

# Seabirds on Lundy: their current status, recent history and prospects for the restoration of a once- important bird area

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**Abstract** Once host to some exceptionally important seabird colonies, the island of Lundy, in the Bristol Channel, lost much of its special seabird interest during the twentieth century. The eradication of rats (significant predators of seabirds on islands throughout the world) from Lundy in 2003–04 may pave the way for a return of the island's once-flourishing colonies. This paper sets out, for the record, what is known of seabird population changes on Lundy. While it is too early to formally recognise the start of recovery, we identify some very encouraging signs that the recent eradication has been effective and that the island once again provides conditions in which seabirds are able to flourish.

Lundy (51°10'N 04°40'W) is a relatively large island, some 430 ha and approximately 5 km long by 1.25 km wide. It lies in the Bristol Channel, some 19.5 km northwest of Hartland Point in Devon (the nearest part of the English mainland), some 45 km SSE from St Govan's Head in Pembrokeshire (the nearest part of the Welsh mainland) and about 70 km southeast of the internationally important seabird colonies of the Pembrokeshire islands of Skokholm, Skomer, Middleholm and Grassholm.

The island is owned by the National Trust and managed by the Landmark Trust. It is a Site of Special Scientific Interest, designated for its seabird interest. The surrounding seas, formerly protected as England's only Marine Nature Reserve, are now within England's first Marine Conservation Zone. Being essentially a rocky outcrop from an otherwise muddy seabed, and with a western seaboard exposed to the full force of Atlantic weather

and a contrastingly sheltered eastern side, Lundy is surrounded by waters that support a rich diversity of sponges, anemones and corals. They also contain the finest examples of rocky reefs in Britain, are one of the few places in Britain where northern and southern species occur side by side and the only place in the UK where five cup corals (Dendrophyllidae) exist together. A 4-km<sup>2</sup> 'no-take zone' has been established off the island's east coast in which all fishing has been banned for reasons of nature conservation. It is the first legally enforced no-fishing area in UK waters. Parts of the island are also a Special Areas of Conservation in recognition of the coastal habitats used by breeding Grey Seals *Halichoerus grypus*.

Lundy itself is a steep-sided island, rising to a granite plateau of some 100–130 m above sea level, with a summit at 142 m on Ackland's Moor. Unimproved grassland and moorland, dominated by Heather *Calluna*

*vulgaris*, covers the greater part of the island's area and is little used by seabirds. By contrast, the island's flanks are, for the most part, steep-sided cliffs above which rise steeply vegetated slopes known locally as 'sidings'. It is here that the island's seabird colonies are to be found. A small farming and tourism-oriented community occupies the southern third of the island, where the greater land area consists of 'improved' grassland.

Though the only non-avian indigenous vertebrate is the Pygmy Shrew *Sorex minutus*, the island supports considerable numbers of introduced Rabbits *Oryctolagus cuniculus*, feral goats, domestic sheep, feral soay sheep and Sika Deer *Cervus nippon*. Both Black Rattus *rattus* and Brown Rats *R. norvegicus* have also been abundant on the island until their recent eradication.

The island's name is derived from the Old Norse 'lundi', meaning 'Puffin' *Fratercula arctica* (and 'ey' meaning 'island'), suggesting a long association of this species with the island. Indeed, the island has at one time been home to some of the most important seabird colonies in England. However, the numbers of birds using the island fell dramatically during the twentieth century and,

in response to growing concerns over the future prospects of some species, notably those of the Manx Shearwater *Puffinus puffinus*, English Nature (now Natural England), the RSPB, the National Trust and the Landmark Trust formed a partnership to establish the Lundy Seabird Recovery Project, whose activities culminated in the eradication of rats from the island in 2004 (Appleton *et al.* 2006 and Box 1).

Of the 26 seabird species that now nest regularly in Britain & Ireland, a total of 10 breed regularly on Lundy. This paper summarises what is known of their status, that of two additional species which have not bred on the island since the 1920s and 1950s respectively, and that of another which may be expected to breed on the island in the near future.

### Sources of information on the status of seabirds on Lundy

The first census of seabirds on Lundy took place as recently as 1939 (Perry 1940). All species were included in the census, but although Manx Shearwaters were confirmed as breeding on the island, breeding numbers were only estimated. An expedition from

#### The eradication of rats from Lundy

BOX 1

The main aim of the Lundy Seabird Recovery Project was to improve conditions on Lundy to allow an increase in the numbers and breeding success of seabirds on the island, particularly those of the burrow-nesting Manx Shearwater *Puffinus puffinus* and the emblematic Puffin *Fratercula arctica*. The main task of the project was to eradicate rats, known predators of burrow-nesting seabirds, and an eradication programme ran from November 2002 to March 2004 with effort concentrated in the two winter periods, when alternative food for rats would be scarce. Expert contractors (Wildlife Management International Ltd), assisted by a team of no fewer than 57 volunteers, conducted the fieldwork. Rats were poisoned using difenacoum (a second-generation anticoagulant which inhibits the production of vitamin K) presented in cereal-based, 24-g wax bait blocks, set in over 2,000 bait stations. These consisted of sections of corrugated pipe, 0.75 m in length and 0.1 m in diameter, placed over a 50-m grid that covered the entire island including the steep sidings and offshore stacks. Bait stations were also placed on the island ferry and in storage buildings on the mainland. All stations were checked regularly and details of bait-take recorded.

Monitoring stations were placed within the bait-station grid during February 2003 to detect any continuing rat presence. Each monitoring station comprised chewsticks – wooden pegs soaked in oil – and candles or soap on which any feeding rats would leave characteristic teeth marks. The final bait-take was recorded during February 2004. Continued regular monitoring (weekly for the remainder of 2004, then monthly during 2005), followed by a final check of the whole island in early 2006, confirmed the rat-free status of the island.

Quarantine measures were drawn up to reduce the risk of rat recolonisation; along with contingency procedures should a rat be detected. Waste management practices on the island have also now been improved. These measures will continue indefinitely.

Jesus College, Oxford University, conducted a second seabird census in 1962, though Manx Shearwaters were excluded (Sinclair 1962). In the interim, periodic censuses of Fulmars *Fulmarus glacialis*, which were in the process of colonising the island, Shags *Phalacrocorax aristotelis* and Kittiwakes *Rissa tridactyla* had been undertaken by the island's wardens and the results included in their annual reports. (The first warden was appointed in 1947, following the formation of the Lundy Field Society in May of the previous year, and wardens have been in post intermittently ever since.) A third census took place in 1969 as part of Operation Seafarer (Cramp *et al.* 1974; Britton 1969), again excluding Manx Shearwaters. Whole-island censuses were also conducted in 1970 and 1971 (Britton 1970, 1971; Gregory 1971), but they were undertaken over a very brief period and the estimates resulting from this work appear to us to be anomalously low. More rigorous counts were made of the auks, Fulmars and Kittiwakes in 1972 and 1973 (Dymond 1972, 1973). Regular censusing, mainly on a 4–5 year cycle, began in 1981, with censuses of all species other than Manx Shearwater conducted in 1981, 1982, 1986

(these results being incorporated into the Seabird Colony Register; Lloyd *et al.* 1991), 1992 and 1996 (Price 1982, 1986, 1992, 1996). The 2000 survey results were incorporated into Seabird 2000 (Mitchell *et al.* 2004), and subsequent censuses were conducted in 2004 and in 2008 (Price 2004; Price & Booker 2008). Specific surveys targeted Manx Shearwaters in 2001 and 2008 (Price & Booker 2002; Booker & Price 2010), while surveys of breeding European Storm-petrels *Hydrobates pelagicus* in 2002 and 2010 failed to find birds nesting on the island (Price 2002; Booker & Townend 2010). The Devon Bird Report and, especially, the Annual Reports of The Lundy Field Society contain counts for some individual species or groups of species in years other than those noted above. We have collated the information contained in these reports and in the two avifaunas of the island, both entitled *The Birds of Lundy* (Dymond 1980; Davis & Jones 2007).

### Survey methods

Richard Perry was the first to undertake a census of seabirds on Lundy. He recorded at a very fine scale during his five-month survey in 1939, recognising 164 individual breeding



Andy Brown

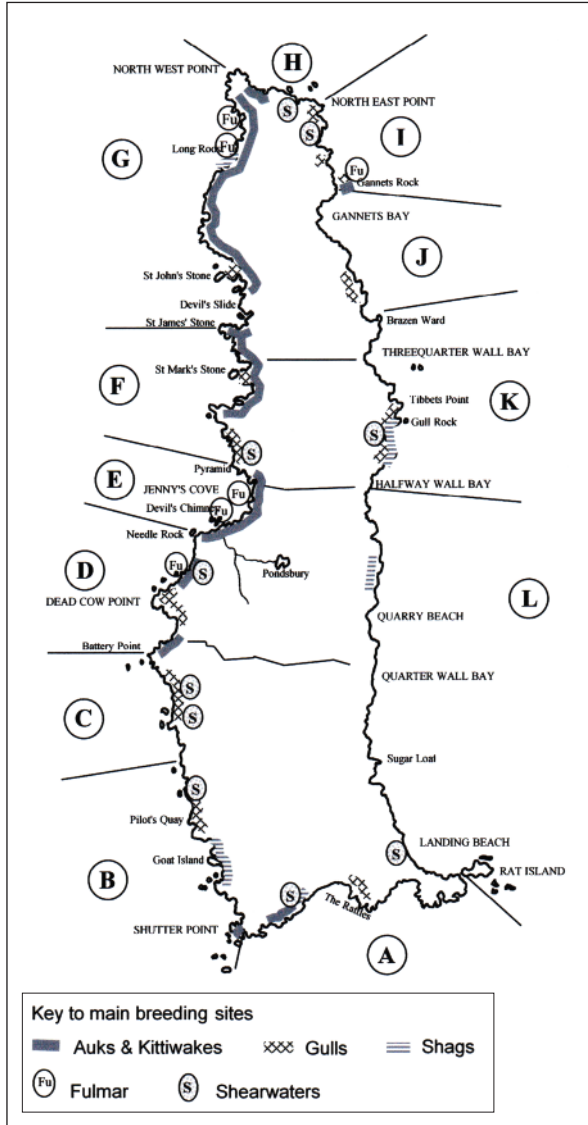
61. Lundy: a general view of the island from south to north, with the endemic Lundy Cabbage *Coincya wrightii* in the foreground; June 2008.

sites on the island. He included all species in his mapping exercise and estimated population sizes for all species. His estimate of Manx Shearwater numbers is based upon limited overnight observations at nesting locations, and counts of birds feeding offshore, and consequently the resulting estimate for breeding

pairs can only be very approximate. R. W. Britton was the next to organise a whole-island census (for Operation Seafarer), in spring 1969. He subdivided the coastline into a series of 12 sections (A–L) during the survey and referred to these again for reporting purposes. These sections continue to be used today. He noted that, since there was no warden on the island at that time, the survey was carried out by a variety of observers, over ‘a longer period than was desirable’ during June and July and that a ‘lack of time became a hazard’ (Britton 1969). The counts are thus likely to be underestimates of the actual numbers present.

All subsequent surveys were organised and conducted by one or more of the authors of this paper. No assumptions were made during these surveys concerning the distribution of seabirds, other than for Manx Shearwater, and so all sites were searched systematically. The survey methods were species-specific and followed standard methodology (see Walsh *et al.* 1995).

Each seabird survey (other than those for Manx Shearwaters and European Storm-petrels) was conducted by a team that visited the island, typically for a fortnight in late May and early June. Surveys were conducted between 08.00 and 16.00 hrs and involved counting birds and mapping their distribution at a detailed site level. Apparently occupied nests (AONs) of gulls, Fulmars and Shags were counted during systematic searches of each coastal section, together with all individual auks (rather than pairs) at breeding sites. Common Guillemots *Uria aalge* and Razor-bills *Alca torda* resting or ‘loafing’ away from breeding sites or out on the sea were excluded but all individual Puffins were recorded wherever they were encountered, with their counts assigned to the nearest apparent breeding site. Between two



**Fig. 1.** Lundy, showing main coastal sections, and principal breeding areas for seabirds.

Footnote: The principal breeding areas are those used by Manx Shearwaters *Puffinus puffinus*, Kittiwakes *Rissa tridactyla*, other gulls or auks in sections supporting 5% or more of the island's breeding population, or by Fulmars *Fulmarus glacialis* and Shags *Phalacrocorax aristotelis* in sections containing 10% or more of the island's population of these species.

and four counts (on different dates within each season) were made at each of the great majority of the breeding sites included in the surveys conducted since 1981. The final count for each species is the sum of the 'best counts' – for auks and Shags it is the highest count in each section and for Fulmars and Kittiwakes it is an estimate based on their distribution and a detailed assessment of nest-site occupation.

Gull numbers are approximations: we counted all apparently occupied territories (AOTs) visible from a distance. This avoided the considerable disruption that would have been caused to the gulls by walking through the colonies and the danger to us of counting nests on steep grassy slopes. The gull counts are thus underestimates of actual numbers. Furthermore, counts conducted prior to 2000 involved substantially less effort than those since and should be treated as minima. The 1986 survey by Wilcox (1987) is an exception, as it was aimed specifically at recording the large gulls and involved rigorous within-colony coverage.

Manx Shearwater censusing was carried out by checking for occupied nesting burrows. We assumed that Manx Shearwaters did not breed in improved fields, on steep unvegetated cliffs, among boulder scree, in woodland or beneath the extensive *Rhododendron* *Rhododendron ponticum* thickets that, until recently, clothed a large area on the island's eastern flank. These areas, together with a very small area of other coastal land judged unsuitable because the soil was too thin to allow burrow creation, or was occupied by Lesser Black-backed Gull *Larus fuscus* colonies or was inaccessible, were not surveyed. Each area of potential nesting habitat within each section was divided into discrete sites. A sufficient number of surveyors were assigned to each site to enable complete cov-



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**62.** Lundy's name is derived from the Old Norse word 'lundi', meaning *Puffin Fratercula arctica*.

erage. Most surveys were carried out by following horizontal contour transects spaced at 5-m intervals across the sidings, each surveyor looking up the slope and searching the ground for burrows above their transect line up to the next surveyor. Where the area to be checked was fragmented and not suitable for contour transects, it was covered as a block, with special care being taken not to duplicate the checking of holes. Full surveys were carried out during 19th–26th May 2001 and 24th–30th May 2008, at a stage before young hatched and before immature non-breeders began to occupy holes. Surveyors searched systematically during daylight hours for burrows and holes beneath boulders in their allocated area. At the mouth of each burrow a recording of the 'duetting' calls of male and female Manx Shearwaters was played for up to 15 seconds in an attempt to elicit a response from incubating adults within the burrow. Apparently occupied burrows were those from which a response was initiated within a further 15 seconds. Other evidence of occupation, such as droppings, claw marks, feathers, eggshell remains or corpses were also noted. In 2001 and 2008, searches for Manx Shearwaters were also conducted on a sampling basis across the island plateau. Seven areas were non-randomly selected on the 'inland' plateau, which together comprised 114,100 m<sup>2</sup> in 2001 and 53,500 m<sup>2</sup> in



Andy Brown

**63.** A view westwards across Puffin Slope, on the north coast of Lundy, towards the lighthouse at North West Point. This area supports a small number of seabirds but it once held very large numbers – notably Razorbills *Alca torda* – with bird activity on this photograph (June 2008) in marked contrast to that evident in the photo in Perry's (1940) book (plate 64).

2008 – respectively (and very approximately) 8% and 4% of the plateau area supporting semi-natural vegetation, i.e. the 150-ha area north of Quarter Wall (see fig. 1). Within each sampling area, surveyors walked transects searching 2.5 m either side of the line, recording burrows and attempting to elicit a response using playback of the calls of adult Manx Shearwaters.

There is no direct evidence that European Storm-petrels breed, or have ever bred, on Lundy, but they are recorded regularly around the island during the breeding season. There are small colonies to the southwest, on the Isles of Scilly, and much larger colonies to the northwest, on the Pembrokeshire islands. We thus investigated the possibility that they breed on Lundy by searching all accessible suitable habitat during a specific survey on 7th–13th July 2002. Each area of suitable habitat that was accessible to us was systematically searched by playing the bird's 'churring' call for approximately 10 seconds at intervals of every 3–4 m in areas where potential nest-

sites were dense or at each burrow or crevice entrance where these were at low density. The habitats we regarded likely to provide suitable nest-sites were dry-stone walls, buildings and ruins, boulder beaches, screes and rock falls, bolder-strewn areas, burrows and cracks in peat and rock, caves, and cracks and crevices on cliffs and buttresses. Most accessible areas were searched for European Storm-petrels but we were unable to visit caves, scree below cliffs, or cracks and crevices on the steeper cliffs and buttresses. The repeat of this survey in 2010, which was conducted earlier in the season (1st–5th June) to allow for night observations at areas of suitable habitat, also failed to reveal signs of nesting storm-petrels.

### Presentation of the data

The coast of Lundy has been notionally divided into 12 contiguous sections for seabird survey purposes since 1969. Fig. 1 shows these 12 sections, together with an indication of the main seabird concentrations around the island. Each discrete area

**Table 1.** Numbers of individuals/pairs of all species recorded during the seabird census of 2008 (24th May to 7th June).

Species	Number of pairs/individuals	Count Unit <sup>1</sup>	% of southwest England total <sup>2</sup>	% of Great Britain total <sup>3</sup>
Manx Shearwater <i>Puffinus puffinus</i> <sup>4</sup>	1,081	AOS	86.34%	0.37%
Fulmar <i>Fulmarus glacialis</i>	170	AOS	6.90%	0.03%
Shag <i>Phalacrocorax aristotelis</i>	63	AON	2.49%	0.24%
Kittiwake <i>Rissa tridactyla</i>	151	AON	4.37%	0.04%
Herring Gull <i>Larus argentatus</i>	534	AOT	4.09%	0.41%
Lesser Black-backed Gull <i>L. fuscus</i>	263	AOT	3.16%	0.24%
Great Black-backed Gull <i>L. marinus</i>	57	AOT	4.07%	0.34%
Common Guillemot <i>Uria aalge</i>	3,302	Individuals	48.28%	0.25%
Razorbill <i>Alca torda</i>	1,045	Individuals	54.88%	0.64%
Puffin <i>Fratercula arctica</i>	14	Individuals <sup>5</sup>	7%	<0.01%

<sup>1</sup> AOS = apparently occupied site; AON = apparently occupied nest; AOT = apparently occupied territory.

<sup>2</sup> Southwest England (regional) total defined here as seabirds nesting in the Isles of Scilly, Cornwall, Devon, Somerset, Gloucestershire, Avon, Dorset, Hampshire and Isle of Wight and in 1998–2002, as given in Mitchell *et al.* 2004, other than for Manx Shearwater, which uses Isles of Scilly total (171 AOS in 2006) from Heaney *et al.* 2008.

<sup>3</sup> Based upon figures from Seabird 2000 (Mitchell *et al.* 2004): Great Britain = England, Scotland and Wales.

<sup>4</sup> Manx Shearwater numbers calculated from 560 actual responses adjusted for an established response rate of 51.82%.

<sup>5</sup> Individuals treated as equivalent to pairs.

(e.g. a single cliff face, a gully or a promontory) within a section that has been found to hold breeding seabirds is formally regarded as a 'site' (and in 2008 the total thus defined was 162 individual sites). Copies of a periodically updated site register (Price 1982, 1986, 1992, 1996, 2000, 2004) containing a detailed description of each site, including maps, sketches, the location of viewing points and the distribution of birds within each section and routes of survey transects, together with a complete history of bird counts, are deposited at the Natural England library, Peterborough, at JNCC Aberdeen, at RSPB, Exeter, and with the Lundy Field Society.

In order to allow comparison of recent counts with those obtained during the 1939 and 1969 surveys, which were based upon *pairs*, we have converted pairs into numbers of *individuals* for both Common Guillemots and Razorbills by multiplying the number of pairs by 0.67 (Harris 1989). All other counts have been taken at face value, though we suspect some considerable under-recording of both Common Guillemots and Razorbills

in section F in 1969. The charts below use shaded grey symbols for the 1981 and subsequent surveys as these data all derive from surveys organised or conducted by one or more of the authors. Other data are drawn from the surveys or reports identified above. The lines in each chart merely join these data points and should not be taken as an indication of population size between the counts – for which periods, and as far as we are aware, there is no information.

### Seabird numbers on Lundy in 2008 and the current regional and national importance of the island's seabird colonies

Table 1 provides a summary of the results of the most recent census of seabirds on the island. No species occurs in numbers that exceed 1% of the British total nor do most species occur in numbers that exceed 10% of the southwest England regional total. Nevertheless, Manx Shearwaters, Common Guillemots and Razorbills occur in numbers of exceptional regional significance.

## Changes in the numbers of selected seabird species on Lundy

### Overall seabird numbers

Only the first and the most recent surveys have included counts or estimates for all species (the majority omitting Manx Shearwaters and/or gulls). Perry estimated an island seabird population of some 40,000 pairs, substantially greater – in fact almost eight-fold – than the overall population of 5,245 pairs (counts of individual Common Guillemots and Razorbills converted to pairs by multiplying by 0.67, Puffin individuals = number of pairs after Harris 1989) in 2008. Although we do not have comparable information on overall seabird numbers for the intervening years, we do have good information for many individual species (see below).

### Fulmar

Fulmars first bred in England in 1922. Breeding began in southwest England in the 1940s, in mainland Cornwall at Porthmissen and Trevone in 1944 and on the Devon mainland at Berry Head in 1949. None nested on Lundy in Perry's time: indeed only nine birds had been recorded in Devon prior to 1938, after which Fulmars were reported regularly from the island. Breeding was finally proved in 1944, in which year four pairs were present in Jenny's Cove and one egg was laid. By 1947, three pairs nested there, with another three pairs at Gannet's Rock. Numbers increased steadily, with 20–30 apparently occupied sites (AOS) during the 1950s, 25–45 during the 1960s and over 100 pairs by 1973. Though numbers

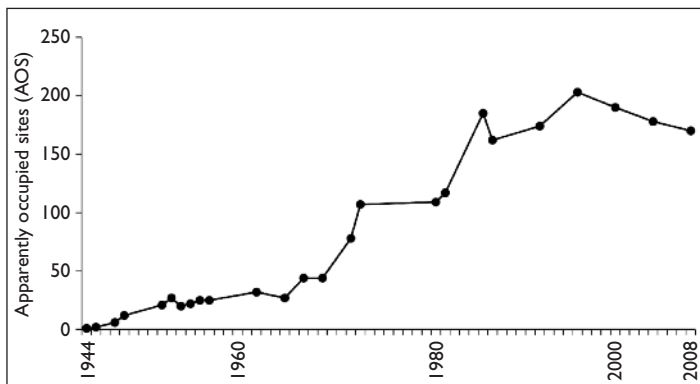
just exceeded 200 AOS in 1996, the population has since fallen back to mid-1980s levels of around 170–180 AOS (fig. 2).

Jenny's Cove remains the main stronghold, with around 40% of the island population, but the original Gannet's Rock colony has declined in recent years from a peak of 67 AOS in 1982 to just 37 in 2008. However, substantial numbers now nest annually southwards from Jenny's Cove, between Battery Point and Needle Rock, and to the north at Long Roost. The colonisation and subsequent increase in Fulmar numbers on Lundy is in line with both regional trends and trends across the North Atlantic.

### Manx Shearwater

Manx Shearwaters are confined as breeding birds to the North Atlantic, with practically all of the global population, of some 338,000–411,000 pairs (Mitchell *et al.* 2004), breeding in Britain & Ireland. Huge numbers breed close to Lundy, with about 102,000 pairs on Skomer and 50,000 pairs on Skokholm and Middleholm. Attempts to assess the numbers nesting on Lundy have proved difficult, not least because for much of the last century there appeared to be very little successful breeding, a feature largely attributed to predation by rats (Taylor 1985). Most estimates were based upon birds seen or heard calling at night and were therefore somewhat tenuous, producing estimates ranging widely, from 100 to several thousand pairs.

In 2001 we carried out the first systematic survey on Lundy, using playback of shearwater calls. In all, 7,155 holes were checked, and from these 154 responses were obtained from incubating birds. The application of a calibration factor of 51.82% for the actual response rate at occupied holes (Booker & Price 2010) produced an estimate of 297 breeding pairs. In 2004, fledgling shearwaters were recorded on the island for the first time in four decades (see Smith 1961 & 1967 for previous proof of



**Fig. 2.** Numbers of apparently occupied Fulmar *Fulmarus glacialis* sites on Lundy, 1944–2008 (apparently underestimated counts in 1970 and 1971 excluded).

breeding), immediately following the successful eradication of rats.

A repeat survey in 2008 found 1,081 pairs (corrected estimate), an increase in breeding numbers of 250% since 2001 (Booker & Price 2010). This remarkable increase has undoubtedly been in response to the eradication of rats, which has allowed nesting to proceed unhindered by predation. The rise in breeding numbers cannot be due to improved breeding success, however, since the young birds do not return to breed until they are 5–6 years old. It must, therefore, have been due to immigration from other colonies. Assuming minimal productivity prior to 2004, this continued influx from other colonies probably prevented the extinction of the species on the island. Subsequent observations have shown that fledged young are now being produced regularly on the island and in increasing numbers. In 2007 an attempt was made to measure productivity using mark-recapture of juveniles at the most densely populated part of the island. Although it proved difficult to determine the number of nesting pairs (and thus productivity) accurately over the whole of this part

of the island, a total of 51 juveniles were ringed in early September from an area that had produced 64 responses to tape playback during incubation, clearly indicative of a successful breeding season (Booker *et al.* 2008).

Fig. 3 shows the results of the two Manx Shearwater surveys, and shows that the distribution of birds is along the coastal sidings, with occupied holes recorded in all sections, but particularly where the depth of soil permits adequate burrow construction. An increase in numbers has taken place at virtually all sites, with the larger colonies growing in size and extent, and with new areas being occupied for the first time.

### Northern Gannet

Northern Gannets *Morus bassanus* are confined as breeding birds to the North Atlantic and are known on Lundy from as early as the thirteenth century (Fisher & Vevers 1943, 1944). Accounts from the fourteenth and seventeenth centuries suggest their continued presence and, more recently, they were reportedly present in 1829, in 1839 and 'plentiful' but decreasing in 1871. Seventy nests were present in both 1889 and 1890. There-

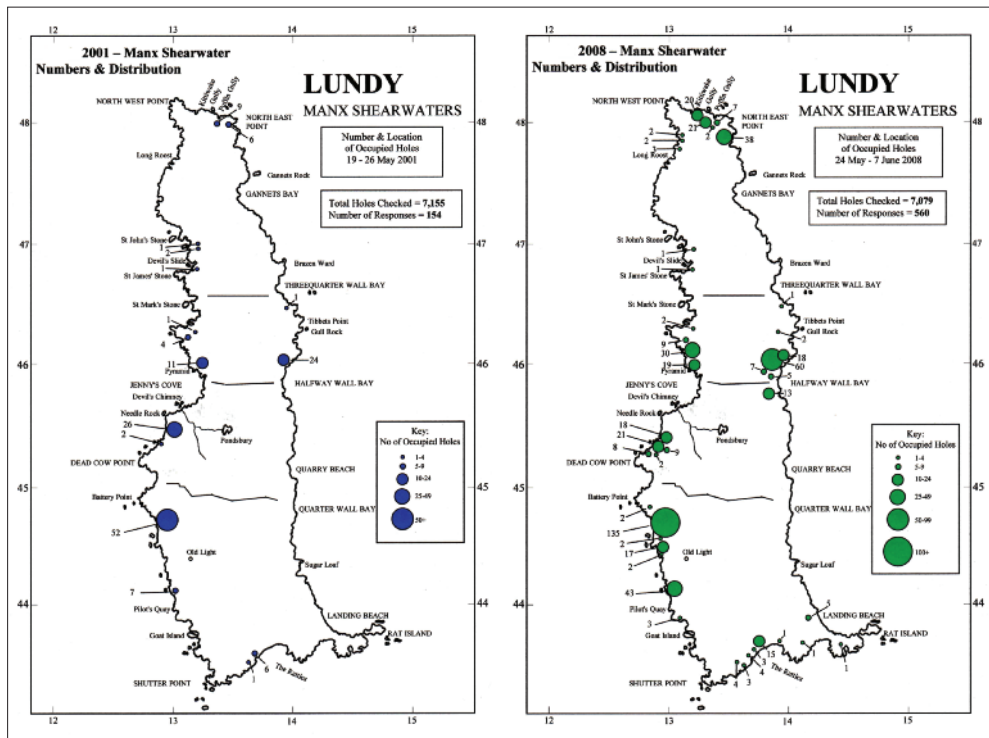


Fig. 3. The results of the 2001 and 2008 burrow surveys of Manx Shearwater *Puffinus puffinus* on Lundy.

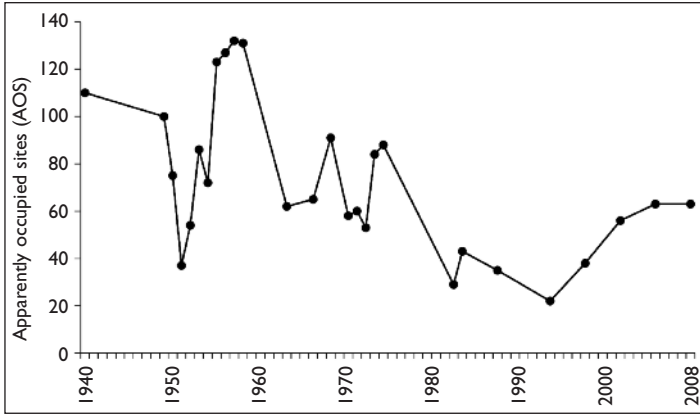
after the numbers fell rapidly, with 30 pairs in 1893, three in 1900, seven in 1901, five in 1903, none in 1904 and two in 1905. The colony was reported as extinct in 1906, though birds attended the colony, without nesting, in 1907. Subsequently, a pair attempted to nest, unsuccessfully, in 1922, just two years prior to the start of attendance at England's only extant colony, at Flamborough/Bempton in Yorkshire (D'Urban & Mathew 1895; Fisher & Vevers 1943, 1944).

**Great Cormorant and Shag**

Perry reported a total of 13 pairs of Great Cormorants *P. carbo* nesting in 1939. Davis & Jones (2007) reported that Great Cormorants only ever bred in small numbers during the last century, but declined in the late 1940s and were last recorded as a breeding species in 1959, when one pair raised four young at a nest-site above Quarry Beach.

Shags are more numerous. Perry reported a 1939 island breeding population of some

110 pairs but, other than during the period of an intensive ringing study by one particular warden, Barbara Whitaker, from 1954 to 1957, the total has never been greater than this. We regard all other counts as underestimates because pairs may have nested undetected low on the cliff faces and, since the species often has an exceptionally protracted breeding season, they may have



**Fig. 4.** Number of apparently occupied Shag *Phalacrocorax aristotelis* nests on Lundy, 1939–2008 (see text for explanation of peak counts 1954–57).



Andy Brown

**64.** A view towards the northeastern end of Lundy, across Gannet's Bay to Gannet's Rock, presumed site of Lundy's former Northern Gannet *Morus bassanus* colony and the first part of the island to be colonised by Fulmars *Fulmarus glacialis* in the 1940s; June 2008.

nested outside the survey periods. However, such counts should be comparable between surveys. Shag numbers declined during the 1970s and 1980s but have remained at some 50–60 pairs in the last decade.

Most birds nest in small groups among boulders, in sheltered gullies and on the more sheltered rocky slopes fringing the base of the cliffs in the vicinity of St Mark's Stone and northwards towards North West Point; in the far southwest of the island, particularly at Goat Island; and in scattered places along the east coast between Quarter and Threequarter Walls – in which area the birds nest on grassy ledges or in small gullies and under overhangs. This pattern of distribution has remained consistent since Perry's time.

### Large gulls

Three large gull species nest on the island. Lesser Black-backed Gulls generally nest in discrete colonies in well-vegetated ground, usually among thick grass, Thrift *Armeria maritima* or Bracken *Pteridium aquilinum* or on the sidings above the cliffs. All but eight pairs are found north of Shutter Point on the west coast, along the north coast and down the east coast southwards to Halfway Wall. In

2008 the largest colony, of 60 pairs, was on the west coast at Dead Cow Point. Perry reported an island population of some 350 pairs in 1939 but numbers were thought to be much lower in the 1950s (e.g. 36 nests were counted in 1956) – almost certainly as a result of gull control and the harvesting of eggs. There appears to have been a steady increase in numbers thereafter, from 75 AOS in 1982 to 443 in 2000, mirroring both regional and national trends. The decline to just 263 AOS in 2008 is thus cause for considerable concern, especially as it parallels recent losses on the Isles of Scilly (Heaney *et al.* 2008).

Herring Gulls *L. argentatus* are widely distributed around Lundy, with the exception of the east coast to the south of Halfway Wall. The majority nest along the west coast from Pilot's Quay to North West Point. The birds nest on platforms and in crevices on the cliffs, more rarely spreading onto the vegetated sidings. They nest singly, in small groups and in larger colonies. Perry estimated an island population of some 3,000 pairs in 1939 – approximately six times higher than now. Many thousands of Herring Gull eggs were collected for human con-



65. Perry (1940) reported 'squadrons' of Razorbills *Alca torda* over Puffin Slope along the island's north coast. Many fewer seabirds nest here today (see plate 63). [Image reproduced from p. 113 of Perry (1940).]

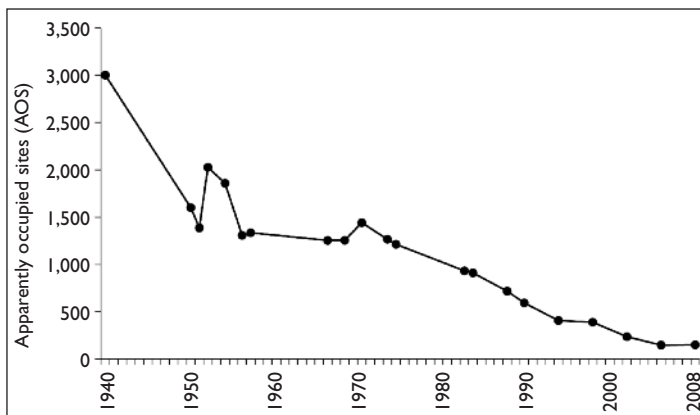
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**66.** Lundy was cleared of non-native Black *Rattus rattus* and Brown Rats *R. norvegicus* during the winters of 2002/03 and 2003/04. Strict controls are in place to minimise the chances of recolonisation, but a series of bait stations remain in place across the island to allow periodic checks for their presence; June 2008.

sumption during the 1940s, 1960s and 1970s and between 1976 and 1983 some 6,500 eggs were pricked as it was believed that gulls were a threat to nesting auks (Davis & Jones 2007). Numbers have been broadly stable since this practice ceased in the early 1980s, approximately within the range 400–750 pairs, though with an estimated 1,117 pairs in 1986 (Wilcox 1987).

Great Black-backed Gulls *L. marinus* tend to nest prominently but solitarily or in very small numbers on Lundy, atop buttresses, stacks, small islands and promontories. The



**Fig. 5.** Number of apparently occupied Kittiwake *Rissa tridactyla* nests on Lundy, 1939–2008 (apparently underestimated counts in 1962, 1970, 1971 and 1997 are excluded).

majority nest in the northern half of the island, though small numbers nest just to the south of Halfway and Quarter Walls and between Shutter Point and Pilot's Quay. Perry estimated an island population of some 57 pairs, identical to the number recorded in 2008. The highest count in the interim was of 66 AOS in 1986, with all others in the period between 20 and 35 pairs.

### Kittiwake

The decline of this highly pelagic species on Lundy has been

dramatic. Perry recorded some 2,887 pairs nesting in 1939 and estimated an island population of 3,000 pairs. The estimated total had dropped by between one-third and one-half by the late 1940s and by two-thirds by the early 1980s, even though there had been a substantial increase in the size of the national population between 1969–70 and the mid 1980s (Lloyd *et al.* 1991). The trend continues and there are now some 20-fold fewer Kittiwakes nesting on Lundy than in 1939.

This precipitous decline is part of the wider pattern now readily apparent across the Kittiwake's British and Irish range. Numbers fell by 23% between 1985–88 and 1998–2002 and by a further 36% between 2000 and 2008 (Mitchell *et al.* 2004; JNCC 2009). Some colonies in south-west England, including the colony at Land's End, Cornwall, have been abandoned since Seabird 2000 and productivity at many others has been negligible in each of the years

2006–10. Productivity has been monitored by the volunteers and wardens on Lundy since 2007 and has been below 0.3 chicks/pair each year (Porter *et al.* 2010). The dramatic decline of the Kittiwake is of some considerable concern. It is likely that poor breeding success and the decreasing numbers are due to reduced prey availability.

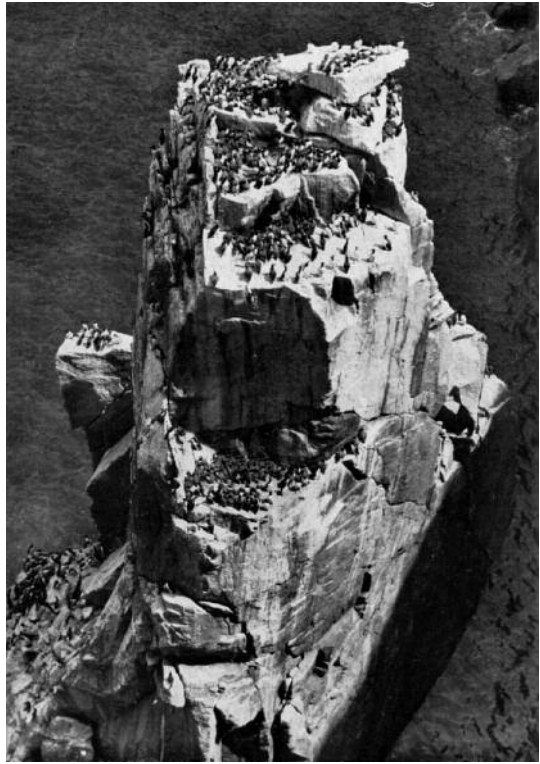
Most of Lundy's Kittiwakes have always nested in gullies and on exposed cliff faces on the west coast of the island, north of Needle Rock, and around the north coast to Gannet's Rock. There is variation in the size of individual colonies in these areas between years, and at some sites sizeable colonies (like that at Puffin Gully, with over 400 pairs in the early 1980s) have disappeared entirely.

**Auks**

Three species of auk nest on the island, two in numbers of exceptional regional significance.

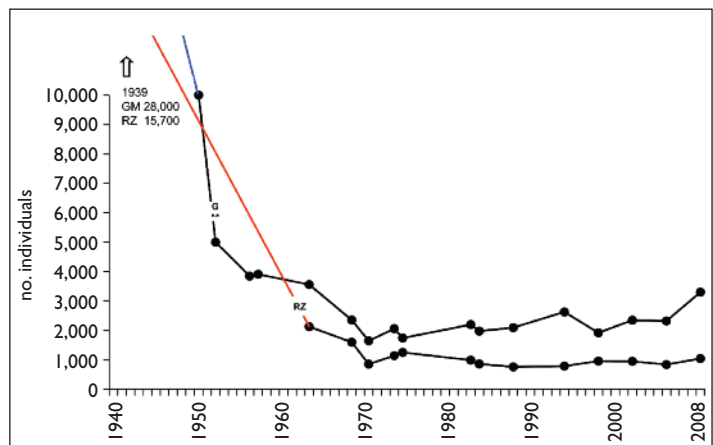
Most of the island's Common Guillemots nest on ledges on the sheer cliffs and stacks between Needle Rock and North West Point, though smaller numbers occur on the north coast and northeast coast southwards to Gannet's Rock. A few nest farther south along the east coast and on the rather unstable and sloping cliff faces found along the south coast. None nest south of Old Light on the west coast, owing to similarly unstable cliff

conditions. This pattern of distribution is similar to that during Perry's time, when he estimated the island population to be 19,000 pairs (actual count 18,530 pairs, equating to some 27,657 individuals). Periodic counts at both South West Point and Gannet's Rock indicate that there was a major decline during the 1940s and the next whole-island census (which included birds on the water) produced an estimate of 3,850



**67.** Common Guillemots *Uria aalge* on the Devil's Chimney. Perry (1940) remarked that here 'there is for most of the day a ceaseless and astounding surge of cawing'. Silent now, no Guillemots have nested on this rock since 1992. [Image reproduced from p. 161 of Perry (1940).]

birds in 1955, with similar estimates made during 1956 and 1962. Some very low counts in the 1970s, including, for example, one of 819 birds in 1970, are thought to be underes-



**Fig. 6.** Numbers of individual Common Guillemots *Uria aalge* (solid line) and Razorbills *Alca torda* (dotted line) on Lundy, 1939–2008. Counts of 'pairs' have been converted to number of individuals.

timates. The population appears to have been relatively stable since 1972, but the 2008 total of 3,302 birds was the highest since recent systematic counts began in 1981.

The relative stability of numbers until 2004 runs counter to national trends, which have seen a rise of 81% between the first national survey in 1969 and the second in 1985–88, and of a further 32% by the third national survey in 1998–2002. The southwest England total almost doubled in the same period, increasing from 3,659 individuals in 1969–70 to 6,839 in 1998–2002. The marked increase in numbers on Lundy between 2004 and 2008 is in line with continuing regional (e.g. along the Exmoor coast and at Tintagel

in Cornwall) and national increases (JNCC 2009; Porter *et al.* 2010).

Perry reported 9,509 pairs of Razorbills on Lundy in 1939, equivalent to 14,193 individuals (Harris 1989) and estimated an island population of 10,500 pairs. The next count, in 1962, found significantly fewer: 2,100 birds. There were no whole-island surveys in the intervening years but the evidence from periodic counts in the southwest of the island is that numbers fell dramatically in the early 1940s. Numbers clearly continued to fall, to a low of 750 birds in 1986. Subsequent counts indicate a small but steady increase in numbers to 950 individuals in 2000 and 1,045 in 2008.

About three-quarters of the island's Razorbills are found between Needle Rock and North West Point. The remainder are widely but thinly distributed around the rest of the coastline, though few are found on the east coast between Rat Island and Halfway Wall. The birds nest in clefts and crevices on the cliffs and among the boulders and fallen rocks below them. The distribution of birds today is much as it was in Perry's time, with the striking difference being that he found very large numbers on the north coast, particularly in the boulder-covered sidings adjacent to Puffin Slope, and his text indicates that this was the species' favoured area.

The pattern of change in numbers since 1969–70 is broadly in line with trends across Britain &



Elisabeth Price

**68.** One of the authors (DP) counting seabirds in May 2004 at Jenny's Cove, site of one of the larger seabird colonies on the island and an area favoured by two of the island's more famous seabird visitors, Puffins *Fratercula arctica* and (the Western Palearctic's only record of) the Ancient Murrelet *Synthliboramphus antiquus* that appeared in the spring of 1990, 1991 and 1992.

Ireland, where numbers increased by some 29% between 1969–70 and 1998–2002 (Mitchell *et al.* 2004). However, the county totals for Devon as a whole, for Cornwall and the Isles of Scilly are down by 24%, 23% and by 56% respectively in the same period. However, Razorbill numbers on Lundy have increased by 10%, across the region by 47% and in the UK by 5% since Seabird 2000 (JNCC 2004). While it is possible that the eradication of rats may have improved nesting success of Razorbills on Lundy, the increase at Tintagel and Exmoor suggests that other factors (such as food availability) are influencing population levels.

Puffins nest in substantial numbers close to Lundy, with an estimated 9,000 pairs in Dyfed (Carmarthenshire, Pembrokeshire and Ceredigion), about 30 pairs in Cornwall, 120 pairs on Scilly, 300 on the Channel Islands and about 1,800 pairs in Co. Wexford (Mitchell *et al.* 2004). Perry reported a huge Puffin colony on Lundy on Puffin Slope, with other nesting birds on the cliffs of Jenny's Cove, Dead Cow Point, and on the Long Roost. The birds now tend to nest in holes in the base of the turf just below the break between the sidings and the steeper cliffs, though they no longer extend up the sidings as they did in Perry's time. All potential nesting areas on Lundy are clearly visible, so the counts of all birds from the four-yearly surveys conducted since 1981 in early June should provide a reasonable indication of colony size. In recent years, specific Puffin counts have also been undertaken by the island wardens, who have integrated these with general counts from the Lundy Field Society's logbook to provide further indications of numbers (Saunders & Wheatley 2008 and 2009).

There is no disguising the precipitous decline of this species on Lundy. Perry reported finding some 2,927 pairs on Lundy in 1939, estimating the island population at some 3,500

pairs. The main area frequented by the species then was the extensive, steep, grass and Thrift-covered siding of Puffin Slope, and the adjacent litter of boulders and rocks at the north end of island. This area then held all but 250 of the nesting pairs on the island. Numbers fell dramatically in the 1940s, such that by the early 1950s there were just 500–800 individuals nesting. About 100–150 individuals nested during the 1960s and 1970s but thereafter numbers fell steadily and by 2004 just single figures remained, all breeding sites except the St Philip's Stone area having been abandoned (fig. 7).

The decline of the Puffin on Lundy through the last century mirrors similar losses elsewhere in the south of its range. Numbers on the Isles of Scilly have been hugely reduced from the 100,000 pairs recorded nesting there at the start of the twentieth century. Numbers on the Channel Islands fell by 72% between 1969–70 and 1998–2002 and by 86% in Cornwall, with the once important colony at Lye Rock, where some 3,000 birds were breeding in the 1940s (Penhallurick 1969), now abandoned. There is considerable variation, though, with numbers in Dyfed almost trebling between 1969–70 and 1998–2002 (though following an earlier catastrophic decline from at least 20,000 pairs in the late 1930s) and overall the numbers in Britain & Ireland have increased by a third between 1969–70 and 1998–2002. We have no direct evidence that rats once predated Puffins on Lundy, but we believe it is likely (and also that, had rats not been

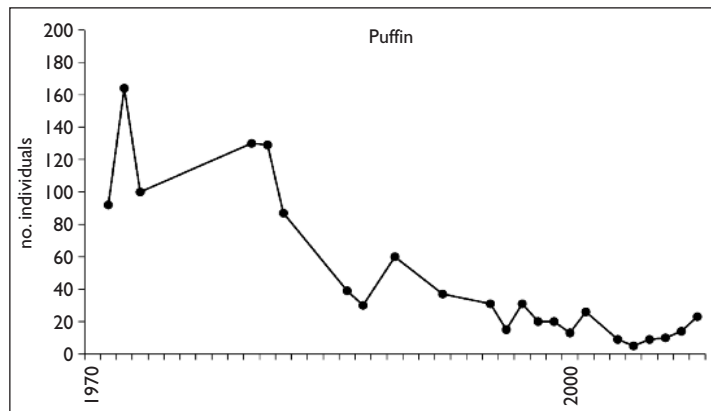


Fig. 7. Numbers of breeding Puffins *Fratercula arctica* on Lundy, 1970–2008. Counts after mid June are excluded as they will have included immature non-breeders.

eradicated in the winters of 2002/03 and 2003/04, Puffins would have declined further and become extinct within a few years). Observations at St Philip's Stone in 2005 established that there were six occupied burrows, and a chick seen on 13th July was proof of successful breeding (Taylor 2006). Subsequently, breeding has been consolidated at this site and overall island numbers have increased, albeit modestly. In 2008, 23 birds were seen at various locations around the island on 10th June, five pairs nested at the St Philip's Stone site (four successfully) and two pairs recolonised Jenny's Cove after an absence of seven years (Saunders & Wheatley 2009). Video evidence of successful breeding was also obtained in that year (Sherman 2008). In 2010, there were 13 probable pairs at nest-sites in Jenny's Cove and three at St Philip's, with others investigating nest-sites at the former Long Roost nesting location. Furthermore, a late-season count (which would include prospecting immatures) revealed 50 birds on land in Jenny's Cove (Nicolas Saunders and Sophie Wheatley pers. comm.). Following the eradication of rats on Lundy, it is hoped that the apparent recovery witnessed in recent years will continue.

## Discussion

We are in little doubt that seabird numbers have fallen enormously on Lundy since 1939, with the evidence indicating that much of the decline took place during the 1940s. We have little information on the overall number of seabirds on Lundy prior to this date nor on whether numbers generally were falling prior to 1939, although we do know that the Gannet was lost as a regular breeding species in the opening decade of the twentieth century.

Much of the evidence for decline lies in a comparison between data from relatively recent counts and those collected by Perry in 1939. Clearly, the veracity of Perry's counts is crucial in our interpretation of the data. Perry was primarily interested in studying the behaviour of individual species and had no point to make in relation to numbers, nor in documenting any increase or decline. He accepted in the second edition of his book (1946) that his estimates of Manx Shearwater numbers may have been less than accurate but he stood by the accuracy of his original counts for other species and documents the numbers and distribution of each species in considerable detail in the appendices of his book (Perry 1940). While it would be wise, of



David Price

69. An increasing number of Manx Shearwaters *Puffinus puffinus* nest on Lundy. Here, a small team of surveyors search for burrows on the steep vegetated slopes known locally as 'sidings' in the vicinity of Benjamin's Chair and attempt to elicit a response from shearwaters by playing recordings of the 'duetting' calls of male and female birds; May 2008.

course, to exercise some caution in making comparison between his and later data, there is no doubt that the numbers of seabirds on Lundy have fallen on a grand scale. Perry's photographic evidence – notably of squadrons of Razorbills in flight at North Light, and of Devil's Chimney thronged with Common Guillemots (plates 64 & 66), where none have nested since 1992 – bears graphic testimony to this and offers strong support to the reliability of his counts.

Lundy's seabird avifauna has some intriguing features. Among the more southerly distributed (and more numerous) of the 26 species that breed regularly in Britain & Ireland (Mitchell *et al.* 2004) are a number missing from Lundy. Terns and Black-headed Gulls *Chroicocephalus ridibundus*, for example, are absent as breeding birds, but they are also absent from the huge seabird islands off the Pembrokeshire coast and, other than the very small numbers on Scilly, no terns or Black-headed Gulls breed regularly any farther southwest in Britain & Ireland. The presence of so few burrow-nesting seabirds on Lundy is also intriguing. Puffins, Manx Shearwaters and European Storm-petrels nest in considerable numbers no more than 70 km from Lundy (Mitchell *et al.* 2004) and all are regular visitors to the island during the breeding season. Much apparently suitable nesting habitat exists for all three species on Lundy. The location of the feeding grounds of birds nesting on the island is unknown but



Peter Slader

**70.** In August 2010, this ringed adult Manx Shearwater *Puffinus puffinus* was caught at the north end of the Old Light colony on Lundy. This had been ringed originally as a full-grown bird on Copeland, Co. Down, in July 2005. Presumably it had been there as a prospecting pre-breeding adult but had perhaps followed some of the Lundy foragers back to take up residence at the Old Light (birds are usually faithful to a site once they first nest there). This provides a little more evidence to support the assumption that much of the increase in shearwaters numbers in recent years, once the rats were eradicated, has been due to immigration.

we might reasonably expect those used by birds from the large Pembrokeshire colonies to be similarly available to any birds from Lundy. Even if they are not, there is nothing to suggest that food stocks have declined around Lundy nor around the nearby islands of Pembrokeshire.

We know of no firm evidence that European Storm-petrels have ever nested on the island but they may once have been present and may, indeed, persist in parts of the island inaccessible both to surveyors and to rats. Lundy Field Society Annual Reports (1947–99) contain numerous records of European Storm-petrels in the waters around the island, including 70 in Lundy Roads on 6th August 1973, following a severe westerly gale, and 10 at night at the Pilot's Quay on 28th July 1976. Furthermore, the remains of several birds have been found on the island and over 200 have been trapped for ringing both with and without the use of tape lures. Birds ringed in Cornwall (three), Scilly (two),

Devon, Dorset, Co. Clare and Co. Down (two) have been controlled on Lundy and birds ringed on Lundy have subsequently been controlled in Dorset, Dyfed, Cornwall (four) and the Calf of Man. The species' apparent absence as a breeding bird from Lundy in 1991, 2002 and 2010 is thus intriguing, as is the loss of both Gannets and Cormorants during the twentieth century.

One key difference between Lundy and the nearby Pembrokeshire islands is that, until very recently, Lundy has been occupied by populations of both Brown and Black Rats. The impact of introduced rats on seabird islands elsewhere has been well documented (Atkinson 1978; Micol & Jouventin 2002) and prior to 2004 we frequently found evidence of Manx Shearwater predation during our survey work, including broken eggs and scattered feathers outside burrows. We also frequently found the carcasses of adults outside burrows but these could just as well have been taken by Great Black-backed Gulls as by rats. We know that numbers of at least one of the burrow-nesting seabirds, the Puffin, have declined enormously on Lundy in the last 60 years and that the eggs and

young of this species and of the Manx Shearwater are highly susceptible to being taken by rats. Studdy (1948) discovered rat-predated carcasses and eggs of Manx Shearwaters and Puffins inside their burrows on Lundy. Extensive searches for Manx Shearwaters in late August and early September between 1979 and 1983, and again in 1988 found no sign of emerging young or of visiting adults (Taylor 1985, 1989). It seems likely that the numbers of burrow-nesting species on Lundy have been limited by predation by introduced rats, with both Manx Shearwaters and Puffins occupying a far smaller area than they might in the absence of these predators.

Both rat species were eradicated from Lundy in winters 2002/03 and 2003/04 and this should provide a test of our hypothesis that seabird numbers have been adversely affected by rats. Manx Shearwater chicks were found on the island for the first time in four decades in 2004 and counts from the 2008 census work show encouraging signs, with a spectacular increase in shearwater numbers since 2001 and the species now breeding in areas found unoccupied in the earlier survey. Young birds raised on Lundy



David Price

71. Juvenile Manx Shearwater *Puffinus puffinus* at the entrance of a nesting burrow at the Old Light colony, Lundy, August 2010. This particular burrow is marked as one where the nesting adults were fitted with data-loggers in 2010 by researchers from Oxford University, in order to study their foraging routes.

in 2003 (when most of the island was clear of rats) should have started to return to breed in 2009; with continued recruitment back into the colony in subsequent years, this should boost the existing population growth from immigration, particularly as at present there appears to be no shortage of habitat for the shearwaters to occupy. The successful breeding of Puffins and the gradual recolonisation of previously abandoned sites is also likely to be related to the removal of rats and it may be more than coincidence that Razor-bill and Common Guillemot numbers have also increased, with many of the latter also nesting nearer to the top of cliffs where they would previously have been readily accessible to rats. In fact, the 2008 census showed that, with the exception of Fulmar and Kittiwake, all other species had increased in numbers since Seabird 2000 and this is the first time such a comprehensive increase has happened over an eight-year period since at least 1939. The island also hosted a male Macaronesian Shearwater *Puffinus baroli*, which sang from its burrow in June 2010 – only the second such instance known from Britain & Ireland. Although it may be rather optimistic to look to colonisation by this species, repeat censuses will allow us to monitor the effect of rat eradication on all seabird numbers on Lundy and will hopefully allow us to chart a substantial increase in the numbers of Manx Shearwaters and Puffins on the island and perhaps its re(?)-colonisation by European Storm-petrels.

Lundy's seabirds have suffered mixed fortunes since the turn of the twentieth century. Although seabird numbers may now be much lower than they were 100 years ago, the declines in most species have stabilised or reversed. The eradication of rats in 2003–04 may well prove to be a pivotal moment in the further recovery of Lundy's seabird populations, particularly for the vulnerable burrow-nesters such as the Manx Shearwater, and the island's totem, the Puffin. The provision of safe nesting sites is, of course, just one critical component in safeguarding the future of seabirds on Lundy, their survival being equally dependent on an adequate food supply within commuting distance of the island. The identification and appropriate protection of the birds' key foraging areas

will thus be of equal importance. The designation, in January 2010, of England's first Marine Conservation Zone in the waters around the island is thus a most welcome development, placing Lundy as the cornerstone of a new network of Marine Protected Areas that are likely to be established around our coasts by 2012. Despite the uncertain impacts of climate change on the marine ecosystem and ultimately on seabird populations, the future of Lundy as one of England's premier seabird islands looks bright. This is good news not only for seabirds, but also for the local economy, as a thriving seabird colony will be certain to attract more visitors to the island, which, in turn, should further enable the effective conservation management of the island.

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