Snowy Owls on Fetlar

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The Snowy Owl *Nyctea scandiaca* was first recorded breeding in Britain in 1967, on Fetlar, Shetland (Tulloch 1968), although it may have nested in the past on other remote Shetland islands (Saxby 1874). The RSPB set up a reserve around the nesting area, and, with the co-operation of the landowner and crofters, kept an around-the-clock watch next to the owls' nest. This paper summarises events during the breeding seasons 1967-75, since when no breeding has been recorded.

Methods

Each year, an observation hide was erected about 100 m from the nest such that one could approach it unseen by the birds on the nest. At the hide, wardens recorded and timed owl movements and behaviour, and, where possible, the identity of prey brought to the nest. Observations were noted in a standard way by 30 main recorders and many other short-term helpers. In 1975, within the owls' 4-km^2 hunting range, waders were counted and their available chicks thereby estimated.

Results

It is believed, from plumage details, that the same pair of owls nested from 1967 to 1974. In 1973 and 1974, the male was bigamous: two females laid eggs and began to incubate; the male supplied his original mate with food, but did not provide for the second female, a younger individual ringed and raised on Fetlar and probably related to the main pair. In 1975, this second female mated with the male at the main nest and reared four chicks. During winter 1975/76, the male disappeared, and breeding came to an end.

During the nine-year study, the population of rabbits *Oryctolagus cuniculus* changed markedly. Myxomatosis was introduced in 1970, and by 1971 rabbits had almost disappeared from the island, and from the owls' diet. In 1974, there were signs of a recovery in the rabbit population, and by 1975 the percentage of rabbits in the owls' prey was near the levels preceding the epidemic (1968-70).

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Breeding biology

The breeding performance of Snowy Owls on Fetlar during 1967-75 is summarised in table 1.

Table 1. Breeding success of Snowy Owls *Nyctea scandiaca* **on Fetlar, Shetland, 1967-75, related to size of population of rabbits** *Oryctolagus cuniculus*

Year	Estimated rabbit numbers	EGGS laid	EGGS hatched	YOUNG fledged	YOUNG Survived to first winter
MAIN NEST					
1967	high	7	6	5	5
1968	high	6	6	3	3
1969	high	6	4	3	1
1970	declining	5	5	2	2
1971	low	5	5	3	3
1972	low	4	4	0	0
1973	low	5	5	2	1
1974	low	5	5	1	1
1975	increasing	6	4	4	4
SECOND NEST					
1973	low	3	0	–	–
1974	low	1	0	–	–
1975	increasing	3	0	–	–

CLUTCH SIZE

The mean clutch size for the main nest over the nine breeding seasons was 5.4 eggs. It was higher in the three years when rabbits were most abundant (1967-69) than in the four years when they were low in numbers.

EGG-LAYING AND INCUBATION

All the first laying dates fell within a week of 16th May (see Appendix 1), the exceptional date of the colonising pair in 1967 being ten days later than any others. Few nest checks were made in the earlier years, when the priority was to protect a rare bird. In 1970, more frequent checks showed a minimum of 201 hours between laying of the first and last eggs, and a mean of 50 hours between each egg. Egg-laying was evenly spaced. In 1968, there was an interval of five days between the third and fourth eggs, coinciding with very cold northeasterly winds (Tulloch 1969).

INCUBATION AND HATCHING

The female started to incubate the first egg as soon as it was laid. In nine years, the mean length of incubation of the first egg was 31.6 days, although the data suggest 32 days or slightly more for later eggs. This compares well with the 32-33 days given elsewhere (Watson 1957; Scherzinger 1974; Taylor 1974).

Of the 49 eggs laid by the main pair, 44 hatched. Hatching success did not vary with food supply; it probably depended more on other factors, such as care during incubation and the amount of disturbance to the female on the nest. On one occasion, in 1975, the female flew with an egg (possibly damaged or infertile) in her bill to the opposite side of the nesting valley, smashed it open with a downward blow of her bill, and ate the contents.

127. Nesting habitat of Snowy Owl *Nyctea scandiaca* in Shetland: female at nest with four young, July 1975 (*Chris Mylne*)

During the nine years, three other eggs disappeared around the time that they should have been hatching.

Mean date for first hatching was 16th June. All first hatches occurred within a week of this, apart from in 1967, when the first egg did not hatch until 4th July (see Appendix 1).

FLEDGING SUCCESS AND DEVELOPMENT OF YOUNG

From the 44 eggs that hatched, 23 young fledged (average 2.5 per pair per year). Twelve of the remaining 21 young died in the first ten days of life, and five more died before leaving the nest. At least three of the fledged young were known to have died in their first three weeks out of the nest. More young fledged in years when rabbits were abundant than in years when their food was predominantly wader chicks (table 1).

From about 16 days of age, owlets began to wander a metre or so from the nest. These excursions gradually became longer and wider-ranging, though the young owls would still return to the nest to be fed. We could not establish the precise age at which each young finally abandoned the nest. Excluding 1973, the mean age for the oldest owlet to leave the nest for good was 26.2 ± 3.4 days. In 1973, the two oldest young were still returning to the nest at 39 and 38 days respectively, attracted there by the female, who was feeding a weak chick. As young abandoned the nest and fed away from it, the interval between successive owlets leaving seemed to narrow, but data on this are insufficient for conclusions to be drawn.

After leaving the nest, the young owls hid among rocks and continued to be fed by the female. The first flights of the oldest young occurred from 22nd July to 16th August (mean 31st July), except in 1967 when the breeding cycle was later. The average age for first flights was 45 days (range 43-50).

Other authors give a slightly longer period: Watson (1957) noted that Snowy Owls were unable to fly strongly until over 50 days old, and Witherby *et al.* (1938) stated that young in captivity began to fly at 51 to 57 days. The Fetlar owls did not have mastery of the air at 45 days, but they were flying buoyantly then and not simply gliding downhill.

Feeding ecology

HUNTING BEHAVIOUR

The owls hunted almost entirely by a sit-and-watch technique. They were seen quartering the ground and hovering (Watson 1957) only occasionally.

Time spent hunting could not be separated from time spent guarding the nest, because the male did both at once. The male could locate prey from his favourite perches overlooking the nesting valley. Fourteen times during 1973-75 he flew to the slopes of a hill in his main hunting area, dropped on to prey and returned with it to the nest. The mean duration of these forays was four minutes. On discovering a brood of wader chicks, he often brought them back one by one, frequently mobbed by waders nesting nearby.

The female was observed making forays to a hunting area about 700 m from the nest, and used the same hunting methods as the male. In 1973, the second female left the nest to kill an Oystercatcher *Haematopus ostralegus* which had landed to feed within 20 m of her. Passerines, such as Wheatears *Oenanthe oenanthe* and Meadow Pipits *Anthus pratensis*, near the nest were always ignored by the incubating female.

In 1975, the female joined in hunting about the time that the young finally abandoned the nest. She brought in only 21% of the food items

128. Snowy Owl *Nyctea scandiaca* nest with seven eggs, Shetland, June/July 1967 (*Bobby Tulloch*)

129. Male Snowy Owl *Nyctea scandiaca* alighting at nest with young, Shetland, July 1967 (*Eric & David Hosking*)

between then and the end of regular observations, which ceased when all four young had flown. Fig. 1 shows the number of prey items delivered to the nest every three days. Both female and young relied heavily on the male for food during the early stages. The female did not hunt much for food for her offspring until they were more than one month old.

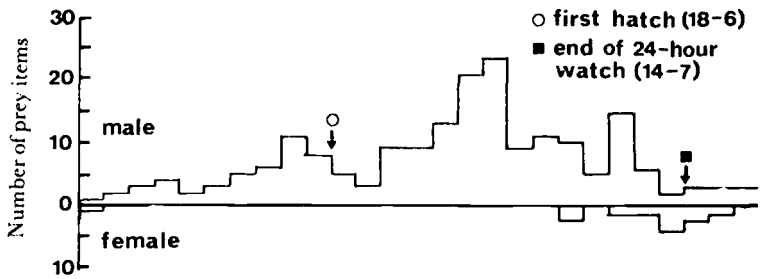


Fig. 1. Number of prey items brought to nest by parent Snowy Owls *Nyctea scandiaca* during 19th May-23rd July 1975, Fetlar, Shetland. Three days per interval

Over the study period, the peak of hunting activity was during the dimmest light, between 22.00 and 03.00 hours (fig. 2). As the light brightened, activity lessened; by 05.00 it was very low, and remained low between 06.00 and 15.00 hours. Watson (1957) thought that his Baffin Island owls were less active around midday and midnight, and Scherzinger (1974) found the same with captive Snowy Owls. The relative difficulty in obtaining food in Shetland may have caused the owls to be more nocturnal.

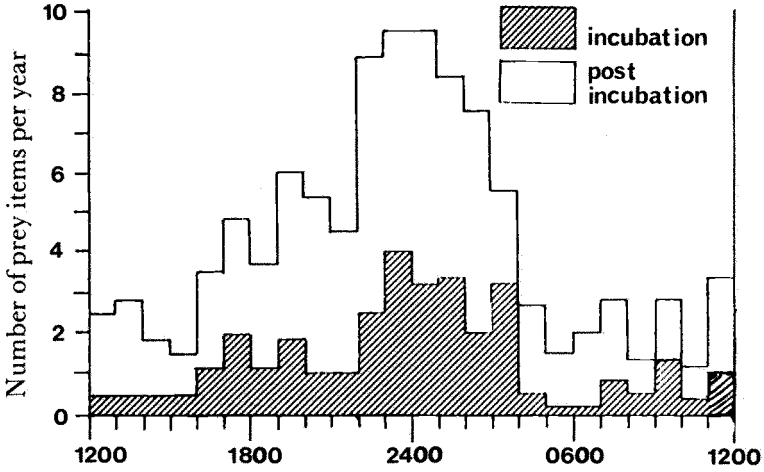


Fig. 2. Number of prey items brought to nest each hour by Snowy Owls *Nyctea scandiaca* over six seasons (286 days), Fetlar, Shetland

In the post-incubation period, the male delivered an average of 0.13 prey items per hour to the nest, as against 0.06 items per hour while the female was incubating. Thus, to supply both female and chicks, the male doubled the number of prey items that he delivered.

FEEDING AND FOOD DEPOSITS

Prey caught by the male was delivered, sometimes headless, to the female at the nest. She then either took it to a feeding station to eat or stored it at a

130. Female Snowy Owl *Nyctea scandiaca* with young, Shetland, July 1967 (*Eric & David Hosking*)

food depot. When there were young in the nest, she would eat bits herself at the same time as feeding them. Surplus food was still removed to a depot.

The male was never seen to tear up prey and feed the young. The female did all of this at the nest soon after the male brought it in. In the later stages, when the young had fledged and scattered, the male would pass whole prey items to them. The male and female of a captive pair took an equal share in feeding the young after they had left the nest (Scherzinger 1974), but this was not the case with the wild Shetland pair.

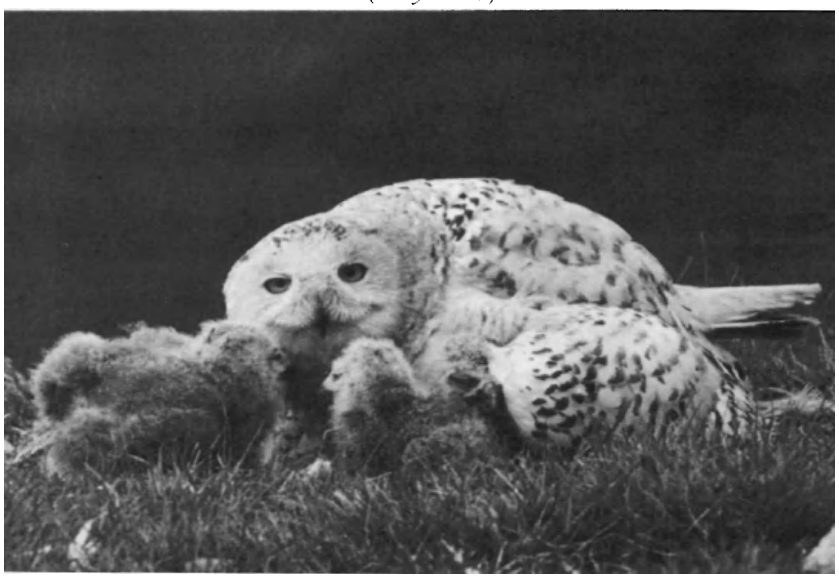
PREY

On Fetlar, where there are no lemmings *Lemmus* or voles (Microtinae), rabbits were the preferred prey. Wood mice *Apodemus sylvaticus* were only occasionally brought to the nest, but they probably formed a larger proportion of the food in winter, when the owls sometimes hunted on lower ground around the crofts.

Several waders, mainly Oystercatchers, Curlews *Numenius arquata* and Whimbrels *N. phaeopus*, nested within the owls' hunting range and were taken. Arctic Skuas *Stercorarius parasiticus* nested nearby, and in the earlier years were caught as fledglings or adults from August onwards; during 1972-75, however, nestlings were taken throughout July, and in 1975 formed 22% of the diet in the first three weeks of that month. Arctic Terns *Sterna paradisaea* were taken occasionally in most years, usually as young on the wing. Chicks of Common Gulls *Larus canus* and of Great Black-backed Gulls *L. marinus* were also occasionally taken. A total of 20 bird species was recorded as prey. The owls preyed on most of the bird species that bred on the hill around them, but showed preferences.

In 1968, before the myxomatosis epidemic, prey brought to the nest

131. Female Snowy Owl *Nyctea scandiaca* in threat/distraction display, Shetland, summer 1967 (*Bobby Tulloch*)



132. Female Snowy Owl *Nyctea scandiaca* feeding pellet to one of her young, Shetland, July 1967 (*Eric & David Hosking*)

consisted exclusively of rabbits and two adult Oystercatchers until the second half of July, when Oystercatcher chicks were more extensively taken (fig. 3). In 1972 and 1974, after the epidemic, rabbits were almost absent from the diet, and the owls relied heavily on waders, Arctic Skuas and other birds. In 1975, rabbits once again made up a large part of the food supplied to the nest during incubation and the owlets' early stages; during July, however, although available, they were ignored in favour of wader chicks, which were then abundant.

The biomass of prey items was estimated using averages from other studies (Appendix 2), and these figures were multiplied by the number of relevant prey items brought to the nest every three days. The errors inherent in assigning weights to prey items, rather than weighing each item, could easily result in unrealistic figures. The biomass calculations in this

Table 2. Estimated weight (g) of food brought to nest for female Snowy Owl *Nyctea scandiaca* and chicks, Fetlar, Shetland

Data based on 24-hour watches

	1968	1972	1974	1975
No. days data collected	66	36	33	57
Total weight of food estimated	37,700	11,800	19,300	34,100
Weight per day	572	328	585	598
Weight per day during incubation period	314	241	390	404
Weight per day after hatching	719	587	726	812

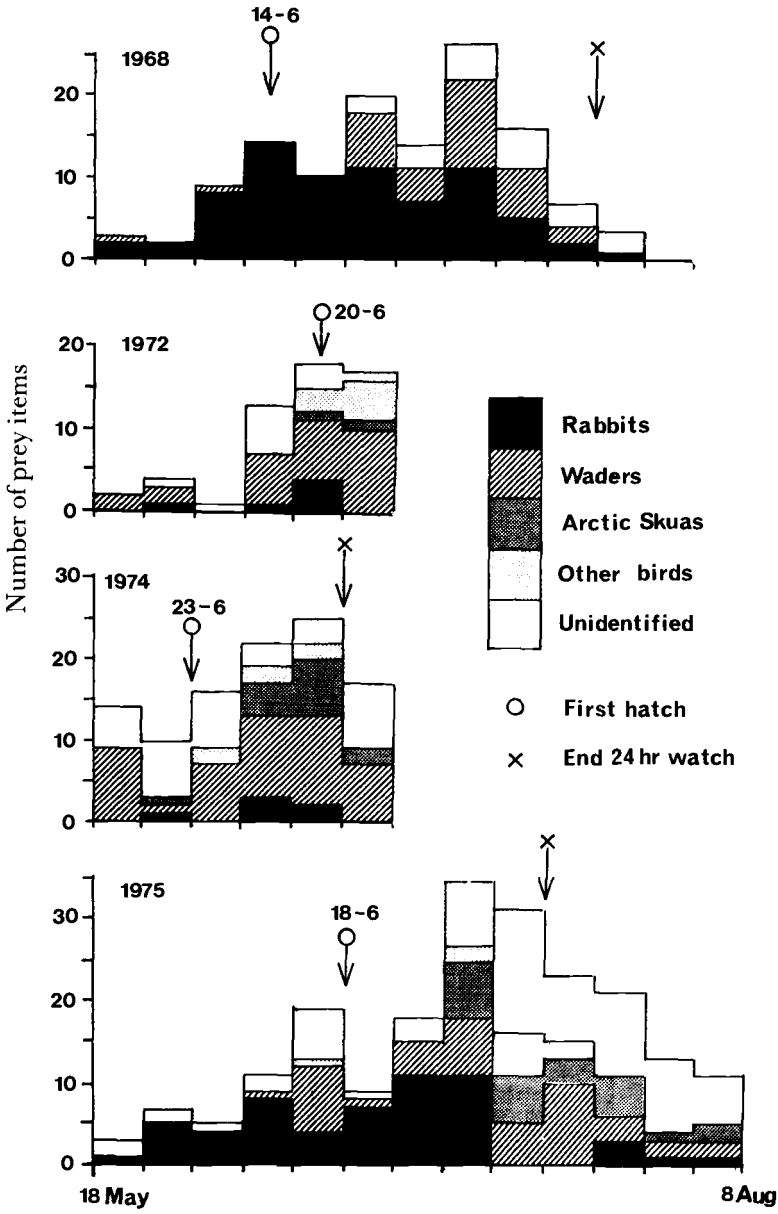
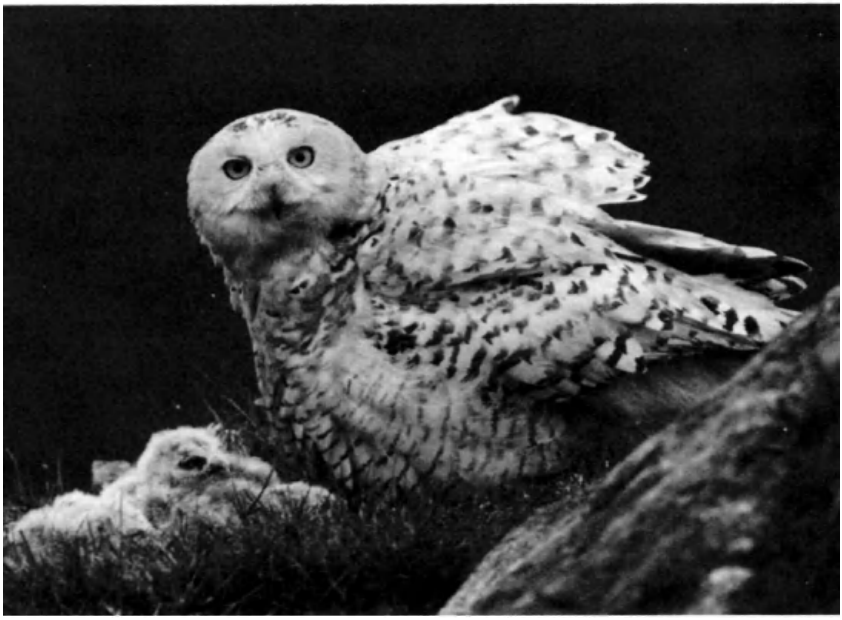


Fig. 3. Profiles of prey brought to nest by Snowy Owls *Nyctea scandiaca*, Fetlar, Shetland, in 1968, 1972, 1974 and 1975. Six days per interval

study should, however, be reliable for relative comparisons. The estimates presented in table 2 were based on data collected during 24-hour watches. In 1972, the biomass of prey brought to the nest was probably lower than in the years when rabbits made up a large percentage of prey.



133. Female Snowy Owl *Nyctea scandiaca* at nest with young, Shetland, July 1967 (*Eric & David Hosking*)

PREY AVAILABILITY

In 1975, the number of wader pairs on the island was counted. The number present in the Snowy Owls' hunting range was compared with prey actually taken (table 3). The owls took fewer chicks of Lapwings *Vanellus vanellus* than expected from their availability. Whimbrel and Oystercatcher chicks were the most frequent wader prey: the owls took 22-26% of available Oystercatcher and Whimbrel chicks, but no more than 3% of chicks of all other waders combined.

Table 3. Proportion of available wader chicks taken as prey by Snowy Owls *Nyctea scandiaca* **during 1975 breeding season, Fetlar, Shetland**

Prey in order of availability	No. of pairs	No. of chicks	% chicks taken as prey
Oystercatcher *Haematopus ostralegus*	19	57	26
Lapwing *Vanellus vanellus*	14	56	4
Whimbrel *Numenius phaeopus*	10	40	22
Golden Plover *Pluvialis apricaria*	5	20	5
Dunlin *Calidris alpina*	4	16	0
Ringed Plover *Charadrius hiaticula*	4	16	0

134. Male Snowy Owl *Nyctea scandiaca* calling, Shetland, July 1967 (*Eric & David Hosking*)

Discussion

In Norway, Snowy Owl clutches of 10-12 eggs have been recorded in peak lemming years, but as low as 3-4 and 4-5 eggs in less favourable years (Portenko 1972). The Fetlar mean of 5.4 is towards the bottom of the range.

In Shetland, long periods of mist and rain are frequent at all seasons. This may have affected the development of the young in two ways. First, the rate of prey-delivery by the male was reduced, sometimes almost to zero; and, secondly, the cold and damp may have laid young owls open to disease. Two owlets that died after fledging in 1969 were examined by a veterinary laboratory: one was infected with pneumonia and contained *Staphylococcus* and the other harboured the fungal infection aspergillosis, both conditions indicative of damp. No post-mortem analyses were carried out on young that died at earlier stages (some young disappeared without trace and others were found half-eaten).

On several occasions, young died when there seemed to be no lack of food. In 1972, all of the four young died over a two-day period, when less than ten days old; the weather had not been unusually bad and the prey brought in should have been sufficient. On three occasions when small young died, however, the food delivered by the male had been considerably

curtailed: during one period in 1970, for example, he delivered only three items in six days. When one of the young died in the nest in 1974, the female fed it to the remaining chicks. This behaviour was suspected on several other occasions. There was no evidence that the female killed any chicks herself, but the possibility cannot be discounted.

In the Arctic, the first eggs are usually laid in May or early June, with some variation (Watson 1957). In Shetland, there is no snow cover in the spring, and the owls, in the absence of lemmings, prey on other species. The appearance of young rabbits above ground and the hatching of avian prey species may have governed the owls' laying dates in some way.

The mean hatching interval is not likely to be shorter than the mean laying interval of 50 hours. This is longer than most observers have noted (Watson 1957; Sutton & Parmelee 1956; Portenko 1972). On the Hardangervidda, Norway, at the same latitude (60° 39′ N) as Fetlar, Barth (in Portenko 1972) gave 44 hours: still considerably less than Fetlar's 50 hours.

The data suggest that Snowy Owls are quite adaptable in their feeding behaviour. In years when rabbits were scarce, they switched to other prey; unable to obtain an equivalent amount, however, they laid fewer eggs and reared fewer young. Hence, the Fetlar owls showed a response similar to that of other Snowy Owl populations, which depend on fluctuating populations of voles and lemmings.

135. Female Snowy Owl *Nyctea scandiaca* alighting at nest with young, Shetland, July 1967 (*Eric & David Hosking*)

136. Female Snowy Owl *Nyctea scandiaca* at nest with young, on 'a very wet day', Shetland, summer 1967 (*Dennis Coutts*)

Conclusion

The disappearance of the male in winter 1975/76 ended breeding on Fetlar, just as the rabbit population had increased and things seemed to be going well again. The year 1975, with four young reared, had been the most successful since the very first one. In 1976, up to five females were on the island at one time, and it was hoped that a new male might arrive. Male Snowy Owls, however, have always been scarcer than females on Fetlar. None of the six males that survived up to their first winter remained on the island, or even, apparently, in Shetland. None has yet been seen since the old male's disappearance, while in most years one or two females have remained on Fetlar throughout the breeding season and have even laid eggs.

If Snowy Owls should breed again on Fetlar, it is questionable whether the rabbit population, affected as it is by myxomatosis, would remain constant enough to support them. The natural arrival of a male from elsewhere would be much welcomed, but the introduction of a captive male into a place with such an uncertain food supply would be hard to justify.

Acknowledgments

We thank Dr Gareth Thomas for encouraging and directing this work; A. J. Prater, Dr R. W. Furness and Dr C. D. T. Minton for advice on weights; previous wardens, A. R. Mainwood and I. S. Robertson, for supplying notes; J. G. Robertson for help with analysis; H. Prendergast for carrying out the census of breeding waders; and P. Kinnear, T. Williams and Dr A. Watson for helpful comments. R. J. Tulloch set up the protection scheme and was the guiding light throughout; many of the islanders on Fetlar helped with its operation, but special

thanks are due to L. Brown of North Dale and his late wife, Jean. About 30 wardens lost a lot of sleep to collect the data. Finally, we thank the RSPB for organising the scheme and allowing time to produce this paper.

Summary

During 1967-75, the breeding biology, feeding and behaviour of Snowy Owls *Nyctea scandiaca* on Fetlar, Shetland, were studied. Mean clutch size over the period was 5.4, being higher in years when rabbits *Oryctolagus cuniculus* were abundant and lower in others. First laying dates fell within a week of 16th May, and the mean incubation period for the first egg was 31.6 days. Of a total of 49 eggs laid, 44 hatched and 23 young fledged (average 2.5 per pair/year); 17 young died in the nest. Fledging success was higher in years when rabbits were abundant. Average age for first flights of young was 45 days. The male supplied almost all the food in the early stages. The preferred prey was rabbits. Wader chicks were frequently taken, and in years of low rabbit numbers waders and other birds formed a major part of the diet; fewer chicks of Lapwing *Vanellus vanellus* were taken than expected from their high availability, but disproportionate numbers of chicks of Oystercatcher *Haematopus ostralegus* and Whimbrel *Numenius phaeopus* were preyed on.

137. Female Snowy Owl *Nyctea scandiaca* with young, Shetland, July 1967 (*Eric & David Hosking*)

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Appendix 1. Breeding chronology of Snowy Owls *Nyctea scandiaca* on Fetlar, 1967-75

In 1975, first egg did not hatch: incubation period taken up to hatching of second egg

Year	FIRST EGG laid	FIRST EGG hatched	Incubation period (days)	Date first young flying	Age (days) first young flying
1967	2 June	4 July	33	16 August	44
1968	12 May	14 June	33	27 July	44
1969	10 May	9 June	30	22 July	44
1970	10 May	10 June	31	24 July	45
1971	13 May	14 June	32	Not known	—
1972	18 May	20 June	33	None flew	—
1973	7 May	7 June	31	26 July	50
1974	23 May	23 June	31	9 August	48
1975	14 May	18 June	36	30 July	43

Appendix 2. Estimates of prey biomass taken by Snowy Owls *Nyctea scandiaca* on Fetlar

Other prey species, less important in bulk, were similarly treated. Mean hatching dates of the various bird species were taken into account so that a prey chick was considered to have a maximum weight by a particular date

Prey species	Size	Age	Weight (g)	Source
Rabbit				
Oryctolagus cuniculus	small	3-6 weeks	280	M. N. Stephens
	medium	6+ weeks	690	(extrapolated)
Oystercatcher				
Haematopus ostralegus	small	7 days	70	A. J. Prater
	medium	19 days	270	(*in litt.*)
	large	30 days	410	
	adult	—	510	Mercer (1968)
Whimbrel				
Numenius phaeopus	small	9 days	60	A. J. Prater
	medium	23 days	190	(*in litt.*)
	large	35 days	290	
Arctic Skua				
Stercorarius parasiticus	small	10 days	190	R. W. Furness
	medium	20 days	360	(*in litt.*)
	large	30 days	440	

We draw readers' attention to the correspondence, headed 'Help for the Snowy Owls?', on pages 253-258. EDS