

Report on the 2006 census of terns on Sable Island

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Summary

Sable Island was surveyed for terns in June 2006 using ground-based surveys by the Canadian Wildlife Service. The island was crossed every kilometre from north to south. Tern colonies were identified and subsequently surveyed. 2426-3960 pairs of terns were identified at 13 colonies. Even accounting for the uncertainty in the estimate, the total suggests that the breeding population has increased considerably over the last five years, mainly because of the growth in a colony near the main station. Species composition of breeding birds at surveyed colonies was 74% Common Terns and 26% Arctic Terns. Three Roseate Terns were identified but breeding status was not confirmed. The average clutch size was 2.41(\pm 0.65) which is comparable to other surveys of terns in the Maritimes (A.W. Boyne pers. obs.).

Surveys of 16 groups of roosting birds on the beaches showed a species ratio of 11% adult Arctic Terns, 26% Common Terns, 62% juvenile Arctic Terns, and 0.2% Roseate Terns. The average group size was 68 individuals (Range 9-299). Roosting birds counts on the beaches adjacent to the two largest Common Tern colonies were largely juvenile and adult Arctic Terns. This emphasizes the importance of Sable Island as a staging and feeding area for Arctic Terns in all age classes.

Introduction

Historical sources suggest that, up until the early 1900s, Sable Island (Fig. 1) had the largest breeding population of terns in North America. Even now, it has one of the largest breeding populations of Common and Arctic Terns (*Sterna hirundo* and *S. paradisaea*) in Atlantic Canada. Over fifty pairs of the endangered Roseate Tern, *S. dougallii*, bred on the island as late as the 1980s, although maxima of only one or two pairs are thought to have bred there in the last two decades (Horn 1998, Horn et al. 2000). Thus Sable Island is an important site for the conservation of terns in Canada.

The breeding population of terns has not been thoroughly censused in five years. A census was attempted in 2002, but yielded a very low population total that was probably attributable to the methods that were used (Horn et al. 2003). The census reported here used more intensive methods (nest counts, rather than flush counts; see below), and experienced personnel to attempt a more accurate population census.

Methods

The field team was on Sable Island from 16 June to 31 June. Tern surveys were conducted from 17 June to 21 June. Colonies were identified while walking transects across the island survey Ipswich Sparrows (Horn 2007). The transects were at one kilometre intervals along UTM lines from north to south. Potential tern colonies were identified by the presence of several terns in the air over an area. When transects were finished, the area was investigated more closely in order to determine if nesting terns were present. Due to the topography of the island, good lines of sight were available, so we are confident that all areas between the 1 kilometre intervals could be seen from the transect line. Interior areas of the island were also investigated if large numbers of terns were seen roosting on the beach.

Surveys were timed to align with the last week of incubation for terns. Due to extended periods of fog and the logistics of getting to such an isolated island, researchers were delayed in getting to Sable Island by a week. Therefore survey times did not align with the last week of incubation in all of the colonies.

When a colony was identified, researchers visually estimated the outer boundaries of the colony from a distance and then used that to decide the survey direction. Walking roughly arms length apart three people walked parallel transects. The outside line of each transect was marked with forestry survey flags which were picked up on the following transect. Researchers recorded nests and the number of eggs and/or chicks in each nest. In very dense colonies, a wooden stir stick was placed at the edge of each nest in order to avoid double counting of nests. The species composition of each colony was determined through a combination of egg size and direct observation of incubating birds prior to the survey or after the survey. In eight colonies, the number of adults flushed from the colony was also recorded, in a so-called “flush count”.

The two largest colonies on the island (East Light and Turbine) were nearly finished incubating (>40% hatch rate at Turbine Colony) and surveying the entire colony with the above mentioned method was not feasible due to a high ratio of hatched nests to incubating nests. With thick vegetation within the colony, researchers could not be confident of where they were stepping relative to nests and chicks, so nest counts were abandoned.

In these cases flush counts were attempted with accompanying digital photos of the flushed colony. Using Adobe Photoshop each bird in the photo was marked with a pixel a known dimension and pure colour. The marks were then isolated and the number of pixels were then counted (using the histogram function). The total number of adults (= pixels) was converted to a total number of nests using the ratio of 1.5 adult per nest from previous literature and supported by a the relationship between adults and nests found in the present study (see Results). This method proved successful at East Light colony but the large area occupied by the Turbine colony made this method impractical even from the tops of nearby buildings.

Three plots (20m x 20m) were laid out within the Turbine colony and complete nests surveys were conducted within them in order to determine nesting density. The outer extent of this colony was circumnavigated with a global positioning system (GPS). It was likely that the

outline was further from the edge of the colony rather than closer, so buffers from the colony edge toward the center were created at 5m intervals up to -25m in a Geographical Information System (MapInfo). The areas of those polygons were then measured. When the average density estimate was applied to these areas a range of population estimates were produced.

Two other surveys were completed within fenced areas below the wind turbines. The dimensions of the fenced areas were measured using a GPS. In the Turbine colony tern chicks within and outside of the fenced wind turbines were banded in an attempt to associate any chick mortality due to the wind turbines or their structures with the nesting location of the chick.

Roosting Birds

Groups of roosting birds were surveyed during the extent of our time on the island. Birds were observed from a distance using a scope, and the number of each species in the group was then determined using a combination of bill colour and size.

The size of some gull colonies was estimated opportunistically, but it was far from a complete census due to time restraints, timing with incubation and the inability to find the sparsest colonies without the aid of an aerial survey. Great Black-backed Gull chicks were fledged and beginning to fly and most Herring Gull nests hatched while we were on the island or earlier.

Results

Thirteen tern colonies were identified on Sable Island in 2006. Of those colonies, only 11 could be counted using ground surveys, which yielded a total nest count of 452. The hatching chronologies of the two largest colonies, East Light colony and Turbine colony, were more advanced than the other twelve colonies. The presence of large numbers of chicks in dense low vegetation made complete ground surveys impractical.

Within the 11 ground surveyed colonies on the island and one suspected abandoned colony (see Table 1), 74% of the terns were Common Terns and 26% were Arctic Terns. Three Roseate Terns were identified at East Light colony but were not observed on a nest within the colony. The hatch rate was 2.8% and the mean clutch size was 2.41 (± 0.65 ; Table 1).

Terns were distributed unevenly on the island with the majority of the colonies on the eastern half of the island (11) and only three on the western half of the island (Figure 2). Furthermore, species were distributed unevenly on the island. The majority of Arctic Terns were on the eastern half of the island (Figure 2).

The average group size of roosting birds was 68 ($n=16$, range 9-299). These groups of roosting birds were composed of 26% Common Tern adults, 11% Arctic Tern adults 0.2% Roseate Terns and 62% Arctic Tern juveniles. Groups of roosting birds near the two largest colonies (Turbine and East Light) were composed mostly of Arctic Terns (91% and 56%

respectively) despite the fact that the colonies were made up primarily of Common Terns. This emphasizes the importance of Sable Island for Arctic Terns (Table 2).

Turbine and East light colony estimates

The largest area for the Turbine colony (the original boundary) was 13.42 ha and the smallest (-25m buffer) was 9.68ha. When the average nest density ($n=5$, $\bar{x}=214 \pm 177$) was applied to these areas, the average colony sizes were 2871 ± 2378 (13.42 ha) and 2071 ± 1716 (9.68 ha). Despite these estimates having a large associated error, the mean values did match the observers' impression of the colony's size, based on their previous experience.

Nonetheless, given the wide confidence limits, the small sample size, and that the median nest counts was higher (albeit not significantly) in larger plots, it might be more appropriate to pool the data from all plots to produce a single estimate of density (ratio estimator; Thompson 1992). This alternative analysis yielded a density of 160 nests/ha, and a colony size of 1549 to 2147 nests, depending on whether the true colony size is 9.68 or 13.42 ha.

Photo estimates of East Light colony yielded estimates of 522 and 637 birds. These estimates for East Light colony are lower than what researchers expected based on visual estimates made on site, perhaps because some adults remained on their nest when others were flushed. (Wiggins and Morris 1987). At the eight colonies with both flush counts and nest counts, regressing adults flushed against the number of nests yielded a slope of 1.43 flushed adults per nest ($F_{1,7}=260.83$, $P<0.0001$), which agrees closely with the ratio of 1.5 used in previous studies (Bibby et al. 1992), including those on Sable Island (Horn and Taylor 2000). Using this ratio and the higher of the two photo counts, the East Light colony comprises at least 425 nests.

When East Light and the lowest estimate for the Turbine Colony are considered, the total number of tern pairs nesting on Sable Island is at least 2426. The true total may be much higher, however. For example, if the area density estimate is used for the larger size estimate of the Turbine colony, and a flushed adult/nest ratio of 1 is used for the East Light colony (following Wiggins and Morris 1987), the total rises to 3960 nests.

Tern chicks were banded as a part of an investigation into the impact of wind turbines on terns in the Turbine colony. Fifty-eight Common Tern chicks were banded along with one Arctic Tern chick.

Gulls were banded opportunistically when colonies or nests were found. Thirty-one Great Black Backed chicks and forty-three Herring Gull chicks were banded.

Discussion

This study is the first in at least two decades to attempt a complete census of the terns of Sable Island through nest counts. Recent censuses instead used flush counts, and suggested that the population held steady at between about 1300 and 1700 pairs since the 1970s (Horn and Taylor 2000, Horn et al. 2003). The minimum estimate from the present study, 2426 pairs,

suggests an increase in the tern population of at least 43 % compared to the maximum of the previous counts (1700 pairs). The increase is not attributable to a change in methods from flush to nest counts; even using flush counts from the present study (estimating a flush count from the Turbine colony as 1549 X 1.5), yields a flush count total of 3413 adults, 67 % higher than the flush count of 2001.

Although we have yet to analyze this population growth in terms of changes in the size of individual colonies, it is clear that the bulk of the increase has occurred at the Turbine colony. Island residents have remarked on the growth of this colony, which has been large in the past (G. Forbes, Z. Lucas pers. comm.), but had virtually no terns in the late 1990s (A.G. Horn, pers. obs.). Since reproductive success tends to be higher on larger colonies (e.g., Horn et al. 2003), the growth of this colony likely bodes well for the island's tern population. In particular, Roseate Terns are attracted to larger colonies of other species of terns (Horn and Boyne 2006), so even though their current presence is tenuous at best, the prospects for their re-establishment are likely better than they have been in decades.

The present census highlights the challenge of accurately estimating the size of large colonies. Since so much of Sable Island's tern population is concentrated in two such colonies, the Turbine and East Light colonies, future censuses should continue to use and evaluate a variety of methods if the island's population is to be accurately monitored.

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Table 1. Clutch Size, nest counts and species ratio of Terns on Sable Island, Nova Scotia June 2006

Colony*	Latitude	Longitude	Date	Clutch Size				Total	Nests Hatched	Percent Hatch	Percent COTE
				1	2	3	4				
1	43.9323	-59.91336	17-Jun	3	25	52	1	81	0	0	95
2	44.0054	-59.71861	18-Jun	1	1	4	0	6	0	0	83
3	44.0100	-59.71026	18-Jun	5	9	20	0	34	0	0	100
(4)*	44.0209	-59.69085	18-Jun	0	0	0	0	0	0	0	100
5	44.0413	-59.65435	18-Jun	2	0	0	0	2	0	0	100
6	43.9788	-59.75478	18-Jun	1	8	12	0	21	0	0	5
7	43.9775	-59.75661	18-Jun	1	14	15	0	30	4	0.13333	3
8	43.9379	-59.84971	19-Jun	8	24	43	0	75	2	0.02667	70
9	43.9345	-59.84958	20-Jun	14	92	50	0	156	23	0.14744	30
10	43.9604	-60.13116	20-Jun	1	11	14	0	26	0	0	100
11	43.9557	-60.12016	20-Jun	1	3	5	0	9	0	0	100
12	43.92947	-59.88448	21-Jun	2	2	8	0	12	0	0	100
13**	43.9602	59.78325									
14**	43.93103	60.00390									

*Site listed as Colony 4 had terns hovering over it, and was suspected of being a recently failed colony (perhaps flooded by recent rains). Thus it is listed here, but is not considered a colony or included in the data relating nest counts to flush counts.

**Hatching chronology of these colonies made ground surveys impractical.

Table 2. Counts of flocks of roosting terns on Sable Island, Nova Scotia, June 2006.

Location	Date	Time	ARTE	COTE	PORT	ROST	TOTAL	% COTE
South beach by East Light colony	18-Jun		5	119	2	2	128	46.85
North beach by East Light colony	19-Jun		0	45	0	0	45	50.00
West tip	20-Jun	10:00	1	12	9	0	22	27.27
South beach by station	22-Jun		3	3	40	0	46	3.26
South beach by station	22-Jun		15	1	134	0	150	0.33
South beach by ARTE colony	22-Jun		20	1	7	0	28	1.79
South beach by East Light colony	22-Jun	15:00	17	23	18	0	58	19.83
North beach by East Light colony	22-Jun	16:00	0	16	0	0	16	50.00
West tip	24-Jun	11:45	1	2	6	0	9	11.11
West spit by smaller of two colonies	24-Jun	12:00	2	5	13	0	20	12.50
South beach by station	25-Jun	11:25	8	15	10	0	33	22.73
South beach by station	25-Jun	16:40	7	13	100	0	120	5.42
South beach by station	26-Jun	14:00	20	5	274	0	299	0.84
South beach by tern colony 1	26-Jun	14:50	11	2	10	0	23	4.35
Adjacent to # 3 life saving station	26-Jun	16:00	7	5	11	0	23	10.87
		Total	117	267	634	2	1020	
		Average					68	17.81

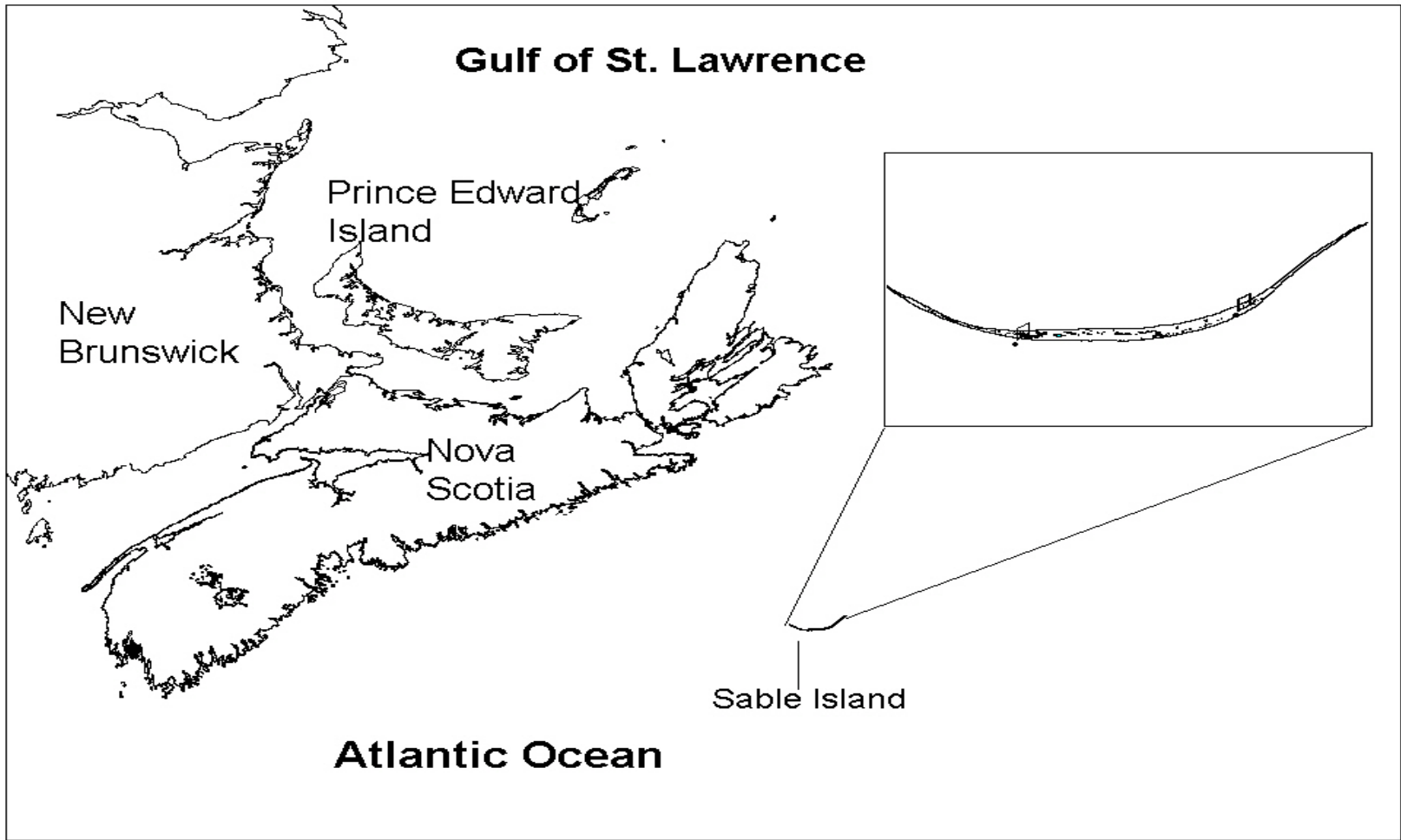


Figure 1. Location of Sable Island, Nova Scotia, Canada

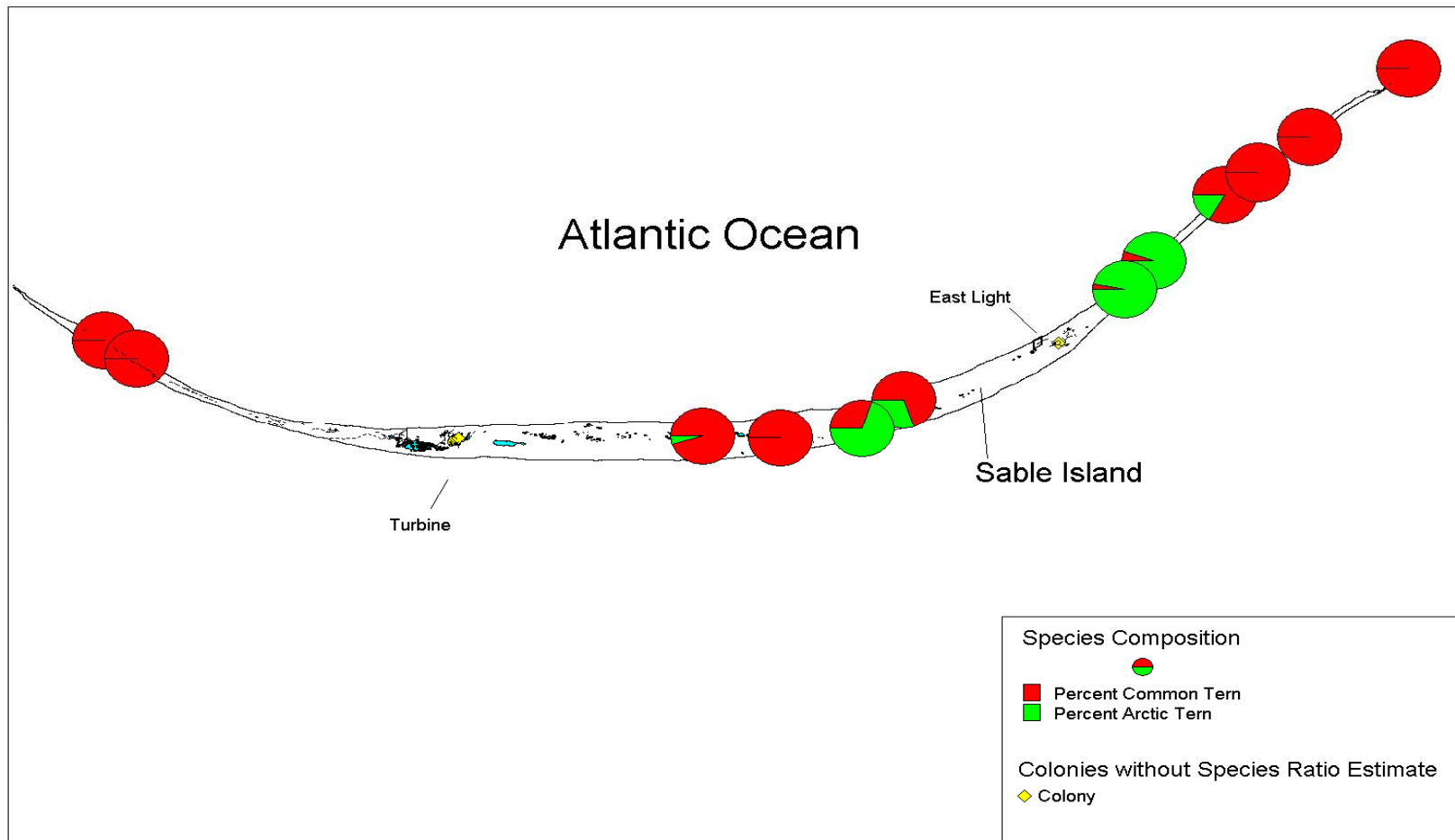


Figure 2. Species composition of tern colonies (and one site with adults; see Table 1), Sable Island, June 2006.