

teeth with the same morphology as those in the radulae of the subadults examined. The conditions of these structures indicated that development was complete and that the young snails were ready to emerge from the capsule.

In all the East Greenland prosobranch, the larval development of which could be determined, Thorson<sup>3</sup> found pelagic larval stages lacking, and rather large larvae were found to develop in capsules and then pass directly into the free bottom stage. Furthermore, Thorson<sup>4</sup> found during his extensive studies that 95 per cent of all the bottom invertebrates of that area do not have planktonic larvae. He concluded that this might be considered an adaptation to life in the Arctic because of the correlation of this habit with numerous special ecological factors related to pelagic development in the cold seas. The precise method of development of *Pyrulofusus deformis* is still unknown; i.e., whether the eggs are large and yolky or whether the material to sustain intracapsular growth to such an advanced stage is provided by nurse eggs in the capsule. But in the light of Thorson's findings indicated above, the large egg capsules and few, large, non-pelagic young that develop therein can be interpreted as an especially well-developed adaptation for reproduction in the Arctic seas.

J. J. GONOR\*

<sup>1</sup>MacGinitie, G. E. 1955. Distribution and ecology of the marine invertebrates of Point Barrow, Alaska. Smithsonian Misc. Collections 128:1-201.

<sup>2</sup>MacGinitie, Nettie. 1959. Marine mollusca of Pt. Barrow, Alaska. Proc. U.S. Natl. Mus. 109:59-208.

<sup>3</sup>Thorson, Gunnar. 1935. Studies on the egg capsules and development of arctic marine prosobranchs. Medd. Grøn. 100(5):1-71.

<sup>4</sup>Thorson, Gunnar. 1936. The larval development, growth, and metabolism of arctic marine bottom invertebrates, compared with those of other seas. Medd. Grøn. 100(6):1-155.

#### BREEDING SUCCESS OF THE COMMON TERN ON THE NORTH SHORE OF THE GULF OF ST. LAWRENCE IN 1961 AND 1962

Colonies of the common tern, *Sterna hirundo*, occur on many of the small islands off the north shore of the Gulf of St. Lawrence<sup>1</sup>. In 1961 and 1962 the author had the opportunity to observe a number of colonies near the mouth of the Nabisipi River, 50°14'N.62°13'W. It was evident that breeding success in the colonies can change greatly from year to year. The breeding in 1962 was an almost complete failure and contrasted sharply with that in 1961. Annual recruitment in the tern colonies is very much influenced by weather and perhaps also by egg collecting.

#### Egg collecting

Along the north shore of the Gulf of St. Lawrence, and indeed along all the remote eastern coastal regions of Canada, there has been a long and unfortunate history of egg collecting. Comeau<sup>2</sup> mentioned egg collecting in the 1800's when the principal harvest consisted of the eggs of puffins and eiders. Palmer<sup>3</sup> stated that in the 1940's eggs of the common tern were gathered in Labrador, Europe, and elsewhere and that in some places they were a valued article of diet. Wetherbee<sup>4</sup> gave a specific example from the Labrador coast. Local residents at Muddy Bay made annual egg depredations on the common tern colony of Green Island and have always done so during living memory. Nowadays, because the numbers of eiders, murre, and puffins have been reduced, the principal victims of the egg collectors are terns, and to a much smaller extent gulls. This is largely because the eggs of these species are readily available. Egg collecting is prompted by the economic conditions in the region. As far as could be ascertained the average earned income of a family in Aguanish was around \$1,200 in 1960-61. In an average family there were between eight and ten children. Family allowances supplement the earned income, but unfortunately many bread winners are unemployed. In Aguanish perhaps

\* Institute of Marine Science, University of Alaska.

50 per cent of the men were unable to find work during the summer of 1962. This means living at the subsistence level and therefore every source of food must be exploited. Egg collecting in the spring has become established as a tra-

delays the effective start of the breeding season by about 2 weeks for the majority of the terns. In some seasons this could affect survival by causing the period of hatching to coincide with an interval of stormy weather.

**Table 1.** Weather records for Sept-Iles, July and August 1961 and 1962. (From "Monthly records of meteorological observations", Canada Dept. of Transport)

	1961		1962	
	July	August	July	August
<i>Temperature</i>				
Daily mean °F	59.7	58.5	56.2	59.0
Difference from normal	+0.5	+0.7	-3.0	+1.2
<i>Precipitation</i>				
Total inches	2.66	2.65	4.12	2.32
Difference from normal	-1.81	-0.69	-0.35	-1.02
Number of days with 0.01 inches or more	8	14	9	7
Number of days with 0.5 inches or more, date in ( )	0.51 (12) 0.53 (30)	1.27 (12)	1.31 (10) 0.65 (11) 0.65 (21) 0.68 (27)	0.95 (1) 0.70 (7)

ditional occupation for the people of this region, notwithstanding that it contravenes the Migratory Birds Convention Act and could result in confiscation of their boats and in fines being levied.

Many of these people are descendants of the first settlers and regard the fish and game of the region as their natural heritage. Protection laws are something imposed on them from outside by people who do not have to rely on the fauna to make existence possible. Exceptions from the regulations are made for Indians and Eskimos, who are allowed to collect eggs for their own consumption. Yet, because of public sympathy, for the Eskimos particularly, they are today as well able to look after themselves as are the inhabitants of remote settlements on the north shore of the Gulf of St. Lawrence. Against this background it is extremely difficult to explain that the laws have been formulated in the interests of conservation.

On the part of the coast where these observations were made eggs are being collected during roughly a 3-week period in late June and early July. This

### Weather

The first tern chicks hatch in early July, presumably from clutches that have remained undisturbed. The majority do not hatch until mid-July or even later. If the period of hatching is followed by bad weather there is a heavy mortality among the chicks. This happened in 1962 when there was a prolonged period of wet and stormy weather in July and August. Hundreds of dead chicks littered the breeding islands, the majority having succumbed during the first week or so of life. By mid-August it was difficult to find any survivors. In 1961 the weather had been fair at the time of hatching and breeding was quite successful in that year. Few dead chicks were seen around the nests and in August fledgling terns were numerous on the islands. Local residents are well aware that the terns do not breed successfully in wet stormy summers.

Significant differences in the weather in 1961 and 62 are not immediately apparent in extracts from the records of the weather station of the Department

of Transport at Sept-Iles (see Table 1). Mean daily temperatures were near normal in both years and precipitation was less than normal even in July 1962. It must be realized that the young chicks suffer most from heavy rains of 0.5 inches or more per day. Such rains numbered only two in July and one, rather too late to have much effect, in August 1961, as against four in July and two in early August of 1962. This explains not only the high mortality in 1962 but also the impression received locally that the summer of 1962 was unusually wet and stormy.

According to Palmer<sup>3,5</sup>, death of the young terns is caused by exposure. In the first week or so of life the thermal regulating mechanism has not developed sufficiently to control the body temperature. Young terns that become wet and chilled become inactive and do not beg vigorously enough to stimulate the feeding reaction of their parents. Chilled, starving chicks have thus a very slim chance of survival. Terns are not alone in this respect. Tuck<sup>6</sup> reports that the greatest mortality among young murrelets results from exposure during the first week of life. A contributory cause of tern mortality during wet and windy weather may be that foraging is more difficult and the parents must expose the young for longer periods.

In conclusion, there is no reason to suspect that the heavy mortality among the young terns in 1962 resulted from any other cause. Since the 1962 weather was very similar to the mean yearly average for the region in respect to precipitation and temperature one is led to suspect that the common tern colonies of the north shore of the Gulf of St. Lawrence and Labrador must often fail to breed successfully.

G. POWER\*

<sup>1</sup>Gabrielson, I. N. 1952. Notes on the birds of the north shore of the Gulf of St. Lawrence. *Can. Field-Nat.* 66:44-59.

<sup>2</sup>Comeau, N. A. 1923. Life and sport on the north shore of the lower St. Lawrence

and Gulf. Quebec Telegraph Printing Co., 2nd Edition, 440 pp.

<sup>3</sup>Palmer, R. S. 1938. Tern mortality along the Maine coast. *Bird-Banding* 9:117-23.

<sup>4</sup>Wetherbee, D. K. 1948. Common terns in Labrador. *Auk* 65:463.

<sup>5</sup>Palmer, R. S. 1941. A behaviour study of the common tern (*Sterna hirundo hirundo* L.). *Proc. Boston Soc. Nat. Hist.* 42:1-119.

<sup>6</sup>Tuck, L. M. 1960. The murrelets. Ottawa: The Queen's Printer. 260 pp.

### Natural gas north of the Arctic Circle

A new gas well with an unusually large flow has been brought in near the village of Tazovskoye, north of the Arctic Circle in western Siberia.

According to Dr. F. Gurari, Deputy Director of the Siberian Research Institute of Geology, Geophysics, and Mineral Resources some twenty deposits of natural gas have been discovered in the Tyumen region of western Siberia. Other new gas fields have recently been found in the extreme north of the western Siberian plain on the shores of Tazovskaya Guba (Bay). The gas occurs here at the relatively shallow depth of 1100 metres and substantiates the predictions of scientists and prospectors that in the northern tip of the plain gas would be found relatively near to the surface.

The Tazovskoye well indicates the presence of large amounts of natural gas. Because of the shallow depth prospecting for oil and gas in this district requires only light-weight drilling equipment, which can be flown-in by helicopter. Since this avoids the difficulties connected with the transport of heavy equipment across the tundra prospecting will be simplified, exploration speeded up and development of the field made less expensive.

This new field in an out-of-the-way corner of Siberia is only 400 km. west-southwest from Norilsk and promises to provide an ample supply of natural gas for this important mining and industrial centre.

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\* Department of Biology, University of Waterloo.