

DISTRIBUTION AND POPULATION CHANGES IN THE WANDERING ALBATROSS *DIOMEDEA EXULANS* AT SOUTH GEORGIA

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1. INTRODUCTION

Tickell (1968) estimated the total breeding population of Wandering Albatross *Diomedea exulans* L. at South Georgia (Fig. 1) in the early

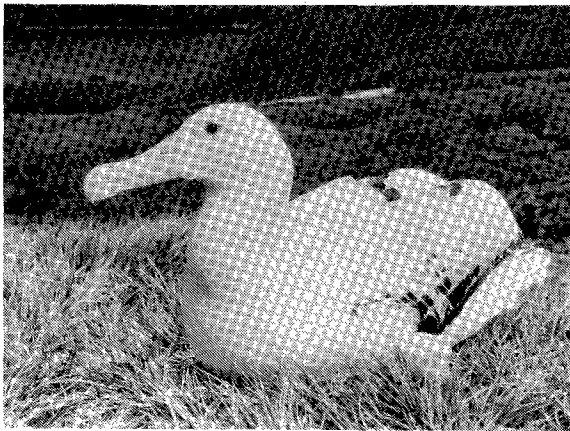


Fig. 1. The Wandering Albatross at South Georgia.

1960's to be about 4600 pairs. Three quarters of this total was at Bird Island and Tickell cited only six other known breeding sites elsewhere on South Georgia. The purpose of this paper is to review the recent counts of the Bird Island population and to give details of the other breeding localities of the species at South Georgia. Following Smith & Tallowin (in press) on King Penguin *Aptenodytes patagonica* this forms the second paper in a series on the current status of South Georgia birds, a general review of which has been provided by Prince & Payne (1979).

2. RESULTS

The location of all breeding sites referred to, and an indication of the size of their breeding population in any one season, is shown in Fig. 2. Numbers refer to those used to designate the South Georgia colonies in the text. For more accurate location information reference should be made to the Department of Overseas Surveys Map 610 (1958).

1. Bird Island

To maintain comparison with Tickell's (1968) work a census of the breeding population has been taken at Bird Island on 31 January each year since 1972 (except 1975 when the field station was unoccupied). Tickell demonstrated that on average 6.9% of breeding pairs have failed (i.e. lost their eggs) by this date and the totals of breeding pairs (Table 1) are census totals corrected by this amount. Since Wandering Albatrosses that raise a chick to fledging breed only every other year (Tickell 1968) to calculate the total breeding population it is necessary to know the number of birds breeding in year n that are unsuccessful and breed also in year $n+1$. Tickell (1968) showed that 20% of pairs do this at Bird Island and the figures for the total population, both at Bird Island and (as there is no other detailed information available) for all other sites listed (summary in Table 4), have been calculated on this basis.

2. Nameless Point, Right Whale Bay

At the end of December 1976 eight breeding pairs were observed (D.I.M. Macdonald *in litt.*).

Table 1. Wandering Albatross breeding populations at Bird Island

Year	Breeding pairs	Total breeding population (pairs)	Breeding success (% egg to fledging)
1961	1954	—	—
1962	1922	3165	—
1963	1666	3204	58.7
1964	2093*	3213	—
1972	1563	—	—
1973	1460	2710	—
1974	1511	2769	—
1976	1416	—	59.9
1977	1523	2656	53.2
1978	1365	2583	70.1
1979	1449	2541	—

* 266 eggs removed early in previous season, resulting in large number of rebreeders in 1964.

3. Reef Point, Right Whale Bay

Rankin (1951) reported 10 breeding pairs in 1946/47 but none were recorded on a visit to this locality in 1976/77 (D.I.M. Macdonald pers. comm.) and it may be that this locality is effectively the same as the preceding one.

4. Bay of Isles

The many tussock-clad islands in the Bay of Isles offer favourable breeding sites for Wandering Albatross and a ground count was made by Rankin (1951) in 1946/47 when he recorded a total of 421 breeding pairs (Table 2).

With the exception of the visit by F. S. Todd to three islands in April 1977 no ground counts have been made since then. In three recent seasons, however, aerial photographs have been taken from helicopters by the flight crews of HMS Endurance to enable estimates of the numbers of incubating albatrosses to be made. In 1975/76 the photographs were taken obliquely and from c. 250 m above ground with a 150 mm Hasselblad. Although albatrosses could be counted with considerable accuracy on the small islands no reliable figures could be derived for the two larger islands, Prion and Albatross. Tern Island and Hogs Mouth Rocks were photographed only in this season. In 1976/77 and 1977/78 a Williams on F 49 Mk 2 camera with 150 mm lens was used to take vertical photographs from c. 300 m with approximately 60% overlap between successive frames and 20% between adjacent strips. For counting purposes these photographs were viewed in stereoscopic pairs. Even with these large birds and photographs from relatively low altitude it was often difficult to determine whether birds were merely standing or sitting on a nest and, if sitting, impossible to tell whether they were incubating or not. Some birds could be eliminated from the count by detecting their movement over a series of successive frames. The photographs were interpreted inde-

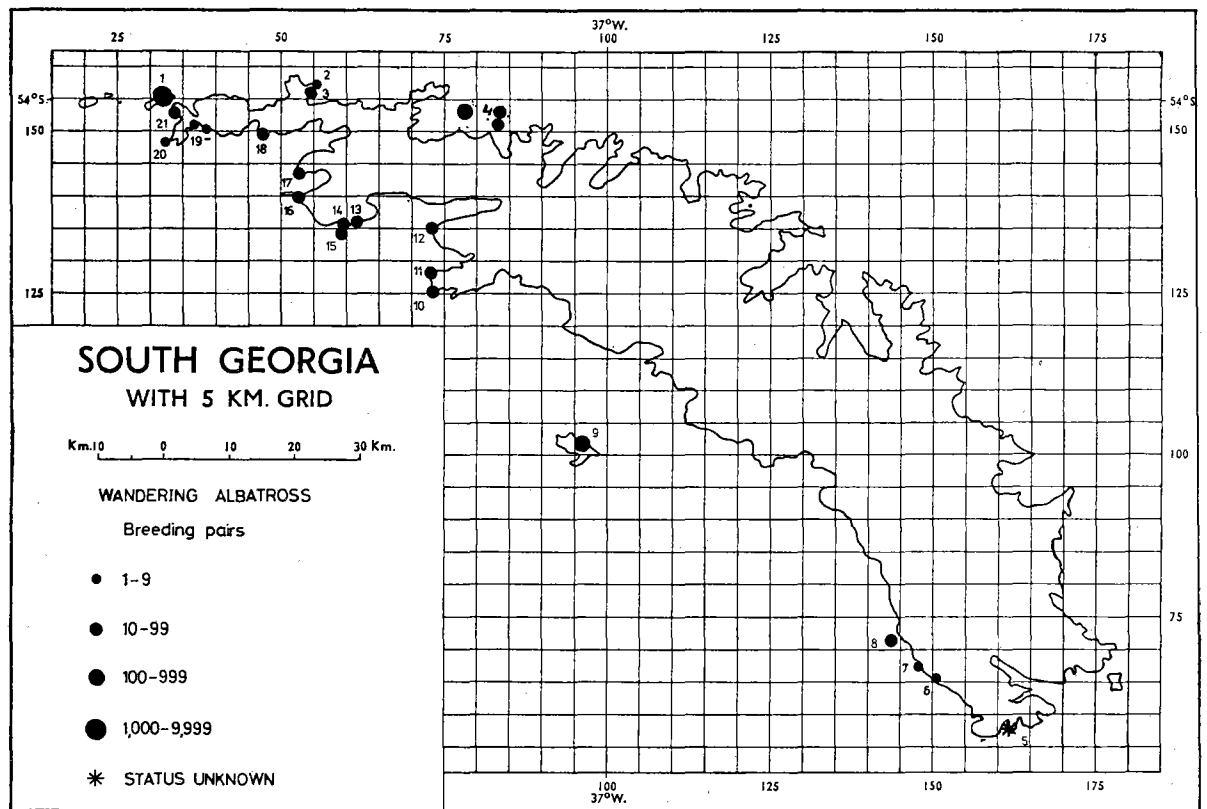


Fig. 2. Breeding stations of Wandering Albatross at South Georgia.

Table 2. Wandering Albatross breeding populations in the Bay of Isles. Uncorrected counts in parentheses

Island	Season: 1946/47	1975/76	1976/77		1977/78
	Date: Dec/Jan Method: Ground	10.1.76 Photo	22.12.76 Photo	2—12.4.77 Ground	28—30.12.77 Photo
Albatross	159	—	152 (220)	142	145 (210)
Prion	100	—	59 (85)	61	62 (90)
Outer Lee	48	28 (40)	28 (41)	—	28 (41)
Inner Lee	23	8 (12)	13 (19)	22	14 (21)
Crescent	31	10 (15)	11 (16)	—	6 (9)
Mollyhawk	21	8 (11)	5 (7)	—	10 (14)
Invisible	15	6 (8)	6 (8)	—	6 (8)
Skua	16	2 (3)	1 (2)	—	1 (2)
Petrel	8	1 (2)	2 (3)	—	1 (1)
Tern	—	0	—	—	—
Hogs Mouth Rocks	—	1 (2)	—	—	—
Total	421		277 (401)		273 (396)

pendently by two individuals and any discrepancies resolved by further inspection. The counts for the three seasons are given in Table 2. To estimate the number of sitting but non-incubating birds vertical aerial photographs at c. 300 m of a small part of the Bird Island breeding area were taken on the same day as an accurate ground count was obtained. Stereoscopic interpretation of the photographs gave a total of 90 birds and the ground count revealed 62 breeding birds, giving an overcount value of 45%. This correction figure was then applied to the Bay of Isles counts and the results of this are also shown in Table 2. It is reassuring that the corrected values for the two most important islands are in good agreement with the ground counts made by F. S. Todd (*in litt.*) in 1976/77. His field counts (Albatross 103, Prion 44, Inner Lee 16) have been converted to the original number of breeding birds by using the mean value (of the last three seasons) for Bird Island breeding failures to 1 April of 27.7% (Croxall & Prince *in press*).

Todd's count at Inner Lee agrees less closely with the corrected value from the photographs and this is probably attributable to the fact that small breeding populations have proportionately fewer associated nonbreeders than larger populations. Thus the mean annual breeding population of 275 pairs from the last two season's corrected figures is probably a slight underestimate and the true value likely to be about 300 pairs.

5. Smaaland Cove

A few birds were observed here by R. I. Lewis Smith (*pers. comm.*) on 5 January 1971 but breeding was not confirmed.

6. Trollhul

On 20 December 1976 three birds were observed on coastal headlands immediately to the north of Trollhul sitting on nests which did not contain eggs (J. Tallwin *in litt.*). At Bird Island the peak laying date is not until 24 December (and the latest date is 17 January) so it is quite probable that these Trollhul birds would have laid.

7. Ranvik

One adult was incubating on the southern promontory of Ranvik on 6 February 1977 (D. M. Birkett *in litt.*).

8. Kuprianov Islands

On the north west island of the group on 20 December 1972, 15 nests were found, six containing chicks, at least one of which was on the verge of fledging. Seven pairs of adults, mostly displaying, were also present (Tallowin *in litt.*). Allowing for egg and chick mortality it is likely that about 10 pairs breed annually. Eight birds were also observed on the island to the south-west on 28 November 1976 (British Antarctic Survey records).

9. Annenkov Island

The geological field party that worked on the island during the 1972/73 austral summer noted breeding Wandering Albatrosses in three areas of the island. Numbers of breeding pairs were estimated as follows (E. Lawther *in litt.*): north west area c. 200 pairs, south west point 30 pairs, south west area 60 to 70 pairs. The annual breeding population is thus in the region of 300 pairs.

10—11. Nunez Peninsula

R. I. Lewis Smith (*pers. comm.*) on 30 December 1970 recorded about 10 pairs on the islands of Semla Reef (colony 10) and 10—20 pairs on two other headlands further south towards Cape Nunez (colony 11), but in neither case was breeding positively confirmed.

12. Cape Rosa

The existence of breeding birds here was recorded by Shackleton (1919), whose party took several individuals for food. R. I. Lewis Smith (*pers. comm.*) on 29 December 1970 estimated that about 30 pairs were breeding but in late December 1976 only 4 breeding pairs were located (D. I. M. Macdonald *pers. comm.*).

13. Nilse Hullet

About 20 pairs were seen by R. I. Lewis Smith (*pers. comm.*) on 31 December 1970 although it was impossible to confirm breeding.

14. Mainland opposite Samuel Islands

On 31 December 1970 R. I. Lewis Smith recorded about 30

birds on nests, most containing eggs, on the cliff tops opposite the Samuel Islands. In the same area J. Hall (*in litt.*) on 23 January 1977 counted 25 nests containing eggs, 3 adults on nests without eggs and eleven other birds. One breeding adult had been ringed as an adult on Bird Island in 1960/61 and had bred there in 1972/73. To the east of the Samuel Islands M. R. Payne (*in litt.*) saw six birds during a helicopter flight on 14 December 1973.

15. Samuel Islands

By a count through binoculars from the mainland J. Hall (pers. comm.) estimated that about 10 pairs were probably breeding on the islands in late January 1977.

16. Saddle Island

Tickell (1968) suggested that Wandering Albatross probably bred at this site and R. I. Lewis Smith (pers. comm.) observed 10–20 pairs there on 3 January 1971.

17. Kade Point

On 3 January 1971 R. I. Lewis Smith (pers. comm.) estimated that 10–20 pairs may breed at this locality.

18. Weddell Point

About 20 pairs were breeding on this and the neighbouring headlands on 25.1.77 (D. I. M. Macdonald *in litt.*).

19. Elsehul area: Undine (Hope Valley) - Smith Point

The three breeding areas on this stretch of coast were visited by Thomas and Kearsley (1977) from the Elsehul field hut during the 1976/77 field season. Their counts and the

Table 3. Wandering Albatross counts in the Elsehul area

Location	Date	Count	Original total (pairs)
Undine-Coal Harbour Frida Hole (Chaplin)	26.3.1977	21 chicks	29
Head-Smith Pt)	1.3.1977	15 eggs	20
Smith Point	1.3.1977	13 eggs	17

dates when they were made, are shown in Table 3, together with the original total of breeding birds, calculated on the basis of the egg losses at Bird Island. The Undine Harbour - Hope Valley area used to support a substantial breeding population as Matthews (1951) recounts that over half of 2000 Wanderer eggs collected on 26 December 1923 came from this site. It was probably a traditional eggging site for the South Georgia whalers and by 1946/47 only 298 nests were noted (Rankin 1951). Although Tickell noted only one fledgling in October 1958 a map prepared by R. Morris between December 1960 and April 1961 indicates that he saw 9 birds on the west side of Undine Harbour, 85 in the vicinity of Coal Harbour and 23 at Smith Point. This total of 117 probably represents a number of breeding birds not greatly different from the 66 pairs recorded in 1977.

20. Jomfruene Island

Morris (in Tickell 1968) noted a single breeding pair and the locality has not been visited since.

21. Cape Alexandra

Between Cape Alexandra and the cliffs beneath Hesse Peak and in the area to the south of Blackcap Peak, Thomas & Kearsley (1977) counted 76 chicks and 7 adults still incubating eggs. This indicates an original breeding population of about 115 pairs which compares favourably with the 50 pairs estimated by Rankin (1951) in 1946/47 but is more similar to the total of 130 birds recorded on Morris' map in 1960/61.

3. DISCUSSION

The location and numbers of Wandering Albatrosses breeding at South Georgia are summarised in Table 4. The overall total is just under 4300 pairs. The similarity to Tickell's figure of 4600 pairs conceals the fact that the present total includes birds from many sites (especially An-nenkov) not known to him and his total includes the 298 birds recorded by Rankin for Hope Valley in spite of subsequent observations suggesting the apparent disappearance of this colony.

With data recently available for a number of other breeding sites it is possible to update the estimate of the world population breeding in any one season from that of c. 9000 (Tickell 1968) to c. 20,600 pairs (Table 5). South Georgia, with 11.3% of this total, is the third most important site, after Auckland Island and Marion Island.

The recent decline in Wandering Albatross populations at South Georgia is, however, demonstrated by the situation at Bird Island and the Bay of Isles. Between 1962 and 1964 the population at Bird Island averaged 3194 pairs and by 1977–78 this had been reduced to an average of 2580 pairs, a mean decrease of 1.38% per annum or 19.2% overall. Similarly the overall decline at the Bay of Isles from at least 421 pairs in 1945/47 to c. 300 pairs in 1977/78 represents a mean decrease of 1.44% per annum or 28.7% overall. Interestingly the decrease has been proportionately least at Albatross Island, which has the largest breeding population, and greatest at islands with the smaller populations (especially Skua and Petrel). This is in accord with expectations that fidelity of return to natal island should

Table 4. Wandering Albatross breeding numbers at South Georgia

Location	Breeding pairs	
	Single season	Total
Bird Island	1438	2593
Right Whale Bay	8	14
Bay of Isles	c. 300	c. 550
Trollhul	3	5
Ranvik	1	2
Kuprianov Is.	c. 15	c. 27
Annenkov	c. 300	c. 550
Nunez Peninsula	c. 25	c. 45
Cape Rosa	4	7
Samuel Is. area	c. 40	c. 72
Kade Point	c. 15	c. 27
Saddle Is.	c. 15	c. 27
Weddell Point	20	36
Elsehul area	66	119
Jomfruene Is.	1	2
Cape Alexandra	115	207
Total	2366	4283

Table 5. World breeding population of Wandering Albatross

Location	Breeding pairs in one season	Reference
Tristan da Cunha	3	Swales 1965
Gough Island	2000	Swales 1965
South Georgia	2400	this paper
Marion Island	3114	Williams <i>et al.</i> 1975
Prince Edward Is	1964	Williams <i>et al.</i> 1975
Amsterdam Is	—	Segonzac 1972
Crozet Is:		
Ile de l'Est	c. 500	Despin <i>et al.</i> 1972
Ile de la Possession	c. 500	Mougin 1970
Ile aux Cochons	1263	Derenne <i>et al.</i> 1976
Kerguelen Island	c. 700	Derenne <i>et al.</i> 1974
Campbell Island	20	Robertson 1975
Auckland Island	7250	Robertson 1975
Antipodes Island	c. 1100	Robertson 1975
Macquarie Island	c. 25	Johnstone 1972
Total	c. 20,606	

Overall breeding population 37,091 pairs ($2 \times 20,606$ minus $0.20 \times 20,606$ since 20% pairs are breeding in consecutive seasons).

be greatest for larger islands and especially those with the most birds, and that such islands stand a better chance than other nearby breeding sites, of "attracting" birds on their first return to the general natal area. In a declining population large populations are thus better buffered than small ones.

There are a number of factors to be considered that might have been responsible, in whole or in part, for the observed decrease over the last 15

years. The likelihood of operation of these factors can in most cases only be assessed by comparing data from the last three years studies with those from the 1960's.

3.1. HUMAN PREDATION

In a species which at South Georgia does not commence breeding until 8 years of age and which is often unsuccessful at raising a chick until 12 (Croxall in press) extensive eggging in several successive seasons would inevitably create a substantial, but considerably delayed, population reduction at the time when few recruits become available to replace the breeding adults as they died. Such an effect was clearly at least partially responsible for the virtual disappearance of the Hope Valley population (see section 2, colony 19). At Bird Island, however, the persistence into the 1960's of a substantial population was probably largely due to landing difficulties for eggging parties. It is most unlikely that any extensive eggging took place on Bird Island and, in any case, it would have ceased by 1950. Its effect would have been to depress recruitment to the population in the years up to about 1960 at most (mean age of first breeding is about 10) and it therefore cannot be responsible for reductions in numbers after then. Tickell's (1968) experimental collection of 266 eggs from one area of Bird Island would have effectively removed c. 80 potential recruits to the breeding population in the mid-1970's but this is much too small a number to account for the decline.

3.2. DECREASED BREEDING SUCCESS

Data on overall breeding success (Table 1) indicate that in the last three seasons this was, at an average of 61.1%, slightly higher than in 1963. As Wandering Albatrosses that fail after about June cannot breed again the next season (Tickell 1968) it is still possible that more birds nowadays may lose well grown chicks. This cannot be tested directly since no-one has overwintered on Bird Island since 1963, but mean fledging success of chicks from eggs that hatch is 84.3% for 1976—78 (Croxall & Prince 1979) compared with 81.3% in 1963 (Tickell 1968).

Whatever the date of their breeding failure, if

fewer such pairs attempt to breed the next season this would automatically reduce the censused population. This has been investigated using three cohorts of known age birds (currently 16, 17 and 21 years old), which together form 8% of the breeding population. Although the proportion of failed birds that breed the following season is variable (62.1%, 38.8%, 61.0% for 1976, 1977, 1978 birds respectively; Croxall & Prince 1979) and probably reflects differences in the timing of chick mortality (see above), the overall proportions of birds that bred in two successive seasons (21.2%, 17.4%, 17.3% respectively; Croxall & Prince 1979) are closely comparable and similar to Tickell's (1968) single value of 20%. However, since a 2.5% decrease in rebreeding frequency can produce a 1.4% decrease in total population count, these figures cannot be taken as convincing evidence either way. Furthermore in addition to rebreeding ability being influenced by the timing of chick mortality, it is also affected by breeding experience and by survival of the partner. Many birds in our sample that failed at the egg stage and did not breed the next year, either bred for the first time or lost their partner during or after the breeding season.

Finally more birds may be losing eggs in the five weeks or so between laying and the census on 31 January than the 6.9% recorded by Tickell (1968). Census rounds of the known-age birds (which are still younger than the breeding population) has shown mean losses to be only 4.5% in the three weeks before the main census round. Nevertheless this whole period will be examined in more detail in future seasons.

3.3. HIGHER MORTALITY

It will be several years before sufficient chicks ringed in the 1970's return to see if any decrease, compared with the 1960's, in prebreeding survival has occurred.

Data on year to year survival of the known-age birds are being analysed at present but preliminary results do indicate a slight increase in annual mortality over the 4.3% per annum found by Tickell (1968). This may, at least in part, be due to the relatively younger age (and breeding experience) of these birds compared with

Tickell's which were a random cross section of the population. A similar random sample will now be monitored to check this point.

Whatever the proximate factors responsible for the decrease it is even less clear what the ultimate causes may be. At Bird Island it might be thought that the disturbance (albeit very slight) of breeding birds in the course of population monitoring could be responsible. The existence of a similar decline in the undisturbed population at the Bay of Isles makes this doubtful. Unless interspecific competition is involved it seems unlikely that a decrease in available food could be responsible, since Grey-headed Albatross *D. chrysostoma* which also feeds extensively on squid (Prince in press), has certainly not decreased since the 1960's (Croxall & Prince 1979). Competition between these two species could take place both during the summer, when Grey-headed Albatross breeds and Wandering Albatross is incubating and feeding young chicks, or during the winter when Grey-headed Albatross seems to stay in high latitudes (Prince, Croxall & Baird in prep.). Analysis of their squid diet, however, indicates that they feed almost exclusively on squid of different species and different sizes also (Clarke, Croxall & Prince in press; Clarke & Prince in prep.).

Immatures and members of the non-breeding demi-population from South Georgia are well-known, from retraps and recoveries of individually marked birds to visit regularly the inshore waters off the coast of New South Wales, Australia (Tickell 1968). In recent seasons reduced numbers of Wandering Albatrosses have been observed in those localities (K. R. Kerry pers. comm.) and it may be that presently less favourable environmental conditions in the Australian area may be partly responsible for the South Georgia decline.

As Wandering Albatross is perhaps the only seabird species at South Georgia for which there is any evidence of a population decrease, it is naturally of great interest to continue to monitor its population size, breeding success and adult and juvenile survival.

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5. SUMMARY

Since the population of Wandering Albatrosses at South Georgia was estimated in the 1960's 15 additional breeding sites have been located. Except for Annenkov Island these have very small populations and all have probably existed for many years. In 1978/79 the South Georgia breeding population was c. 2370 pairs which, in this essentially biennially breeding species where only c. 20% of pairs breed in successive seasons, gives an overall total of c. 4280 pairs. In the two most important breeding areas decreases of 19.2% over 15 years to 2580 pairs annually (Bird Island) and 28.7% over 21 years to 300 pairs (Bay of Isles) have occurred. This decline is probably unrelated to egg collection by whalers. Bird Island population data indicate that egg and chick survival is slightly higher than in 1963, but that adult survival and the proportion of failed breeders that breed again the next season may have dropped very slightly. As other albatrosses at South Georgia are not decreasing in numbers, it is difficult to suggest ultimate factors responsible for the decline, other than possible interspecific competition but dietary differences make this unlikely.

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