# The effects of disturbance on growth rate and survival of young Razorbills *Alca torda*

*Peter Lyngs*

## INTRODUCTION

Daily disturbances in colonies of Guillemots *Uria aalge* is known to reduce survival and growth rate of the chicks (Harris & Wanless 1984, Hatchwell 1989). However, nothing has been published on the effects of disturbance on Razorbills *Alca torda*, which usually breed at a lower density and at less exposed sites than Guillemots. This paper reports on the effect of human disturbance on growth rate, weight at departure and survival of young Razorbills from Græsholmen, Denmark (55°19'N, 15°11'E), in the central Baltic Sea.

## METHODS

In the breeding seasons of 1985 and 1986 three areas on Græsholmen were selected so that each area could be visited without causing disturbance at the others. Areas 1 (1985-86) and 2 (1986) were visited daily around 1800 hours from 5 days before the first egg hatched to the day that the last chick left. These areas are termed Heavily Disturbed Areas (HDA). The knowledge gained of the timing of hatching and chick departure in HDA was used in planning the visits to other areas. Area 2 (1985) was visited every 3-5 days from when the first egg hatched until most chicks had left, and is termed a Moderately Disturbed Area (MDA). However, on two occasions around hatching and around chick departure, MDA was visited on two successive days. From these visits the exact dates of hatching and departure were obtained for 6 MDA chicks. Nests in Area 3 (1985-86) were visited 1-3 times during the chick-rearing season, and this area is termed a Slightly Disturbed Area (SDA). Together the three areas contained about 100 pairs, 28% of the Razorbill population on Græsholmen (see Lyngs 1992). Nest sites (almost all under boulders) were numbered and their contents recorded. An approximate age of SDA chicks was estimated by comparing their wing-length with the wing-length of chicks whose age were known exactly. In HDA and MDA, chicks were considered to have departed successfully if they disappeared overnight at an age of 15 days or more, while in SDA, chicks were considered to have departed successfully if they reached an age of at least 10 days and were not later found dead in the nest. Sixty-three of the 69 (91%) SDA chicks were between 12 and 20 days old (mean 16.0 ± SD 2.4 days) when last visited. In HDA 30 out of 31 (97%) chicks which reached an age of 8 days departed successfully, the last disappeared at the age of 11 days. Investigations in other years confirms this pattern: for example, at 17 sites checked daily in 1984 all 11 chicks which reached an age of 8 days departed successfully.

In 1985 and 1986, 125 and 51 chicks respectively, from Area 3 and other undisturbed areas on the island were measured and weighed once. Chicks from HDA were weighed (to nearest g) daily using a Pesola balance, and maximum wing-length was measured (to nearest mm). Chicks from MDA were weighed and measured on every visit.

Measurements of 68 eggs (maximum length and breadth) from HDA were taken to the nearest 0.1 mm, and egg volume was calculated using Coulson's (1963) equation $V=klb^2$ (V=volume in $cm^3$, k=0.54 (Lloyd 1979), l=length in cm, b=breadth in cm).

Several studies of alcids have shown that wing growth is relatively independent of nutrition (references in Hatchwell 1989), so I assume that wing growth was independent of level of disturbance.

As there were no significant difference in measurements, weight or day of departure in HDA

chicks from 1985 and 1986, data from the two years have been combined. The mean weights (compared to wing-length) of chicks handled only once in 1985 and 1986 did not differ significantly, so these data have also been combined.

In 1986 all 18 departing chicks from Areas 1 and 2, and 50 of the chicks weighed and measured once (30 chicks from Area 3 and 20 chicks from other undisturbed areas) were ringed with British-made triangular rings (see Lloyd & Perrins 1977). The return of these chicks in later years was documented by reading the numbers using a telescope.

## RESULTS

Combining data from 1985 and 1986, overall breeding success in HDA was significantly lower than in SDA (Table I; $x^2 = 23.6$, 1 df, $P<0.01$). Mean hatching success in the two areas was 80% and 86%, respectively, but in HDA 57% of the chicks died or disappeared (93% within 6 days after hatching) compared with 13% from SDA. In 1985 breeding success in MDA and SDA did not differ significantly ($x^2 = 0.03$, 1 df, ns).

TABLE I. BREEDING SUCCESS OF RAZORBILLS IN DIFFERENT STUDY AREAS ON GRÆSHOLMEN 1985-86.

| *Area* | *Pairs* | *Eggs* | *Hatched (%)* | *Departed (%)* | *Departed chick/pair* |
|---|---|---|---|---|---|
| Area 1,1985 (HDA) | 26 | 27 | 25 (93) | 12 (48) | 0.46 |
| Area 2,1985 (MDA) | 22 | 22 | 21 (95) | 15 (71) | 0.68 |
| Area 3,1985 (SDA) | 47 | 47 | 39 (83) | 34 (87) | 0.72 |
| Area 1, 1986 (HDA) | 31 | 34 | 24 (71) | 9 (38) | 0.29 |
| Area 2,1986 (HDA) | 25 | 26 | 21(81) | 9(43) | 0.36 |
| Area 3,1986 (SDA) | 46 | 46 | 41(89) | 35(85) | 0.76 |

Notes: HDA, Heavily Disturbed Area; visited daily.
MDA, Moderately Disturbed Area; visited every 3-5 d.
SDA, Slightly Disturbed Area; visited 3-4 times during chick-rearing period.

Of the 68 eggs measured in HDA, those which produced departing chicks had a mean volume of 98.0 ±6.0 $cm^3$ (range 83.0-108.1 $cm^3$, n = 25), while those where the breeding attempt failed had a volume of 93.7 ±7.6 $cm^3$ (range 75.0-113.1 $cm^3$, n = 43). The difference in mean egg volume between these two groups is statistically significant ($t = 2.39$, $P<0.02$, two-tailed).

There was no difference in the weight/wing-length relationship of chicks from HDA and chicks from slightly disturbed areas (ANCOVA, P= 0.35, ns; Fig. 1).

Twenty-eight chicks from HDA departed at a mean weight of 212 ± 24.2g (range 163-253g), a wing-length of 82 ± 6.9mm (range 62-94mm) and at an age of 20.4 ± 2.2 days (range 16-26 days). Comparable data for six MDA chicks were 212 ± 30.6g (168-249g), 78 ± 4.3mm (71-84mm) and 18.8 ± 0.7 days (18-20 days) respectively. There was no significant difference between the two groups in any of these variables ($t = 0$, -1.35 and -1.71 respectively; all ns).

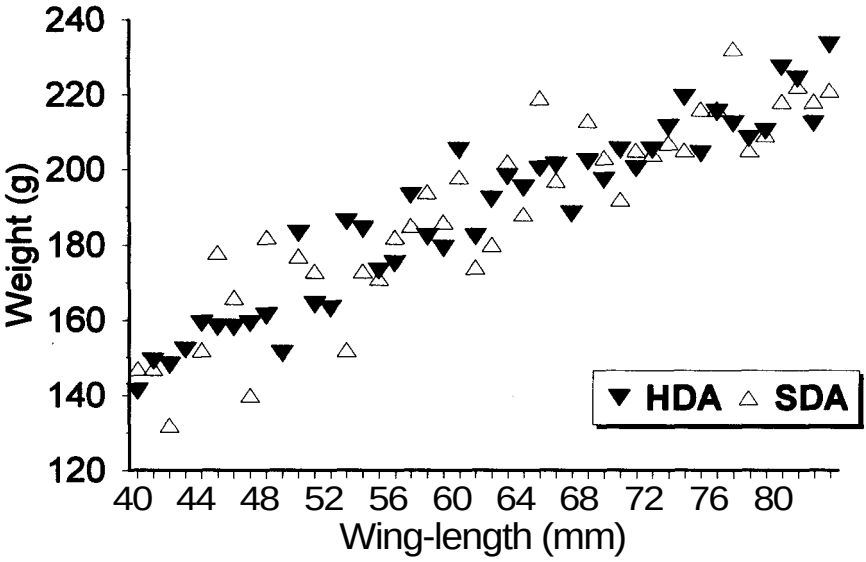


Figure 1. Relationship between mean chick weight and wing-length for daily weighed chicks (HDA; filled triangle; 32 chicks, 311 measurements) and chicks handled once (SDA; open triangle; 176 chicks, 176 measurements). Each point represent 2-13 sample values.

It was not possible to obtain data on weight and age at departure for chicks from SDA. However, as weight and age at departure of chicks from HDA and MDA did not differ significantly, and as there was no difference in the weight/wing-length relationship of chicks from HDA and SDA, it seems reasonable to assume that the daily disturbances did not have any significant negative influence on weight of departure.

Two of the 18 ringed chicks from HDA in 1986 were reported dead at an age of 12 and 13 months, while eight others were controlled on Græsholmen in 1990 and seven of them again in 1992 or 1993. First-year survival was therefore at least 55%, and survival to the fourth and sixth year of life (breeding age) 44% and 39%, respectively. Of the 50 ringed chicks in different SDAs in 1986, two were reported dead at an age of 21 and 51 months, while 22 others were controlled on Græsholmen in 1990 and 20 of them again in 1992 or 1993. First-year survival was thus at least 48%, and survival to the fourth and sixth year of life 44% and 40%, respectively. These findings suggested that post-departure survival was not affected by the daily disturbances in the colony.

## DISCUSSION

The overall breeding success of HDA Razorbills was significantly lower than that of SDA birds, but growth rate, age and weight at departure and post-departure survival of HDA chicks were not affected. Birds laying smaller eggs were apparently most influenced by the disturbances. As egg size increases with age of the female Razorbill (Lloyd 1979), this suggests that younger breeders are more sensitive to disturbance than older birds.

Harris & Wanless (1984) and Hatchwell (1989) reported that breeding success, growth rate and age at departure of Guillemot chicks were reduced by daily human disturbances. Hatchwell (1989)

proposed that the effect of disturbance might be due to 'reduced provisioning of chicks by parents, increased energy demands for thermoregulation in the absence of brooding, and/or increased energy expenditure due to the stress of being handled'. I made no attempts to quantify these possibilities, but sitting with a chick on my lap who first stared inquisitively at the great world outside its nest and then calmly started preening, I was led to imagine that Razorbill chicks may be less prone to stress than Guillemot chicks, and that this might be due to differences e.g. in nest sites and in the density of breeding birds.

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SUMMARY

Daily disturbance of Razorbill sub-colonies resulted in a significantly reduced nesting success, whereas growth rate, weight and age of departure and post-departure survival were not affected.

REFERENCES

COULSON, I. C. 1963. Egg size and shape in the Kittiwake *(Rissa tridactyla)* and their use in estimating age composition of populations. *Proc. Zool. Soc. Lond.* 140: 211-227.

HARRIS, M. P. & WANLESS, S. 1984. The effects of disturbance on survival, age and weight of young Guillemots *Una aalge*. Seabird 7: 42-46.

HATCHWELL, B. J. 1989. The effects of disturbance on the growth of young Common Guillemots *Uria aalge*. *Seabird* 12: 35-39.

LYNGS, P. 1992. Breeding birds on Græsholmen, Ertholmene in the Baltic Sea, 1925-90. *Dansk Orn. Foren. Tidsskr.* 86: 1-93.

LLOYD, C. S. 1979: The factors affecting breeding of Razorbills *Alca torda* on Skokholm. *Ibis* 121: 165-176.

LLOYD, C. S. & C. M. PERRINS 1977. Survival and age of first breeding in the Razorbill *Alca torda*. *Bird-Banding* 48: 239-252.

*Peter Lyngs, Møllegade 23, 2tv, DK-2200 Copenhagen, Denmark.*