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12 January 1978

NEST TREE SELECTION AND VULNERABILITY
TO PREDATION AMONG HOODED CROWS
CORVUS CORONE CORNIX

Several authors have stated that Carrion and Hooded Crows *Corvus corone* subspp.
prefer conifers to deciduous trees as nest-sites (Tenovuo 1963, Wittenberg 1968, Loman
1975). This has been explained by reference to the branching pattern of pines, suitable
to support a crow's nest, as well as to the greater concealment from predators obtained
in pine and (especially) spruce as compared with deciduous trees before leafing. Among
conifers, Tenovuo (1963) found a preference for pine over spruce. This caused Wittenberg
(1968) to believe that a tree's suitability to support a nest was more important than the
visual protection offered.

In this paper I examine the nest tree selection in relation to the probability of nest
predation for a population of Hooded Crows *Corvus corone cornix*. It supplements my
previous study, which treated other aspects of nest-site, nest tree and nest area selection
(Loman 1975).

The study area is 20 km², mainly grazed land but with numerous copses and marshes,
situated in south Sweden (55°40′N, 13°30′E). Conifers present are Pine *Pinus silvestris*
and Spruce *Picea abies*. The dominant deciduous trees in moist areas are Alder *Alnus
glutinosa* and Birch *Betula pubescens* and *B. verrucosa*, while in dryer areas Birch, Beech
Fagus sylvatica and Oak *Querqus robur* are the most common species. The deciduous

trees in the study area come into leaf during the first week of May. At the same time the crows' eggs hatch. The mean date of hatching for the first nestling in the broods varied between 30 April and 10 May during the years of study.

Despite the lack of conclusive evidence in this study area (but in view of the findings of other authors) it seems that the most likely predators of crows' eggs are other crows (Wittenberg 1968, Charles 1972). Losses of nestlings were probably mainly attributable to Buzzards *B. buteo*, but Cats *Felis catus*, Goshawks *Accipiter gentilis* and Tawny Owls *Strix aluco* were alternative possible predators.

Most cases of predation involved nestlings that were at least 12 days old (Loman, unpubl. data). There was little predation involving only part of a clutch of eggs and probably none involving only part of a brood of nestlings. Only cases of complete removal of eggs or nestlings from a nest are considered predation in the following analysis. Most nests in the study area were protected. The rate of destruction by humans is thus not representative but the distribution of destroyed nests on different nest trees probably is.

In 1971–77 I recorded the nest tree and the proportion of different kinds of trees within 40 m of the nest (defined as the 'nest area') for each of 356 nests. In 1973–77 I recorded the fate (destruction by humans, predation of eggs, predation of nestlings or successful) of 219 of these nests. Some additional nests were deserted by the crows, but these are not considered in the following analysis.

RESULTS

Considering all potential nest areas in the study area there was a tendency to avoid sites in pine. This was true both when considering the area covered by different kinds of trees ($\chi^2 = 12.5$, $P < 0.001$) and the amount of copse border made up of different kinds of trees ($\chi^2 = 17.1$, $P < 0.001$). I think the latter measure is the better, since the former underestimates the lines of single trees (usually made up of deciduous trees) and over-estimates the importance of spruce which—in contrast to the other tree species— are mainly concentrated in one large stand.

Considering only the nest areas utilized, there was no tendency to prefer any particular kind of tree ($\chi = 2.16$, $P > 0.05$) (Table 1). When considering only the few nest areas that offered a choice between deciduous trees, pine and spruce (that is, at least two of these three kinds were available within 40 m of the nest) a clear preference for conifers was found (pine:deciduous trees, $P > 0.001$, spruce:deciduous trees, $P < 0.01$, bi-nomial tests) (Table 2).

TABLE 1

Nest tree and tree availability. The different kinds of trees are given scores in proportion to their abundance within 40 m of the crow nests. Two other expressions of nest tree availability are also given. The last refers to borders between copses and open areas. The length of lines of single trees is also included

	Times serving as nesting tree	Proportion of abundance within 40 m of nest trees	Area covered by the different kinds of tree in the study area (ha)	Length of border zone of the different kinds (km)
Spruce	46 (13%)	38 (11%)	20 (16%)	3 (9%)
Pine	71 (20%)	66 (19%)	35 (28%)	10 (29%)
Deciduous trees	239 (67%)	252 (71%)	70 (56%)	22 (63%)
Totals	356 (100%)	356 (100%)	125 (100%)	35 (100%)

TABLE 2

Nest tree in nest areas (within 40 m of the nest) where a choice of two kinds of trees was possible. The relative abundance of different kinds of trees in nest area of these nests is also given

Composition of nest area	Deciduous trees and spruce	Deciduous trees and pine	Spruce and pine
Nest tree			
Spruce	14		10
Pine		13	5
Deciduous trees	3	0	
Total abundance in the nest areas			
Spruce	8·3		7·5
Pine		6·7	7·5
Deciduous trees	8·7	6·3	

TABLE 3

The fate of nests in different kinds of trees

Nest tree	Destroyed by humans	Nest with eggs lost to non-human predators	Nest with nestlings lost to non-human predators	Total loss	Number of nests
Spruce	0 (0%)	0 (0%)	3 (15%)	3 (15%)	20
Pine	4 (10%)	1 (3%)	5 (14%)	10 (27%)	37
Deciduous trees	15 (9%)	11 (7%)	40 (25%)	66 (41%)	162

Nests in conifers suffered less non-human predation than those in deciduous trees ($\chi^2 = 5\cdot00, P < 0\cdot05$) (Table 3).

I interpret the results thus. Considering the whole study area, pine copses were avoided, probably because they were often situated on very dry and possibly unproductive ground or, in some cases, they consisted of small trees. However, when the crows could chose between conifers and deciduous trees, conifers were clearly preferred (Table 2). The lack of a clear preference when all nest areas are considered (Table 1) is because this material is 'swamped' by many nest areas without a choice.

This preference is probably an adaption to reduce predation on eggs and nestlings. The protection may result from the fact that nests in deciduous trees are poorly hidden before leafing. It is surprising that predation on nestlings is higher for nests in deciduous trees than for those in conifers, though the former carry leaves at the time the crows have nestlings. A possible explanation is that the predators note the presence of the nests before leafing, but postpone predation until later, either because they prefer the older and larger nestlings (and are prepared to take the risk that someone else comes before) or, more likely, because it is easier to rob the nest when the female crow has ceased brooding at a nestling age of about one week.

At least from the ground, nests in spruce seem to be better concealed than those in pine. This is probably the reason for the lack of human interference with nests in spruce (Table 3). Superior concealment may explain the tendency to prefer spruce as nest tree

to pine, despite the fact that the branching structure of pine probably is better than that of spruce (Wittenberg 1968). The dominance of pine to spruce as nest tree that Tenovuo (1963) found may after all (as Tenovuo considered but rejected) be due to the fact that nests in spruce are, for humans, hard to find.

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2 September 1977
Revision 29 June 1978

SEASONAL VARIATION IN INTRA-CLUTCH HATCHING INTERVALS AMONG COMMON TERNS *STERNA HIRUNDO*

Studies of Herring Gulls *Larus argentatus* and Common Terns *Sterna hirundo* have shown that intra-clutch hatching intervals increase in length from the beginning to the end of the nesting season (Parsons 1972, MacRoberts & MacRoberts 1972, Nisbet & Cohen 1975). Seasonal variation in incubation attentiveness has been suspected as a major cause of this phenomenon. Yet very little information on incubation attentiveness has been reported in these cases. This paper presents two years of attentiveness data for Common Terns, among which seasonal differences in intra-clutch hatching intervals were observed. Seasonal differences in egg laying intervals and incubation patch development are also presented and discussed in relation to hatching intervals.

The site for this investigation was an artificial island breakwater located in Lake Erie approximately 0·5 km from the terminus of the Welland Canal. The study was conducted during the 1976 (26 April–10 August) and 1977 (27 April–4 August) nesting seasons.

Daily visits were made to the colony. During each visit new nests were marked with a numbered tongue depressor, and new eggs were numbered with a non-toxic felt pen according to the laying order of each in its clutch. The date and sequence of hatching of eggs in a clutch was also recorded on a daily basis.

To determine the assiduity with which clutches were incubated, monitoring devices were used at the nest in conjunction with two 20-pen Esterline Angus event recorders (cf. Morris & Hunter 1976). Monitoring began as soon as the first egg in the clutch was laid, except for the majority of the early 1976 sample in which monitoring started upon clutch completion. In 1976 monitoring of individual clutches was stopped when the first egg in the clutch hatched. In 1977 monitoring was continued through the hatching period until the last egg in the clutch hatched.

In 1977 defeathering and refeathering of the incubation patch were noted. Birds were caught on the nest using walk-in traps made of poultry netting (cf. McNicholl 1968).