Rep. Lundy Field Soc. 53

LUNDY CABBAGE POPULATION PEAKS – ARE THEY DRIVEN BY RABBITS AND MYXOMATOSIS?

By

STEVE G. COMPTON [1], ROGER S. KEY [2] AND ROSY J.D. KEY [2]
[1] Centre for Biodiversity and Conservation, School of Biology, University of Leeds, Leeds, LS2 9JT
[2] English Nature, Northminster House, Peterborough, PE1 1UA

ABSTRACT

The three recorded myxomatosis outbreaks on Lundy have led to widely fluctuating rabbit populations. Outbreaks two and three preceded the two largest recorded peaks in the numbers of Lundy cabbage (no data are available from the period after the first myxomatosis outbreak). These dramatic fluctuations may be because Lundy cabbage numbers are kept low in the years when many rabbits are present, but once their numbers crash the plant can exploit the widespread bare ground that has been generated. The peaks are brief because the general vegetation quickly closes over, forcing out the cabbage, and rabbit numbers rapidly recover.

Keywords: *Lundy cabbage, herbivory, myxomatosis, population dynamics, rabbits.*

INTRODUCTION

In some years, visitors arriving on Lundy by boat are treated to sections of the cliffs and the sidelands from Landing Beach to Gull Rock that appear bright yellow with Lundy cabbage (*Coincya wrightii*). In contrast, since 2001 the plants have been so scarce that only the more vigilant visitors will have noticed them at all. Here we ask what it is that drives this between-year variation. We argue that rabbits may play a significant role, generating both 'good' and 'bad' years for the cabbage, but we also conclude that our ten years of thorough data collection do not cover a long enough period to give a definitive answer.

LUNDY CABBAGE

Lundy cabbage is a short-lived perennial crucifer endemic to Lundy. It has a 'weedy' life style that is favoured by soil disturbance. Its population size can vary greatly from one year to the next (Compton *et al.,* 2002), which is naturally of concern from the point of view of its continued survival, and a study funded by English Nature of the plant and its associated insects (some of which are also restricted to Lundy) has been underway since 1993 (Key *et al.,* 2000). Annual counts of the numbers of plants in flower, taken in late May and early June, were initiated in 1994 after a pilot study the previous year. The counts were not always complete, in that some sub-populations could only be counted in years when a boat was available, but only a small number of plants were involved and they had little influence on overall count figures. It was necessary to record the number of plants in flower, rather than total plant numbers, because most of the plants are on steep cliffs that can only be viewed through binoculars, and small non-flowering individuals would easily be missed. Non-flowering individuals are only recorded from the small number of readily accessible sub-populations.

RABBITS ON LUNDY

Lundy was once a Royal Warren, and may have been one of the earlier parts of Britain where rabbits (*Oryctolagus cuniculus*) were introduced, with records dating back prior to 1219 (Linn, 1997). The rabbits were highly prized because a high proportion of them were (and still are) the generally rare black form. On islands such as Lundy, rabbits face fewer predators than on the mainland. The ravens, greater black-backed gulls, rats (until recently) and domestic cats on Lundy may take some rabbits, but none can be considered as specialist predators. Lundy is also particularly favourable for rabbits because of its mild climate, allowing reproduction to be only briefly interrupted in mid winter. Not surprisingly, and despite winter hunting, rabbits can reach high densities on Lundy and have probably been doing so since they were introduced. This is indicated by quotes such as "There is an immense quantity of rabbits all over the island" (Grose, 1785). More recently, various estimates of peak rabbit numbers have been made, for example 60,000 rabbits were present in 1982 according to the Exeter University Psychology Department Web page, over 20,000 in 1991 (Gibson, 1992) and approximately 20,000 in January 1996 (based on pellet counts, Petterson and Compton, unpublished).

Because rabbits were a valuable resource, their numbers were probably kept in check by harvesting during those periods when the islands were occupied, with sometimes huge annual culls (nearly 11,000 were trapped in 1929, Gade, 1978). There have been periods, however, when Lundy apparently did not have a resident human

population, during which rabbit numbers presumably reached local carrying capacity. Grose's account comes from such a period when the island was apparently deserted.

MYXOMATOSIS

Myxomatosis first reached Lundy in 1983, starting from the SE of the island, probably through deliberate introduction (Parsons, 1984). The few subsequent references to rabbits in LFS annual reports suggest that after the initial collapse, the numbers of rabbits quickly recovered, before there was a further outbreak in 1992, which reduced numbers to a few hundred. Myxomatosis reappeared for a third time in May 1996 (Liza Cole, Pers. Comm. unpublished). It reduced rabbit numbers by the following winter to an estimated 2000 or so, surviving at the two ends of the island (Petterson and Compton). It is possible that myxomatosis has been present continuously at low frequencies since its introduction, only flaring up intermittently, or they may have been three separate introductions (the 1992 outbreak, which started after Christmas 1991, was attributed to infected fleas imported with ferrets, Gibson, 1992). Whatever its origins, it has been highly successful at reducing rabbit numbers on Lundy, albeit temporarily, leading to very rapid swings in the numbers of rabbits on the island. Rabbit haemorrhagic disease (RHD), also known as rabbit calicivirus disease (RCD), is another potentially fatal disease of rabbits. It has also been recorded from Lundy in recent years, but seems to have had negligible effects on overall rabbit numbers.

RABBIT GRAZING AND LUNDY CABBAGE

Lundy cabbage has probably been managing to coexist with rabbits for hundreds of years. During this time there have been repeated and extended periods of high rabbit densities that were perhaps as high or higher than those currently being experienced. Direct observations of rabbits feeding on Lundy cabbage do not seem to have been recorded (except on plants grown for experiments in Leeds), but indirect evidence is all too obvious when rabbit numbers are high. For example, most plants in Millcombe during summer 2003, and all the young plants in December, were heavily grazed, despite the recently erected stock fence.

More direct evidence comes from the exclosures that have been set up at Half Way Wall and north of St. Helena's Combe for several years. These are divided into two, with one half accessible to rabbits but not larger grazing mammals, (particularly domestic sheep and sika deer), and the other accessible to neither. Control areas, accessible to both, are nearby. At Half Way Wall, Lundy cabbage has flowered every year since the rabbit-proof section was erected, but never in the rabbit accessible section. In the more southern exclosure, it flowered briefly in the rabbit-proof section, before dying-out, probably because a dense sward developed (largely of Yorkshire fog, *Holcus lanatus*). In the rabbit accessible area, there was still extensive bare-ground and only limited vegetation succession in 2003. These results show not only

that Lundy cabbage is highly attractive to rabbits, but also that it can be eliminated locally by rabbit feeding. Nonetheless, across the island as a whole there will always be rabbit-free refugia, especially on the cliff faces. These allow Lundy cabbage to persist even at times of exceptional rabbit densities, although it is of concern that these plants may be less suitable for its dependent insects than those growing in more sheltered situations further inland.

RABBIT IMPACTS ON LUNDY CABBAGE

1983-1989

The 1985 report by Irving (Table 1) provides one of the lowest ever estimates of Lundy cabbage numbers from a relatively thorough count. Although almost certainly an underestimate, this count is likely to have coincided with very high rabbit numbers, as it was made in the same year as the introduction of myxomatosis to the island ("probably deliberately", Parsons, 1984). Furthermore, the Exeter University Web page gives an estimate of 60,000 rabbits for 1982 - probably the highest ever mentioned. The absence of further counts of the plant from this period means that we have no idea whether the post-myxomatosis recovery of Lundy cabbage was as spectacular as that seen after subsequent outbreaks.

Table 1. **Rabbits and Lundy cabbage 1983-1993.**

YEAR	RABBITS	LUNDY CABBAGE
1983	Myxomatosis arrives	590 (Autumn count)
1986	"as plentiful as ever, free of Myxomatosis."	No account available
1990	"explosion" ("linked to rat control?")	No account available
1991	"over 20,000, causing erosion"	Photo -"one of the best years" – but written in 1992?
1992	"almost wiped out" by Myxomatosis	"Lundy cabbage increasing"
1993	Only "several hundred left"	Exceptionally high with a incomplete count of over 5000

Based on Warden's annual summaries in the *Annual Reports of the Lundy Field Society* (by N. Willcox & A. Gibson) and from Irving 1985, Parsons 1984 and the 1993 count by Farrell *et al.* 1993 We do not have information from the other years.

1990-1993

Rabbit numbers had "exploded" by 1990 (Table 1), with the warden at the time (Andrew Gibson) attributing their abundance to a period of determined rat control. Lundy cabbage counts were not made immediately prior to the winter 1991-92 outbreak of myxomatosis, but a rapid increase in plant numbers was reported in 1992. Our annual counts were piloted in 1993, when an incomplete count nonetheless reported around 5000 Lundy cabbage plants in flower – the second highest total ever reported. The numbers of plants in flower had rapidly dropped by the next year, when the standardised annual counts were introduced (Figure 1).

1994-2003

This is the best documented period, as rabbit numbers were censused using pellet counts between 1996 and 2001, with unquantified notes on rabbit numbers taken in other years (Petterson and Compton, unpublished). Detailed counts of Lundy cabbage are also available from 1994 onwards. Numbers of Lundy cabbage have varied greatly over this period, with the lowest counts in the four years when rabbit numbers were recorded as very high, and with by far the highest count, two years after the appearance of myxomatosis in 1996 (Figure 1).

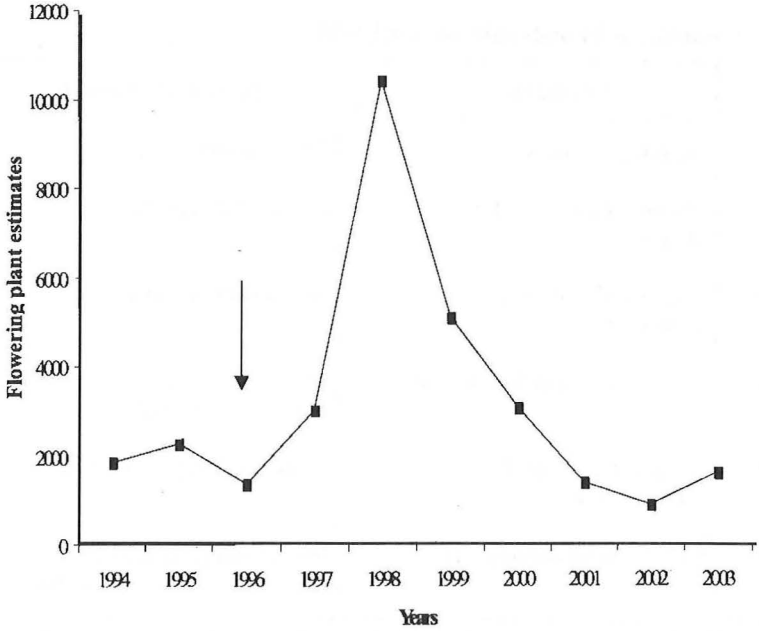

Figure 1. Counts of Lundy cabbage in flower between 1994 and 2003.

A rough count in 1993 estimated around 5000 plants. The arrow indicates when a myxomatosis outbreak occurred. Note that the years when rabbit numbers were noted as being 'very high' were 1996, 2001, 2002 and 2003, the years when Lundy cabbage numbers were lowest. Plate 1 illustrates changes in the abundance of Lundy cabbage in relation to Myxomatosis outbreaks

DISCUSSION

A build-up to a short-lived but nonetheless dramatic peak two years after myxomatosis outbreaks has been a feature of at least the last two disease outbreaks, and possibly the one before. This leads us to suggest that the dramatic swings in Lundy cabbage numbers that we have seen may be driven by the even more dramatic changes in rabbit numbers brought about myxomatosis. It seems likely that peak rabbit populations severely depress Lundy cabbage numbers through very high grazing pressures, but at the same time they create bare soil and depress general sward densities. The eventual collapse of rabbit numbers due to myxomatosis then releases the plant from herbivory at a time when there are many micro-sites suitable for colonisation. The plant reaches a flowering peak two years later, after which numbers rapidly decline, possibly because of sward closure and competition with other plant species and/or the subsequent recovery in rabbit numbers. If this scenario is correct then the spectacular numbers of Lundy cabbage seen in 1993 and 1998 would not have been seen on Lundy prior to the introduction of myxomatosis about twenty years ago.

Other factors are also likely to have an impact on Lundy cabbage numbers, most obviously the weather. It may influence the plant both directly (droughts in one year may favour Lundy cabbage the next year, for example) and also indirectly via the numbers of rabbits on the island. In some areas, livestock access and abundance are also clearly important.

It has taken ten years of surveys, in combination with earlier literature records, to appreciate the likely significance of rabbits for Lundy cabbage. Even now, the link between rabbits and the plant can only remain tentative until there is another collapse in rabbit numbers on Lundy. Looking to the future, rabbit numbers are not expected to be influenced by the current rat extermination programme (D. Bullock, Pers. Comm.), even though rats probably ate some Lundy rabbits (Appleton *et al.,* 2002) and the plant might even benefit if the rats used to eat its seeds. The current high rabbit levels are therefore likely to persist, along with low cabbage counts until and unless myxomatosis returns to the island when we predict a brief, but spectacular, recovery in Lundy cabbage and the plant will once again become obvious to the island's visitors.

ACKNOWLEDGEMENTS

Thanks to David Bullock (National Trust) for his input on mammal population dynamics on Lundy and to the wardens and staff on the island for their help over the years.

REFERENCES

Appleton, D., Booker, H., Bullock, D., Cordrey, L., Sampson, B. and Cole, L., 2002. *Lundy seabird recovery project. Project summary*. Peterborough: English Nature.

Compton, S.G., Key, R.S and Key, R.J.D., 2002. Conserving our little Galapagos – Lundy, Lundy cabbage and its beetles. *British Wildlife* 13, 184-190.

Farrell, F., Compton, S., Key, R. & Key, R., 1993. Rare plant monitoring report: *Coincya wrightii*. Unpublished report to English Nature. 8pp.

Gade, F.W., 1978. *My life on Lundy*. Reigate: Myrtle Langham.

Gibson, A., 1992. Warden's report for 1991. *Annual Report of the Lundy Field Society* 42, 6-10.

Grose, F., 1785. *Antiquities of England and Wales*. London: S. Hooper.

Irving, R.A., 1985. Notes on the distribution of the Lundy cabbage. *Annual Report of the Lundy Field Society* 35, 25-27.

Key, R.S., Compton, S.G. and Key, R.J.D., 2000. Conservation studies of the Lundy cabbage between 1994 and 2000. *Annual Report of the Lundy Field Society* 49, 74-81.

Linn, I., 1997. Wild Mammals of Lundy. R.A. Irving, A.J. Schofield and C.J. Webster (eds) *Island Studies* 107-115. Bideford: Lundy Field Society.

Parsons, A.J., 1984. Notes on some mammals on Lundy. *Annual Report of the Lundy Field Society* 34, 40.