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INFLUENCE OF PACK ICE ON NON-BREEDING SOUTHERN BLACK-BACKED GULLS (*Larus dominicanus*) IN ANTARCTICA

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ABSTRACT

Winter movements of Southern Black-backed Gulls at Palmer Station, Antarctica, correlate with shifts in pack ice. Numbers of gulls increase when open water appears near shore, exposing foraging sites, and when human wastes are available.

INTRODUCTION

Bird behaviour and reproductive success in polar regions are often influenced by ice cover (Taylor 1962, Yeates 1968, Bianchi & Karpovitsch 1969, Ainley & LeResche 1973, Watson 1975, Parmelee *et al.* 1977 and 1978, and Ainley *et al.* 1978), and many birds migrate from these areas as winter pack ice forms and prevents inshore foraging (Murphy 1936). During the 1979 austral winter, I studied effects of fluctuating pack ice concentrations on movements and near-shore foraging behaviour of the Southern Black-backed Gull *(Larus dominicanus)* in the Antarctic Peninsula region. I was interested in the following: (1) How changes in ice concentration affected movements of gulls in and out of inshore areas, (2) What climatic patterns influenced changes in ice concentration, and (3) How changes in ice cover affected food availability. Whereas several studies (e.g. Divoky 1979, Alexander 1980, Stirling 1980, and Brown & Nettleship 1981) have noted greater food supplies at the edges of sea ice than in open sea and established

the benefit of pack ice as a source of winter food, I shall emphasise the negative aspects of pack ice.

METHODS

I recorded numbers of wintering gulls daily from 1 March to 15 October 1979 in the vicinity of Palmer Station (64°45'S, 64°03'W) on Anvers Island near the Antarctic Peninsula (Fig. 1). I assessed the ice cover daily, but unlike the estimates of others, I was assessing the amount of shoreline, where gulls forage, and sea covered by ice on a 10-point scale (Fig. 2). Wind velocity and direction, temperature, dew point, cloud cover, and marometric pressure were recorded three times daily at 0830, 1430, and 2000 local time. Wind speed was converted to Beaufort scale (Fig. 2) after Ainley & LeResche (1973).

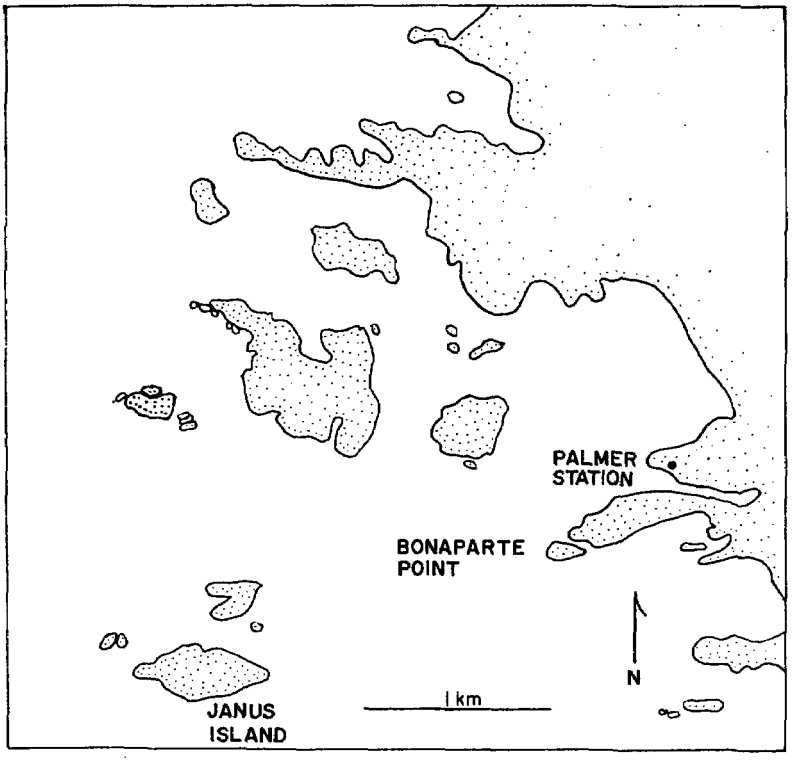
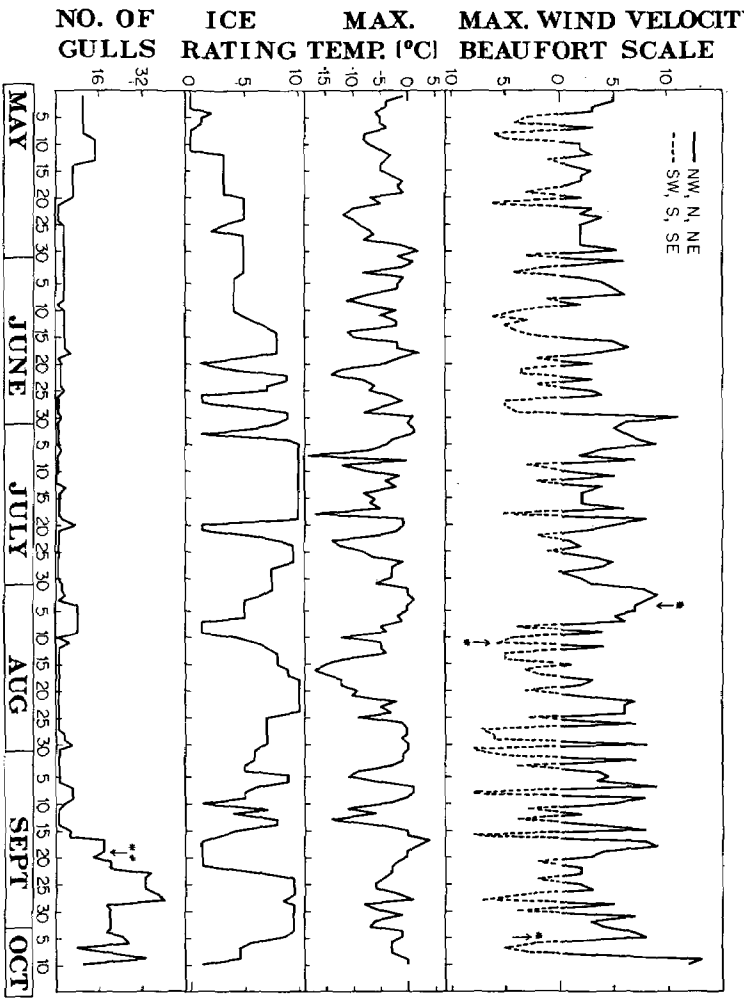


FIGURE 1 — Location of Palmer Station in Arthur Harbour, Anvers Island, Antarctica



* Northerly gusts up to force 12

** Onset of cannon-net baiting

Ice conditions: 0 = most of area and shorelines ice-free; 1 = area within 1 km mostly ice-free, possibly with pack ice beyond; 2 = loose brash and thin pancake ice with most shorelines ice-free; 3 = thickening of the ice with over 50% of the shorelines ice-free; 4 = ice almost completely frozen, together with less than 50% of the shorelines ice-free; 5 = only harbour area within 1 km of the station ice covered, but areas beyond mostly ice-free; 6 = area covered by pack ice with large areas of open water; 7, 8, and 9 = area covered by pack ice with small patches of open water of decreasing size; and 10 = no ice-free areas. Beaufort Scale (km/h): 0 = up to 1.6, 1 = 4.8, 2 = 11.3, 3 = 19.1, 4 = 28.8, 5 = 38.4, 6 = 49.6, 7 = 60.8, 8 = 73.6, 9 = 86.4, 10 = 100.8, 11 = 115.2, 12 = 217.6

FIGURE 2 — Relationship between climatic variables and gull numbers during the austral winter of 1979 at Palmer Station, Antarctica

RESULTS AND DISCUSSION

Observations of breeding gulls during the austral summers of 1978-1979 and 1979-80 clearly showed that their main food was the Antarctic limpet *(Nacella concinna)*, which the gulls captured in shallow coastal waters by plunging from short heights or by dabbling. Although Fraser (pers. comm.) noted a large winter population of gulls foraging for limpets at Palmer Station throughout the winter of 1976, limpets were not conspicuous and the number of gulls was small in the winter of 1979. Nevertheless, examination of three regurgitations and one stomach during the winter of 1979 showed that gulls were finding at least a few limpets. All garbage is sealed at Palmer Station and was not available to scavenging birds. Therefore, all inshore foraging of gulls depended on lack of ice cover.

Whereas about 50 gulls regularly breed on or near Bonaparte Point (Fig. 1), all but 5-10 gulls left the area in March 1979, when almost all limpets disappeared from shorelines. The breeding gull population did not return until 17 September, when the ice suddenly cleared (Fig. 2) and revealed thousands of limpets below the sea surface on all shorelines. Picken (1980) noted similar downward autumn migrations and synchronous spring spawns of limpets at Signy Island, 100 km north of Palmer Station. The 5-10 gulls stayed at Palmer Station until mid-May, when brash and pancake ice formed in Arthur Harbour. Thereafter, only 1-3 gulls were regularly seen until mid-September (Fig. 2). One colour-ringed bird remained all winter. It occasionally consumed raw station sewage that was pumped directly into Arthur Harbour, and it also foraged on limpets when available.

I did not find the large, stable winter population of territorial gulls that Fraser (pers. comm.) had found in 1976. Despite sudden reductions in ice cover on 20 June, 26 June and 3 July, gull numbers did not increase, but at the next ice-free period, 20 July, gull numbers increased rapidly from 2 to 9. The extra 7 birds departed when ice refilled the harbour 12 hours later. Sudden fluctuations in gull numbers in response to ice shifts were also observed between 3 and 10 August and 5 and 10 September (Fig. 2). Gulls were apparently associated with open water close to the station (ice condition 5 or less).

The influence of ice cover on the station's gull population was obvious on 17 September when winds created an unseasonable ice-free harbour and 18 gulls, including some colour-ringed breeders, suddenly appeared. These gulls remained, even though pack ice drifted into the harbour and new ice formed on 23 September. Cannon net baiting provided food for gulls from 19 September onwards, and 40 remained on 28 September when warm air temperature (1.0 °C) melted the freshly frozen surface ice that had held the old pack ice beyond Bonaparte Point (Fig. 2). On 29 September, overnight southerly winds had moved pack ice close to shore, and only 19 gulls appeared at the baiting.

Feeding was stopped on 1 October to see if the gulls would leave for lack of food. Only 5 birds appeared at a mock baiting on 3 October, although more were seen that day, and after 2 days of a severe, widespread storm, only 4 birds were present at 1330 on 6 October, a clear cold day with almost full ice cover. At 1630, the temperatures rose from −8.0 to −3.5 °C in less than 5 minutes, and north-eastern gusts (force 7) opened water west of Janus Island (Fig. 1) as freshly frozen surface ice melted. By 1730, as the winds moderated, 18 gulls were at the station; 15 minutes later, 27 gulls were there regurgitating limpet shells on the ice. I later inspected the western shore of Janus Island and found that limpets were near the surface. These observations demonstrate not only how the gulls are associated with open water, but also how inshore pack ice can prevent foraging.

Although ice cover was the ultimate factor influencing presence or absence of gulls inshore, weather was the proximate mechanism by affecting movements of pack ice. Because winters at Palmer Station are not alike, meteorological data had to be used to interpret winter observations of gulls. In some winters, winter pack ice remains solid after formation, but in 1979, ice conditions were highly variable. All nine of the sudden reductions in ice cover were attributed to north winds, especially north-easterly winds, usually of at least force 7 (Fig. 2). High winds in Arthur Harbour are therefore usually of the right direction to clear the harbour of ice.

In this study, wind-caused shifts in pack ice exposed gull feeding areas and resulted in sudden increases in numbers of gulls near Palmer Station, whereas decreases in open water resulted in lower gull numbers. Open water within the pack ice some distance away may have provided pelagic foods for the small population of gulls, which quickly moved into the harbour whenever the ice cover decreased. Similar observations of bird movements correlated with wind-caused changes in ice concentrations were noted at Cape Crozier, Antarctica, by Ainley *et al.* (1978).

While it is known that at least two banded juvenile gulls migrated from the Palmer area to Argentina and Chile (Parmelee, pers. comm.) and that juveniles and adults form separate groups before autumn migration, it is not known where the majority of birds of both age groups go. In contrast, despite greater pack ice cover, Faraday Base (Great Britain) reported no reduction of adult gulls throughout the seasons. Faraday Base, however, has an open garbage dump, as did Palmer Station until January 1976. The high winter population of gulls observed at Palmer Station by Fraser in 1976 may be attributed to the gulls foraging at the Palmer dump because too few limpets would have been available to support so many gulls in mid-winter. These observations and those made during the cannon net baiting show that the availability of winter food is very important.

Gulls that winter in Antarctica are closely associated with open waters, unless an artificial food supply is provided. Weather-caused shifts in pack ice affect the availability of inshore prey and so influence winter population levels of gulls near land. However, for a complete picture of the winter ecology of the gulls, studies are needed of how climate affects winter foraging of gulls at sea.

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CORRECTION

On page 277 of the Sooty Shearwater paper in *Notornis* 29 (1982) errors occur in two places. On line 20 for 'burrows/m^2' read 'burrows/100 m^2' and on line 34 the figures given for surface eggs are also per 100 m^2. The errors were of the authors' making.

JOHN WARHAM