Movements of prions *Pachyptila* spp. and low pressure systems at Marion Island

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ABSTRACT

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In the austral winter of 1975 great numbers of Salvin's Prions *Pachyptila salvini* and Fairy Prions *P. turtur* returned sporadically to Marion Island (46 57S, 37 45E). These influxes occurred, and ended abruptly, just before a severe cold front passed the island. It is suggested that prions moved south to avoid inclement weather and poor feeding conditions behind the front. Once south of the low pressure cell they would have been out of the cold front's path. After the front had passed and weather extremes had abated, the prions probably moved north again. In winter there is a regular procession of fronts in the Subantarctic and northerly and southerly movements by prions may be equally regular.

INTRODUCTION

Prions *Pachyptila* spp. breed in the austral summer mainly on islands in the Southern Ocean (Serventy *et al.* 1971). During winter they desert their breeding islands either completely (Dove Prion *P. desolata* (Tickell 1962)), or return sporadically (Fairy Prion *P. turtur*, and Broadbilled Prion *P. vittata* (Broekhuysen & Macnae 1949, Richdale 1965, Swales 1965)). In the winter of 1975 Salvin's Prions *P. salvini* and Fairy Prions returned occasionally to Marion Island (46 57S, 37 45E). These visits were spectacular events with prions massing offshore in great numbers. It appeared that the influxes were related to the passage of cold fronts at the island. This paper sets out to document this, and suggests a model of prion movements in the Subantarctic winter.

Both Salvin's and Fairy Prions breed at Marion Island (Rand 1954, Van Zinderen Bakker 1971). The observations mainly concern Salvin's Prion since it is by far the most abundant species.

METHODS

From 1 July to 31 October 1975 I kept a daily record of prion numbers at Marion Island. Relative abundance was expressed as a percentage with 100 % indicating very large numbers. This subjective index was considered adequate to show differences between days with and without prion influxes. Weather data were obtained from the meteorological station on the island and from daily synoptic charts (South African Weather Bureau). A detailed description of Marion Island is given in Van Zinderen Bakker *et al.* (1971).

RESULTS

Prion influxes during winter were spectacular. From one point on the shore certainly tens, if not hundreds of thousands of birds were visible at one time. Most prions were further than 0,5 km from the shore and flocks extended outwards at least several kilometres. Influxes lasted one to two days. On many days numbers increased during the day, and on two mornings an influx of prions had disappeared by the afternoon. Prions also frequently came ashore, usually at night but often also during the day. For example, on 26 July prions started moving inland at 14h30 and between 15h00 and 16h45 50 birds were caught in 40 m of mist net. On land, prions visited nest burrows and frequently circled nesting areas. It is not known if nests were prepared during these visits. Perhaps pair bonds and nest ownerships were re-affirmed; Dove Prion pair bonds and nests are maintained in successive years (Tickell 1962).

Fig. 1 presents a daily record of prion numbers. Days with 40 % or more abundance indicate obvious influxes. Smaller values of 5 - 39 % are considered unimportant because (a) they do not indicate big changes in numbers, and (b) some birds were seen every day towards the start of the breeding season (late October). There was an average interval of 4,7 ± 1,9 days between visits of 40 % or more abundance.

Influxes occurred just before substantial temperature decreases (Fig.2) caused by the inflow of polar air following a cold front (Taljaard *et al.* 1961). However, not all cold fronts were preceded by prion influxes. Great numbers of prions were observed usually before cyclones with pressures lower than 1 000 mb at the cell centres (Fig.2). These were relatively deep systems with strong invasions of cold air. Shallower systems with higher pressures were not followed by substantially lower temperatures or preceded by prions. The arrival of a cold front was heralded by the abrupt disappearance of prions 6 - 18 h previously.

Prion influxes largely occurred with north or north-west winds and seldom during southerlies or south-westerlies (Fig.3). South or south-west winds were cold winds and north to north-

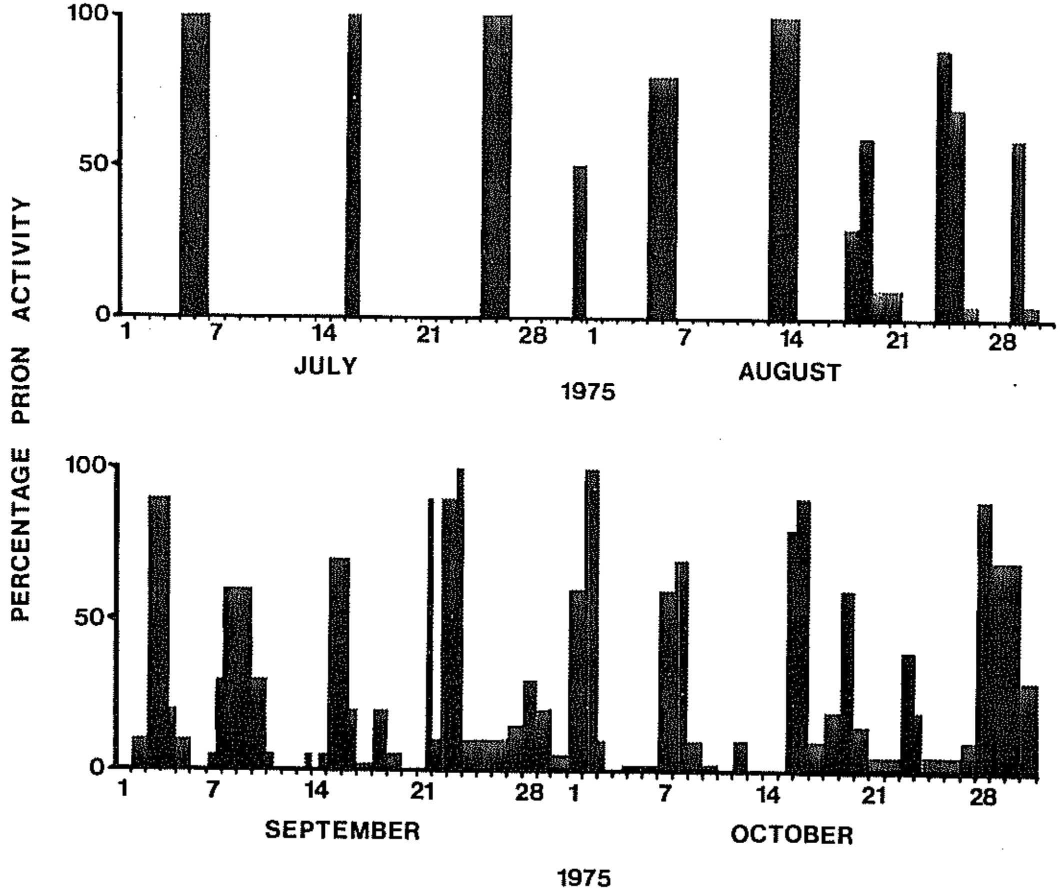

Figure 1

Daily prion *Pachyptila* abundance at Marion Island, 1975

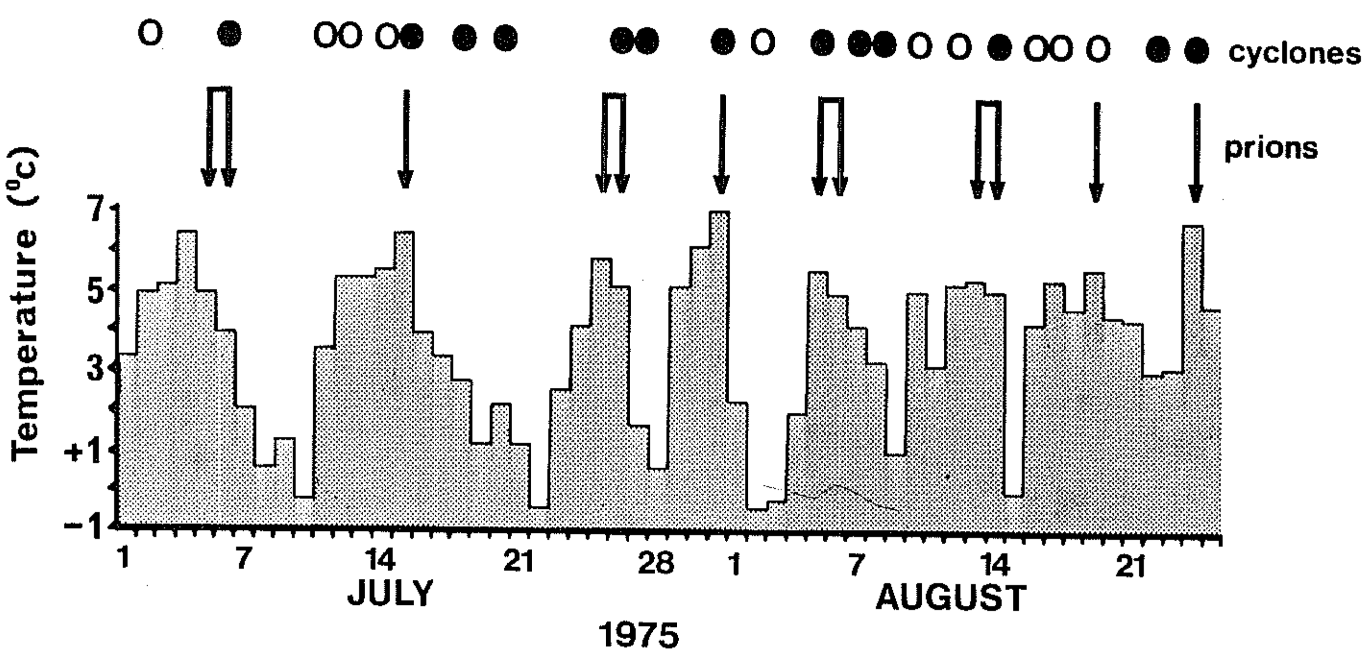

Figure 2

Mean daily temperature and the incidence of prion *Pachyptila* influxes (arrows) and cyclones (circles) passing Marion Island. Cyclones with pressures at the cell centre estimated as below 1 000 mb are indicated by solid circles; open circles indicate pressures above 1 000 mb

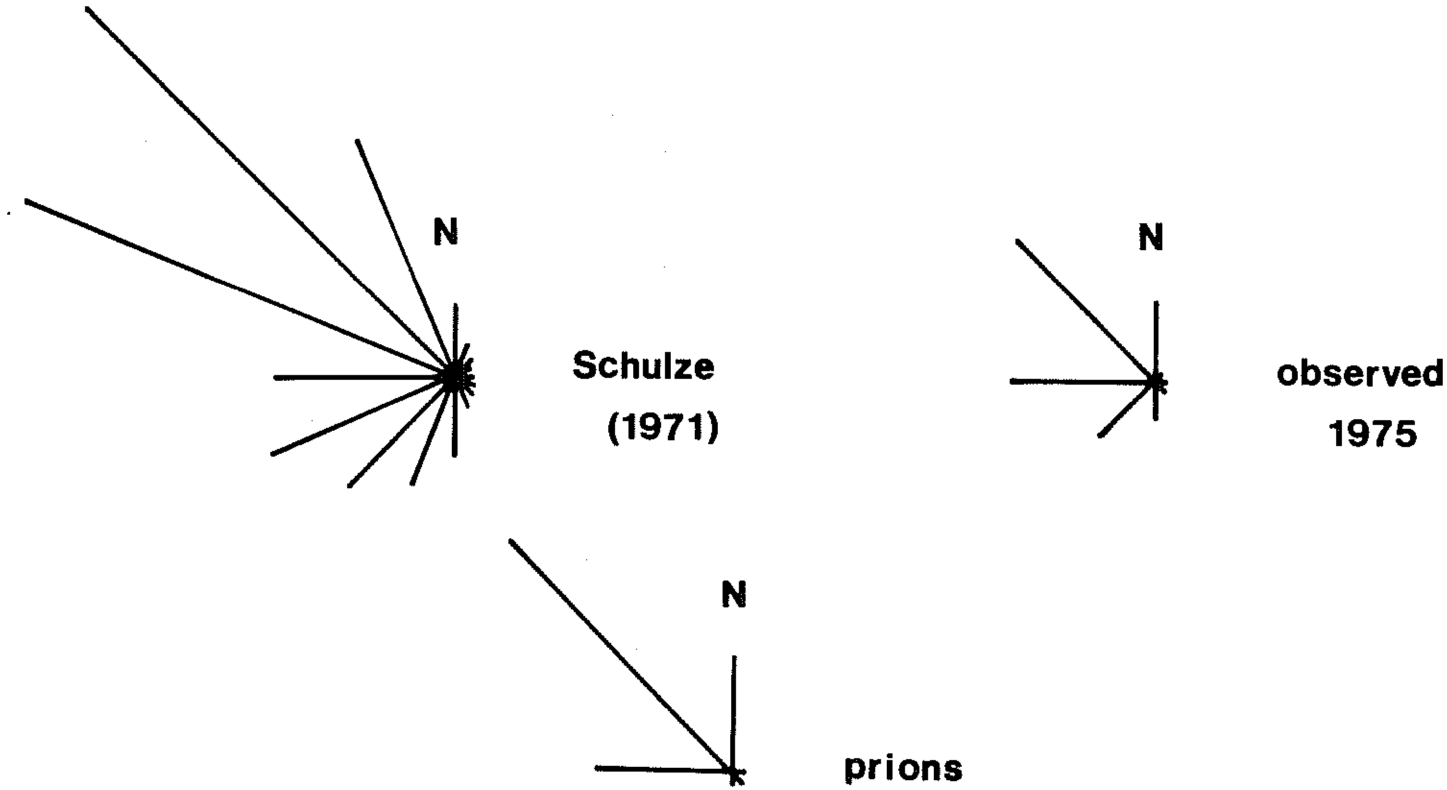

Figure 3

Wind roses at Marion Island for July to October over several years (after Schulze 1971), the 1975 study period, and for days when prion influxes occurred. The frequencies in the latter two roses differ significantly ($X^2_8 = 22,3$; $p < 0,005$)

west winds fed warm tropical air into the region (Taljaard *et al.* 1961, Schulze 1971).

In October 1975 Whitechinned Petrels *Procellaria aequinoctialis* began to arrive and breed at Marion Island. Greater numbers were observed on days when prion influxes were present suggesting a similar reaction to the passage of fronts.

DISCUSSION

It should be noted that the differences between deep and shallow low pressure systems are only relative (Taljaard *et al.* 1961). Thus the 1 000 mb criterion by which cyclones are classified in Fig. 2 is merely a convenient one that may not be useful in different latitudes and seasons.

The disappearance of prions before a cold front arrived suggests they actively avoided the front and its associated weather. Large-scale prion mortality during storms is well known (Serventy *et al.* 1971). Strong winds, within the average range of winds occurring at Marion Island, are alone unlikely to be hazardous. Prions were observed predominantly during north-westerlies which averaged stronger than south-westerlies (Schulze 1971). Temperatures behind a cold front were also not extreme, varying between *c.* -2^0 and $+2^0$ which is higher than average temperatures only 5 - 15^0 latitude further south. Perhaps strong wind and low temperature together on a 'wind-chill' basis pose an energetic stress for prions. Snow and soft hail (*graupel*) falls were often associated with cold fronts and these too might be hazardous.

Prions feed on crustaceans and cephalopods in the neuston (Tickell 1962, Serventy *et al.* 1971, Prince 1980). The neuston probably breaks up and disperses to deeper water in rough seas following a cold front (A. de Decker *in litt.*). Under these conditions prions would face a food shortage and be obliged to move accordingly.

The position and predominant winds of a model low pressure system on two consecutive days are shown in Fig. 4. It is suggested that prions move south on north and north-west winds out of the paths of cold fronts. South of the low pressure cells prions would be in an area of warm or occluded fronts. Weather conditions on either side of these fronts are not as extreme as those at cold fronts (Taljaard *et al.* 1961). After the passage of a cold front prions probably fly north to resume their previous geographical position. Weather conditions far behind a cold front are more moderate than those at the front itself, and winds in the region with a southerly component (Taljaard *et al.* 1961) would assist northerly movements by the prions.

The speeds at which low pressure systems and prions move are

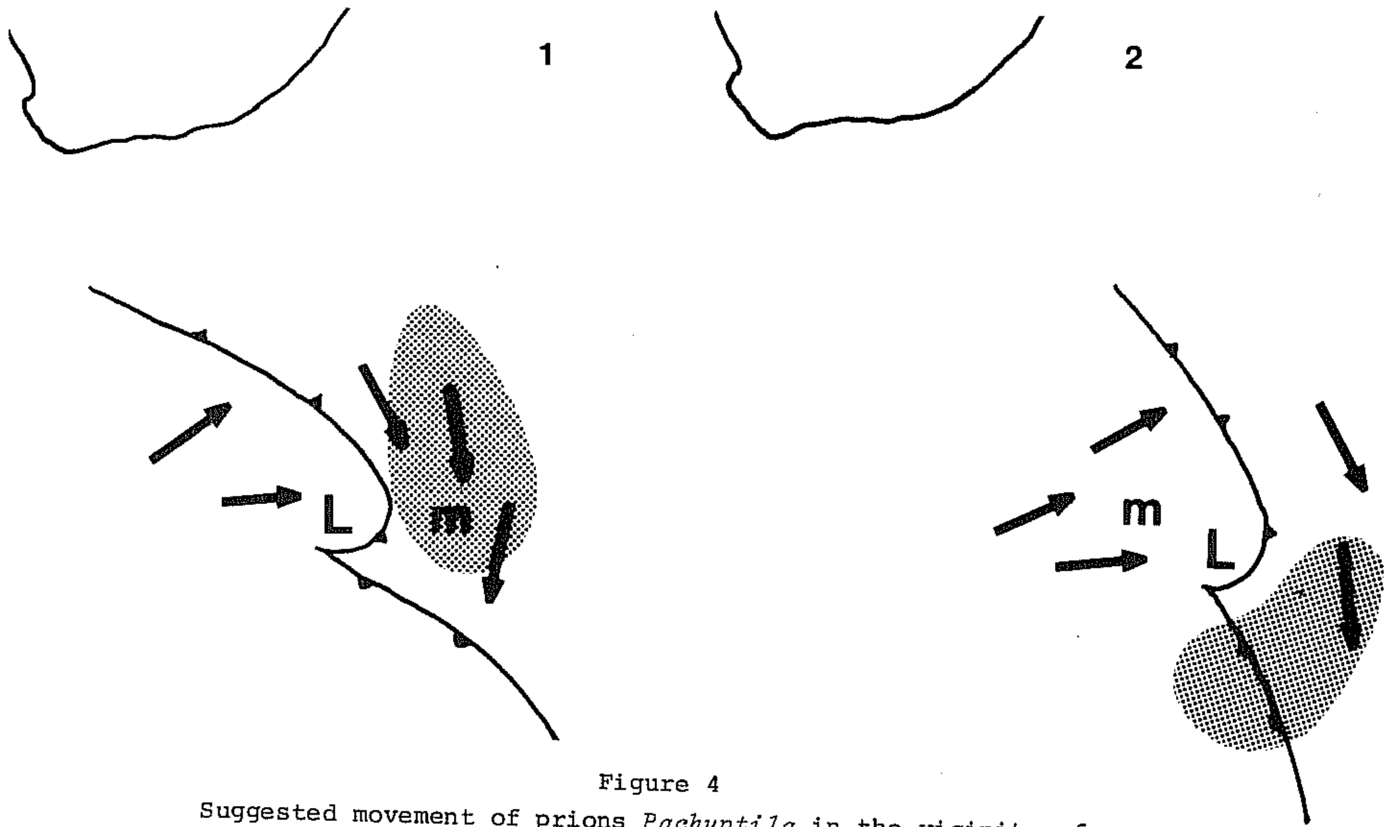

Figure 4

Suggested movement of prions *Pachyptila* in the vicinity of Marion Island (M) on two consecutive days. Prion flocks are stippled, predominant winds are shown by arrows, and conventional symbols indicate fronts crucial to this hypothesis. Cyclone speed is highly variable (Schulze 1971). Charts showing the daily positions of cyclone centres (South African Weather Bureau) indicate speeds of 300 - 1 000 km/day. It is to be expected that only those prions reasonably near the depression centre would attempt to move south, winds and temperatures further out being less extreme (Taljaard *et al.* 1961). Cold fronts may extend from Marion Island to the South African coast but I have observed that prions in this area do not disappear from the region of fronts. If prions vacate an area with an axis of 500 km (from the cyclone centre north along the cold front), they would have to move this distance within two to three days of the front arriving. Their presence at Marion Island one to three days before the front arrived indicates they can predict its advance by a suitable margin. In two days prions could fly 720 km, at a flight speed of 30 km/h (see Tickell 1962: 43) for 12 h/day. Flight speeds may be higher with a tail wind of 20 - 50 km/h (Schulze 1971). At these speeds and distances prions could conceivably move away from a front and back to their original position within five days.

Seabird movements in association with frontal systems are well known in the northern hemisphers (Manikowski 1971, Davenport 1975, W.R.P. Bourne pers.comm.). The land masses of North America, Greenland and Eurasia (and their respective topographies) influence pressure zones considerably and frontal movement is less uniform than in the Subantarctic (Crowe 1971). Between 35° S and 65° S there is an almost continuous belt of open ocean with a regular procession of fronts along roughly predictable routes (Schulze 1971). Considering these factors, regular winter seabird movements according to frontal patterns should be expected.

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The 1978/79 spring passage of Siberian Knot *Calidris canutus*

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ABSTRACT

The spring migration of Siberian Knot *Calidris canutus* was studied in a cooperative project of the Wader Study Group involving over 50 participants in 15 countries, from South Africa northwards to Finland. Regular counting at a network of estuaries showed that Knot occurred in large numbers at a few key estuaries, particularly the Anse d'Aiguillon in France and the Wattenmeer in Germany, and did not alight at some other sites known to be of importance to Knot during autumn migration. Migration from wintering grounds in South and West Africa was shown via the European Atlantic seaboard, Baltic Sea and Gulf of Finland. Studies by catching at three sites enabled the timing of migration to be related to fat accumulation and published flight range formulae, and the results were consistent with the long flights suggested by the estuary counts. It was suggested that a proportion of the Mauritanian wintering population migrated directly from there to the German Wattenmeer, and that the Knot occurring in France were probably those in least good body condition. Ringing recoveries indicated that South African birds predominated in France. In 1979, the migration was a week later than in previous years and the lightest birds probably had insufficient time to accumulate enough fat reserves to reach the breeding grounds. The German Wattenmeer, parts of which are under threat of reclamation, was shown to be the most important single staging area for Siberian Knot. The evidence suggested that Knot migrated from there directly to the breeding grounds without further fattening. The migration strategy of the Knot was discussed in relation to other species of wader wintering in Africa but following overland migration routes to the same breeding areas. It was suggested that the requirement of the Knot of an intertidal feeding habitat dictated the following of a longer but coastal route via western Europe.

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