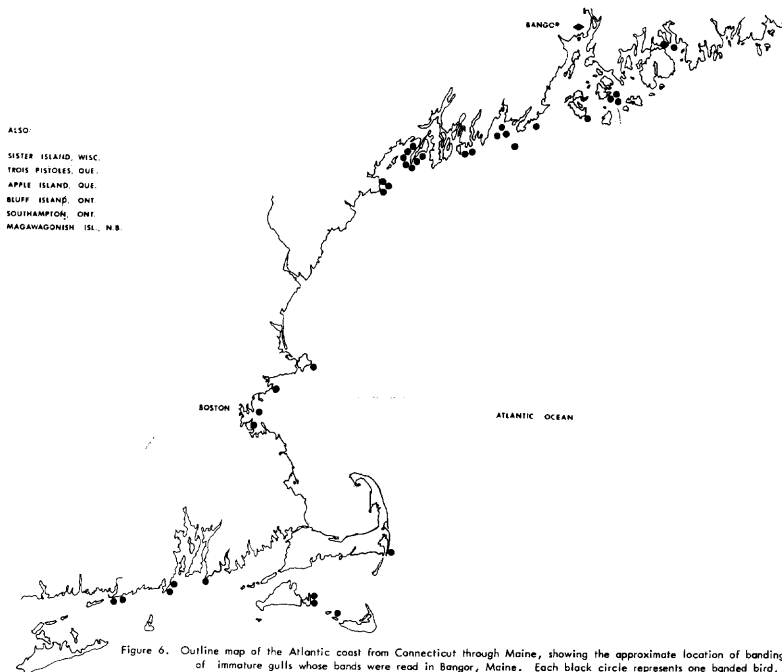


Figure 6. Outline map of the Atlantic coast from Connecticut through Maine, showing the approximate location of bandings of immature gulls whose bands were read in Bangor, Maine. Each black circle represents one banded bird.

TABLE 3. HERRING GULLS BANDED AND RESIGHTED IN THE BANGOR, MAINE REGION IN 1965

Date	Gulls Caught			Gulls Resighted		
	Adult	Inter	Chick	Adult	Inter	Chick
Jan. 27	4	0	0	—	—	—
Feb. 6	33	5	0	—	—	—
" 13	28	10	0	—	—	—
" 27	55	17	0	—	—	—
May 1	19	3	0	0	0	0
" 9	30	6	0	1	2	0
" 23	42	16	0	5	10	0
June 25	22	1	0	3	0	0
" 30	4	20	0	0	9	0
July 12	32	4	0	2	2	0
" 14	8	2	0	2	1	0
" 19	24	9	0	6	6	0
" 26	24	7	0	3	6	0
Aug. 12	6	24	4	3	16	4
" 18	12	9	20	6	5	8
" 26	1	8	17	0	3	8
Sept. 18	12	12	35	7	3	17
Oct. 2	8	6	9	3	2	3
" 7	10	15	17	5	9	10
" 9	8	18	17	6	9	12
" 30	41	18	8	22	4	4
Nov. 7	17	6	8	8	2	3
" 13	24	4	0	12	1	0

the year and the numbers of these gulls seen during the two-week period following banding. I used two weeks as an arbitrary period of time after banding for which to measure the amount of dispersion. This period might allow the gulls to overcome the psychological "fright" of being caught and handled and return to the banding site. During a two-week period I made approximately five to eight visits to the study area and this gave a good sampling of the birds in the region. I am sure that I missed some birds which were present, either because we were not in the same place at the same time or I was unable to read the tag or band exactly. However, this method does give a good indication of a bird's presence or absence. Any tag number about which there was any doubt was omitted from this analysis.

Table 4 is a summary by seasons of the banding and sightings of the tagged gulls. The months were grouped according to Drury's (1965) analysis of gull population movements. Numbered tags were not used in January and February 1965, so no analysis was possible of these bandings. The percentages listed under "caught" are the percentages of the various age classes caught during that season. The percentages under "seen" are the percentages of the

TABLE 4. SUMMARY BY SEASONS OF HERRING GULL BANDING AND RESIGHTINGS IN THE BANGOR, MAINE REGION IN 1965

	Gulls Caught			Gulls Resighted		
	Adult	Inter	Chick	Adult	Inter	Chick
May	91	25	—	6	12	—
June July	114	43	—	16	24	—
Aug.	19	43	41	9	24	20
Sept. Oct. Nov.	120	79	94	63	30	49

total number of the age class banded in that period and then seen during the following two-week period. Statistical analysis by the chi-square contingency table method revealed that there is a highly-significant difference in dispersion between adults and intermediates between May and June-July. Between August and September-October-November no difference exists between either of the age-classes. Comparing the individual age-classes throughout the period, only the adults show a difference in dispersion; highly-significant difference between May and June-July, and significant difference between June-July and August, but no statistical difference between August and September-October-November.

Figures 7, 8, and 9 are graphic representations of the tag-reading results. The months are divided into ten three-day periods. During these three-day intervals I observed the birds once and sometimes on all three days, so this method gives a good indication of the presence of a specific bird. No observations were made on the periods 2 to 11 June, 1 to 10 September, and 17 December 1965 through 1 January 1966. Each band number of a bird sighted is given, the date of banding is indicated by a triangle and the days a bird was seen are blacked in.

Adults

I banded 343 adults and 94 (27 percent) were sighted again. The analysis of the amount of dispersion is presented above, but study of these figures reveals some interesting facts about the movement of gulls. Adults banded during May, June, July, and August were rarely seen in the area over the following weeks and months. After the end of September, however, adults banded previously were consistently seen feeding here until the first week of December, after which few marked adults were seen. During the fall months, several of these adults (586-29633 and 586-29669), were seen frequently over two months or more. The banded adults were usually not seen for 3 to 6 days after banding and then were

ADULTS

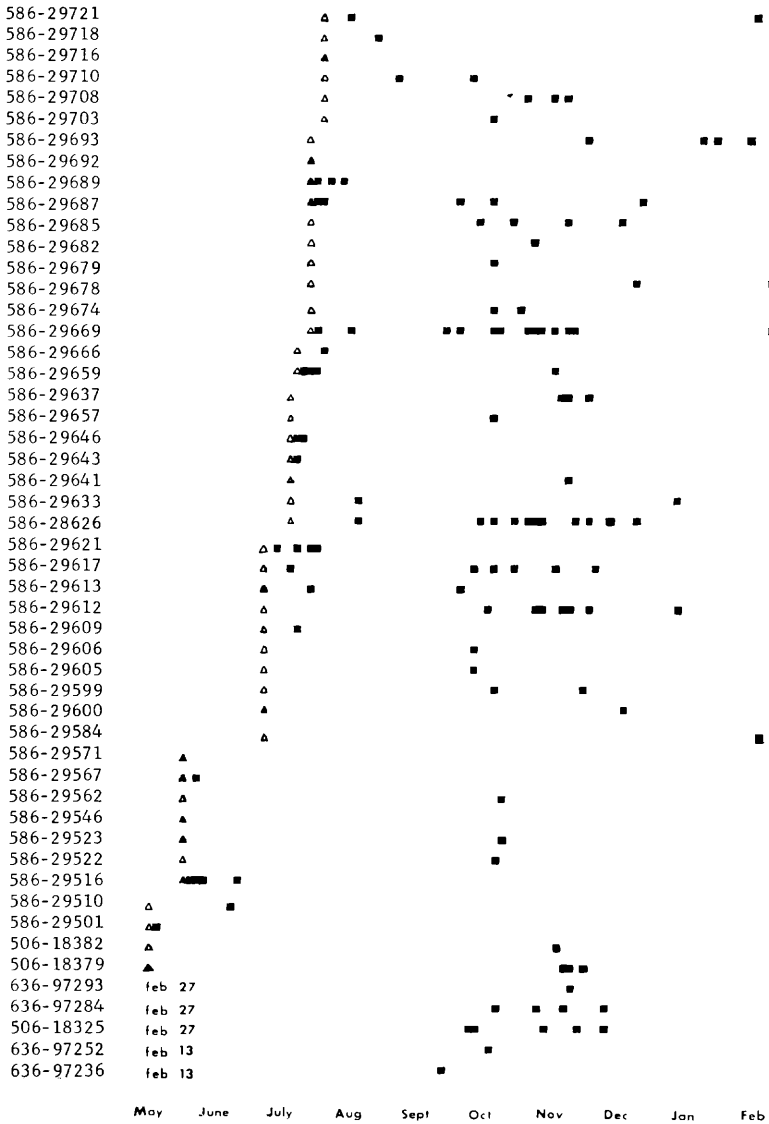


Figure 7. Adult gull banding and resight dates during, 1965-66. See Observations for interpretation.

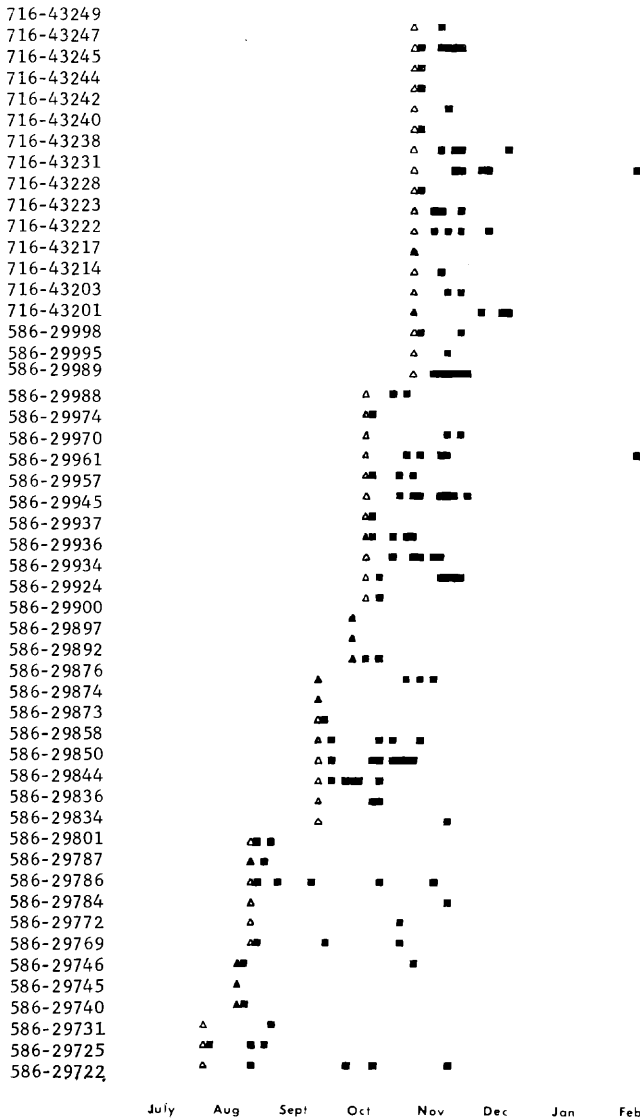


Figure 7 (cont.). Adult gull banding and resighting dates during 1965-66.

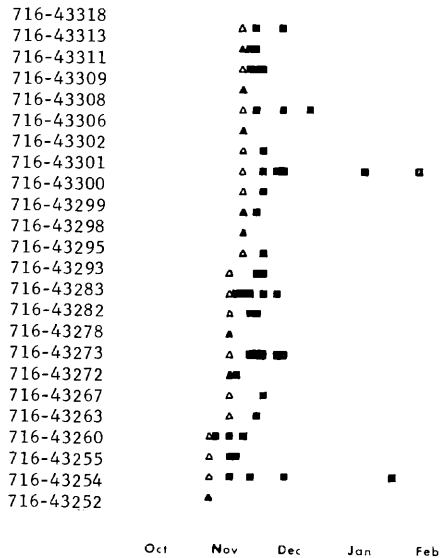


Figure 7 (cont.). Adult gull banding and resight dates during 1965-66.

sighted again. After the middle of December, 15 adults were seen, three of these more than once. Several adults seemed to reappear on a fairly set pattern (716-43301, 586-29710, 685-29722, 586-29769, 586-29789). I believe it is possible that the gulls follow a regular route in their foraging travels. Five adults banded in February were sighted after seven months or more, still with their tags intact; one of them (586-18325) was seen on six different days, and another (636-97284) on five days in October and November. There is also evidence that these birds were moving as pairs or small groups within the total population. See 586-29562 and 586-29523, 586-29606 and 586-29605, 586-29637 and 586-29641, 586-29679 and 586-29674 for birds sighted on the same day or within a day of each other after not being seen together for two months or more. Sighted together after shorter periods were: 716-43301, 300 and 295; 716-43293 and 263; 716-43249, 240 and 217; 716-43255, 254, 228, and 586-29995; 586-29989 and 957; 586-29934 and 924; 586-29858, 850 and 844. These do not include any groups seen within the first five days after banding.

Intermediates

I banded 190 intermediate birds and 90 (47 percent) were sighted again. The banded intermediate birds do not show the distinct departure from the area during the summer months that characterized the adults. Three intermediates (586-29569, 586-29654, and 586-29728) were seen consistently in the area for over

INTERMEDIATES

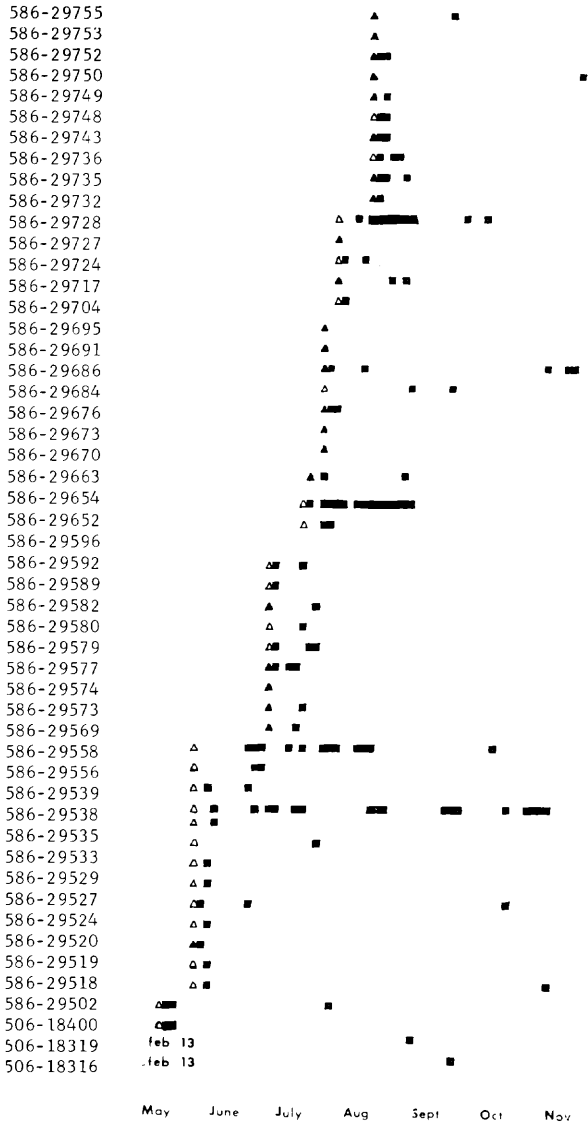


Figure 8. Intermediate gull banding and resighting dates during 1965-66. See Observations for interpretation.

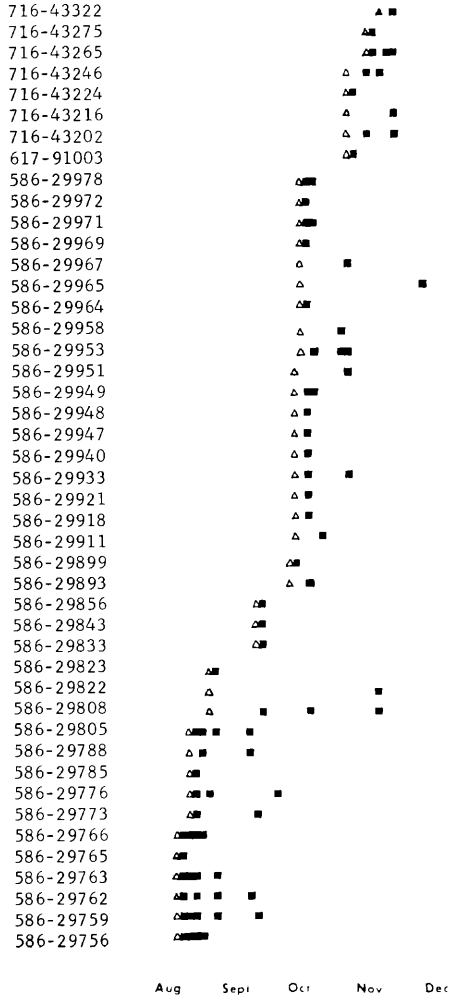


Figure 8 (cont.). Intermediate gull banding and resight dates during 1965-66.

CHICKS

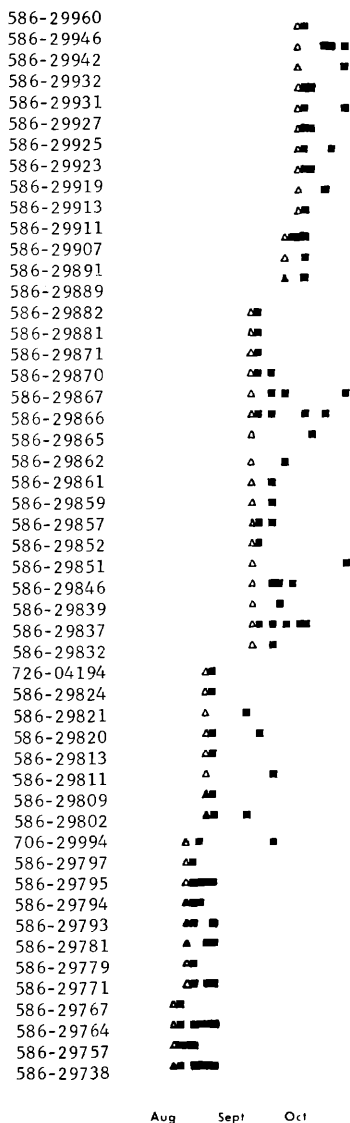


Figure 9. Chick gull banding and resight dates during 1965-66. See Observations for interpretation.

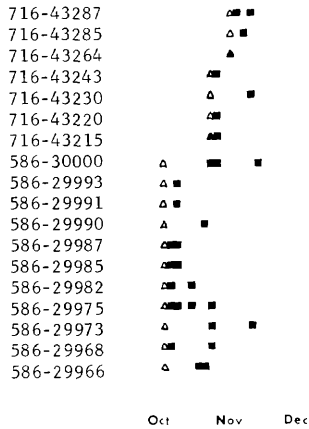


Figure 9 (cont.). Chick gull banding and resight dates during 1965-66.

a month. Another (586-29539) was the individual seen most often during the study. I banded this bird on 23 May, and saw it 1, 21, 27, 28 June; 7 and 11 July; 12, 14, 15, 17 August; 14, 18, 21 September; and 12, 19, 23, 25, 31 October. All of these sightings were in the Bangor dump. The intermediates banded in October and November were not seen as consistently over the following weeks as the adults banded the same time. Evidence for group movement among intermediates is not as noticeable as in adults. Two examples were 586-29539 with 538 and 586-29533 with 529. After December none of the intermediates was observed. Possibly the less obvious results in the intermediates than appear in the adults are a result of a smaller number of intermediates banded. However, the number of intermediates and adults resighted is essentially the same (90 and 94) even though 153 more adults were banded than intermediates. During the fall the adults showed less dispersion than the intermediates; in the spring adults stayed in the region less than intermediates (7 percent and 47 percent). This is undoubtedly because, during May and June, the adults were moving to nesting colonies. For two to five days immediately following banding the intermediates were seen more than adults. The handling attendant upon capture and banding probably acts as a stronger "fright" stimulus to an adult than to a younger bird.

Chicks

I banded 135 chicks and 69 (52 percent) were sighted again during the two weeks after banding. The chicks showed a strong tendency to remain in this area for several weeks after banding, but as the days got shorter migration occurred and few were seen.

None was sighted after 18 November. With few exceptions the chicks were seen after banding for about two weeks but then were not sighted. There were only three cases of chicks reappearing over a month after banding (586-29851, 706-29994, 586-29958).

Little evidence can be found for inter-age-class group movement. The examples are: adult (586-29522) with an intermediate (586-29524) were seen within one day of each other after not having been seen for over a month. An adult (586-29786) with an intermediate (586-29805); an adult (586-29936) with a chick (586-29942); and an intermediate (586-29951) with a chick (586-29932) appeared together after a week or more. By coincidence, these were the only four examples found showing the three age-classes moving together. Probably the general lack of evidence for the interclass group movement is caused by the relatively few numbers of birds banded and the wide difference in the numbers banded between the age-classes.

Usefulness of Tags

It was impossible during this study to determine the amount of tag loss. During the study I found three tags that had been removed by the birds. They had remained on a gull two, five, and 12 weeks. During the period of observation only nine birds which had lost their tags were seen or their bands read. Three tags were seen on birds after ten months. Up to three months there was little apparent tag loss and I feel that for up to a year the tag loss percentage is not great. The "Marks-a-Lot" number does begin to fade after about a month but several numbers are still legible after as long as seven months. All three tags which I found removed had broken at the noose attachment point, where the fabric is the narrowest. With a modified design and more permanent numbering system on tags, I feel sure that for studies of up to two years this tagging system would be a successful method for identifying Herring Gulls. It certainly is more efficient for following individual birds than reading band numbers alone.

DISCUSSION AND CONCLUSIONS

A concentrated study of a gull population in a rather restricted area, using banding and marking of individual gulls for field identification, is a fruitful method for learning about the daily routines of gulls. When the results of this type of study are combined with other banding data, a relatively complete picture of the gull movements can be obtained. This study should be carried out over at least three years but some preliminary conclusions can be made at this time.

Population Stability

As Drury (1963) found in the Boston region, a relatively discrete population of Herring Gulls exists in this region. From reports by the public of dyed gulls and my sightings of tagged individuals it appears that summer gulls in the Bangor region

remain within a funnel extending throughout Penobscot Bay. During the fall this localization disappears as the younger birds migrate and a southern displacement of all gulls takes place. This region includes an abundant food supply and many nesting islands. In the spring and summer the adults probably travel up to 35 miles from the nesting colonies to feed in the outer portions of the population range. Having been trapped at this feeding area they do not return to feed here again until the end of the nesting season, when a mass exodus from the colonies occurs. During this same period nonbreeding gulls do not leave the area of trapping as noticeably as the older birds.

Seasonal Population Fluctuations

The factor most important in influencing the seasonal population fluctuations is the onset and ending of the breeding season. This study area is 35 miles from the nearest known breeding colony of gulls in Penobscot Bay. Gross (1940) reported that the adult gulls appear on Kent Island around the 19th of March, the first nesting activity on the island occurs during the first two weeks of April, and the first eggs are laid during the middle of May.

During the last week of April there is a large increase of adults in this region, but during the following two weeks of May the adults have decreased and by the end of May there are very few adults in the region. I feel that the peak in April is caused by the adults moving back into the area from the wintering regions to the south. Then, final movement to the nesting colonies for the summer occurs during May, causing the drop of the total population. Throughout the summer there is a gradual increase in adults. Probably after the first of June the adults which have been unsuccessful in nesting begin to move away from the colonies and return to this feeding area. Contributing to the large increase in number of adults and the total population in the fall is the fact that through August and September the gulls, both adults and chicks, leave the nesting colonies. Also, probably some of the northern nesters have begun to disperse south, while the gulls nesting in this region have not yet begun to migrate. With the short days of December the adults which are going to migrate have done so, and the winter population becomes stabilized.

In May the ten-month-old birds and intermediates move back into this summer range from the south. Their numbers are fairly constant during the summer with a gradual drop in August. One explanation for this August drop could be that the birds are molting and so contribute to the next age class. As the intermediates drop off in number, the adults show a slight increase and the molt could account for some of this fluctuation. After the first of October the intermediates decrease gradually as they migrate south and are supplanted by birds from the north. The first chicks were sighted in the Bangor dump on 3 August. The chicks quickly reached a peak in September and the first two weeks of October and then rapidly dropped in numbers as they migrated south.

I believe that the differences in the numbers of birds present during the winter 1964-65 and the winter 1965-66 is a yearly fluctuation, possibly illustrating the increase in the total gull population on the Atlantic coast.

Gull Feeding Concentrations

Evidence is strong that the gull population within this region concentrates at human refuse disposal areas. The only permanent major feeding concentration point of the gulls outside of the dumps is on the river at the sewage outlet of the Eastern Maine General Hospital. At only two times during the year were any large concentrations of gulls known to feed elsewhere. In the spring the eels run up the Penobscot River. During this time the portion of the population along the river increased. Even then the gulls were not feeding directly on the eels. Rather, they "parasitized" the Common Mergansers (*Mergus merganser*) which gathered in numbers along the river. The gulls waited for a merganser to surface with an eel and then descended and robbed the duck of its prey before it could swallow the fish. During the spring and fall the gulls concentrated in the fields where the farmers were plowing. This behavior in the Herring Gull was first reported in the United States by Cruickshank (1938) but had long been known in Europe. In the Bangor region never more than a fifth of the total population could be found feeding in the areas of plowing. Perhaps this additional food source does help contribute to the peaks in the population that occur in the spring and fall. It would be interesting to analyze food of these gulls throughout the region to determine the exact amount of "natural feeding" and the amount of refuse taken.

Age-Class Movements

The data presented above on the percentages of the age classes in the area and the returns from banding form a good picture of the migratory movements of the Herring Gull. During the spring and summer when the numbers of adults were low, few of the banded adults were seen in the area. These gulls had probably moved to the nesting colonies. The number of intermediates in the region during this time was quite high and a large percentage of these banded birds was consistently seen in the area. During the fall the adults moved back from the nesting colonies and many of the adults banded in the spring were seen again. All the birds banded in the early fall remained for a time in this area but a gradual movement away was noted later in the season. With the really cold weather of December the population dropped from its fall peak to a consistent winter population and the age-class make-up for the winter was established. By the middle of November the chicks left the region. By December the intermediates were down to near 10 percent and the adults were the predominant age-class. All the intermediates banded in the fall departed by Decem-

ber. Probably the younger birds departed first, not only in response to the migratory stimuli but because competition for food during the cold weather is stricter. The adults are more adept at foraging, so the chicks respond to this pressure first, followed by the intermediates. The adults comprised 90 percent of the population in December and there were scattered sightings throughout the winter of adults which had been banded during the summer and fall.

The sightings of marked birds immediately after banding showed an interesting difference between adults and young gulls. During the five or six days following banding almost no banded adults were seen. After this period many reappeared. Younger birds, however, were usually seen during this period and than a general movement away from the area occurred. Increased wariness of the adults may account for this difference; the survival value is obvious. Most of the banding was done in the mornings and the firing of the cannon net caused all birds to leave the dump. By later afternoon gulls had returned to the dump and were feeding on the remaining bait. During July and October I caught gulls with the net with only one day between bandings. Only one bird was caught twice in the net but I feel that this is because of the wide dispersal of the gulls rather than because the gulls learned to avoid the baited net.

Through the use of a telescope for reading bands the wandering dispersal of the gulls at the end of the breeding season can be observed.

Because of the short term of this study and the limitations of doing such a project alone I do not feel that more specific conclusions should be drawn. The methods of doing this type of study have been examined and the possibilities for more extensive work with these techniques are certainly promising.

SUMMARY

1. The gull population in the region of Bangor, Maine was studied from 1 December 1964 through 15 February 1966. With a cannon net 810 gulls were caught and then banded with Fish and Wildlife Service bands and also with a numbered, plastic leg tag. The methods of using the cannon net, the making of the tags, and their usefulness is discussed.

2. The fluctuations in the age-class percentages and the actual numbers of the gulls present in the area are discussed, with an explanation for these fluctuations during the seasons. During the winter 1964-65 the population varied between 150 and 500 birds. In late April the numbers peaked to approximately 900 birds. June through August the population was consistently 200 to 300 birds. From September into November the population peaked to about 1600 to 1700 birds. In December and into February 1966 the population averaged near 750 gulls.

3. During the winter 1964-1965 the adults made up 87 to 95 percent of the population but in May they dropped to 13 percent;

throughout the summer a gradual rise occurred until late December when the number of adults built back up to near 90 percent.

4. The percentages of intermediate gulls and six-to-ten month old birds during the winter 1964-65 were low (one to ten percent) but both increased to near 40 to 50 percent during May. Through the summer and into October these groups slowly dropped off in numbers, and in November they were back to near five to ten percent of the population.

5. Chicks first appeared in this region during the first week of August and reached 65 percent of the population by the first of September. After that date there was a steady rapid drop to one to three percent of the population December through February 1965-1966.

6. The fluctuations noted above are explained in relation to the breeding season and the migratory tendencies of the species.

7. A daily fluctuation in the numbers of birds in the area is correlated with weather changes. Clear days invariably had a lower population than the preceding cloudy day.

8. Evidence is presented that during the summer the gulls found near Bangor were staying within a funnel shaped area in the Eastern Penobscot Bay from Schoodic Point to Belfast, Maine. During the fall, as migration begins, this demarcation is less rigid as displacement southward occurs.

9. Through reading band and tag numbers of free gulls with a telescope, the wandering dispersal of the young as they leave the nesting colonies and the daily movements of individual gulls are obtainable. Gulls banded in the summer of 1965 throughout most of the range of the Herring Gull from the Sister Islands, Wisconsin to Sandy Point, Rhode Island, were seen in Bangor during the summer and fall of the same year.

10. With a cannon net 343 adults were caught and banded and 94 (27 percent) were sighted again. During the summer these adults were rarely seen but during September and October many of these adults reappeared and were seen consistently until December. After the first week of December few marked adults were seen. Adults were rarely seen three to six days immediately following banding.

11. Out of the 190 intermediates banded 90, or 47 percent, were sighted again. These intermediates were seen consistently throughout the summer. During the fall, however, fewer intermediates were sighted. During the three to six days after banding the intermediates were seen more than the banded adults.

12. Of 135 chicks banded 69 (52 percent) were sighted again. The chicks showed a decided persistence in this area for several weeks after banding, but after the middle of November none were seen.

13. This information along with the age-class numbers and composition of the population gives a good idea of the migratory tendencies of the Herring Gull.

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