REPRODUCTIVE SUCCESS OF ISLAND NESTING RING-BILLED GULLS AND COMMON TERNS IN THE ST. LAWRENCE RIVER

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Interest in the basic biology of colonial water birds has increased in recent years as their importance as indicators of environmental change has been appreciated. The Ring-billed Gull *(Larus delawarensis)* and Common Tern *(Sterna hirundo)* nest on low uninhabited islands in the St. Lawrence River along the New York-Ontario border. We were interested in discovering if a pattern of nest placement existed in these colonies and in egg-laying dates, clutch size and nest-success rates. Most of the information available on these species is from marine or lake colonies. Less information is available on colonies situated along river systems. Several papers have increased our knowledge of the Ring-billed Gull (Emlen 1956, Ryder 1975, Shugart 1976) and of Common Tern biology (Blokpoel and Fetterolf 1978, Gochfeld 1977, LeCroy and Collins 1972, Morris *et al.* 1980, Nisbet 1973).

STUDY AREA AND METHODS

From 5 May to 1 August 1978 daily visits were made to Ice Island and Murray Island, Leeds Co., Ontario, to obtain breeding biology data. The 0.17-hectare (56m x 30m) Ice Island (Universal Transverse Mercator 4335, 49229 Chippewa Bay Quad. 7.5 min. topo.) supported 123 Ring-billed Gull and 126 Common Tern nests. Murray Island, a 0.24-hectare (50m x 48m) island (UTM 4474, 49378 Morristown Quad. 7.5 min. topo.) supported 43 Common Tern nests. Both islands were granite rock, partially covered by grasses and herbs. No trees or shrubs were present on Ice Island, whereas Murray Island had a few shrubs and trees along the edge of the island. The birds mainly nested in the grassy areas and the chicks were able to hide in cracks in the rock, under clumps of grass, and in debris washed up on shore.

All nests on Ice and Murray Islands were marked by numbered golf tees placed in the ground next to each nest. The chicks were banded with Canadian Wildlife Service metal bands when they were three weeks old.

RESULTS AND DISCUSSION

Of the 161 Common Tern nests with completed clutches on both islands, 83% contained three eggs, 14% had two eggs, 2% had one egg, and 1% had four eggs. Mean clutch size on Ice Island was 2.86

TABLE 1

Comparison of Egg Laying Dates and Clutch Size of Common Tern Nests on Ice and Murray Islands, Ontario, during Summer, 1978

Common Tern Egg Laying Dates—Ice Island[1]

Completed Clutches	11-24 May	25 May-7 June	8-21 June	22 June-5 July	6-19 July	After 20 July	For Year
2 egg nests	7	2	1	4	1	2	17
3 egg nests	80	16	1	4	0	1	102
Total Clutches	87	18	2	8	1	3	119
Total Eggs	254	52	5	20	2	7	340
Mean Clutch Size	2.92	2.89	2.5	2.5	2.00	2.33	2.86
Clutches to Date	87	105	107	115	116	119	---
Eggs to Date	254	306	311	331	333	340	---

[1] These data were based on 119 of the 126 active nests studied. Seven nests were omitted due to incomplete egg laying data.

Common Tern Egg Laying Dates—Murray Island[2]

Completed Clutches	14-23 May	24 May-2 June	3-12 June	13-22 June	After 23 June	For Year
1 egg nests	0	0	1	0	3	3
2 egg nests	1	1	0	0	3	5
3 egg nests	18	4	7	2	1	32
4 egg nests	1	0	0	0	0	1
Total Clutches	20	5	8	2	7	42
Total Eggs	60	14	22	6	12	114
Mean Clutch Size	3.00	2.80	2.75	3.00	1.71	2.71
Clutches to Date	20	25	33	35	42	---
Eggs to Date	60	74	96	102	114	---

[2] These data were based on 42 of the 43 active nests studied. One nest was omitted due to incomplete egg laying data.

eggs and on Murray Island was 2.71 eggs. The majority (66%) of the Common Tern clutches were completed between 11 and 24 May on both islands, whereas the remaining clutches were completed during the next eight weeks. By 24 May, 314 eggs had been laid on both islands, or 69% of the total eggs (454) laid (Table 1).

Of the 116 Ring-billed Gull nests on Ice Island with completed clutches, 51% contained three eggs, 41% contained two eggs and only 8% contained one egg. The mean clutch size was 2.43 eggs. Eighty percent of the Ring-billed Gull clutches were completed between 5 and 28 May. The remaining nests had full egg complements by 11 July. Two hundred forty eggs had been laid by 28 May, which is 85% of the total eggs (282) laid (Table 2). Vermeer (1970) reported that over 90% of the Ring-billed Gulls studied on Miquelon Lake had completed clutches by the end of May.

The clutch size in both species was greater at the beginning of the egg laying period in May than at the conclusion of the egg laying period in July. Ring-billed Gull clutch size showed a significant ($z=4.52$)* decrease from 2.76 during early May to 1.95 in early June. Common Tern clutch size decreased significantly ($z=3.31$) from 2.92 in May to 2.42 in July on Ice Island, and on Murray Island decreased significantly ($z=4.15$) from 3.00 in early May to 1.71 in

TABLE 2.

Egg Laying Dates and Clutch Size of Ring-billed Gull Nests during Summer 1978 on Ice Island, Ontario

	Ring-billed Gull Egg Laying Dates[1]					
Completed Clutches	5-12 May	13-20 May	21-28 May	29 May-5 June	After 5 June	For Year
1 egg nests	0	2	0	4	3	9
2 egg nests	5	8	22	12	1	48
3 egg nests	16	20	20	3	0	59
Total Clutches	21	30	42	19	4	116
Total Eggs	58	78	104	37	5	282
Mean Clutch Size	2.76	2.60	2.48	1.95	1.25	2.43
Clutches to Date	21	51	93	112	116	---
Eggs to Date	58	136	240	277	282	---

[1] These data are based on 116 of the 123 active nests studied. Seven nests were omitted due to incomplete egg laying data.

* Standard Score (z), $p<0.01$ (Downie and Heath, 1970)

late June. The reason for reduction in clutch size of late nesters may be the fact that early nesters tend to be older, experienced birds and late nesters are young recruits just beginning their breeding experience. Several investigators have been able to correlate reduced clutch size and lower nesting success with late nesting young birds (Coulson and White 1958, Haymes and Blokpoel 1978, Morris *et al.* 1976).

Nests were considered successful if one egg in the clutch hatched. Nesting success for the Common Tern was 85% on Ice Island and 79% on Murray Island. The number of eggs hatched compared with the number laid or the hatching success for terns on Ice Island was 82% with 2.28 eggs hatching per nest. The Murray Island terns showed a similar hatching success of 80% with 2.14 eggs hatching per nest (Table 3). Haymes and Blokpoel (1978) reported a range of 2.36 to 2.63 eggs hatching per nest for Common Terns at Toronto Harbor, which is slightly higher than our findings. The nesting success for Ring-billed Gulls on Ice Island was 87%. Their hatching success of 74% with 1.80 eggs hatching per nest falls within the 1.18 to 2.61 range of eggs hatched per nest reported by Haymes and Blokpoel (1978) also in Toronto Harbor.

Nesting success and hatching success showed a direct relationship with nest sites for Ring-billed Gulls, but not for Common Terns. Common Terns nesting on grassy areas did not have significantly better nesting success on Ice Island ($X_c^2=0.47$)* or Murray Island ($X_c^2=0.15$) and hatching success on Ice Island ($X_c^2=1.11$) or Murray Island ($X_c^2=0.49$) than those nesting on bare areas. Ring-billed Gulls showed different relationships, as those nesting on grassy areas had significantly better nesting success ($X_c^2=8.62$, $p<0.01$) and hatching success($X_c^2=5.35$, $p<0.05$) than those nesting on bare areas on Ice Island (Table 3).

There was a direct relationship between hatching success and clutch size, with larger clutches being more successful than smaller clutches. This was true for Common Terns but not for Ring-billed Gulls. Common Tern three-egg clutches hatched significantly more successfully than two-egg clutches on Ice Island ($X_c^2=22.76$, $p<0.001$) and on Murray Island ($X_c^2=9.85$, $p<0.01$). LeCroy and Collins (1972) and Morris *et al.* (1976) reported similar observations on the influence of clutch size on hatching success in Common Terns. Morris and Haymes (1977) found no such correlation of clutch size with hatching success in the Herring Gull. Similarly Ring-billed Gulls on

* Chi Square with Yates correction (X_c^2). (Downie and Heath, 1970)

TABLE 3

Comparison of Nesting Success of Common Terns and Ring-billed Gulls at the Edge and Center[1] of the Colony on Ice and Murray Islands, Ontario

	Ice Island						Murray Island		
	Ring-billed Gull			Common Tern			Common Tern		
	Bare Edge	Grassy Center	All	Bare Edge	Grassy Center	All	Grassy Edge	Bare Center	All
Active Nests	35	88	123	34	72	126	24	19	43
No. of nests producing at least 1 nestling[2]	25	82	107	44	63	107	20	14	34
% nesting success	71	93	87	81	88	85	83	74	79
No. of eggs laid	70	228	298	150	202	352	65	50	115
No. hatching	44	177	221	118	169	287	54	38	92
No. of hatched eggs per nest	1.26	2.01	1.80	2.19	2.35	2.28	2.25	2.00	2.14
% hatching success	63	78	74	79	84	82	83	76	80

1 Edge nests were located from 1-8 meters from shore and center nests were 9-18 meters from shore on Ice Island. On Murray Island, edge nests were 5-12 meters from shore and center nests were 13-22 meters from shore.

2 Nests were considered successful if one egg in the clutch hatched. Within one day the young chicks scattered in the colony and could no longer be identified with their birth nests.

Ice Island did not show a correlation. The hatching success for the gulls two-egg and three-egg clutches was identical (Table 4).

Hatching success was significantly better in early nests than it was in late nests for both the Common Tern and Ring-billed Gull. Common Tern nests on Ice Island with early clutch completion dates had a 95% hatching success, while nests with later clutch completion dates had a 51% hatching success (X_c^2=90.31, $p<0.001$). Similar results were found for nests on Murray Island with early clutch completion dates having a hatching success of 93% and nests with later clutches having a 67% hatching success (X_c^2=11.32, $p<0.001$). Ring-billed Gull nests with early clutch completion dates on Ice Island had 85% of their eggs hatch while late nests had only 72% hatch (X_c^2=6.66, $p<0.01$) (Table 5). Morris *et al.* (1976) studying Common Tern colonies on the lower Great Lakes reported similar relationships between hatching success and time of clutch initiation.

Reproductive success as measured by nesting success and hatching success showed direct relationships to clutch size with larger clutches being more successful, and to clutch completion dates with early nests more successful than later nests. These relationships were statistically significant in both colonies and for both the Ring-billed Gull and Common Tern except for a lack of correlation of reproductive success with clutch size in the gull colony on Ice Island. These findings are in general agreement with studies cited above indicating that lake and river colonies may have similar requirements for reproductive success.

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TABLE 4

Hatching related to clutch size in Common Tern and Ring-billed Gull colonies on the St. Lawrence River

Colony	Clutch Size	Clutches (n)		Eggs Hatched (n)		Eggs Hatched per Eggs Laid		Mean Hatch per Nest	
		Tern	Gull	Tern	Gull	Tern	Gull	Tern	Gull
Ice Island	1	0	9	0	2	0	0.22	0	0.22
	2	17	48	15	77	0.44	0.80	0.88	1.60
	3	102	59	271	142	0.89	0.80	2.66	2.41
	4	0	0	0	0	0	0	0	0
Murray Island	1	3	---	0	---	0	---	0	---
	2	5	---	4	---	0.40	---	0.80	---
	3	33	---	85	---	0.86	---	2.58	---
	4	1	---	3	---	0.75	---	3.00	---
Totals		161	116	378	221	0.83	0.81	2.35	1.91

TABLE 5

Hatching related to time of clutch completion in Common Tern and Ring-billed Gull colonies on the St. Lawrence River

Colony	Dates	Nests(n)	Eggs Hatched (% Total Laid)	Mean Hatch per Nest
Common Tern				
Ice Island	11-24 May	87	242(95.3)	2.78
	25 May-26 July	32	44(51.2)	1.38
Murray Island	14-23 May	20	56(93.3)	2.80
	24 May-25 July	22	36(66.7)	1.63
Ring-billed Gull				
Ice Island	5-20 May	51	116(85.3)	2.27
	21 May-11 July	65	105(71.9)	1.62