Departure of Manx Shearwater *Puffinus puffinus* fledglings from Bardsey, Gwynedd, Wales, 1998 to 2013

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Very little has been published about how soon Manx Shearwater *Puffinus puffinus* fledglings leave the area around the natal colony, clearly because of the difficulty of re-catching them after they are first ringed and of knowing whether or not recaptured birds had flown (Perrins *et al*. 1973; Perrins 2014). Fledglings are thought to depart southwards promptly after they finally leave the natal burrow because the food supply near the colony is deteriorating as the breeding season draws to a close, as suggested by the earlier departure of the adults and the lighter weights of later fledglings, and also as evidenced by the paucity of recoveries immediately after fledging, gale-wrecked birds apart (Brooke 1990). Catching Manx Shearwaters on Bardsey, Gwynedd, Wales at lighthouse attractions within the perimeter of the lighthouse complex, and re-catching them there and on the ground elsewhere on the island, showed that not all fledglings left the area immediately, with a few remaining for up to five/six days. The data published here relate to the numbers initially attracted to the lighthouse and later re-attracted or otherwise caught again in late August and September, between 1998 and 2013.

Bardsey (52°76'N 4°78'W) is three km long from north to south and a little over one km at its widest point (Figure 1). A small colony of breeding Manx Shearwaters has been known on the island since early in the 20th century (Cramp *et al*. 1974) and the species currently breeds in burrows, mainly in soil on the steeper slopes, but also in or by the earth-covered stone boundary walls in the low-lying areas. The island's Manx Shearwater colony is perhaps the fifth largest in Britain and Ireland (Newton *et al*. 2004) and the most recent whole-island surveys in 2001 (Leaper 2001; Newton *et al*. 2004) and in 2008, 2009 and 2010 (Else 2009, 2010, 2011) estimated the breeding population at between 9,000 and 16,000 pairs. The productivity mean for the ten-year period 2001–10 was 0.77 (Brown & Stansfield 2011). In 2008–10 the island was subdivided into three survey areas for censusing the population: Area A on the steep east side cliffs held 9,610 apparently occupied burrows (AOB), Area B held 4,071 AOB, and Area C held 2,178 AOB (Else 2009, 2010, 2011). The lighthouse stands in Area C towards the southern tip of the southern promontory (Figure 2), at a point where burrow densities are low, there being probably fewer than 50 AOB within a radius of 100 m.

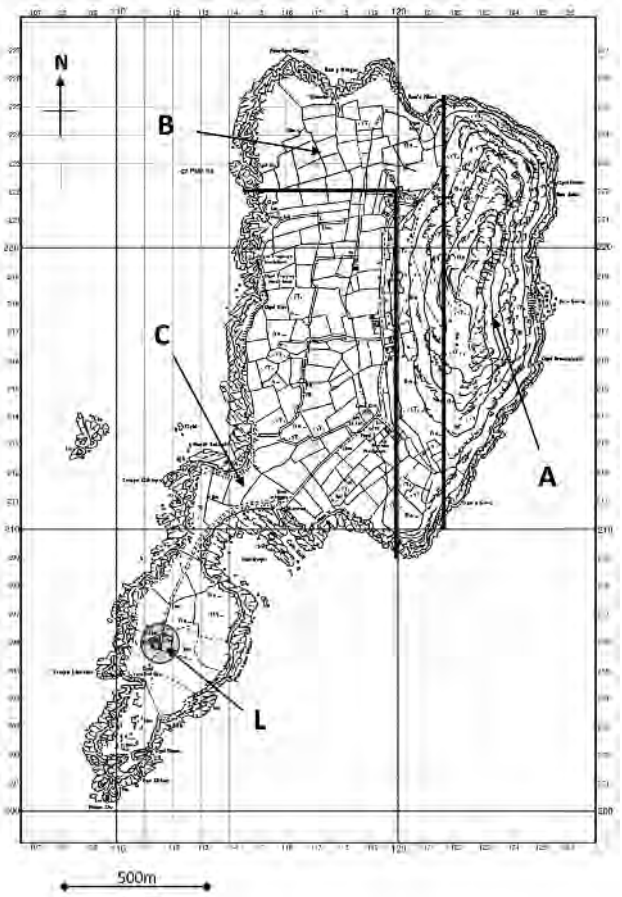

Figure 1. Map of Bardsey showing the position of the lighthouse (L) and the extent of the three survey areas (A, B and C).

Juvenile shearwaters exercise their wing muscles vigorously outside the burrows during the final nights before fledging (Brooke 1990), but very few of these on Bardsey were observed to fly, and those that did flew no more than 20–30 m in level flight nor to a height of more than one metre. The lighthouse lantern light is at about 30 m above ground level, and during 1998–2013 birds were attracted to the light in numbers in weather conditions involving very poor visibility and general mistiness, with rain and a cloud ceiling not far above the upper part of the lighthouse; very small numbers were also attracted from time to time on clearer nights. The attracted birds usually circled in the revolving beams of the light for several minutes and often much longer before colliding with the light and falling to the ground or escaping its attraction and flying off (Stansfield 2010). Birds found on the ground within the lighthouse complex can be assumed to have been free-flying, as a substantial perimeter wall prevented fledglings from wandering into the complex area on foot (Figure 3). Further, 27 of the fledglings attracted, but not re-attracted, were retraps, of which 23 had been ringed as juveniles at least 600 m and as much as 2,500 m from the lighthouse, and between two and 13 nights earlier (mean = 4.91). Thus juveniles attracted to the light were assumed to be fledglings and on their maiden or a subsequent flight. Trinity House altered the light in 2014, precluding the likelihood of any further attractions and gathering further like data.

Regular checks were made at night by Bardsey Bird Observatory staff for attracted birds, which were later ringed. Juveniles were distinguished from adult birds, often by retained down on the crown and/or belly, but also by a combination of fresh, unworn primaries with no bleaching on the tips of the primaries or secondaries, unworn and hence sharp claws, and more subjectively, the soft juvenile feel and, on occasion, the characteristic earthy burrow-smell. None showed any sign of injury.

Whilst the precise time of capture at attractions was not recorded, the post-midnight date was ascribed by convention to the ringing procedures, regardless of whether a bird was picked up before or after midnight. These birds were usually ringed, if not

previously ringed at the burrow, (processed) and released by manual launching into the wind, to fly away over the sea and out of sight, in mid/late afternoon or in the evening before dusk, and therefore possibly up to 20 hours after capture, and possibly within four hours of re-capture on the 'following night'. The birds picked up elsewhere and subsequent to the initial attraction were processed there and then and the date and time were usually recorded to the nearest hour.

Accepting that the attracted fledglings were almost certainly reared on Bardsey, at least 21 of those first attracted did not permanently leave the immediate vicinity of their natal colony for between one and six days, 16 being re-captured at lighthouse attractions and five on the ground elsewhere on the island (Table 1). Of those five, three were at least 750 m distant from the lighthouse at the West Coast (1) and in the Lowlands (2), one was c. 600 m distant at Solfach, and the fifth was at the South End, between 50–400 m distant. These 21 fledglings were part of a cohort of 220 fledglings caught at attractions on ten nights. To complete the picture, a further 628 fledglings, caught below the lighthouse on 177 nights at other very minor attractions and usually in twos and threes, were not caught again. The attracted birds were assumed to be Bardsey-fledged. Whilst the possibility of catching a fledgling from a colony elsewhere cannot be ruled out entirely, only a single fledgling ringed elsewhere has been controlled on Bardsey since 1953, compared with 140 adults. Furthermore, the likely minimum number of fledgling shearwaters departing Bardsey in any of the subject years would be about 6,900, calculated by multiplying the likely minimum number of breeding pairs (say 9,000) by the likely productivity mean (0.77).

Figure 2. View of Bardsey, looking southwest towards the lighthouse from the slopes of Mynydd Enlli, May 2015. © *Connor Stansfield*.

Figure 3. Bardsey Lighthouse and the perimeter wall that surrounds it, viewed from the south, May 2015. © *Connor Stansfield*.

Table 1. Numbers of fledgling Manx Shearwaters *Puffinus puffinus* attracted (A) at the Bardsey lighthouse and re-captured at a subsequent attraction or elsewhere on the island shortly afterwards, 1998–2013 and (B) captured and ringed on the ground on Skokholm and re-captured there afterwards, 1967, and the interval in days between captures.

Number of days from first to last capture	A. Number of Bardsey recaptures	Total days: product of first and second columns	B. Number of Skokholm recaptures	Total days: product of first and fourth columns
1	6	6	22	22
2	11	22	23	46
3			14	42
4	2	8	5	20
5	1	5	3	15
6	1	6	2	12
7			2	14
8			1	8
Totals	21	47	72	179
		Mean = 2.24		Mean = 2.49

The Skokholm numbers given here are slightly at variance with those in Perrins *et al.* (1973); of the 72 birds, 39 were weighed on both first and last recapture, covering a total of 104 'days' with a mean loss per day of 14.4 g.

Further, the birds caught at the first attractions may or may not have been on their maiden flights and there is no sure means of telling. As the majority of Welsh birds go overland to the sea on fledging (Brooke 1990), rather than flying, those scrambling to the sea might not have had time, or been able to fly well enough, to be attracted to the lighthouse light on their first night at sea, thus extending the post-fledging periods before the recapture attractions or other recapture for at least another 24 hours and perhaps longer.

So infrequent were the closely-spaced nights of double attractions that only 16 fledglings were both attracted and re-attracted to the lighthouse, while five originally-attracted birds were subsequently recaptured on the ground elsewhere on the island during occasional general ringing activities. The recapture of these five attracted fledglings, away from the lighthouse, indicates that some birds return to land after maiden fledging or other flights and before final departure.

Similar, but larger, samples of data arise from the capture, ringing and recapture of Manx Shearwaters on the ground outside the burrow on Skokholm Island, Pembrokeshire, Wales in 1967 (Table 1). The date of ringing on the surface was taken as indicative of the date of fledging in respect of birds not assumed to have ever flown (Perrins 2014).

Acknowledgements

Thanks are due to Professor Chris Perrins, the Wildlife Trust for South & West Wales (its current name) and Skokholm Bird Observatory for providing the Skokholm data in Table 1 with commentary. Members of the Bardsey Bird Observatory staff and visitors caught, re-caught, ringed and processed the fledglings at attractions and elsewhere on the island. Martin Heubeck, Professor Chris Perrins and another, anonymous, referee greatly improved the manuscript with their comments.

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