Manx Shearwaters on Skomer: population and mortality due to gull predation

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Skomer Island, lying off the south-western tip of the rocky Pembrokeshire coast, has long been recognised as an important breeding site for Manx Shearwaters *Puffinus puffinus*. The breeding biology and winter migrations of this species are now well known (Lockley 1942, Harris 1966a, b, Perrins *et al.* 1973). Two attempts have been made to census the breeding population on the neighbouring island of Skokholm, and the difficulties involved in a census of nocturnal burrowing birds have been outlined and discussed (Harris 1966a, Perrins 1967). Skomer is considerably larger than Skokholm, 292 ha (722 acres) against 98 ha (242 acres). Probably because of the greater size and generally more difficult terrain of Skomer, no attempt was made to census the shearwater population there until 1971: estimates had varied from 25,000 pairs (Saunders 1962) to 50,000 pairs (Lockley 1953).

In 1971 an attempt was made to census the shearwaters nesting on that part of Skomer known as the Neck, a geographically separate area of about 32 ha (80 acres) at the eastern end; a census of the shearwater population of the whole island was thought impracticable with the limited resources available. The Neck was considered suitable partly because of its isolation and partly because it contained the island’s only undisturbed breeding colony of Great Black-backed Gulls *Larus marinus*, 49 pairs being present in 1971. On both Skokholm and Skomer these large gulls prey heavily on shearwaters, especially fledged young and immatures, and consequently their numbers have been controlled in recent years by successive wardens. There is, however, very little information available on the severity of this predation, other than that of Thomas (1972) who demonstrated that on Skokholm a reduction of about 70% in the resident breeding population of Great Black-backed Gulls resulted in fewer predated shearwater remains being found.

Previous estimates of the numbers of shearwaters killed each year by Great Black-backed Gulls on Skomer were 2,500 (Buxton and Lockley 1950), 4,000 (Davis 1958), 8,000 (Saunders 1962) and 8,000-10,000 (Mylne 1960). None of these took into account the complication of puffinosis, a virus disease which annually kills a considerable number of chicks at fledging time in some of the central bracken-covered areas (Harris 1965). Since most of the corpses were counted in spring, when the vegetation was low, deaths
from any cause in the previous season, including puffinosis, must have been included in the totals. Puffinosis has not been recorded on the Neck since 1967 and so cannot have been a source of error in the 1971 census.

**METHODS**

*Population estimate*

Closely following the ringing/recapture method described by Perrins (1967) for censusing shearwaters on Skokholm, the Neck was visited by day between 4th and 20th August 1971 and 400 shearwater chicks were ringed, using British Trust for Ornithology size 'F overlap' rings. To reduce bias, volunteers with no previous knowledge of the shearwater distribution traversed the whole area and helped locate the chicks by reaching down into burrows. In the central bracken-covered area the burrows tended to be deeper and the chicks more difficult to find, but subsequent observations at fledging time showed them to be very thinly distributed there (see fig. 1), reducing any possible error arising from relatively poor coverage. For convenience the Neck was divided into two parts, based on the natural topography, and a temporary line of coloured cord erected to demarcate a precise boundary for ringing purposes. The smaller area, known as South Castle, was about 8 ha (20 acres) in extent, and the main area about 24 ha (60 acres) (fig. 1).

On dark nights during the fledging period (14th August to 14th September) extensive ringing of the chicks was carried out over the whole Neck area. Before finally leaving the island, the young shearwaters come to the surface for several nights to exercise, when they are easily caught in large numbers for ringing (see Perrins et al. 1973). At night all birds were marked with size 'E elliptical' rings, and all those retrapped wearing 'F overlap' rings had the serial numbers recorded.

Although the plumages of adult and juvenile shearwaters are basically similar, juveniles can always be recognised in the hand by the presence of wisps of down still clinging to the feathers, excessive subcutaneous fat deposits and the generally dull black appearance of the upperparts. It was occasionally necessary to examine the bases of wing and tail feathers to detect the remains of the waxy feather sheaths present in young birds.

*Mortality*

Shearwaters start to arrive at the Skomer colony before the end of February, and large numbers are usually present before the second week of March. In the autumn most of the fledglings have departed by the middle of September, but occasionally late chicks are seen well into October.
At weekly intervals from 15th March to 15th October 1971 the whole Neck area was carefully searched and all dead shearwaters removed and counted. A close watch was also kept for Great Black-backed Gulls eating shearwaters on the sea adjacent to the Neck, and beaches in that area were periodically searched for any corpses washed ashore. Uneaten corpses were allowed to remain for two days, to avoid stimulating the gulls to kill again for food. To check that the corpses collected on the Neck were of birds resident there, 200 adult shearwaters were ringed in early March 1971 on the main part of the island, just beyond the boundary of the Neck. It was anticipated that only potential breeders with a strong burrow attachment would be present so early in the season: certainly relatively few birds under the age of four years are found at such times (Perrins et al. 1973). None of these ringed individuals was among the bodies subsequently collected from the Neck.

Fig. 1. Plan of the Neck, Skomer Island, Pembrokeshire, showing subcolonies of Manx Shearwaters *Puffinus puffinus* (stippled) and nest sites of Great Black-backed Gulls *Larus marinus* (solid triangles) in 1971, and the boundary line (A-B) between the two study areas.
RESULTS

**Population estimate**

Fig. 1 shows the distribution of shearwater subcolonies on the Neck, the nesting sites of the 49 pairs of Great Black-backed Gulls, and the boundary line between the two study areas. It is not intended to represent an accurate distribution map but is a good guide to those areas inhabited by shearwaters, to the approximate relative densities and limits of the main subcolonies, and to those areas not used for nesting. In general most of the breeding shearwaters were concentrated on the gentle grassy slopes between the flat central area and the steep rocky cliffs, but grassy ledges and gullies on the steeper cliffs were also occupied. Most of the Great Black-backed Gull nests were in areas of low shearwater density, and it was also noted that the large colonies of Lesser Black-backed Gulls *L. fuscus* on the central plateau were likewise very thinly populated by shearwaters.

Table 1 gives the ringing and recapture totals, and the estimated numbers of shearwater chicks fledging, in the two areas and over the Neck as a whole. The calculation is based on the recapture rate at night of birds taken from burrows and ringed by day. The percentages recaptured were very similar in the two areas, indicating that the ringing effort was fairly evenly applied.

### Table 1. Ringing and recapture totals, and estimated numbers, of fledging Manx Shearwaters *Puffinus puffinus* on the Neck region of Skomer Island, Pembrokeshire, in 1971

<table>
<thead>
<tr>
<th>Study area</th>
<th>A Ringed in burrows by day</th>
<th>B Recaptured at night</th>
<th>C Recapture rate</th>
<th>D Total caught at night</th>
<th>D ÷ C Estimated total population</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Castle</td>
<td>113</td>
<td>25</td>
<td>22.1%</td>
<td>351</td>
<td>1,587</td>
</tr>
<tr>
<td>Main</td>
<td>287</td>
<td>65</td>
<td>22.7%</td>
<td>1,320</td>
<td>5,828</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>400</strong></td>
<td><strong>90</strong></td>
<td><strong>22.5%</strong></td>
<td><strong>1,671</strong></td>
<td><strong>7,427</strong></td>
</tr>
</tbody>
</table>

Perrins (1967) stated that on Skokholm breeding success averaged 60% (100 pairs of shearwaters raising 60 young to the fledging stage). This figure is slightly lower than the 75% given by Harris (1966). Subsequent experience (Dr C. M. Perrins verbally) has shown that breeding success on Skokholm in 1967 was slightly lower than normal and that a rate of 70% is more usual. Assuming that the Skomer shearwaters, in comparable ecological circumstances, have a similar success rate, it is then possible to estimate the number of breeding pairs on the Neck as follows:

\[
\text{Number of breeding pairs} = \text{Number of fledglings} \times \frac{100}{70} = \text{c. 10,500}
\]
It is also possible to extend this calculation one stage further and estimate the total number of pairs breeding on the whole of Skomer, if we make the assumption that their density over the rest of the island is roughly similar to that on the Neck. In the light of experience of shearwater distribution on the main part of Skomer, this assumption is not unreasonable. As the Neck has an area of about one ninth of the whole, it can be postulated that the total island population is in the region of 95,000 breeding pairs.

**Predation**

Fig. 2 shows the number of corpses of adult and juvenile shearwaters collected on the Neck each month during the 1971 breeding season. The remains of another 15 shearwaters found at the nest of a pair of Buzzards *Buteo buteo* are not included, and all the remaining predation was directly attributable to the 49 pairs of Great Black-backed Gulls nesting on the Neck. Occasionally Lesser Black-backed Gulls and Herring Gulls *L. argentatus* also kill shearwaters (personal observation, J. W. F. Davis verbally), but Great Black-backed Gulls characteristically turn the skins inside-out. I could find no evidence of predation by the other gull species on the Neck in 1971.

During 1971 a total of 261 corpses was collected on the Neck, and of these 45 (17%) were juveniles. This gives a density of 8.1 corpses per hectare (3.3 per acre) over the whole season, a considerably lower figure than the 23.6 per hectare (9.6 per acre) found by Mylne (1960) on the main part of Skomer for the period until the end of July. Very few corpses were found before the end of April, probably because most Great Black-backed Gulls do not roost on the Neck.
before laying their eggs in early May; also, those shearwaters which arrive early in the season are likely to be experienced breeders, which are probably less at risk than the large numbers of non-breeders that visit the colonies in the middle of the breeding season (Perrins 1967).

Although the Great Black-backed Gull population, and therefore, presumably, the demand for shearwaters, was fairly constant from early May until late July, monthly variations occurred in the numbers of shearwaters killed. These are thought to reflect changes in the numbers at risk through the season. Lockley (1942) described how shearwater attendances fluctuated with the weather and the phase of the moon; in the present study very few birds were killed on clear moonlit nights, but a sharp rise occurred in the number of corpses collected following moonless or dark, foggy nights, when more non-breeders had come ashore.

Although only 45 fledglings were recorded killed during August, September and October, by that time many Great Black-backed Gulls had already left the Neck for the winter, indicating that the remaining gulls were relatively more successful at killing shearwater chicks.

On very dark, foggy nights, I twice observed (by torchlight) Great Black-backed Gulls killing shearwaters. Both incidents involved colour-ringed adult gulls and on the first occasion both birds of a pair were involved. They were at their normal roosting site within the breeding territory and it appeared that the victim had blundered into the site and had been captured; there was no indication that they had been hunting actively for shearwaters. On a third occasion in early September, after the gulls' breeding season, a colour-ringed Great Black-backed Gull was twice seen hunting for fledglings at dusk, 400 metres from its nest site.

An examination of Great Black-backed Gull nests on the Neck showed that at no site did shearwaters comprise the only food remains, suggesting that when they were unavailable the gulls turned to other foods (garbage, fish and Rabbits *Oryctolagus cuniculus*). At 45% of nest sites no shearwater remains were found, but two nests had more than ten skins each, reflecting a degree of specialisation in the occupants' feeding habits. The average number of skins per nest over the whole season was 5.3; Mylne (1960) found an average of 9.3 skins per pair on the main part of Skomer on 11th July 1959. On near-by Midland Isle, where a few pairs of shearwaters breed, only two of their skins were found in a search of 110 Great Black-backed Gull nests.

It is not known to what extent the collection of corpses reflects the true mortality due to gulls, because some victims are eaten on the sea and the corpses lost. From general observations, and from
the number of corpses collected from beaches, I would guess that less than a quarter of the remains are lost in this way. On this basis the total number of shearwaters killed on the Neck during the 1971 breeding season would be not more than 350, which represents less than 2% of the breeding population. This estimate includes juveniles and an unknown proportion of non-breeding adults, and so it may be concluded that the predation pressure exerted by Great Black-backed Gulls breeding on the Neck has no serious effect on the shearwater population as a whole. The localised effect of predation by a group of gulls nesting close together may, however, influence the distribution of breeding shearwaters (fig. 1), since predation was concentrated around the gulls' nesting territories.

ACKNOWLEDGEMENTS
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SUMMARY
The breeding population of Manx Shearwaters *Puffinus puffinus* on that part of Skomer Island, Pembrokeshire, known as the Neck was censused during the 1971 breeding season, using the ringing/recapture method previously described for censusing shearwaters on near-by Skokholm. The sub-colonies were mapped, as were the nests of the 49 pairs of Great Black-backed Gulls *Larus marinus* on the Neck. Data on mortality were obtained by regularly collecting skins of shearwaters killed by the Great Black-backed Gulls, by recording the food remains at each gull nest, and by general observations on the gulls' feeding behaviour.

A breeding population of about 10,500 pairs was estimated for the Neck, and a total population of very roughly 95,000 pairs was postulated for the whole island. Predation by Great Black-backed Gulls was estimated to account each year for less than 2% of the adult shearwaters, and for an even smaller number of fledglings, and was not thought to have a serious effect on the population except in the vicinity of gull nests, where it was concentrated.

REFERENCES
--- 1966a. 'Age of return to the colony, age of breeding and adult survival of Manx Shearwaters'. *Bird Study*, 13: 84-95.
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