RATS ON LUNDY. A REPORT 1971

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Introduction

During 1970 the Devon Bird-watching and Preservation Society and the Lundy Field Society became increasingly concerned about the fall in numbers of breeding seabird populations, in particular those of the puffin (*Fratercula artica*) and the manx shearwater (*Procellaria puffinus*), on Lundy. It was speculated that this may be related to the size, distribution and habits of the rat populations on the island (Langham, personal comm. 1970). Moreover, the status of the black rat (*Rattus rattus*) on the island was in some doubt.

In 1962, the Oxford Lundy Expedition reported that the brown rat (*Rattus norvegicus*) and three morphs of the black rat (*Rattus rattus rattus*, *R. r. frugivorus* and *R. r. alexandrinus*) were present on the island. Mr. F. W. Gade, the agent on the island for many years, reported (personal comm. 1971): 'It is only a matter of guessing that I feel that the number of black rats is falling, and has fallen during the past ten years. I have no definite evidence to show that this is happening, except that no one has reported seeing black rats of late.'

A preliminary survey of the rats on Lundy was carried out by the authors in April 1971, to discover the present distribution of black and brown rats in relation to seabird colonies and human habitation. If the results suggested a causal relationship between the rat populations and the decline of burrow-nesting seabirds, then more intensive studies could be carried out in the future.

Methods

Six trapping sites were selected covering a cross section of possible rat habitats at points adjacent to human habitation, and near areas where burrow-nesting seabirds were known to have nested in previous years. A summary of the trapping sites, trap layouts and the baits used is given in Table 1. In all, 182 break-back traps were used for a period of five days and five nights (910 trap nights). Twenty Longworth box traps were set around the 'Old Light' for five days and nights (100 trap nights) to see whether any young rats or pygmy shrews (*Sorex minutus*) could be captured. Unfortunately trapping on Rat Island was not possible because the state of tides prevented passage to the island.

The break-back traps were fastened to six-inch metal stakes by stout wire and placed under cover wherever possible. The trap locations were marked with two-foot sticks with small marker flags. Care was taken so that the marker flags were some small distance from the traps in order to minimise avoidance behaviour of the rodents to the flags. Where possible each trap was placed in a likely rat runway, although signs of the presence of rats were often obscured by the activities of the large number of rabbits (*Oryctolagus cuniculus*) which were found commonly over most of the island. The trapping sites were checked once a day, with the exception of those at Millcombe and near the hotel. These traps were released at 7 a.m. and reset at 11 p.m. to reduce the likelihood of capture of local pet cats and guinea pigs.

Captured rats were removed to the 'Old Light', where they were weighed, measured and examined. The rats were skinned and the skulls and stomachs removed and preserved. The skulls and skin were required by the British Museum for taxonomic studies.

Discussion

Details of the animals captured are given in Table 2. In all, only 14 rats were captured: four black and ten brown. (No animals were captured in the Longworth traps.) Two black rats were captured at the Landing Beach and two near human habitation (one near the hotel and the other at the top of Millcombe). All were adult; the three males had scrotal testes and the single female had seven embryos *in utero*. All four belonged to the same morph, *Rattus rattus frugivorus*

Of the ten brown rats, four were juveniles, three adult males with scrotal testes and three adult females, one with four embryos *in utero*. The three females and the four juveniles were captured at the north end of the island at Puffin Bay. Two of the remaining adult brown rats were captured on the Landing Beach, and one at Needles Bay. Although the two species were found only to cohabit the Landing Beach, the data are too scanty to state that the two species do not cohabit other parts of the island.

Only one brown rat was captured on the west coast, despite the fact that there were trapping sites at the 'Old Light', Battery Slopes and Needle Rock Bay Slopes. Rabbits were perhaps most plentiful on this coast, and their numbers may have affected those of the rats. This distribution of rats captured agrees with the two recent sightings by the islanders; one of brown rats around the rubbish tip at the 'North Light' and one of a rat (type not known) on the Landing Beach.

A brief investigation of the stomach contents revealed that the black rat stomachs contained well chewed vegetable matter with some mollusc and insect remains and a few hairs (probably from grooming). The brown rats, however, contained far less vegetable material; they contained insect, crustacea and centipede remains and also up to, in one instance, 80% solid matter. This was the skin and hairs of a young mammal, probably that of a rabbit. No signs of bird remains were found.

The break-back traps, as recommended for field use by Greenwood (1963), were found to be fairly manageable on the rough, steep terrain, although the availability of transport would have greatly helped in the carrying of the traps and in the daily checking of the traps. All of the baits captured rats with approximately the same efficiency, but peanut butter and, in particular, meal were difficult to attach to the traps, and the latter became detached in exposed situations, so that bacon is recommended for future work.

Eleven of the fourteen rats taken (both species) were captured on the first two nights of trapping. This indicates that new object reaction to break-back traps is very small; this is interesting because most wild populations of rats (both *R. norvegicus* and *R. rattus*) normally exhibit a marked 'new object reaction' or neophobia in such situations (Barnett, 1958).

The results of the study suggest different trends from those reported by the Oxford Lundy Expedition of 1962 in the status of the rats on Lundy. The data collected by Pearson and his team suggest that the black rat was present in larger numbers over a wider territory than the brown rat; that the black rat dominated the sea-shore and Landing Beach, and that the black rat showed no tendency to gravitate towards human habitation—a marked feature of the brown rats on Lundy. In a paper in 1964, he suggests that the three colour forms he had captured were morphs of *Rattus rattus*. He also contradicts his previous statement by saying, '*R. rattus* has a marked tendency to be caught within 1000 feet of human habitation and at more than 1000 feet from seabird colonies in June and July'.

The black rat is still present in small numbers, but does not dominate the sea-shore and Landing Beach, and does tend towards human habitation. Only one morph of the black rat was captured, i.e. *R. r. frugivorus*, and the number of rats appears to have decreased since 1962.

If our results are taken as indicative of the changes stated above, then the differences in the relative abundance of the two species may be only temporary, or they may be due to displacement of the black rat by the brown through competition. Barnett and Spencer (1951) indicated that a decline in numbers in a confined *R. rattus* population and replacement by *R. norvegicus* was due to competition between the two species. They state that this may be particularly applicable at nesting sites in which the brown rat is successful because of its greater size.

The decline in the numbers of rats as a whole may be partially due to control measures, although the only known measures are those of 1948 and the recent poisoning of the brown rats at the 'North Light' rubbish tip. Low catches may in part have been due to the time of the year, since rodent populations are often low in the spring before the recruitment of juveniles. The Oxford Expedition in

1962 trapped in June and July and captured twice as many rats as the present study. Their 719 break-back trap nights yielded 23 rats, an efficiency of 3·2% (Greenwood, *loc. cit.*). The present programme captured 14 rats over 910 break-back trap nights, a 1·54% efficiency.

Competition for living space and food by the large number of rabbits may have affected rat numbers, but both have co-existed on the island for several centuries. Few records exist, however, on the relative abundance of rabbits, black rats and brown rats.

In the past rat populations have been maintained by recruitment from shipwrecks, but Matheson (1939) has stated that the black rat is capable of maintaining itself in some numbers in various premises at seaports in Britain without notable recruitment from ships. However, Bentley (1959) points out that black rats in the United Kingdom have declined in range and numbers in the five years after 1951, and the Ministry of Health (1955) and Matheson (1958) have both indicated a steady decline in the numbers of ship-borne rats arriving in British seaports. In all, the explanations for the decline in the numbers of rats are not simple.

Since the populations of rats are small at the present time, we believe that they are not affecting the breeding of puffins and manx shearwaters to any great extent. Whether they significantly affected them in the past and caused the decline in the numbers of these birds is open to conjecture, but seems possible. There are several references in the Lundy Field Society Annual Reports to damage to ground-nesting birds and their eggs, but these data are scanty and intermittently reported. The Second Report of 1948 points out that rat-eaten manx shearwater corpses were found at the West Battery Slope, and that the rats probably destroyed numerous puffin eggs at Puffin Slopes. In this report Studdy also states that rats could prevent shearwaters from establishing colonies. The Fourth Report of 1950 points out that the brown rat was common and did considerable damage to burrow-nesting birds, buildings and stores.

The rats in these cases indicate a contributory cause to the decline in numbers of puffins and shearwaters. It must be pointed out here, however, that the cliff-nesting auks of Lundy are also showing a decline in breeding numbers (Lundy Field Society 21st Annual Report, 1970), which it is thought cannot be attributable to rats. Moreover, puffins in other British islands which do not have rat populations are declining. (Flegg (1971) has put forward several possible causes as to the significant decline in puffin numbers on the islands of the Outer Hebrides. He indicates that oiling disasters, like gull predation, are probably only minor factors. Flegg dismissed lack of food as a cause, because other seabirds feeding on the same foods are flourishing on St. Kilda. Specific data on these points are not available for Lundy. Disease seems unlikely since there is no evidence from corpses, although further investigation into this and toxic chemicals may be worthwhile. (Jones, 1963–64, reported in the 16th Lundy Field Society Annual Report, that a peregrine falcon, *Falco peregrinus*, had sufficient quantity of chlorinated hydrocarbon in its liver to cause its death.) Another possible cause suggested by Flegg (*loc. cit.*) was a natural northward shift in the geographic range of the puffin, but this seems unlikely since the Faroes were reporting similar declines.

This, there may be several reasons for the decline in puffin and manx shearwater on Lundy. Rats may have been important some years ago, but today this is unlikely since their numbers are also very low. Extensive control measures on the rat populations are probably unnecessary, but localised control trapping around areas where the seabirds are nesting may aid the re-establishment of successful breeding in these ground-nesting birds. Further, control measures aimed at the rabbit populations may reduce disturbance to the nesting seabirds. Regular surveys of the relative abundance of rats, rabbits and seabird populations would provide much useful information as well as detailed examination of seabird corpses for the presence of disease and toxic chemicals.

Summary

1. Six trapping sites on Lundy were selected and break-back trapped for five days and nights.

2. Both species of British rats, i.e. *R. norvegicus* and *R. rattus*, were captured, the only morph of the black rat beint *R. r. frugivorus*.

3. *R. norvegicus* was captured more frequently than *R. rattus* and it occurred on the north and west coasts. *R. rattus* was trapped only in the south of the island, either on the beach or near to human habitation.

4. The stomach contents of the rats showed no signs of bird remains, but the brown rat stomachs did contain fairly large proportions of mammalian skin.

5. Both species were present at low intensities and the animals caught exhibited little 'new object reaction' or neophobia.

6. The relative abundance of the two species appears to have changed since 1962.

7. It is thought most unlikely that the rat populations at the present levels affect the numbers of burrow-nesting birds, namely the puffin and manx shearwater on Lundy.

8. Extensive control measures aimed at the rat population are not thought necessary, but localised control trapping around nesting grounds may aid the re-establishment of nesting colonies.

9. The cause in the decline in numbers of these seabirds is not known but some suggestions are presented. More work is required to investigate annually the changes in number of seabirds, rats and rabbits on Lundy. Corpses of puffins and shearwater should be examined for (a) damage from rats or gulls and (b) disease or presence of toxic chemicals.

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REFERENCES

Bentley, E. W. (1959). The distribution and status of *Rattus rattus* L. in the United Kingdom in 1951 and 1956. *J. Anim. Ecol.* **28,** 299.

Barnett, S. A. (1958). Exploratory behaviour. *The Brit. J. Psych.* **49,** 289–310.

Barnett, S. A. and Spencer, M. M. (1951). Feeding, social behaviour and interspecific competition in wild rats. *Behaviour* **3,** 229–42.

Flegg, J. (1971). Puffins in Peril. *B.T.O. News* No. 46.

Greenwood, J. (1963). Rat traps for field use. The Mammal Society of the British Isles. *Bulletin* No. 20.

Lundy Field Society 2nd Annual Report 1948.

Lundy Field Society 4th Annual Report 1950.

Lundy Field Society 16th Annual Report 1963–64.

Lundy Field Society 21st Annual Report 1970.

Matheson, C. (1939). A survey of the status of *Rattus rattus* and its sub-species in the seaports of Great Britain and Ireland. *J. Anim. Ecol.* **8,** 76–93.

Matheson, C. (1958). The black rat at British seaports. *Pest Technol.* **1,** 47.

Ministry of Health (1955). Rep. Minist. Hlth. London 1954, Pt. II.

Oxford Lundy Expedition Report 1962.

Oxford Lundy Expedition Report—1962 (1963). The Mammal Society of the British Isles. *Bulletin* No. 20.

Pearson, A. D. (1964). Distribution of black and brown rats on Lundy. The Mammal Society of the British Isles. *Bulletin* No. 21.

Table 1. Trap sites

Trap site	Grid ref.*	Our ref.	Trap layout: Line No.	No. traps	No. trap pstns	Distance between traps (m)	Height above sea level (ft)	Direction of line	Bait	Description of site
Landing Beach	SS 143 438	L	1	20	10	10	Near sea level	N to S	Peanut butter	Little cover except for stones, rocks and driftwood. Possible foods washed ashore
The Old Lighthouse	SS 132 443	O	–	12	6	10	c. 400	Round Old Light	Bacon rind	Cover provided by walls, outbuildings, and grassy tussocks. Little food.
Battery Slopes	SS 128 418	B	1	20	10	15	c. 100	N to S	Alternate p. butter and bacon rind	Rocky outcrops interspersed with patches of male fern and heather and provided cover. Rabbits present.
			2	20	10	15	c. 200	N to S		
Puffin Bay Slopes	SS 132 134	PB	1	20	10	15	c. 100	W to E	Alternate p. butter and meal	Grass short, sea-pinks common, little cover except for burrows. Rocky outcrops at bottom of slope. Very steep slopes.
			2	20	10	15	c. 200	W to E		
Needle Rock Bay Slopes	SS 130 456	NB	1	20	10	15	c. 100	S to N	Alternate p. butter and meal	Plenty of cover provided by rocks; some heather but little fern.
			2	20	10	15	c. 200	S to N		
Hotel	SS 137 141	H	12 traps. 4 traps in hotel garden around culvert. 8 traps set east of garden wall						Bacon rind	Scraps left in garden for gulls. Cover present.
Mill Combe	SS 137 141	M	14 traps set at 10 m intervals. 2 traps/pt., W–E down Mill Combe Gulley						Bacon rind	Plenty of cover due to presence of gorse, shrubs and garden walls.
Shop	SS 137 141	S	4 traps set in store room						Bacon rind	Plentiful supplies of food and shelter.

* Ordnance Survey Map—Parts of Sheets SS14 NW and SS14SW.

Table 2. Animals caught

Date captured	Our Ref. No.	British Museum No.	Species	Bait	Sex	Condition	Weight (g)	Measurements (cm.) Head and body	Tail	Hind foot	Ear
1.5.71	1L4	1971 2067	*R. norvegicus*	Peanut butter	Male	Breeding	280	21·00	19·50	4·00	1·50
1.5.71	1L8	1971 2078	*R. rattus*	Peanut butter	Female	Preg., 7 embryos	220	19·00	23·50	3·60	2·10
1.5.71	1L19	1971 2066	*R. norvegicus*	Peanut butter	Male	Breeding	245	19·75	16·50	3·80	1·45
1.5.71	1M6	1971 2076	*R. rattus*	Bacon	Male	Breeding	200	20·00	22·00	3·70	1·80
1.5.71	1H11	1971 2077	*R. rattus*	Bacon	Male	Breeding	265	21·00	25·00	3·85	2·10
1.5.71	1NB3	1971 2068	*R. norvegicus*	Meal	Male	Breeding	345	21·25	18·50	3·80	1·60
1.5.71	1PB5a	1971 2069	*R. norvegicus*	Peanut butter	Female	Preg., 4 embryos	350	21·75	18·50	3·60	1·50
1.5.71	1PB5b	1971 2070	*R. norvegicus*	Meal	Female	Adult	295	20·50	17·50	3·85	1·50
2.5.71	2L2	1971 2079	*R. rattus*	Peanut butter	Male	Breeding	210	19·50	21·50	3·70	2·10
2.5.71	2PB5	1971 2071	*R. norvegicus*	Peanut butter	Male	Juvenile	60	12·50	10·50	3·30	1·40
2.5.71	2PB7	1971 2072	*R. norvegicus*	Meal	Female	Adult	340	21·50	17·50	3·80	1·60
4.5.71	4PB7	1971 2073	*R. norvegicus*	Meal	Male	Juvenile	65	13·60	10·30	3·30	1·50
4.5.71	4PB8	1971 2074	*R. norvegicus*	Peanut butter	Male	Juvenile	73	14·30	11·20	3·40	1·50
4.5.71	4PB10	1971 2075	*R. norvegicus*	Peanut butter	Female	Juvenile	60	13.20	10·90	3·30	1·40