Report on

CWS contract # 7475-010

Breeding Biology of Herring Gull (*Larus argentatus*) colonies at Port Colborne, Ontario. (summer, 1974)

INTRODUCTION

This report constitutes the third progress statement on work initiated during the summer of 1972 on the breeding biology of colonial fish-feeding birds in the lower Great Lakes. The original intent for the summer of 1974 was to engage in egg-swapping experiments between the Hamilton Harbor and Port Colborne Common Tern colonies to better assess whether colony failure at the Hamilton Harbor site in previous years was a consequence of pollutant loading in the egg, in the parent or both. Failure of the Common Terns to return to the Hamilton Harbor site in 1974 resulted in a shift in emphasis to an attempt to correlate steroid levels in the blood of adult Herring Gulls to their reproductive success and to a continuing effort on the incubation attentiveness of Common Terns at the Port Colborne site.

Despite extensive amount of time given to the steroid work on Herring Gulls, there was little indication that steroid levels varied significantly among the birds sampled. A complete report on this work will await full discussion of the results with the team which collected samples from ~~Nicholson Island~~ Scotch Bonnet Island in eastern Lake Ontario. Further, a complete analysis of the incubation attentiveness data is still in progress. This report briefly summarizes population demographic data collected from the Port Colborne Herring Gull colonies during the summer of 1974. A subsequent report will review findings from the Port Colborne Common Tern colony.

METHODS

1. The Study Areas and Data Collection Procedures

   Complete descriptions of the Port Colborne colony sites and of data collection procedures are presented elsewhere (Morris *et al*, MS). As visitation to all colonies was made at 1-2 day intervals throughout the summer, the data

collected are considered to fairly represent the reproductive performance of all colonies. The majority of nests were fenced with chicken wire, either singly or in small groups in order to permit a better assessment of fledging success.

2. Additional Procedures

a) A total of 8 Herring Gulls representing 2 mated pair and 4 individuals of uncertain mate affiliation were collected from the Port Colborne 'lighthouse' colony between 4 June and 6 June 1974. Blood samples, liver sections and various morphological criteria were taken from the birds and the eggs were collected for residue analysis and incubation experiments.

b) Data on nest attentiveness of selected Common Tern rain from the Port Colborne lighthouse colony were collected with the use of two, 20-pen Esterline-Angus event recorders. Control nests adjacent to the monitored nests were under visual observation.

RESULTS

The Herring Gull colonies were located at the Port Colborne 'lighthouse' and the Port Colborne 'Canada Furnace' sites. In most reproductive parameters, the lighthouse colony closely resembled the Canada Furnace colony although there were some exceptions to be cited later.

Individuals in the two colonies began egg laying within 5 days of one another in late April, 1975. A total of 62 nests and 37 nests were monitored at the lighthouse and Canada Furnace colonies respectively. In both cases, the nests sampled represented the entire colony of nesting birds.

Hatching Success

Although previous studies have shown that 3-egg clutches are more successful than smaller clutches (Paynter, 1949; Harris, 1964; Brown, 1967), we were unable to find a clear correlation between clutch size and hatching success (Table 1). Although 3-egg clutches hatched significantly better than 2-egg clutches at the Canada Furnace colony ($X^2_c = 4.55$, $p < 0.05$), they did not do so at the lighthouse

colony (X^2_c = 1.17, p > 0.1). This analysis is complicated by the removal of the first egg from fifteen, 3-egg clutches from nests at both colonies on 10 May 1975. The purpose was to investigate hatching success under artificial incubation conditions (Gilbertson et al, in press). We are uncertain of the effect of this procedure on the hatching success of the remaining eggs. However, we found no significant difference in the hatching success of the clutches from which one egg was removed, and the remaining 3-egg 'control' clutches (X^2_c = 2.051, p > 0.1).

Hatching success was clearly dependent on the time of clutch initiation (Table 2). Egg laying at both colonies was concentrated in the early part of the season during which 68-70% of the total numbers of eggs laid were produced. A second, smaller peak of egg laying activity occurred later. The split dates used for separating the total season sample into 'early' and 'late' time periods were 30 April, 1975 (lighthouse) and 10 May 1975 (Canada Furnace). Eggs laid early in the season hatched significantly better than eggs laid later in the season at both the Lighthouse (X^2_c = 27.1, p < 0.001) and Canada Furnace (X^2_c = 5.51, p < 0.05) colonies (Table 2).

The interaction between clutch size and time of clutch initiation on hatching success is shown in Table 3. With the exception of 'early' 2-egg clutches at the Canada Furnace colony, eggs laid early in the season hatched equally well independent of clutch size. 'Late' 3-egg clutches hatched better than 'late' 2-egg clutches at the lighthouse colony whereas the reverse occurred at the Canada Furnace colony.

Fledging Success

Chick loss between the time of hatching and fledging (post-hatch mortality) resulted from known death within or disappearance from the enclosed areas. Chicks which disappeared 30 days or more after hatching were assumed to have fledged unless a carcass was found.

The correct measure of post-hatch mortality is the number of chicks fledged

from eggs which hatched (Table 4). Based on this assessment, the fledging rate at the Lighthouse colony was not significantly different from that at the Canada Furnace colony (X^2_c = 0.011, p > 0.1). There did not appear to be a predictable relationship between clutch size and fledging success (Table 4).

Similarly, no predictable relationship emerged from an analysis of the influence of time of clutch initiation on fledging success (Table 5). There were no significant differences (Fisher Exact Test) in fledging rates between the early and late time periods at either colony. The principle contributor therefore to the differences between early and late nests measured as fledged young per nest (Table 5) was the significantly higher pre-hatch mortality levels in nests started lated in the season (Table 2).

Organochlorine Residues

A summary of organochlorine residue levels in small numbers of eggs from Herring Gull colonies in the Great Lakes is shown in Table 6. Eggs from the Scotch Bonnet and Nicholson Island colonies in eastern Lake Ontario appear to show residue values higher than those from the other colonies although there are substantial overlaps in several of the residue values. It is not obvious that the colonies in Lake Superior are substantially different from those at either Port Colborne or Muggs Island.

Total Reproductive Performance

Reproductive data for the Muggs Island and Port Colborne colonies in 1973 and 1974 are compared to that from Scotch Bonnet Island in 1973.(Table 7). There were no significant differences in hatching success among any of the Muggs Island or Port Colborne colonies although the difference between the Port Colborne Lighthouse colony (1973) and the Port Colborne Canada Furnace colony (1974) was just short of the required level of significance (X^2_c = 3.23, 0.1 > p > 0.05). All colonies in all years realized a significantly higher hatching success than the Scotch Bonnet colony.

Similarly, there were no significant differences in the post-hatch mortality rate among all test combinations of the Muggs Island and Port Colborne colonies. The fledging rate at the Scotch Bonnet colony was significantly lower than the Port Colborne - Lighthouse in 1974 ($X^2_c = 7.3$, $p < 0.01$), and the Port Colborne-Canada Furnace in both 1973 ($X^2_c = 5.08$, $p < 0.05$) and 1974 ($X^2_c = 4.19$, $p < 0.05$). The difference in fledging success between the Muggs Island colony and Scotch Bonnet in 1973 was just short of the required level of significance ($X^2_c = 3.34$, $0.1 > p > 0.05$).

DISCUSSION

While only in preliminary stages of analysis, the data seem clear in showing that the north-eastern Lake Erie colonies are achieving a substantially higher reproductive success than a Herring Gull colony at Scotch Bonnet Island in eastern Lake Ontario. Reproductive data cited in Keith (1966) and Kadlec & Drury (1968) show that the hatching success in colonies outside the Great Lakes varied between 0.64 and 0.96 per egg laid. The colony studied by Keith in Lake Michigan had a hatching success of 0.41 per egg laid while that studied by Gilbertson & Hale (1974) had a hatching rate between 0.12-0.17 per egg laid. The hatching rate of the colonies reported here for Lake Erie varied between 0.41-0.55 per egg laid. Further, the numbers of young fledged per nest at the Port Colborne colonies (0.32-0.48) were substantially higher than those reported for Scotch Bonnet (0.06).

Given the geographically isolated nature of Herring Gull colonies in Lake Superior, one might speculate that reproductive performance would be higher than colonies in the lower Great Lakes. In view of the apparent similarity in the organochlorine residue values of eggs from the Lake Superior colonies and those from Port Colborne, baseline reproductive data from the Lake Superior colonies will prove of considerable interest. It would appear desirable to view the Port Colborne colonies as representing an intermediate reproductive situation between that of northern Lake Superior and eastern Lake Ontario in a search for

clinal variations in reproductive success relative to the influence of factors in the physical, chemical and biological environments of the species.

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Table 1 - Hatching success related to clutch size at the Port Colborne Herring Gull colonies.

Colony Site	Clutch Size (number)	Number Eggs Laid	Number Eggs Hatched	Number Eggs Hatched per Egg Laid
Port Colborne Lighthouse	1 (3)	3	2	0.667
	2 (20)	40	23	0.575
	3 (38)	99*	52	0.525
	4 (0)	0	-	-
	5 (1)	5	1	.200
Total	62	147 (162)**	78	0.531
Mean clutch size = 2.61****				
Port Colborne Canada Furnace	1 (2)	2	0	0.0
	2 (9)	17***	4	0.235
	3 (25)	60*	27	0.450
	4 (1)	4	3	0.750
	5 (0)	0	-	-
Total	37	83 (98)**	34	0.409
Mean clutch size = 2.65****				

* 15 eggs from 15 different 3-egg clutches removed for incubation

** actual number of eggs laid

*** 1 egg accidentally broken

**** Realized Mean clutch size

Table 2. Hatching success related to time of clutch initiation at the Port Colborne Herring Gull colonies

Colony Site	Time Period	Number Nests	Mean Clutch Size	Number Eggs Hatched	Number Eggs Hatched per egg laid
Lighthouse	early*	49	2.57	74	0.65
	late	13	2.78	4	0.12
Canada Furnace	early**	25	2.81	28	0.51
	late	12	2.33	6	0.21

* clutches initiated on or before 30 April, 1975.
** clutches initiated on or before 10 May, 1975.

Table 3. Hatching success related to clutch size and time of clutch initiation at the Port Colborne Herring Gull colonies.

Clutch Size	Lighthouse				Canada Furnace			
	early*		late		early**		late	
	# nests	#hatched per egg laid	# nests	#hatched per egg laid	# nests	#hatched per egg laid	# nests	#hatched per egg laid
1	3	0.667	0	-	0	-	2	0.0
2	17	0.676	3	0.0	4	0.286	5	0.2
3	28	0.696	10	0.143	21	0.542	4	0.083
4	0	-	0	-	0	-	1	0.75
5	1	.200	0	-	0	-	0	-
Total	49	0.65	13	0.12	25	0.51	12	0.21

* clutches initiated on or before 30 April, 1975
** clutches initiated on or before 10 May, 1975

Table 4. Fledging success related to clutch size at the Port Colborne Herring Gull colonies.

Colony Site	Clutch Size (number)	Number Fledged	Number fledged per egg laid	Number fledged per egg hatched
Lighthouse	1 (3)	0	0	0
	2 (20)	13	0.325	0.565
	3 (33)	16	0.162	0.308
	4 (0)	-	-	-
	5 (1)	1	0.2	1.00
Total		30	0.204	0.385
Canada Furnace	1 (2)	0	0	0
	2 (9)	0	0	0
	3 (25)	12	0.20	0.444
	4 (1)	0	0	0
	5 (0)	-	-	-
Total		12	0.145	0.353

Table 5. Fledging success related to time of clutch initiation at the Port Colborne Herring Gull colonies.

Colony Site	Time Period	Number Nests	Number Fledged	Fledged per egg hatched	Fledged per nest
Lighthouse	early*	49	28	0.38	0.57
	late	13	2	0.50	0.15
Canada Furnace	early**	25	11	0.33	0.44
	late	12	1	0.17	0.08

* clutches initiated on or before 30 April, 1975
** clutches initiated on or before 10 May, 1975

Table 6. Organochlorine resideus in Herring Gull eggs from selected colonies on the Great Lakes. (ppm - wet weight).

Colony (Lake)	Year	Percent Water	DDE	Dieldrin	PCB
Port Colborne (Erie)	1972	78.4	12.1	0.20	55.8
		79.6	16.4	0.17	71.4
Muggs Isl. (Ontario)	1972	76.8	17.4	0.20	49.5
		79.5	21.4	0.17	96.9
Granite Isl* (Superior)	1973	77.0	20.9	0.17	42.1
		74.8	26.5	0.37	56.1
Buck Isl.* (Superior)	1973	76.4	15.9	0.37	44.1
		75.9	33.9	0.39	54.7
Scotch Bonnet** (Ontario)	1972	80.5	25.9	0.36	91.4
		78.0	28.5	0.28	105.0
Scotch Bonnet ~~Nicholson~~** (Ontario)	1972	79.3	29.9	0.54	122.0
		73.7	58.2	0.60	227.0

* pooled samples of four eggs; Ryder (1974)
** Gilbertson, pers. comm.

Table 7. Comparative reproductive performance of selected Herring Gull colonies on the Lower Great Lakes.

Colony (year)	Number Nests	Number Eggs Hatched	Hatched per egg laid	Number Chicks Fledged	Fledged per egg hatched	Fledged per nest (per pair)
Muggs Isl. (1973)	36	52	0.495	16	0.308	0.45
Port Colborne L.H.(1973)	49	72	0.545	-	-	-
Port Colborne L.H.(1974)	62	78	0.531	30	0.385	0.48
Port Colborne C.F.(1973)	21	25	0.455	10	0.400	0.48
Port Colborne C.F.(1974)	37	34	0.409	12	0.353	0.32
Scotch Bonnet (1973)	97	40	0.163	5	0.125	0.06*

* Based on 79 adult pair (Gilbertson and Hale, 1974)