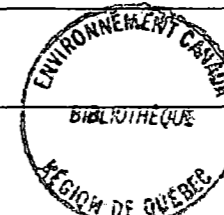


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Differences in the plumage patterns of Brant breeding in High Arctic Canada

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Abstract

Marking of flightless moulting Brant (*Branta bernicla*) in the Queen Elizabeth Islands, NWT, in 1973-75 showed that there were at least four breeding stocks in the Canadian Arctic, wintering as far apart as Mexico, the State of Washington, the US Atlantic coast and Ireland. Additional captures of flightless Brant in 1985-87 have extended and updated information on the relatively small differences in appearance of geese in these stocks. Between 1975 and 1987, the geese breeding on the Parry Islands (chiefly on Melville Island) and wintering in Washington tended to become paler, increasingly resembling those wintering on the US Atlantic coast and in Ireland. This does not seem to have been due to the immigration of Irish-wintering Brant to Melville Island, which had been predicted.

Introduction

The Brant (*Branta bernicla*) has a circumpolar breeding distribution in high latitudes, occurring in Greenland, Svalbard, Siberia, Alaska and Canada. There is considerable variability, between breeding populations, in the colour of the underparts (varying from very pale grey to nearly black) and in the extent of the "necklace" and "fan" patterns formed by white tips to the black feathers on the neck.

It used to be thought that the Brant of North America were of just two populations, wintering on the Pacific and Atlantic coasts respectively: the former were dark-bellied (*B. b. nigricans*) and the latter pale-bellied (part of *B. b. hrota*). During the 1970s and early 1980s, ringing and colour-marking of Brant in the Queen Elizabeth Islands and Foxe Basin showed that the situation was more complicated. Pale-bellied Brant breeding in the northeastern Canadian Arctic were found to winter in Ireland (Maltby-Prevett *et al.* 1975), whereas those wintering on the US Atlantic coast originated from Southampton Island and Foxe Basin (T. Barry, K.L. Abraham, A. Reed, unpubl.). Another relatively pale-bellied form, breeding chiefly on Melville Island, was found to winter in Puget Sound, Washington; and the majority of dark-bellied western Brant from northwestern Canada and Alaska wintered farther south on the Pacific coast, principally in Mexico (Fig. 1; see Bellrose 1981).

Boyd and Maltby (1979) compared information on the plumage of Brant breeding on the Parry Islands (the western Queen Elizabeth Islands) in 1973-75 with information on Brant plumage from other parts of Canada and from a study of museum specimens from parts of the breeding range outside Canada.

This note reports results of additional capture and marking of Brant carried out in northern Foxe Basin in 1985 and in the Parry Islands in 1985 and 1987. The new data confirm and extend the previous findings and suggest changes in the appearance of Parry Islands Brant between 1975 and 1987.

The recent studies were based, as was the work in 1973-75, on the capture of flightless moulting adult Brant using a helicopter (Maltby 1977). While the geese were being fitted with standard leg bands and colour marks (neck collars in 1974 and 1975, plastic leg bands in 1985 and 1987), notes were taken on the extent of the white feather-tips on the neck and of the base colour of the contour feathers on the upper belly, just below the border between the black neck and the belly. The colour was matched against standard chips included in the Munsell Soil Color Chart, hue 10YR, with colour values ranging from 2 (nearly black) to 7 (very pale grey) on the 8-point scale (Boyd and Maltby 1979).

There are great variations in the extent as well as in the colour of the dark belly feathers of Brant. Although the classification of colour from only a single area of the upper belly ignores most of the available information, more elaborate recording seemed to be ruled out by the need to keep handling time to a minimum to reduce stress on the geese, which is considerable (Boyd and Maltby 1979). Both the assessment of belly colour by matching against a chart and that of the extent of the white feather-tips on the neck involve judgements, rather than precise measurements. The necklace can vary greatly in appearance according to the way in which the goose holds its head while being handled, and the markings on the sides of the neck are often not symmetrical. Thus, the data are crude, although different observers seem able, with some practice, to assign very similar values to the belly colour and to assess the extent of the necklace and fan consistently. In 1973-75, the belly colour was assigned only to the nearest unit value on the chart. In 1985-87, values were interpolated to the nearest 0.1 to provide a more nearly continuous distribution of assigned values and hence a better assessment of means.

Boyd and Maltby (1979) described the methods of assessing necklace completeness and height. Four categories of completeness were used: 2.0 for complete encircling of the neck; 1.5 for incomplete at back or front; 1.0 for incomplete back and front; and 0.5 for very incomplete. In 1974 and 1975, the greatest height (in millimetres) was measured from the lower edge of the white feathering upwards to the limit of white. In 1987, for those birds on which a distinct necklace existed, its breadth was measured; for

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those on which the necklace was not clearly distinguishable from the fan above it, the entire height was used. (This change in measuring technique has exaggerated an apparent reduction in necklace size.)

In early August 1985, AR and HB caught and measured Brant on Bathurst Island and on Prince Charles and North Spicer islands in the northern part of Foxe Basin. From 6 to 12 August 1987, they marked and measured Brant on Melville and Prince Patrick islands (in the Parry Islands group); on 13 August 1987, they were unable to find any Brant still flightless on Bathurst Island.

Results

The similarities and differences in belly colour and necklace size between the different groups of Brant handled in 1985 and 1987 are summarized in Table 1 (means and standard deviations) and Figure 2 (percentage frequency distributions). Table 2 compares the appearance of geese from other islands with those from Melville Island, where the largest numbers of Brant were found and which seems to be the principal home of one population.

Earlier recoveries of banded Brant (Boyd and Maltby 1979) showed that most birds from Melville and Prince Patrick islands winter together in Puget Sound or along the Pacific coast south to Mexico; most of those from Bathurst Island winter in Ireland; and Brant from Foxe Basin winter on the US Atlantic coast. It might therefore be expected that the Brant from Prince Patrick Island would closely resemble those from Melville Island: that was the case in 1987, although they tended to have paler bellies and taller necklaces. As Bathurst Island is only 60 km east of Melville Island, whereas North Spicer Island is about 1180 km and Prince Charles Island 1250 km to the southeast, it might also be expected that the Brant of Bathurst Island would more closely resemble those of Melville Island than those of Foxe Basin islands. That is less certainly the case. In 1985, Bathurst Island geese tended to be markedly paler than Melville Island Brant; the great majority of them had necklaces interrupted both back and front; and the necklaces of females were smaller than those of Melville Island Brant.

Table 1

Mean belly-colour values and necklace heights of moulting adult Brant captured on Prince Patrick and Melville islands in 1987 and on Bathurst, Prince Charles and North Spicer islands in 1985*

Capture location	Belly colour			Necklace height (mm)					
	(n) [†]	Mean	SD	Males			Females		
				(n)	Mean	SD	(n)	Mean	SD
Prince Patrick Island	(47)	4.36	0.48	(40)	32.8	8.2	(32)	28.0	8.0
Melville Island	(377)	4.17	0.55	(96)	24.1	18.3	(125)	27.1	9.7
Bathurst Island	(42)	4.98	0.92	(20)	22.8	10.8	(20)	14.3	3.9
Prince Charles/ North Spicer islands	(78)	4.76	0.34	(39)	18.0	8.1	(39)	15.0	4.7

* Belly colours of males and females taken together; necklace heights of males and females tabulated separately.

[†] (n) = sample size.

Table 2

Characteristics of belly colour, necklace height and completeness of necklace of moulting adult Brant caught on Prince Patrick Island in 1987 and on Bathurst, Prince Charles and North Spicer islands in 1985 in relation to plumage characteristics of those examined on Melville Island in 1987

Capture location	Belly colour	Necklace height	Necklace completeness
Prince Patrick Island	Paler	Taller	Similar
Bathurst Island	Much paler	Similar	Less complete
Prince Charles/ North Spicer islands	Paler	Shorter	More uniform

From the small samples examined in 1985, it is not possible to differentiate between the Brant of Bathurst Island and those of northern Foxe Basin. Boyd and Maltby (1979) measured no live specimens from Foxe Basin and obtained only belly-colour data from Bathurst Island. From limited museum material collected on Southampton and Baffin islands, not Prince Charles or North Spicer islands, they concluded that Foxe Basin Brant were nearly as pale as those from the eastern Queen Elizabeth Islands, with necklaces of much the same height and completeness. The 1985 data are consistent with those inferences.

Changes in the belly colour of Brant over time

Among 22 Brant captured in 1973–74 and recaptured in 1974 or 1975 for which the belly colours were noted on each occasion, 16 (2, colour value 2; 6, colour value 3; 4, colour value 4; and 4, colour value 5) showed no change, 2 originally classed as colour value 4 were classed on recapture as colour value 3 (darker) and 4 were subsequently classed as colour value 5 (lighter).

The distribution of colour values in samples from one stock in different years may reflect either variation in the colour of the same surviving individual or changes in the composition of the group due to births and deaths or immigration and emigration. Boyd and Maltby (1979, Table 7) reported substantial differences between the belly colours of Brant on Melville and Prince Patrick islands in 1973, 1974 and 1975. Very dark-bellied geese were more frequent on both islands in 1973 than in 1974, when there

were disproportionately few dark-bellied and unusually many light-bellied Brant in the Melville Island samples. In 1975, the Melville Island distribution resembled that of 1973.

The relative frequencies of different belly colours of Brant recorded on Melville and Prince Patrick islands in 1987 are compared with those in 1973–75 in Figure 3. On Melville Island, the modal value was 4 in three of the four years of record, with a much higher proportion at that value in 1987 than in the earlier years. Some of the apparent variation between years on Prince Patrick Island may be due to the presence of moult migrants. The relative frequencies of different belly colours of adult females with brood patches are shown separately in Figure 3 (dashed lines). (No females with brood patches were caught in 1974: this does not mean that no "residents" were present, but reflects unsuitable conditions for breeding that year because of very late snowmelt.) The relative frequencies of different belly colours among breeding females were similar to those in the entire sample in 1987 and not very different in 1975. In 1973, there were proportionately fewer darker (colour value 2) or lighter (colour values 5, 6) breeding females than in the entire sample.

The distribution of High Arctic Brant on the islands on which they breed is very poorly known, because their nests are highly dispersed, often well inland, and because they are hard to find, so that censuses would be difficult and very expensive to perform. After the young hatch, throughout the period of adult wing moult and probably until the time of departure in August, groups of Brant assemble on sedge meadows close to the coast or around lakes with feeding areas close by. Evidence from recaptures suggests some tendency for individual geese to reoccupy the same areas in different years, although movements of 60–100 km between sites on Melville Island have also been detected. It is therefore of interest to examine whether the frequencies of different belly colours in different regions of Melville Island have fluctuated, independently or in phase. The catch sites in 1973–75 were mapped by Boyd and Maltby (1979, Fig. 1). Catches in 1987 were similarly concentrated in the east of the island, where most of the suitable lowland wetlands occur.

For comparative purposes and in order to assemble numbers large enough not to be too greatly affected by chance, it seems appropriate to assemble the Melville Island belly-colour data in two regional groupings: (1) Hecla and Griper Bay which includes all sites around Sabine Bay, from Nias Point in the south to Macdougall Point in the northeast; and (2) Byam Martin Channel, from Bridport Inlet on the southeast coast to Eden Bay near the northeastern tip of the island. Figure 4 shows that in 1975 and 1987, the relative frequencies of different belly colours were nearly identical in these two regions, although very different between those years. In contrast, in 1973 and 1974 the distribution patterns were very different, with high proportions of dark geese in BMC in 1973 and in HGB in 1974 and with a very

high proportion of light geese in BMC in 1974.

There are no apparent differences between the original groups in the distribution of completeness and height of necklace.

Discussion

Some differences will be found between any sets of data, particularly when, as in this case, the measurements involve subjective ratings and the assessors are different. The interest in the material described here stems from the demonstration by Boyd and Maltby (1979, Table 6), based on the recovery locations of Brant banded in 1973–75, that the geese found in any one of the three wintering areas (Mexico-California; Washington-Oregon; and Ireland) tended to differ in appearance from those found in the other wintering places: those in Mexico were dark-bellied (all colour value 3), those in Ireland were predominantly light (mode 5, mean 4.9) and those in Washington were intermediate (modes 4 and 5, mean 4.4).

Boyd and Maltby (1979) speculated that the Parry Islands Brant, the form breeding principally on Melville Island and wintering mostly in Puget Sound, was under threat from the intrusion of Irish-wintering Brant from the east and from (probably irregular) influxes of dark-bellied moult migrants originating farther south, (e.g., from Banks Island and perhaps also from Wrangel Island and Siberia).

If "swamping" of the local breeding population were occurring, it would have been expected that by 1987 the distribution of different belly-colour frequencies among the females with brood patches (i.e., identifiable residents) would have become more skewed in favour of darker-bellied (western) or lighter-bellied (eastern) forms. That has not happened: the preponderance of colour value 4 has increased, although the coefficient of variation has also increased (1973—18.75; 1974—19.47; 1987—25.89). Had the growing population of Irish-wintering Brant, breeding from Bathurst Island eastward, expanded on to Melville Island, geese with colour values of 6 as well as geese marked on Bathurst Island in 1984–86 should have been found there in 1987: none were caught.

Boyd and Maltby (1979) urged that additional protection be given to Parry Islands Brant by reducing the heavy hunting pressure in Puget Sound, which had helped to cut the numbers of Brant wintering there from a mean of 21 000 ± 5700 in 1955–65 (peak 34 200 in January 1964) to a mean of only 6700 ± 2500 in 1970–75 (low 4300 in January 1974). By the time that plea appeared, action had already been taken by the State of Washington and the US Fish and Wildlife Service to restrict hunting in Puget Sound to periods when migrants, en route to Mexico, were present. There was at first an encouraging response (Fig. 4), but the increase to 18 100 in January 1978 has not been sustained, the mean in 1980–85 being only 7500 ± 2800, with a low of 3100 in January 1983. Thus, this distinctive group of grey-bellied Brant remains very small, although capable of breeding successfully, as in 1987.

Acknowledgements

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Figure 1A
Breeding areas of Brant in Canada

Ranges of 4 principal breeding groups, wintering respectively (a) on Pacific coast, from British Columbia to Mexico (black); (b) the "Parry Islands Brant", wintering chiefly in Puget Sound, Washington, with same as in (a) or (d) (grey); (c) on U.S. Atlantic coast; and (d) in Ireland. The shading is conventional, including all coasts of islands (except Baffin I.) where breeding seems to occur regularly, although large parts of the coasts of some are unsuitable. Overlapping of ranges occurs, especially between groups (a) and (c), around Queen Maud Gulf.

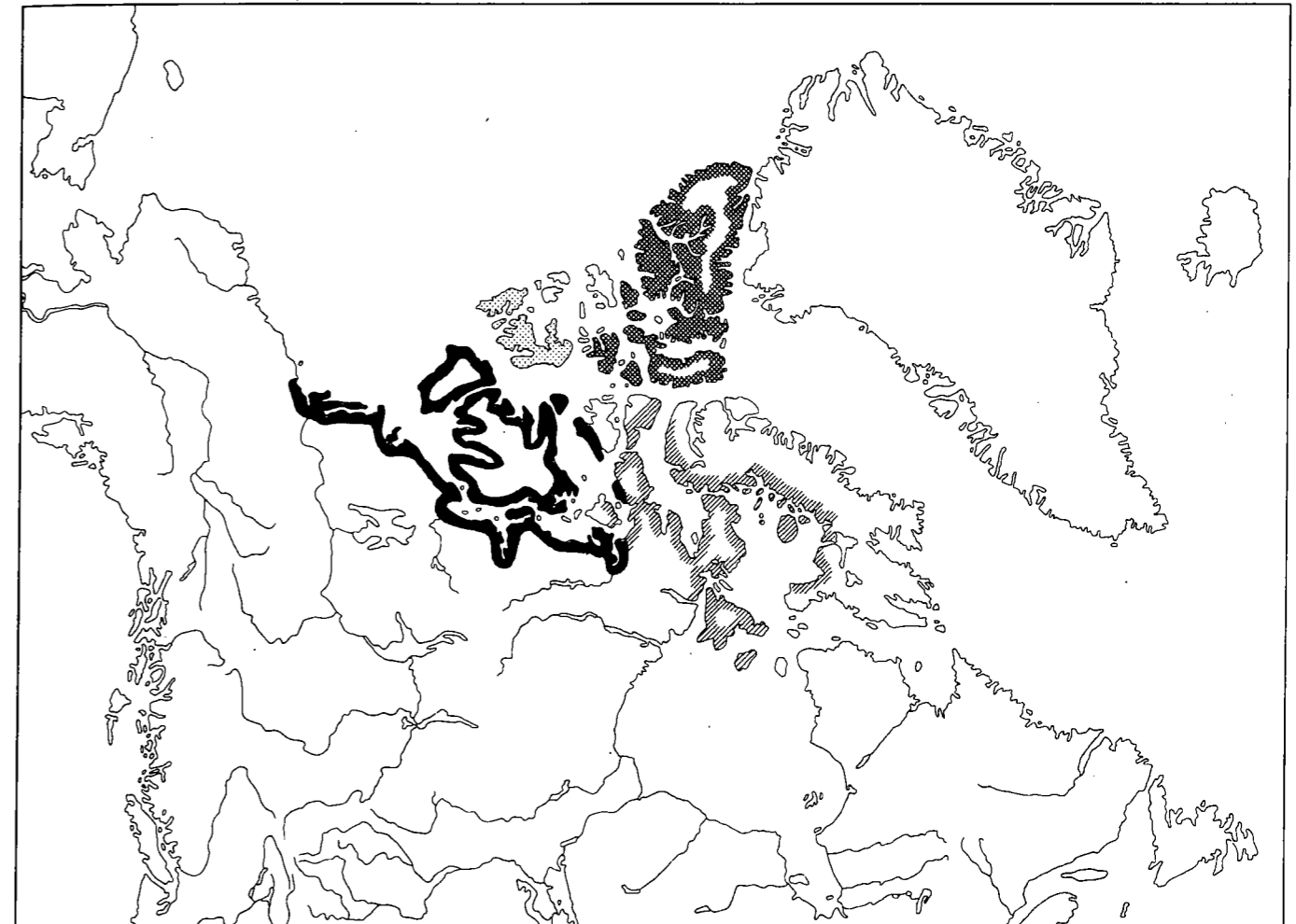


Figure 1B
Islands where moulting Brant used in this study were caught and other names referred to in the text.

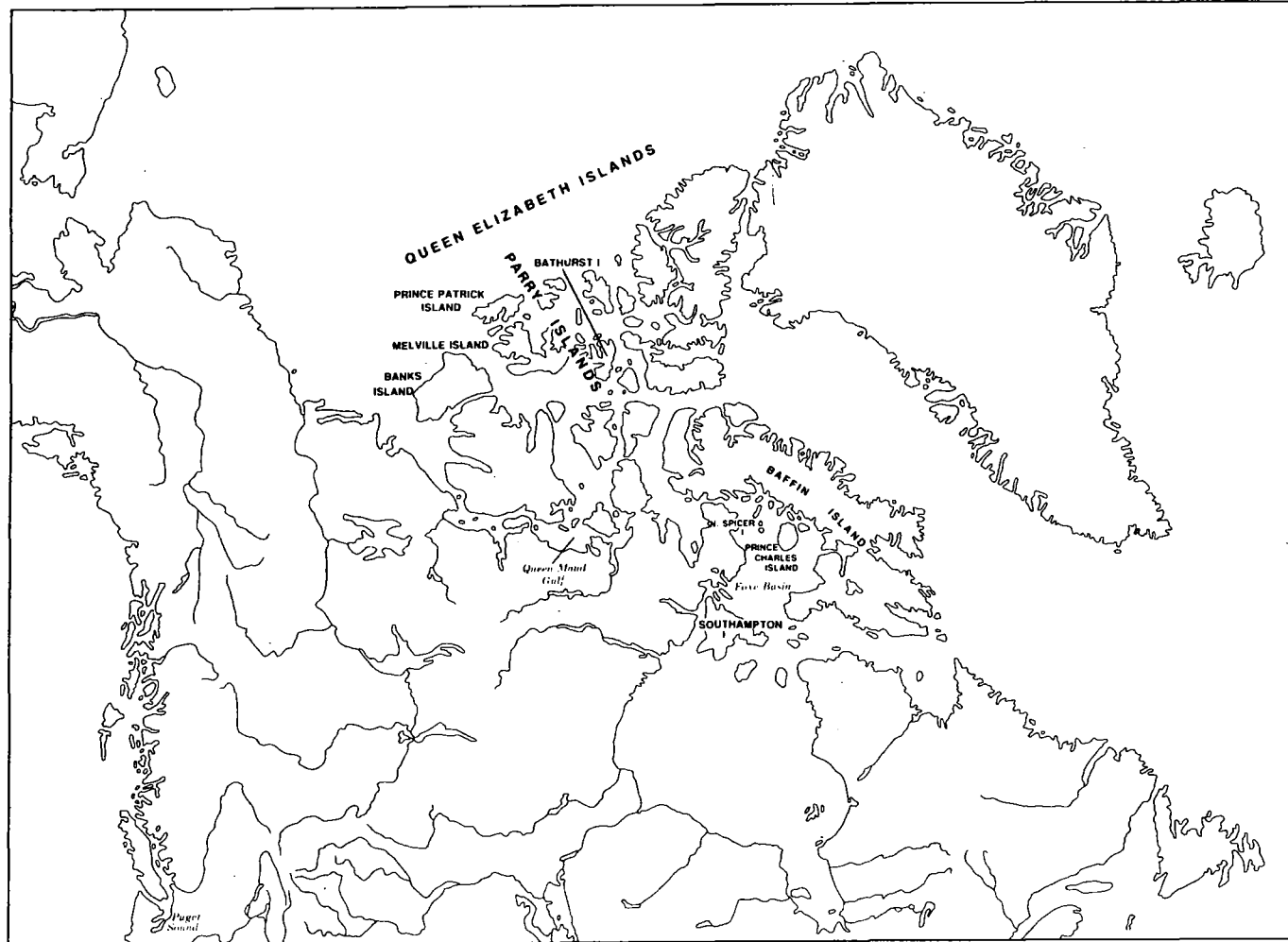


Figure 2
Frequency distributions (as percentage of island sample) of necklace height, necklace completeness and belly colour of moulting adult Brant on Prince Patrick (1973-74, 1987), Melville (1973-75, 1987), Bathurst (1955), Prince Charles (1986) and North Spicer (1985) islands.

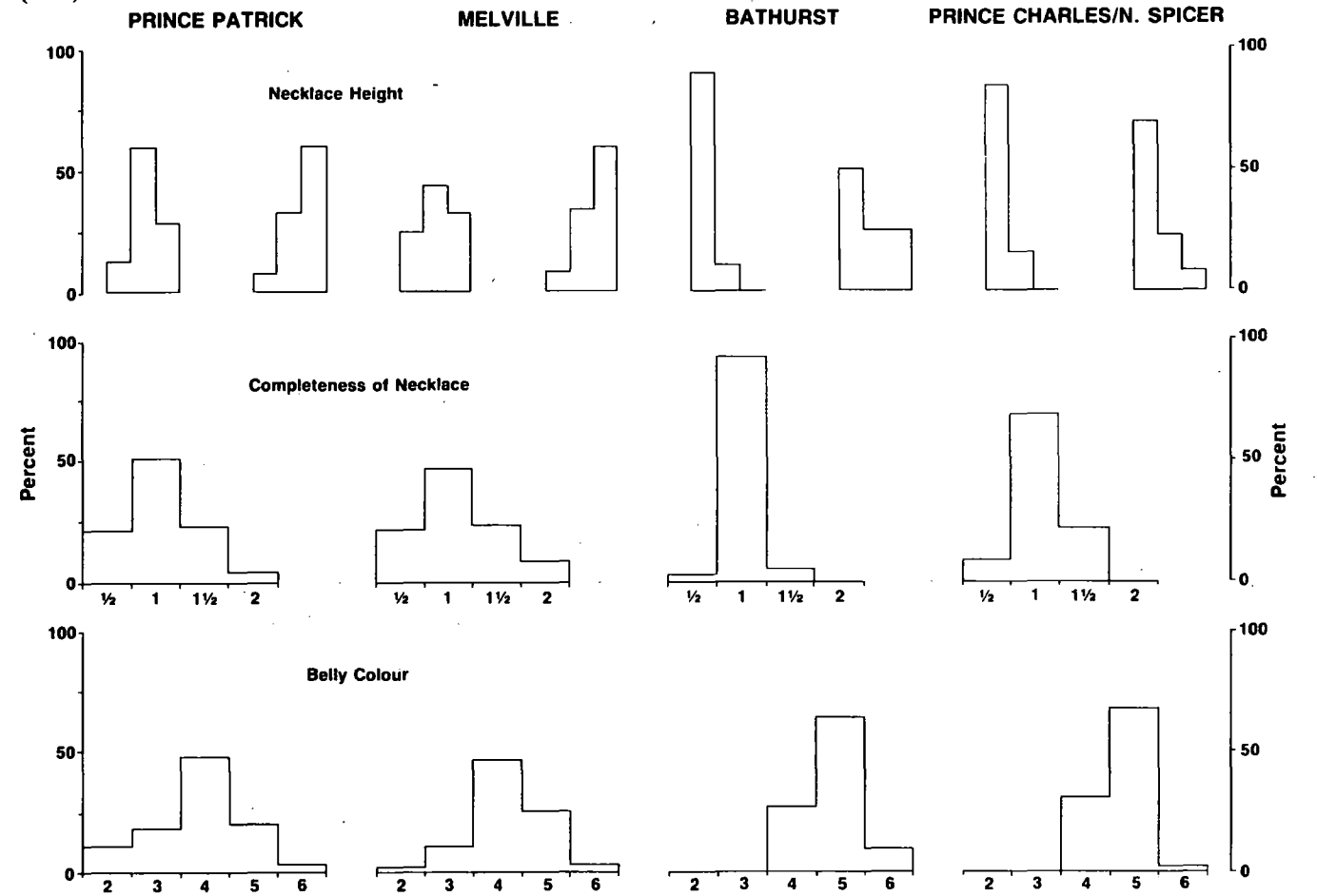


Figure 3
Frequency distribution (as percentages of island sample) of belly colour of moulting adult Brant caught in different years on Melville and Prince Patrick islands.

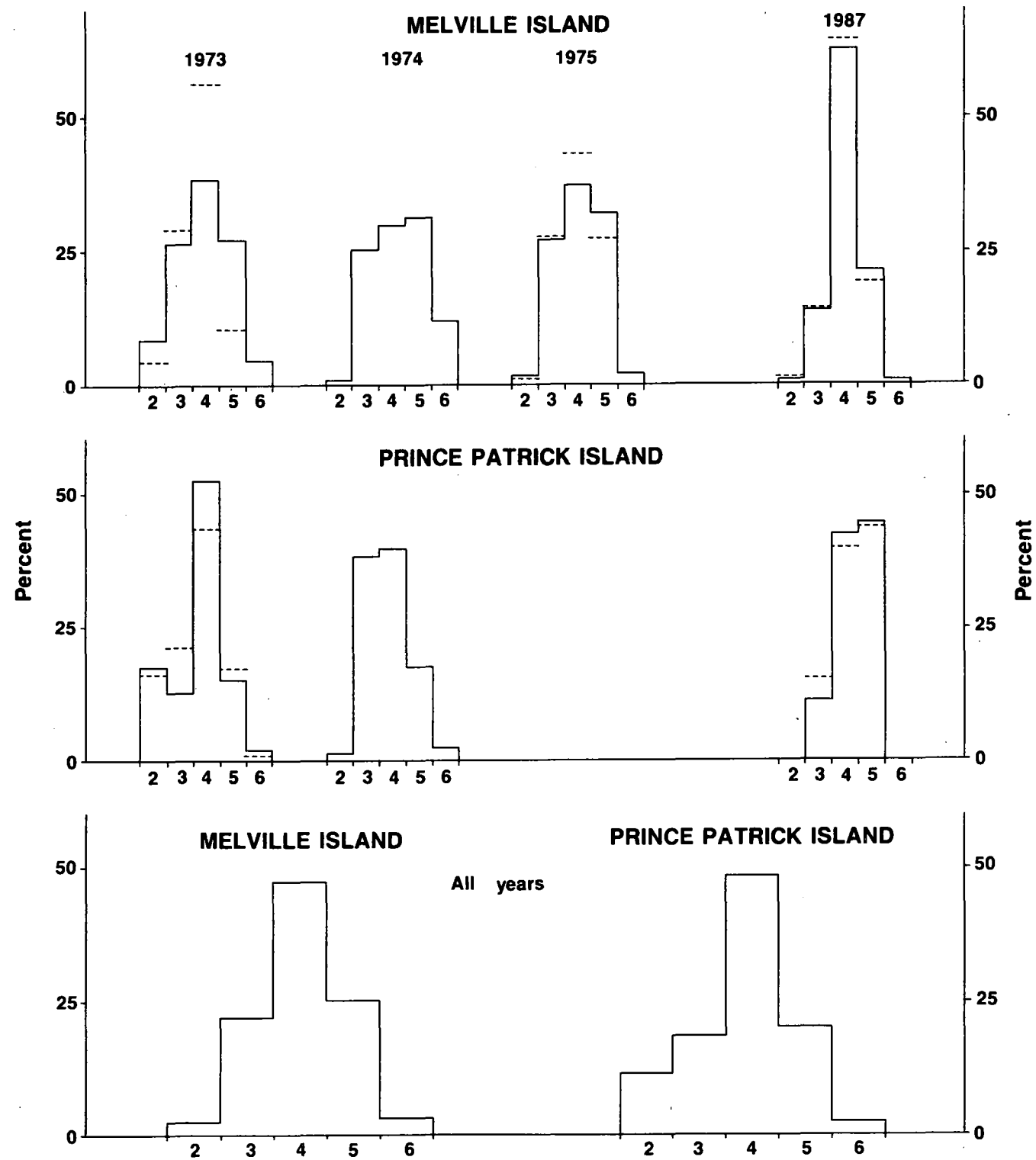


Figure 4
Frequency distributions (as percentages of regional samples) of belly colour of moulting adult Brant caught on eastern Melville Island in 1973, 1974, 1975 and 1987. H & G = shores of Hecla and Griper Bay; BMC = shore of Byam Martin Channel and Parry Channel.

