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The Summer Seabird Community of the Flemish Cap in 2002

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Abstract

We describe the seabird community and the distribution of seabirds in the Flemish Cap in the summer of 2002. Data were collected by means of sixty-six 300 m wide boat transects of varied length in the first half of July. A total of 802 seabirds and 8 species were counted within census transects. Over 70% of seabirds were Great Shearwaters (*Puffinus gravis*), followed by Northern Fulmars (*Fulmarus glacialis*) with 17.1% of the seabirds recorded. The number of seabirds recorded per census transect was, on average, very low (mean = 10.68, SD = 19.54) and no seabirds were observed in 20 transects. Overall seabird abundance was 8.78 birds km^{-1} (n = 66, SD = 16.98). Seabird abundance and seabird species richness were not evenly distributed across the Flemish Cap but seemed to concentrate at the edges of the southern half of the study area. This pattern suggests that seabirds were mostly distributed in the area of confluence of the North Atlantic Current with the Labrador Current. We also call attention on the possibility that the Flemish Cap may be an important area for wintering Great Shearwaters.

Key words: Flemish Cap, *Fulmarus glacialis,* Great Shearwater, Northern Fulmar, *Puffinus gravis*, seabird distribution.

Introduction

The knowledge of the distribution of seabirds at sea can be important for different reasons. For example, these data have been used to identify areas vulnerable to pollutants such as oil (Piatt, 2002), to describe the pelagic distribution of rare and endangered bird species or to reflect prey availability (Hunt, 1997; Skov and Durinck, 2001). The distribution of seabirds at sea is patchy since it is influenced by oceanographic features and prey distribution (Haney and Solow, 1992). Seabird numbers have been related to some oceanographic processes such as internal waves (Haney, 1987), frontal eddies (Haney, 1986; Ribic *et al*., 1997), or the upwelling of cold ocean waters (Stahl *et al.*, 1985; Speckman, 2002), while some other studies have provided evidence of close spatial relationships between prey availability and seabird distribution and abundance (Schneider and Hunt, 1982; Schneider, 1990; Piatt, 1990; Parrish *et al.*, 1998). Moreover, it is well known that the distribution and abundance at sea of many seabird populations can be determined to a great extent by human fishing activities because they may provide a large source of discards and offal (Garthe and Hüppop, 1994; Oro and Ruiz, 1997; Skov and Durinck, 2001).

Here we present data on the composition of the Flemish Cap summer seabird community in 2002 based on systematic seabird counts made during a fishing research cruise across the area. Ship-based surveys have provided a considerable amount of data on the distribution and abundance of seabirds at sea (i.e.: Piatt *et al.*, 1989; Garthe and Hüppop, 1994; Garthe, 1997; Camphuysen and Webb, 1999; Skov and Durinck, 2001; Piatt, 2002). Nevertheless vessels rarely operate far offshore with the specific aim of studying birds, thus most data for offshore areas have been obtained from opportunistic observations onboard ships visiting or passing by for other purposes. The large scale scientific study of the Flemish Cap was started in 1997 by Canadian and Russian researchers, followed by Spanish and Portuguese teams from 1988 onwards. The main aim of the research at Flemish Cap is to gain knowledge on the stocks of different commercial fish species such as Atlantic cod (*Gadus morhua*) and, as far as we know, no previous attempts have been made to study seabirds systematically. Moreover, the Flemish Cap constitutes an offshore fishing area with distinct oceanographic and biological characteristics (see Coulbourne and Foote, 2000) and thus it may potentially give insights on the factors underlying the distribution of seabird populations.

Methods

Study area. The Flemish Cap is located in international waters (47ºN, 45ºW) regulated by international agreements under NAFO (North Atlantic Fisheries Organization). Formerly, the Flemish Cap fishery consisted mainly of Atlantic cod (*Gadus morhua*) and flatfish species such as American plaice (*Hippoglossoides platessoides*) while, more recently the fishery includes species such as Redfish (*Sebastes* sp.), Greenland halibut (*Reinhardiius* *hippoglossoides*), Roughhead grenadier (*Macrourus berglax*) and Northern shrimp (*Pandalus borealis*). The Flemish Cap is a relatively small bank (28 000 km^2) with average water depths of 280 m. To the west the Flemish Pass, with maximum water depths of about 1 100 m, separates the Cap from the Grand Banks. The closest land to the Flemish Cap is Newfoundland, some 800 km to the west. The general circulation of water masses in the area is determined by the confluence of the Labrador Current (3–4ºC and 34–35 salinity) and the North Atlantic Current (4ºC and more than 34.8 salinity) (Colbourne and Foote, 2000).

Data collection. Data on seabirds was collected on board of the R/V *Cornide de Saavedra* from 30 June to 16 July 2002 during the fishing research cruise "FC02". Seabirds were counted along 66 one strip (300 m wide) transects over 10 minute time intervals (Fig. 1). The method we used comprises counts of birds that are on or "using" the sea during a standard time period (10 min) in a single 300 m wide distance band on one side of the boat (see Bibby *et al.,* 2000 and references therein for details). Counts were made during trawls (51 transects) and while the ship was cruising between trawls (15 transects). The speed of the vessel when trawling was 3 knots and increased to 8–10 knots while cruising, thus transect lengths varied approximately from 1 000 m in trawling (low speed) transects to 3 000 m in the cruising (high speed) ones.

For every seabird species, frequency of occurrence was defined as the proportion of transects where at least one individual was sighted within the 300 m band. Seabird abundance was recorded as number of birds per kilometer. Birds outside transect boundaries have not been used to calculate abundance estimates. All contour maps were made from a grid traced with a linear variogram (kriging method) using "Surfer" software.

Results

Community composition

A total of 802 individuals and 8 seabird species were recorded within transects (Table 1). With the exception of Storm-Petrels (Hydrobatidae) and Terns (*Sterna* sp.), all individuals observed within transects were identified to the taxonomic level of species. Great Shearwaters (*Puffinus gravis*) and Northern Fulmars (*Fulmarus glacialis*) were, in that order, the most common seabird species (73.3% and 17.1% of all the birds counted). The percentage of Arctic skuas (*Stercorarius parasiticus*), Great skuas (*Catharacta skua*) and Sooty shearwaters (*Puffinus griseus*) was less than 5% while Storm-Petrels, Razorbills (*Alca torda*) and Terns were even scarcer (Table 1). In addition, some other species were identified during non systematic observations between counts including Great Black-backed Gulls (*Larus marinus*), Gannets (*Morus bassanus*), European Storm-Petrels (*Hydrobates pelagicus*) and Leach's Storm-Petrels (*Oceanodroma leucorhoa*). One of the European Storm-petrels was observed between transect numbers 58 and 59 (Fig. 1) and the other one landed on board. The number of species recorded per census transect was very low (Fig. 2) and in 20 transects no seabirds were observed. Despite lower overall abundance, Northern Fulmars showed the highest frequency of occurrence (59.7%) while Great Shearwaters were recorded in less than half of the transects (46.3%). In fact, Northern Fulmars were the only species recorded in 14 transects. Other species with a frequency of occurrence over 10% were Great skuas (11.9 %), Sooty shearwaters (10.4%) and Arctic skuas (8.9%).

Patterns of seabird abundance and seabird species richness

According to our data, average seabird abundance in the Flemish Cap was 8.78 birds km^{-1} (n = 66, SD = 16.98). The values for the two most common species were 6.38 birds km^{-1} (n = 66, SD = 14.97) for Great Shearwaters, and 1.70 birds km^{-1} (n = 66, SD = 3.01) for Northern Fulmars. The distribution of seabird abundance shows that most seabirds were recorded in transects located at the edge of the southern half of the study area (Fig. 2) a pattern that closely resembles the spatial distribution of seabird species richness (see Fig. 2). As expected, Great Shearwater abundance follows overall seabird abundances (Fig. 2), but the picture for Northern Fulmars is somehow different with an area of high relative abundance (over 5.0 birds km^{-1}) in the upper northern half of the Flemish Cap (Fig. 2).

Discussion

Ship-based surveys of seabird abundance and seabird community composition by means of linear strip transects have been widely used although the method presents some difficulties and flaws. For example, some species are attracted to ships while others flee away, small or dark species are much harder to detect than the larger and paler species and there is a risk to overestimate the number of seabirds if birds tend to cross the ship's route (Bibby *et al.,* 2002).

Our study took place at the middle of the reproductive season (chick rearing) for seabirds in the Northern Atlantic, thus we should expect relatively low seabird abundances as well as poor seabird species richness

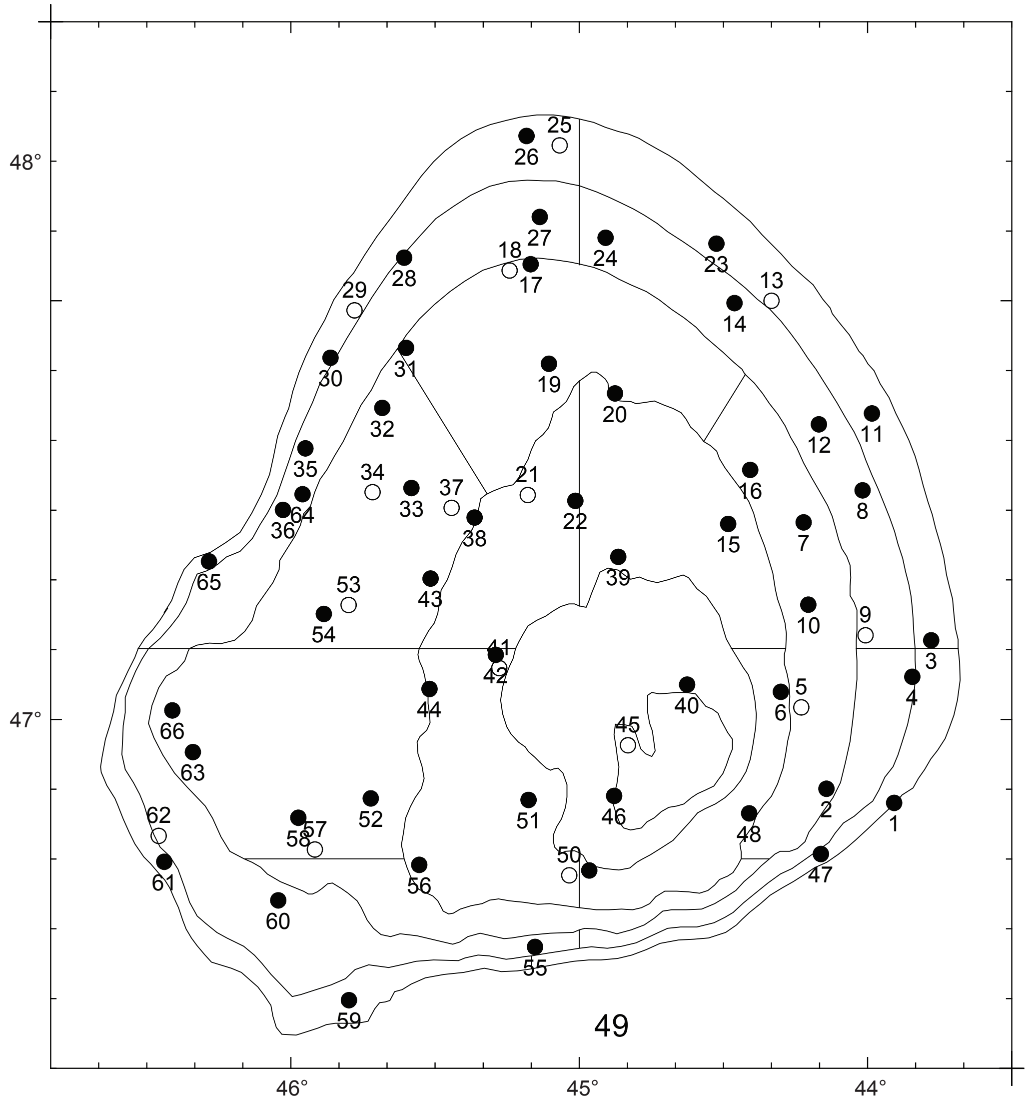

Fig. 1. Location of transects of seabirds counts on Flemish Cap (30 June–16 July, 2002). The black circles are counts made during trawls (low speed) and white circles are counts made while the ship was cruising (high speed). The study area appears divided into 19 strata according to depth.

because the Flemish Cap lies well out of the reach of the birds breeding at the nearest seabird colonies in Newfoundland, an area which, otherwise, holds very large seabird populations (Snow and Perrins, 1998). Foraging activities of breeding seabirds are constrained to a limited distance around colonies because they have to attend their breeding sites (i.e.: to provide food to their chicks) regularly (i.e.: Schneider and Hunt, 1982; Garthe, 1997; Hunt, 1997; Parrish *et al.*, 1998; Kitaysky *et al.,* 2002; Falk *et al.,* 2002). As an example, Northern Fulmars may spend an average of up to 29 hr away from their breeding grounds, flying as far as 120 km away to forage (Furness and Todd, 1984). In fact, the community of seabirds at the time of our study was largely dominated by wintering Great Shearwaters, a species that is known to breed in just three localities of the South Atlantic Ocean. From April to September Great Shearwaters undertake transequatorial migration into the western half of the North Atlantic where they are widely distributed from the Newfoundland Grand Bank to Greenland (Snow and Perrins, 1998). Northern Fulmars, however, are dispersive and breed from May to September at temperate and subarctic latitudes, both in the eastern and western Atlantic, including Canada and Greenland. Thus, we expect that the Fulmars at Flemish

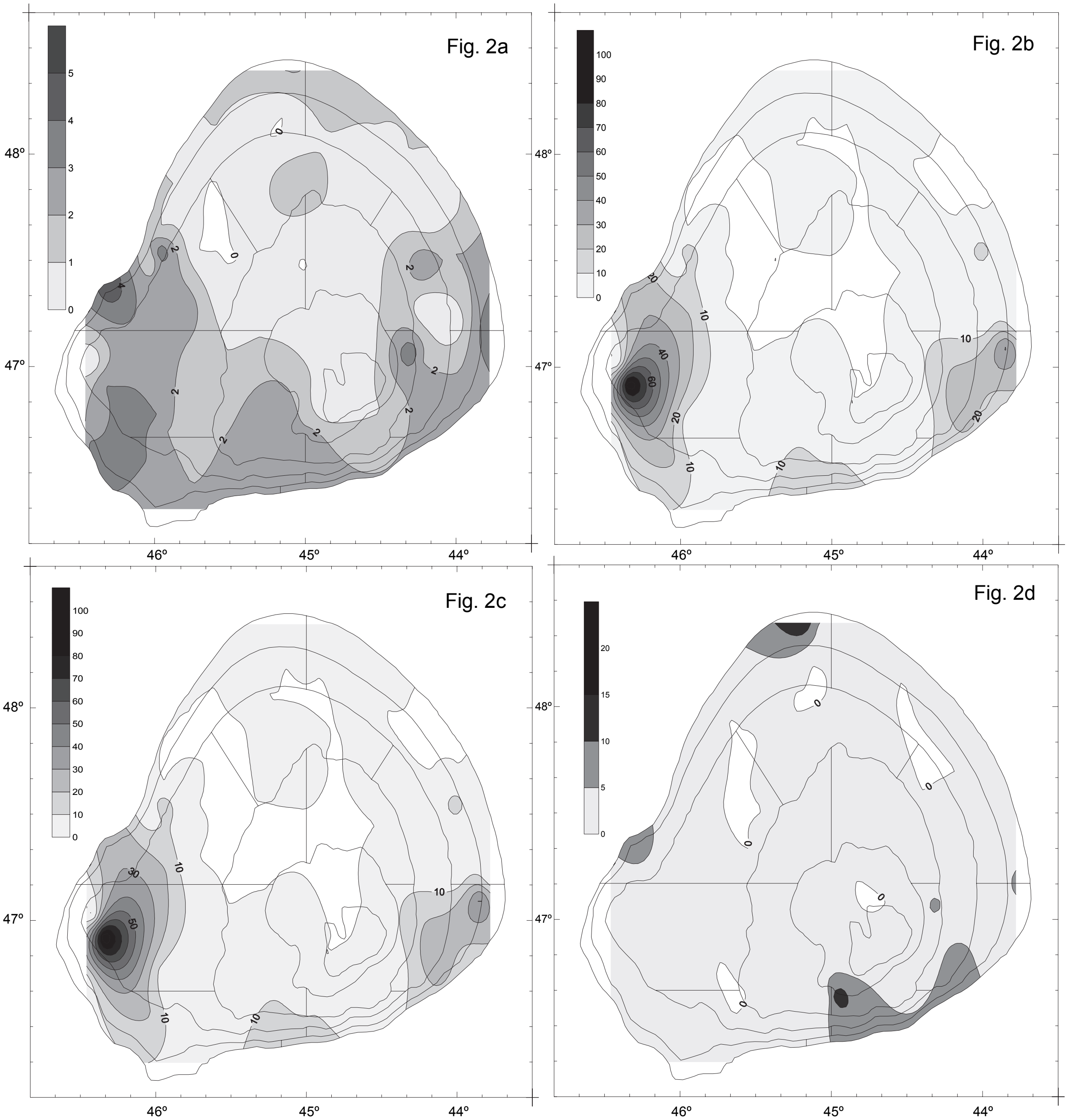

Fig. 2. Distribution and abundance of seabirds at the Flemish Cap (30 June–16 July, 2002) **a**) Seabird species richness; **b**) Total seabird abundance (birds km^{-1}); **c**) Abundance (birds km^{-1}) of the Great Shearwater (*Puffinus gravis*); and **d**) Abundance (birds km^{-1}) of the Northern Fulmar (*Fulmarus glacialis*).

Cap were juveniles and non-breeders which, with the exception of Great Shearwaters, is probably the case for the rest of the seabirds recorded.

Our results indicate that seabird abundance and seabird species richness were not evenly distributed across the study area but seemed to concentrate at the edges of the southern half of the Flemish Cap. According to the general oceanographic model for the Flemish Cap (Colbourne and Foote, 2000), this spatial pattern suggests that seabirds were mostly distributed in the area of confluence of the North Atlantic Current with the Labrador Current. Oceanographic features such as frontal systems, water temperature and salinity, vertical stratification, and bathymetry

TABLE 1. Total numbers of seabirds counted on board during cruising (high speed) and trawling (low speed) transects at the Flemish Cap (30 June–16 July, 2002). Occurrence is the number of occasions when the species was seen expressed as percentage relative to the total number of transects performed (n = 66).

Common Names	Species	Cruising	Trawling	Total	Percentage	Occurrence
Northern Fulmar	*Fulmarus galcialis*	23	114	137	17.1	59.7
Great Shearwater	*Puffinus gravis*	92	496	588	73.3	46.3
Sooty Shearwater	*Puffinus griseus*		12	12	1.5	10.4
Storm-Petrels	Hydrobatidae spp.		4	4	0.4	4.5
Arctic Skua	*Stercorarius parasiticus*		33	33	4.1	8.9
Great Skua	*Cataractha skua*	2	23	25	3.1	11.9
Terns	*Sterna* sp.		1	1	0.1	1.5
Razorbill	*Alca torda*		2	2	0.3	2.9
Totals		117	685	802	100	

can influence seabird distribution and behaviour (Piatt, 1994; Decker and Hunt, 1996) usually by their action in concentrating or dispersing seabird prey species or the zooplankton those forage organisms consume (Swartzman *et al.*, 1994, 1995; Mehlum *et al.*, 1996; Speckman, 2002). Moreover, procellarids (shearwaters, fulmars and petrels) have been shown to be associated with cold, nutrient-enriched upwelling waters (Speckman, 2002).

Numerous studies on seabird distribution and abundance in relation to fishing vessels have documented that trawling may generate an important food source for several species and thus trawlers can attract large numbers of seabirds (Camphuysen *et al.*, 1995; Oro and Ruiz, 1997; Camphuysen and Webb, 1999; Skow and Durinck, 2001). Great Shearwaters, Northern Fulmars and also Skuas make extensive use of fishing discards and fish offal, thus fishing activity at the time of our study could well explain our results. However, the little overlap between Great Shearwaters and Northern Fulmars may be an indication that the factors responsible for the distribution of these seabird species are not quite the same. Interspecific competition with larger seabird species should not be rejected, at least in the case of Northern Fulmars (see Garthe and Hüppop, 1994).

Our study is largely inconclusive due to the lack of replicates. Routine imcorporation of the study of seabirds during fisheries research surveys would be of great benefit. Firstly because there is still a large gap to bridge between ornithology and fisheries science and neither seabirds nor fishing vessels can be ignored if we are to understand the functioning of marine oceanic ecosystems as a whole. Secondly, because the addition of basic seabird research on board is inexpensive and needs little more than a trained ornithologist with a pair of binoculars. Moreover, fisheries research surveys may provide means to assess the conservation status for threatened seabirds that are often very difficult to study. Indeed, our data suggests that the Flemish Cap could be an important area for wintering Great Shearwaters.

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