

Wintering tactics of the Kingfisher *Alcedo atthis*

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A three-year study of individually marked Kingfishers *Alcedo atthis* L. wintering on a small river in central Poland revealed that the earliest migrants settled in their winter territories in October/November and left in March/April. The turnover of Kingfishers on the river was high, with a mean residence time of 57 days (SD 33.0, n=42). Juvenile Kingfishers were found either as single birds (n=20) or in pairs with another bird (n=4 pairs). Pairs occupied the best habitats and stayed there the longest. Adult birds (n=14) were always single. Nine adults occupied new territories, while 5 returned to their previous-winter sites. Adult Kingfishers returning to territories appeared on the river earlier than other birds. Different wintering tactics might have evolved in response to intraspecific competition which seems to be enhanced by severe winter conditions. Family bonds persisting beyond the breeding season (a phenomenon common in other alcedinids) may underlie the 'co-operative' wintering by young Kingfishers.

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Introduction

The Kingfisher *Alcedo atthis* belongs to a predominantly tropical and subtropical family, which possibly evolved on islands of the Pacific and Indian Oceans and then infiltrated Asia, southern Siberia, and Europe (Robiller 1978). It there became so well adapted to seasonality of climate that it no longer undertakes long-distance migrations. However, data on the winter ecology of Kingfishers are scarce (Eastman 1969).

In this paper we report a 3-year study of Kingfishers wintering on a small river in Central Poland. We describe the wintering tactics of juvenile and adult birds in relation to intraspecific competition and dispersal patterns in other species of Alcedinidae.

Study area, methods and material

We studied Kingfishers on a 12-km stretch of the Utrata River in lowland central Poland (about 52°10'N, 20°53'E). The river, of discharge 1–2 m³ s⁻¹, is 2–5 m wide, 0.2–2 m deep and is dammed in three locations. In winter, it often freezes except for several meters of running water near the hatches and dams. The studied stretch flowed through a sparsely settled

valley, where meadows, old parks, and alder *Alnus glutinosa* forests predominated. The northern end of the stretch which passed the suburbs of an industrial settlement was heavily polluted. The river supported two systems of commercial fish-ponds.

Riparian habitats were diverse, ranging from excellent to very poor in terms of Kingfishers' habitat requirements. We evaluated the Kingfishers' winter sites according to the following 5 classes of habitats: (1) very poor sites: water heavily polluted, bank drained and bare of shrubs and trees; (2) poor sites: water unclear, banks drained and overgrown with low herbaceous vegetation only; (3) medium quality sites: water clear, river flows through low-laying meadows, scattered trees or bushes on the banks; (4) good sites: clear water, banks high (up to 2 m), trees and shrubs on both sides; (5) very good sites: clear water, trees and shrubs on either side, rich riparian vegetation, river connected with fish-ponds by hatches.

Kingfishers were surveyed 1–6 times a month from October to March–April during 3 winters (1982/83–1984/85) and at least twice during the rest of the year. Observers walked along the bank, recorded the presence of Kingfishers, and described in detail the site occupied and the behaviour of the birds. Within a few days after the survey, most often at

dawn, we tried to capture previously observed birds in mist-nets stretched across the river within the presumed territories of the birds. Birds were ringed and their sex (the female mandible is bright red with black verge, the male mandible is black) and age (adults' legs are red, juveniles' legs are blackish and smooth till November, and then exfoliate till February) were recorded.

We ringed a total of 37 Kingfishers; 50 recaptures were made. For these birds the residency time on the river was calculated as the time from the first record of a bird (usually followed by a capture within a few days) to the last recapture or the last observation of it.

In spring and summer the river was generally not inhabited by Kingfishers. Only three apparently dispersing juveniles were noted in July 1983, and one breeding pair with a successful brood was recorded in May–June 1984.

The data on Kingfishers (total no. per 10 km stretch and whether single or paired) from a macroscale winter survey of waterfowl on the Vistula River and its tributaries in January 1985 (Dombrowski et al. 1985) are also presented.

Results

Eleven, 17, and 11 individual Kingfishers were caught during the first, second, and third winters. The birds appeared on the Utrata River in late October and left in late March or early April. Kingfishers were recorded in all five types of habitats (see Methods). In mild winters birds remained in types 2–5, and in extremely severe winters only type 5 habitat ensured survival. Birds were strictly territorial (Jędrzejewski et al., in prep.) but the turnover of individuals was high. They were usually evicted from the sites by the sudden and temporary icing of the river. New birds arrived and settled throughout winter after the sudden onset of frost. The mean residency time was 57 days (SD 33.0, $n=42$). The disappearance of birds does not necessarily mean their deaths, as they might resettle in new places after moving. However, the forced midwinter movements pose a serious risk of death owing to either freezing and starvation or the failure of birds to find an ice-free patch and to establish themselves in a new place. It was, therefore, advantageous for a Kingfisher to settle in the best, i.e. not readily ice-bound site as early in autumn as possible and remain there till spring.

Juvenile Kingfishers ($n=24$) used two alternative wintering tactics. They were found either as solitary

Table 1. The mean time of residency and territory quality (scale 1–5) of Kingfishers using different wintering tactics. SD in parentheses; n = number of birds. The four groups of birds differ in their times of residency (Kruskal-Wallis test, $H=8.51$, $df=3$, $P<0.05$) and in the quality of territories ($H=14.48$, $df=3$, $P<0.005$).

Tactic (n)	Mean time of residency (days)	Mean territory quality
Birds in pairs (8)	82 (25.8)	5.0 (0)
Single juveniles (20)	63 (36.2)	3.9 (0.74)
Single adults in new site (9)	48 (23.3)	3.5 (0.88)
Single returned adults (5)	78 (31.4)	3.7 (1.17)

birds or in pairs (Table 1), with the two birds flying together within 0.2–2 m, and communicating by calls. When disturbed and separated the birds rejoined quickly. It proved difficult to catch both birds, because when the first was netted, the second avoided the net. From 4 pairs, only 4 individuals (from 3 pairs) were captured (3 females and a male, all juveniles). Pairs always occupied the best habitats (Table 1), significantly different from single juveniles (2-tailed Mann-Whitney test, $P<0.05$) and from single adults in new territories ($P<0.001$). Birds in pairs had the longest residence times (Table 1), significantly longer than single juveniles (2-tailed Mann-Whitney test, $P<0.001$), single adults in new territory ($P<0.001$), and returned adults ($P<0.005$).

In this study paired birds made up 22% of all captured Kingfishers. In macroscale surveys on the Vistula River and its tributaries, a total of 117 Kingfishers was noted: 102 (87.2%) single birds, 10 (8.5%) in pairs, and a flock of 5 individuals (4.3%). A total of 12.8% of the Kingfishers were in pairs or groups.

All adults ($n=14$) captured on the Utrata River in winter were single birds. Of these, 9 birds (5 males and 4 females) occupied new territories, while 5 (3 males and 2 females) returned to, or near to, sites occupied the previous year. Birds which returned to known places had longer (not significantly though) residence times than new adults. One bird (a male) spent the first winter (as juvenile) in a pair and then returned near to its site the following winter. Returning may, however, start at adulthood. We captured an adult female in a new territory one winter, and again in the same place the next winter.

The four groups of Kingfishers differed significantly as to the time of their arrival on the river

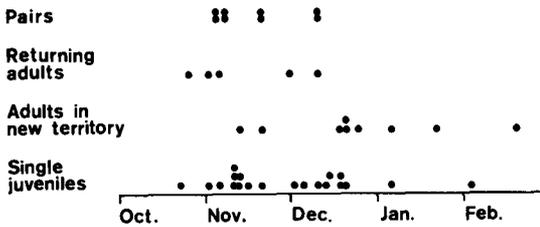


Fig. 1. Arrival dates of Kingfishers wintering on Utrata river in 1982–1985. Each dot marks an individual bird. The four groups of birds differ significantly in their arrival dates (Kruskal-Wallis test, $H=12.44$, $df=3$, $P<0.01$).

(Fig. 1). Pairwise comparisons revealed that returning adults arrived significantly earlier than single juveniles (2-tailed Mann-Whitney test, $P<0.001$) and adults in new territories ($P<0.01$). Single adults in new territories were the latest birds to arrive ($P<0.01$ in comparisons with all other groups).

Discussion

We do not know the origin of the Kingfishers wintering on the Utrata River. Data for European Kingfishers show that in France the autumn migration is to the Atlantic coast (Morgan & Glue 1977). Kingfishers ringed in Poland in summer and early autumn were recovered in West Germany, Holland, Austria, and Italy in winter ($n=6$, data from the Ornithological Station of the Polish Academy of Sciences, Gdańsk).

Cooperative wintering by two or more Kingfishers implies the suppression of territoriality and aggression in the birds involved. This probably takes place only in very good conditions in the best habitats. In our study only two pairs were captured (one in summer and one in winter). Both consisted of juveniles (two females in a winter pair). During our summer survey in July 1983 we observed and captured a pair of dispersing juveniles (a male and a female). They stayed in one place for several days. Hassler (1983) observed that 5 young Kingfishers from one brood stayed, and roosted together close to the breeding hole for some days after they had emerged from their nest.

In other Alcedinidae that do not undertake clear seasonal migrations the young often remain in their parents' territory and serve as helpers at the nest.

Kookaburras *Dacelo gigas* living in Australia are social and live in territories with either a permanent mate or a family consisting of a mate and one or more (up to 4) non-breeding birds, which are the progeny of previous seasons. They remain round the year and help in defence, nest attendance, and provisioning of young (Parey 1977). The Pied Kingfishers *Ceryle rudis* in East Africa live singly, in pairs, or in small groups along the shore area when not breeding (Reyer 1980). In the breeding season they move to rivers and canals and form breeding colonies. Some pairs (a male and a female) arrive in the colony with the yearling son(s) of at least one pair member. These young birds serve as helpers at the nest. No similar study on the breeding behaviour of *Alcedo atthis* has been done. Our observations in winter, which is a crucial time for survival, showed that the tendency of juvenile Kingfishers to stay in pairs or groups also occurred in this species. Pairs may consist of siblings from one brood or from family groups. However, a more thorough study on relatedness using colour ringing or DNA "fingerprinting" is needed to resolve this problem.

The intraspecific competition for suitable wintering territories is locally very strong. In our study we recorded frequent territorial conflicts between neighbouring birds and between invading and established Kingfishers (Jędrzejewski et al. in prep.). Birds in pairs clearly win this competition: they hold the best sites and persist there the longest. However, the stability of pairs and groups is probably to some extent dependent on external conditions. Pairs may easily get separated when no suitable territories are free, or when frost forces repeated movement.

Returning to the same winter territory by adult Kingfishers may also be affected by weather conditions. One of our successful returners had to leave its territory in January, when ice covered its fishing place. The next days this bird was recovered 5 km down the river in equally good territory. It therefore seems possible that at least some of the adults appearing on our study river in late winter were the birds that had returned to their last year site but had to leave it and seek running water.

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Selostus: Kuningaskalastajan talvehtiminen Puolassa

Kirjoittajat tutkivat kolmen vuoden ajan yksilöllisesti merkittyjen kuningaskalastajien talvehtimistä pienellä joella Keski-Puolassa. Aikaisimmat muuttajat asettuivat talvireiureilleen loka-marraskuussa ja poistuivat pesimäpaikoilleen maaliskuuhuhtikuussa. Kuningaskalastajat viipyivät joella keskimäärin 57 päivää (SD 33.0, n = 42), joten vaihdunta oli suuri. Nuoret linnut oleilivat joko yksittäin (20 lintua) tai pareittain (4 paria). Parit olivat parhailla paikoilla ja viipyivät pisimpään.

Vanhat linnut (14 yksilöä) olivat aina yksittäin. Yhdeksän vanhaa lintua oli uusilla talvireiureilla, viisi palasi edellis-talviselle paikalleen. Erilaiset talvehtimistavat ovat saattaneet kehittyä lajin sisäisen kilpailun seurauksena. Erityisesti ankarina talvina kilpailu voimistuu. Perhesiteiden säilyminen pesintäajan ulkopuolellakin (yleinen ilmiö kuningaskalastajien suvussa) saattaa olla edellytys sille, että nuoret kuningaskalastajat talvehtivät pareittain.

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