The breeding biology of Mute Swans *Cygnus olor* in southeast Cork, Ireland

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The breeding success of Mute Swans nesting in southeast Cork, Ireland, from 1972-89 is analyzed. Data from 151 nests are presented. Eight percent of pairs that built nests failed to lay eggs. Mean final clutch size was 5.5 eggs. Seventy-one percent of clutches hatched successfully. The mean brood size at fledging was 3.8 per clutch. No significant difference was found in the mean number of cygnets produced per clutch across habitat types. The mean clutch size was lower, and the number of cygnets fledging per clutch higher than reported in most studies.

The Mute Swan *Cygnus olor* is widely distributed in Ireland, with population estimates varying between 5000-7000 (Hutchinson 1979, Monval & Pirot 1989). The Irish Mute Swan population is sedentary. O'Halloran & Collins (1985) have reported that of 61 birds ringed and recovered in Ireland, 30% had travelled more than 32 km, but almost 90% travelled less than 65 km and no adult had travelled this distance. One Irish-ringed bird has been recovered in Wales and one ringed in England recovered in Cork (Collins 1985). To date, 14 birds colour ringed in the Western Isles, Scotland have been sighted on the north coast of Ireland (Hutchinson 1989). These movements are the exception. Thus the Irish Mute Swan population can be considered a genetically isolated pool and therefore breeding biology data collected elsewhere, for example in the U.K. (Perrins & Reynolds 1967), may not be applicable.

Despite the wide distribution little detailed breeding biology data are available on Irish Mute Swans. A breeding census was carried out in 1978 and 20% of the total 10 km squares were completely surveyed. The results of this survey yielded 549 pairs holding territory and 2214 non-breeding birds in the study area (Forsyth 1980). A study of Mute Swans in the Dublin area commenced in 1983 and is ongoing with some patterns emerging (see Collins 1990). In Ireland most Mute Swan pairs breed solitarily, though 42 colonial nests were found at Inch Lake, Co. Donegal in 1987 and 15 pairs nest in a colony most years in Co. Wexford, but little is known about them (Hutchinson 1989). Forsyth (1980) recorded some lakes with high breeding densities, but these are, apparently, not colonial.

In view of the absence of baseline population data, this study set out to describe some basic breeding biology data, hitherto unavailable, on rural breeding Irish Mute Swans.

Study area

The study area covered 370 km² in southeast Cork (Fig. 1). The area is relatively flat, rich agricultural land mostly on carboniferous limestone and includes the eastern and northern shores of Cork Harbour. Most swans nest on

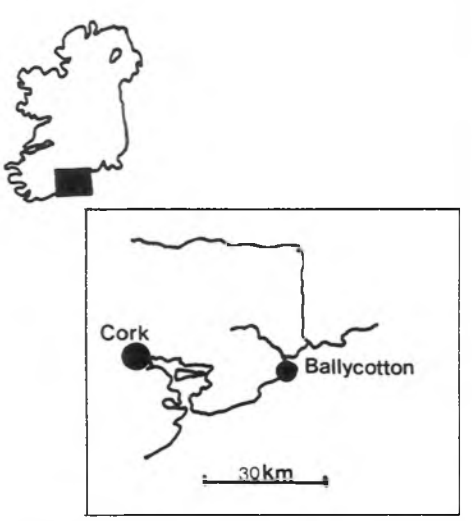

Figure 1. The study area in southeast Cork, Ireland.

small lakes and ponds scattered throughout the region and on the main river in the study area, the Womanagh.

Methods

Records of breeding Mute Swans were kept from 1972-89. A full breeding biology survey was carried out between 1987-89, with data from a further 70 breeding pairs obtained between 1972 and 1986 inclusive. The number of nests, first egg date, final clutch size, the hatching and fledging success of all clutches and broods were recorded for all years where possible. In some cases, particularly in the earlier years, first egg date and clutch size were not known.

Results

The history of 151 nests examined within the study area from 1972 to 1989 was recorded. The clutch size of only 71 of these was known, with the outcome of 61 clutches fully recorded. Detailed data on the proportions of breeding pairs (i.e. those that laid eggs) and non-breeding territory holding pairs are only available for the years 1987-89. There was little variation in the total number of breeding pairs recorded in each of these three years, with an overall mean density of 0.07 pairs per km². The proportion of non-breeding swans holding territory showed a moderate increase in 1989 (Table 1). All lakes and ponds usually held only a single pair, but occasionally at two sites, Lough Aderry and Ballybutler Lake, three and two pairs respectively were recorded. At Ballycotton (Fig. 1), a reed fringed coastal lake, up to eight pairs bred, but not colonially, each pair being out of sight of its nearest neighbour.

Table 1. Numbers and proportion of breeding Mute Swans *Cygnus olor* in southeast Cork Ireland.

	1987	1988	1989
Total number of pairs holding territory	38	36	44
Breeding pairs	28	25	28
%	74	69	64
Non-breeding pairs	10	11	16
%	26	31	36

Eight percent of nests (n = 151) were lost before egg laying commenced and a further 29% of clutches (n = 139) were lost during incubation.

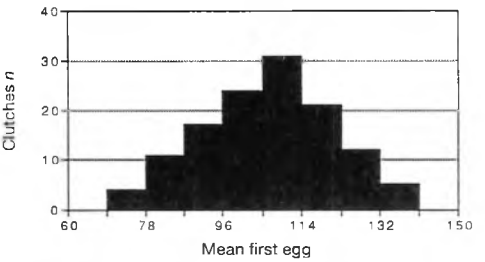

Figure 2. Dates of first egg, calculated from 1 January, for Mute Swans *Cygnus olor* in southeast Cork Ireland, (mean = day 106, 15 s.d., n = 125) 1972-89.

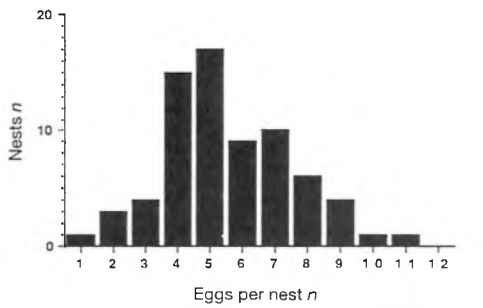

Figure 3. Clutch size for Mute Swans *Cygnus olor*, in southeast Cork Ireland, (mean = 5.5, 0.25 s.e., n = 71) 1972-89.

Eggs

The mean first egg date (calculated from 1 January) was day 106, equivalent to 16 April (Fig. 2). The final clutch size varied from one to 11 with a mean of 5.5 (Fig. 3). Even if the clutches of one and two eggs were erroneous the mean final clutch size would still be low at 5.7. Table 2 compares mean clutch size found in this study with those of other studies. There was no significant difference in mean clutch size across habitat types (Anovar $F_{3/57} = 0.22$, n.s.).

Table 2. Mean clutch size of Mute Swans *Cygnus olor* in southeast Cork, Ireland, with those reported from the United Kingdom, for comparison.

Oxford (Birkhead 1982)	6.9
Dublin, Ireland (Collins 1990)	6.7
Oxford (Bacon 1980)	6.6
Hebrides (Spray 1981)	6.1
Oxford (Perrins & Reynolds 1967)	6.0
Cork, Ireland (this study)	5.5
Abbotsbury (Perrins & Ogilvie 1981)	4.8

Young

All habitats combined

Eight percent of swans that built nests failed to lay eggs (Table 3). Of those nests that had eggs

Table 3. Breeding success and habitat utilisation of Mute Swans *Cygnus olor* in southeast Cork, Ireland 1972-89.

Habitat type	No. of nests	No. of nests with eggs(%)	Clutches hatched(%)	Broods fledged(%)
Lake	96	91 (95)	72(79)	65(71)
River	11	11(100)	8(73)	8(73)
Bog	21	18 (86)	13(72)	10(56)
Estuary	23	19 (83)	6(32)	5(26)
Total	151	139 (92)	99 (71)	88(63)

(139), 71% of clutches successfully hatched. The mean brood size at hatching was 5.0 (s.e. = 0.22, n = 99) per clutch (Table 4). Seventy-six percent of cygnets that hatched successfully fledged. The mean brood size at fledging was 3.8 per clutch (s.e. = 0.20, n = 88) Table 4).

Between habitat types

Table 3 represents the utilisation of different habitat types for nesting by Mute Swans. Lakes are the most favoured sites for nesting (X^2 = 122, P<0.01, df = 3, all chi-squared tests are based on numerical frequencies). There was a significant difference in the number of pairs which successfully hatched (X^2 = 17.38, P<0.01, df = 3), and fledged cygnets (X^2 = 13.97, P<0.01, df = 3) across all four habitat types; pairs at estuaries being less successful than all other sites (Table 3).

No significant difference was found when comparing mean number of eggs at hatching and mean number of cygnets fledging across all habitat types (Table 4).

Discussion

The Irish Mute Swan is one of the most under-studied populations in Western Europe (Cramp & Simmons 1977). Lack of data and coverage prevented a trend analysis of the population to be made by the International Waterfowl Research Bureau (Monval & Pirot 1989). It is important that basic breeding biology data are available to set a baseline against which changes in the future can be measured.

The breeding density recorded here is considerably higher than that reported for the other two Irish studies (Forsyth 1980, Collins 1990), but not as high as some U.K. studies (see Spray 1981). In the case of the Dublin study (Collins 1990), this is not surprising since much of the study area encompasses the city with a population approaching one million people. The study by Forsyth (1980) included many 10 km squares with negative results, thus density values are invariably low.

The mean first egg date is similar to dates reported in other studies, though clearly many factors including temperature, age, experience, weight and genotype of parents are important (Birkhead *et al.* 1983). In this study area much of these parameters are unknown and are currently under investigation. The mean clutch size (5.5) is lower than that reported for most other studies (Table 2), the exception being

Table 4. Mean final clutch size, mean number of young at hatching and fledging of Mute Swans *Cygnus olor* in southeast Cork, Ireland (s.e. in parenthesis) 1972-89.

		HABITAT			
	Total	Lake	River	Bog	Estuary
Mean final clutch size	5.5 (0.30)	5.5 (0.40)	5.6 (0.30)	5.0 (0.45)	5.8 (0.75)
Range	1-11	2-10	5-7	4-7	1-11
n	61	34	9	6	12
Mean no of young at hatching	5.0 (0.22)	5.2 (0.26)	3.5 (0.50)	4.8 (0.50)	4.2 (1.00)
Range	1-10	1-10	1-5	2-8	1-8
n	99	72	8	13	6
Mean no of young at fledging	3.8 (0.20)	4.1 (0.30)	2.8 (0.50)	3.4 (0.70)	3.4 (0.70)
Range	1-9	1-9	1-4	1-8	1-8
n	88	65	8	10	5

Abbotsbury (Perrins & Ogilvie 1981). This value is close to that recorded in 1979 by Spray (1981) for an isolated flock in the Western Isles, Scotland.

The proportion of clutches lost before hatching is similar to U.K. studies (Bacon 1980, Spray 1981, Birkhead & Perrins 1986), but higher than studies in Dublin as reported by Collins (1990). These losses are probably natural, as human interference and vandalism are low and clutch losses are most likely due to inexperienced adults and poor site attributes. Losses were highest during egg laying and incubation, particularly at estuaries. Though high losses occur early in the breeding season, once a brood has hatched most are likely to fledge (Table 3 and Table 4). In this study the mean number of cygnets fledged per successful clutch was 3.8 with no significant differences across habitat types. This is slightly higher than in the Dublin study (Collins 1990) where the mean number of cygnets at fledging was 3.5 per successful clutch. It is also higher than the mean number of cygnets fledging per successful clutch in other U.K. studies (e.g. Reynolds 1965 mean = 3.0, Perrins & Reynolds 1967 mean = 3.1, Minton 1968 mean = 3.5 cygnets). The high mean number of fledglings per clutch recorded in this study is similar to that recorded by Coleman & Minton (1980) during the years 1961-78 in an area south of Staffordshire. They suggested that the increase in the mean number of cygnets (3.8-4.0) fledged per brood could be accounted for by a reduction in the breeding population with pairs being able to avoid poor habitat, with a consequent increase in the number of young fledged per brood. In this study, however, there was no apparent decrease in the number of breeding pairs (Table 1). For this reason we hypothesise that the population may be increasing, however further data are needed to support this hypothesis.

In conclusion, whilst the mean clutch size and the proportion of nests succeeding to hatch is low the final productivity as measured by the number of fledglings per clutch is high. The reason for this seems to be the success of the swans in the study area in raising young once they have hatched. At estuaries, for example, where the number of losses are high in the early breeding season (Table 4), there is no significant difference between other habitat types in the number of young hatching or fledging per clutch. Why the Mute Swans in this area are so successful in rearing young is not known, but the rich macro-vegetation in this highly agricultural area is thought to play an important role in food availability. Thus, despite large numbers of birds in the 'catchment' of the study area having high lead burdens (O'Halloran *et al.* 1988), their reproductive output does not seem to be impaired.

From this study it is clear that investigations into the biology of the Mute Swan in Ireland are at a very early stage. Little data are available on age of first breeding, movements, genetic heterogeneity and many more details of the Mute Swan's life history. However, data presented here serve to illustrate this point, indicate new areas of research and underline the need to carry out research on a very common member of the Irish avifauna.

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