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## Late breeding by Great Cormorants *Phalacrocorax carbo*

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### Abstract

Two distinct waves of synchronised breeding occurred at a colony of Great Cormorants *Phalacrocorax carbo* in west Scotland in 2007. The second wave led to young fledging in September, exceptionally late for this species locally. Evidence from elsewhere suggests that this second wave was not double-brooding (raising of two broods in one year by the same pair) but breeding by newly-arrived birds that had failed at a nearby colony earlier in the year.

### Introduction

At a small colony of Great Cormorants *Phalacrocorax carbo* (hereafter 'Cormorants') in Scotland in 2007, there were two distinct

waves of successful breeding separated by 2.5 to 3 months. In June, the normal fledging season, 47 young fledged from 18 nests. Then, in September, 28 young fledged from 14 nests in the same small area (details in Appendix 1). A well-synchronised pulse of many young fledging together so late in the year is unusual, at least in this part of Scotland where such an occurrence seems not to have been reported before. The first purpose of this short note is to place this event on record.

Our second objective is to consider whether these two waves were caused by the same pairs breeding for a second time (successful 'double-brooding'), or by incoming birds nesting in the same small colony area, or possibly a mixture of these. There were no ringing data to resolve this question directly. We therefore approach it indirectly by examining other records of late breeding in this and a closely related species. If it was genuine double-brooding, 14 of the original 18 pairs raised successful second broods. This percentage (78%) will be compared with similar measures from elsewhere.

### Late breeding

Late breeding has been recognised as an aspect of Cormorant breeding behaviour at, at least, two colonies in continental Europe. In 1992 and 1993, the colony at Val Campotto in the Po

delta, Italy, was studied by Grieco (1994). Breeding occurred from February to September with two peaks of laying, the main one in spring and a smaller one in summer. In 1992 when the colony had 250 nests, there were 13 late breeders in a sample of 75 nests (17%). In 1993 when the colony had 270 nests, this proportion was 19/115 (17%). Most of the later breeders used nests built by other birds earlier in the year but, in both 1992 and 1993, Grieco suggested that some cases of reuse of a nest after successful fledging occurred because the same parents initiated a new clutch. He based this suggestion on the behaviour of the adults concerned; thus, for example, the adults sometimes fed the large or fledged young and did not drive them away. In 1992 Grieco recorded four such nests with presumed second breeding, in one of which a second brood fledged (three young in August). Thus, in his 1992 sample of 75 nests, the proportion with successful double broods was 1/75 (1.3%).

Late breeding has been described at other colonies in Europe, including the large colony at Vorsø in Denmark. This grew from 1,000 nests in 1980 to 5,000 nests in 1991. Each year a proportion of breeding attempts failed, mostly during incubation but some at the chick stage. In some of these nests, a second clutch was laid, either by the same pair or by another pair. Most second clutches occurred after the loss of the first eggs or young or, more rarely, after young had fledged. The proportion of second clutches varied from year to year: 9–19% of nests in 1980–84, 0–2% in 1985–88, and 0–3.2% in 1990 and 1993–95 (based on 97–348 nests with eggs followed throughout each season; Bregnballe 1996). In 1980–1983, the years in which second clutches were most frequent, the annual percentages of new clutches after fledging of a first brood were in the range 3.3–9.6%, and successful second broods (nests where chicks fledged both in the first and in the second attempt) ranged from 2.3 to 4.6%. Both these quantities are expressed as percentages of the number of nests where eggs were incubated in the first attempt (214 nests in 1980, 348 in 1981, 293 in 1982 and 280 in 1983) (Bregnballe & Gregersen unpubl.). In some of these nests, chicks of the

first brood were tolerated by the adults if they returned to a nest where a second clutch was being incubated, suggesting that, in at least some cases, one or both of the adults was breeding for a second time after fledging a brood. The range of 2.3 to 4.6%, calculated for the 'best' of the study years, thus places an upper limit of about 5% on same-pair successful second broods.

Second-brood behaviour has also been seen at a tree colony in France (Demongin 1993) but, like the above Danish and Italian data, these reports were not based on marked birds. Unequivocal identification of double-brooding requires observation of individually marked birds.

#### Double-brooding by marked adults

At Vorsø, 23–318 breeders (on average 156) with individually marked colour-rings were followed from egg-laying onwards annually from 1981 to 2004. During this period, there were four cases of marked birds with successful first broods followed by a second clutch that was incubated (Bregnballe & Gregersen unpubl.). Of these, the outcome of one (in 1987) was unknown. Of the other three, all in 1984, one fledged no young, while two fledged second broods. Both involved marked females that had each laid first clutches in February, fledged a first brood in May, laid second clutches starting 30 May and 1 June, and respectively fledged one and two young. The number of colour-ringed birds known to have had at least one clutch in 1984 was 186, so the proportion of known successful second broods in that year was 2/186 or 1.1%. It was zero among the ringed parents studied in the other 23 years of the study.

#### Data from similar species

At a colony of European Shags *P. aristotelis* (hereafter 'Shags') in Brittany, France, Cadiou (1994) described a ringed 12-year-old female which, in 1993, began its first clutch on 7–9 February, fledged three young in early May, laid a second clutch early in June and fledged two young early in September. Cadiou cited reports of similar cases from three sites in Britain (one at each), noting that at one the adults had not been marked so two pairs might have been involved. He considered the

frequency of such cases to be very low - one in several thousand nests.

Wanless & Harris (1997) made a detailed study of Shags nesting at the Isle of May, Scotland during 1985–1996. Breeding numbers varied between a maximum of 1,916 nests in 1987 and a minimum of 501 nests in 1995 after a major population crash in 1994. About 40% of the birds had been ringed and, when possible, identities were checked of birds involved in two attempts at breeding in the same year. Second breeding attempts were noted only in 1987 and 1995, years in which the median laying dates were the earliest in the study. In 1987, three nests from which young had fledged in June continued to be occupied in July; two of these pairs then laid and one clutch hatched, but no young fledged. In 1995 a remarkable 27 nests continued to be occupied, eggs were laid in 20, five clutches hatched and all five fledged two young each. The authors did not specify whether any of these five successful pairs were individually identifiable but they noted that, of the 27 cases, two involved the same pair breeding

twice while, in four, one adult was known to have remained the same. There was no evidence in any of the 27 that change in site-holders had taken place. The authors suggested that the unusually high number of second breeders in 1995 was a density-dependent response to the crash of 1994. The five successful second broods represented 1% of the 1995 breeding population of 501 nests, but no such cases were recorded in the other 11 years of the 12-year study. Wanless & Harris cited other evidence that genuine double-brooding in this and related species is uncommon.

### Conclusion

These studies of both Cormorants and Shags show that successful double-brooding is a rare event. While second clutches are not unusual after failed clutches, they are less common after failed broods and rare after successful broods. The two most detailed studies with individually marked birds, those of Bregnballe & Gregersen (unpubl.) with Cormorants and Wanless & Harris (1997) with Shags, concur in several important findings. Both found that in most years there was no



**Figure 1.** Great Cormorant *Phalacrocorax carbo* chicks, Glas Eilean, Loch Fyne, 27 August 2007 © Tom Callan.

double-brooding, but that there were occasional good years when, after successful first broods, second clutches and broods tended to occur. The few available records of identifiable individuals with successful second broods showed that all laid their first clutches early in the year (February in the case of Cormorants in continental Europe, March–April in Shags in Scotland) – perhaps not surprisingly, in view of the time needed to raise two successive broods. In the occasional years when they occurred, successful second broods formed very low proportions of the number of nests at a colony, about 1% in each study. Data from unmarked Cormorants at Vorsø (Denmark) and from Val Campotto (Italy) suggested upper limits to this quantity of about 5% and 1% respectively.

These percentages are very much lower than the 78% observed at Glas Eilean in 2007. (The difference is so large that we are justified in ignoring the relatively minor differences in methods and interpretation between the projects considered above.) Thus it is reasonable to infer that the event at Glas Eilean was not genuine double-brooding and that most or all of the 14 late-breeding pairs were not among the original 18 pairs. Where might these new birds have come from?

There are three other annually-occupied colonies of Cormorants within 30 km of Glas Eilean. The nearest is at Eilean Buidhe, 16 km to the south. In 2007, 22 pairs of Cormorants nested there but almost all failed. Human interference was suspected. The incubating adults were counted from the sea on 21 May and again on 11 June; no young were visible on either date. On 2 July counting ashore found 14 empty nests and three nests with small or medium-small young. On 23 July there were three large young.

These facts strongly suggest that Eilean Buidhe was the source of the second wave of birds that bred at Glas Eilean. Not only was Eilean Buidhe the nearest Cormorant colony, but the numbers of birds involved and the timing of events were both consistent with this explanation (c. 20 pairs left Eilean Buidhe some time between 11 June and 2 July; 14

pairs started laying at Glas Eilean from late June to early July, estimated from clutches and small young there on 5 August). It remains unclear how these birds were able to reproduce successfully so late in the year, at a time when Cormorants in this area have normally stopped breeding and environmental cues are presumably unfavourable.

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**Appendix 1.**

**Description of Glas Eilean and events there in 2007:** Glas Eilean (grid reference NR912857; 56°01'N 5°21'W) consists of two small islets about 350 m from the mainland in Loch Fyne, a long sea loch in southwest Scotland. Records since about 1950 show that, while large gulls have bred there for decades, Cormorants were not recorded breeding until 2007. Shags bred for the first time in 2004 (one or two pairs) and 2005 (two pairs) but none were recorded in 2006 (Gibson 1958a, 1958b, 1985; Craik unpublished annual records 1987–2007).

Several seabird species bred on Glas Eilean in 2007, mainly Herring Gull *Larus argentatus* (c. 75 pairs) and Great Black-backed Gull *L. marinus* (c. ten pairs) together with smaller numbers of Shag (five pairs), Black Guillemot *Cephus grylle* and Common Eider *Somateria mollissima* (at least two pairs of each, probably considerably more). The Cormorant colony was on the larger, southern islet, which measures c. 150 x 100 m. Observations at the Cormorant colony in 2007 were as follows.

**27 May:** During the annual count ashore of gull clutches and nests, the new colony of Cormorants was not approached closer than c. 100 m in a line of vision, as experience elsewhere has shown that large gulls quickly learn to prey on exposed eggs and small young of Shags and Cormorants. On this occasion, the sitting Cormorants did not leave their nests and an incomplete count of ten incubating adults was made from the sea.

**11 June:** The Cormorant colony was entered. There was one disused nest. The 18 active nests all held large, mobile young, and (unusually) there were no eggs or small young. Thirty-seven young were ringed and c. ten were too large to catch. Thus c. 47 young are estimated to have fledged from 18–19 pairs in this first laying.

**21 July:** On a routine visit to count large young gulls, the ringed young Cormorants were flying in the area, settling on tidally exposed rocks and at the colony edge (as expected); at least 19 were counted.

Unexpectedly, however, at least 12 adult Cormorants were seen incubating on nests in the same nesting area. The colony was again not approached, for the above reason.

**5 August:** The colony was entered and nest contents were recorded. There were 14 nests (two with eggs and 12 with small young, none large enough to ring). Continuous observation after departure revealed no predation by gulls before the return of the adult Cormorants.

**14 August:** Seven nests held 15 young that were large enough to ring. The other seven held 15 young too small to ring, including two runts.

**27 August:** Thirteen more chicks were ringed. Two of the 15 (the two runts?) were not found and had probably died, although a search for remains was not made. Thus 15 + 13 = 28 young are believed to have fledged in early to mid September from the 14 late-nesting pairs.

JCAC has ringed Cormorant chicks in this part of west Scotland for over 20 years and, later each summer, often visited many of the same sites to count and ring chicks of other species. After the normal midsummer fledging of most Cormorant chicks, it is not unusual to find a few late-nesting Cormorant pairs with eggs or small young in early July. However, there are no local records of an entire colony with many young fledging together in September. In 2007, JCAC monitored six other Cormorant colonies in the area, all on small islands along the mainland coast between Kintyre and Mallaig, but none of these behaved in this way. One failed completely as a result of mink predation of eggs; the colony at Eilean Buidhe raised almost no young, apparently because of human interference and/or disturbance allowing predation of eggs and young by large gulls; and four colonies reared single broods that fledged in midsummer in the normal way. That the breeding pattern at Glas Eilean in 2007 was atypical was confirmed by Robin Sellers, National Organiser of the UK Cormorant Breeding Colony Survey (R. M. Sellers pers. comm.).