SHIP AND COMMON RATS ON LUNDY

By

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INTRODUCTION

Lundy is well known for its unique population of Ship rats (*Rattus rattus*), the only free living population in the British Isles known to co-exist with the Common rat (*Rattus norvegicus*) (Linn 1997, 110-11). The Ship rat in Britain has now declined to as few as 1300 individuals (Harris *et al* 1995), of which the Lundy population is believed to account for 500. This makes it probably the most endangered mammal in Britain, although its plight is unlikely to attract much sympathy. Human intolerance of rats, combined with effective pest control, has further reduced the numbers of this species throughout Britain. The rats on Lundy are also subject to control measures, involving the use of rodenticide, from October to April. However, the situation on Lundy presents a rare opportunity to study this animal, apparently living sympatrically with the very species that has out-competed it over most of its historical range. Morris (1993) singles out the Lundy population as "worthy of further attention, and perhaps even encouragement", and it is therefore important to study this population while it persists, and perhaps find ways to encourage it while keeping it out of conflict with humans.

This study investigates aspects of the two species' ecology and distribution, in an attempt to understand their apparent avoidance of competition. It also looks at the structure of rat populations at two sites, one where rodenticide was being used, and one which is left undisturbed. This study also aims to provide a snapshot of current population trends, and to make suggestions about the future of the Ship rat on Lundy since previous studies (referenced below) have reported very different population levels and trends for the two species.

METHODS

The data were obtained from eleven days of fieldwork in October 1997. Tomahawk live traps were used at two sites, Millcombe valley and gardens in the south east of the island, and at the Quarries on the east coast. Previous papers had reported the presence of both rat species around Millcombe, while Common rats had been reported from the Quarries (Island Administrator, pers. comm.).

Traps were placed over areas of comparable size, in places likely to be attractive to rats. The traps measured approximately 15 x 15 x 45 cms and were placed at intervals of between 15 - 50 m. They were baited with a mixture of peanut butter and rolled oats and covered with bracken and grass to provide camouflage and bedding. The first site, at Millcombe, is close to the presently occupied village and contained several poison bait sites. The 1997-98 poisoning programme began two days before the start of this study. Here six traps were used over forty-four trap nights. The Quarries site was about 1 km to the north of this, in an area of little human activity and currently not subject to any rat control measures. In this case five traps were used for a total of thirty-two trap nights. Whilst the poison alone is unlikely to be responsible for all the differences in population levels and ecology, the two sites can be used to compare the effects of these different management strategies.

The traps were checked early each morning to minimise the time any caught rats spent in captivity. Captured rats were identified to species, and to morph in the case of *R.rattus*. They were weighed and sexed wherever possible. All rats were marked by fur-clipping, so they could be identified if recaptured. The distances travelled by recaptured rats between traps were also recorded. Some rats were also 'spooled' by gluing 120 m spools of fine nylon thread to their rumps with commercial superglue. This procedure was carried out while the rats were immobilised in a wire handling cone and completed within five minutes to minimise distress. The rats were then released and the spool lines followed the next day, to allow them time to recover from their shock and return to normal behaviour. The first 10-15 m of line were disregarded as fleeing distance. Spool lines of both species could then be compared to look for differences in use of space, and possible spatial segregation.

RESULTS

Rats captured at the two sites

The results for both sites are shown in Tables 1 and 2.

Table 1: Rats caught at Millcombe.

Ship Rats

Rat no.	No. captures	Locality	Weight (g)	Morph	Sex
MR1	1	Millcombe gardens	155	Frugivorus	-
MR2	2	Millcombe valley	145	Alexandrinus	-
MR3	3	Millcombe gardens	210	Frugivorus	F
MR4	1	Propane store	210	Rattus	F
MR5	1	Propane store	85	Rattus	-

Common Rats

Rat no.	No. captures	Locality	Weight (g)	Sex
MN1	1	Millcombe valley	-	-
MN2	1	Millcombe valley	210	F
MN3	1	Millcombe gardens	255	F

Table 2: Rats caught at the Quarries.

Ship Rats

Rat no.	No. captures	Locality	Weight (g)	Morph	Sex
QR1	1	Bonfire site	180	Alexandrinus	-
QR2	2	Bird trap	90	Rattus	-
QR3	1	Woodpile	150	Rattus	F
QR4	2	Bonfire site	240	Rattus	M
QR5	4	Bird trap, woodpile	190	Rattus	F
QR6	1	V.C. Quarry	190	Rattus	F

QR7	2	Bonfire	160	Rattus	F
QR8	2	V.C. Quarry	150	Rattus	-
QR9	2	Bird trap	160	Alexandrinus	M
QR10	2	Pond	150	Frugivorous	F
QR11	1	Pond	155	Rattus	F
QR12	1	Bonfire	150	Rattus	F
QR13	1	Pond	130	Rattus	M
QR14	1	Bird trap	165	Alexandrinus	F

Common Rats

Rat no.	No. captures	Locality	Weight (g)	Sex
QN1	2	Bonfire, bird trap	320	F
QN2	2	V.C. Quarry, bonfire	330	M
QN3	1	Bonfire	180	M
QN4	1	V.C. Quarry	355	M

Comparisons between sites

i. Weight

Millcombe	(mean body weight in g.)	
Ship rats	161	(5 individuals)
Common rats	228.3	(3 individuals)

Quarries	(mean body weight in g.)	
Ship rats	161.4	(14 individuals)
Common rats	296.3	(4 individuals)

T-tests showed that there is no significant difference in weight between the Ship rat populations at the two sites ($p>0.05$). The difference between the weights of the Common rat samples at the two sites is significant at $p<0.05$, with those at the Quarries being slightly heavier than those at Millcombe.

ii. Trap success

Trap success at the two sites was compared by looking at the number of individuals caught at least once at each site, and performing a Chi-squared test, the results of which are shown in Table 3. Total trap successes for each site were also calculated, including all recaptures. These results are shown in Table 4.

Table 3. Trap successes at the two sites (excluding recaptures).

Site	First captures	Re & non-captures	Totals	Trap success
Millcombe	8	36	44	8/44 = 18.2%
Quarries	18	14	32	18/32 = 56.3%
Totals	26	50	76	

Chi-squared = 11.92, df = 1, $p<0.01$.

Capture rates were therefore significantly different at the two sites. Comparison of the percentage trap successes (defined here as the number of first captures divided by the number of trap nights), shown on the right-hand side of Table 3 show that trap success was much higher at the Quarries than at Millcombe.

Table 4. Total trap successes at the two sites (including recaptures).

Site	Captures	Non-captures	Totals	Total trap success
Millcombe	11	33	44	11/44 = 25%
Quarries	29	3	32	29/32 = 90.6%
Totals	40	36	76	

Chi-squared = 32.01, df = 1, $p<0.01$.

There is a significant difference in capture rates between the two sites, the percentage trap success at the Quarries being much higher. Total trap success in this case is defined as the number of capture events (first and re-captures) divided by the number of trap nights.

iii.Differences in recapture rates

Recapture rates for both species at the two sites are too small for any statistically meaningful comparisons.

iv.Movement within sites

Seven rats (five Ship and two Common) at the Quarries site were successfully spooled, producing lines of between 42.0 m and 110.7 m. The length and direction of each section of spool line were recorded, in addition to the substrate passed over (however, there were problems in the analysis and graphical representation of these data and they are not presented in this paper). Results demonstrated no obvious differences in the use of space by individuals of the two species. Spool lines of both Ship and Common rats were found throughout the same areas, often crossing over each other. This technique needs some refinement before it can be used more conclusively on Lundy. Further evidence of movement within the sites comes from the capture-mark-recapture element of the study, which allowed recaptured rats to be identified and their movements between traps to be monitored.

At Millcombe only two rats, both Ship rats, were caught more than once. One was caught in two traps in Millcombe gardens (approximately 15 m apart), while the other was caught in two traps in Millcombe valley (approximately 20 m apart). Both species of rats were caught in two out of the six traps at this site. Three traps caught only Ship rats and one trap caught nothing.

At the Quarries site, nine out of eighteen rats were caught more than once. Six of these, all Ship rats, were recaptured in the same trap in which they were first caught. Three others, two Common and one Ship rat, were recaptured in different traps. The Ship rat was caught in two traps 48 m apart, while the Common rats were caught in traps 81 m and 128 m apart. Three out of the five traps at this site caught both species of rat during the course of the study, the other two catching only Ship rats.

DISCUSSION

Differences between sites

The results presented here highlight a number of differences between the two sites, with rats at the Quarries being notably more numerous, or at least easier to catch. There also seem to be many more Ship rats at this site. The Common rat capture rate remained low but was constant across the two sites. The weights of the Ship rats were similar at the two sites, suggesting that they were in comparable condition. There are a number of factors which could influence trap success at the two sites, and these may work in combination. The most likely is that there are simply more rats at the Quarries than at Millcombe. However, the rats at Millcombe are in closer proximity to humans (and cats) and this extra pressure may make them more wary of novel objects and hence less likely to enter traps. If the Ship rats at Millcombe are being more cautious than their Quarries counterparts, recapture rates might be expected to be lower. The results of this survey suggest this may be the case, but the actual numbers of rats involved was very small. The fact that the rats here are also being exposed to poison bait (which they were readily consuming) will also affect their likelihood of recapture, as the poisoned animals die off. They were being poisoned with a slow acting anticoagulant compound, which can take over a week from ingestion of a lethal dose until death occurs. However, the fact that rat activity persisted for two weeks after the onset of poisoning suggests that some rats were not eating it, or that new rats were constantly moving into the area.

Movement within sites

The results of the capture-mark-recapture part of the study, along with the limited spooling data, support the idea that the two species do not use spatial segregation as a means of avoiding competition. Smith *et al* (1993), working on Lundy, trapped Common rats in areas where Ship rats had been radio-tracked. It is possible that the two species are exploiting different food sources, but this can only be confirmed by the analysis of stomach contents or faecal pellets. However, there appears to be no broad spatial niche separation, making the coexistence of the two species even more remarkable. Further spooling, radio-tracking and dietary analysis could be used to identify more precisely the ways in which the two species avoid competition.

Comparison with previous studies

Capture rates were much higher here than in previous studies, and this is also the first time that Ship rat captures have exceeded Common rat captures. Furthermore, this is the first occasion since 1962 that all three Ship rat morphs have been recorded on Lundy (see Table 5) . Previous studies typically only found Ship rats at the very south-eastern tip of the island, although Wolton (1995) reports that in 1992 they were spread across the island all the way to the North Light. The existence of such an apparently high population at the Quarries however appears to have been unknown. The findings of this study suggest that the Ship rat is thriving away from its former stronghold in the south east, and away from conflict with humans. This study, like all the other short studies of rats on Lundy, can provide only a snapshot of the status of rats on the island. Differences in trapping regime, type of trap used and time of year will undoubtedly affect trap success, and hence population estimates. This study has found the Ship rat population apparently much healthier than in previous studies, having weathered previously recorded low numbers, and ten years of poisoning.

Table 5. Summary of previous studies.

Author	Study date	Trap success (%)	Ship:Common	Ship rat morphs
Oxford Expedition	June 1962	23/179 (3.2%)	-	R, F, A
Perrin and Gurnell	April 1971	14/910 (1.5%)	4 :10	F
Smith (1985)	Oct 1983	24/167 (14.4%)	5:19	R, F
Smith *et al* (1993)	April 1991	10/328 (3%)	4:6	R, A
Varnham	Oct 1997	26/76 (34%)	19:7	R, F, A

Key: Trap success = no. of first captures/ no. of trap nights;
Ship:Common = ratio of no. of Ship rats caught to no. of Common rats caught;
Morphs: R = Rattus, F = Frugivorus, A = Alexandrinus.

The future of the Ship rat on Lundy

The Ship rat appears from these findings to be a little more secure than previously supposed. While the presence of rats around human settlements is hard to justify and will attract little support, particularly on an island dependent on tourism and farming, there is at least no evidence that rats of either species are doing any other harm, for example adversely affecting bird populations (Perrin and Gurnell 1971, Aspinall 1991, Natynczuk *et al.* 1992). Wolton's (1995) recommended rat control policy (to improve food storage and disposal, to poison only in the immediate vicinity of the settlement, and to monitor Ship rat, Common rat, Puffin and Manx Shearwater numbers annually) seems both practical and pragmatic. Introducd rodent species are never going to be a conservation priority, but with a policy of 'benign neglect' the Ship rat population of Lundy should continue, allowing further in-depth studies of Lundy's rat ecology.

ACKNOWLEDGEMENTS

I am extremely grateful to The Lundy Field Society for a grant towards the costs of this study. I would also like to thank Roger Quy of CSL for the loan of the traps, and to the Warden, Administrator and other staff on Lundy for their help and support.

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