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Un-paint it black: Avian prey as a component of the diet of nestling Hooded Crows *Corvus cornix*

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ABSTRACT. The Hooded Crow (*Corvus cornix*) is often considered the main nest predator of many bird species, especially waterbirds. Such relationship should be particularly clear during the breeding season in wetlands, when the need to supply their nestlings with the highest quality foods forces predators to intensify their hunting activities. Hence, waterbirds should be their basic prey. We examined the composition of the diet of nestling Hooded Crows in the flooded river valley of the "Ujście Warty" National Park in western Poland, which is a bird refuge of international importance and provides nesting habitat for numerous bird species. Despite the richness of potential avian prey, the dominant components of Hooded Crow nestlings' diet were insects, fish and plants. Contrary to expectations, birds were only supplementary to the diet of nestlings, and thus, we suggest that crows are likely to have only a marginal influence on nest failures of potential avian prey species in regions similar to the studied area.

KEY WORDS : *Corvus cornix*, diet, Hooded Crow, nestlings' food, protected areas

INTRODUCTION

The Hooded Crow *Corvus cornix* is a dietary generalist, consuming a wide spectrum of foods of both animal and vegetable origin (Cramp, 1998). Invertebrate prey includes molluscs (Berrow, 1991; Berrow et al., 1991; Berrow et al., 1992 a; b) as well as crustaceans, insects, arachnids and a number of other groups (Deckert, 1980; Ewins, 1986; Massei & Genov, 1995; Cramp, 1998; Horgan & Berrow, 2004). Moreover, Hooded Crows are known to feed on carrion (Picozzi, 1975, author's observations) and prey on a number of vertebrate taxa (Stahl, 1985; Cramp, 1998; Vorgin & Vorgin, 1998; Najbar, 2001; Krivosheev, 2004). There are individual reports of crows catching birds in flight, e.g. the Common Swift (*Apus apus*) (Camolese et al., 2003) and the European Starling (*Sturnus vulgaris*) (Edholm, 1979; Gagsch, 1980) and studies considering the Hooded Crow as a nest predator and demonstrating its influence on the clutch success of numerous bird species (mostly waterbirds) are prevalent (e.g. Witkowski, 1983; Cadiou, 1999; Grant et al., 1999; Green & Yurlov, 1999; Volponi, 1999; Opermanis et al., 2001). For this reason, the idea that birds constitute a basic food item of the Hooded Crow is a predominant one. However, most relevant data provide only indirect information, derived from nest visits on selected bird species. Additionally, such visits seriously increase the risk of nest predation (Major, 1990; Tryjanowski & Kuźniak, 1999). Other data concerning hunting behaviours of the Hooded Crow result from experiments with the use of artificial nests (Göransson et al., 1975; Loman & Göransson, 1978; Sonerud & Fjeld, 1985; Fjeld & Sonerud, 1988), and this approach is also known to be laden with potential biases (e.g. Pärt & Wretenberg, 2002; Zanette, 2002). Except for one study from the Danube Delta (Kiss et al., 1977) using destructive methods (analysis of stomach contents of dead birds), there are no direct, representative data related to the diet of the Hooded Crow on wetlands, the primary biotope of this species (Tomiałojć & Stawarczyk, 2003). Moreover, there are no studies using non-destructive methods to determine the diet of nestling crows. Such data would be indispensable for determining actual relationships between this predator and its potential prey during the breeding season.

In this paper we present the results of a study on the composition of the diet of nestling Hooded Crows. The research was carried out in the lowland of a permanently flooded river estuary, abundant in potential avian prey species of this predator. Therefore, we paid special attention to the contribution of birds in the diet of this species. Furthermore, we demonstrated the qualitative and quantitative contribution of all food components.

MATERIALS AND METHODS

The study was carried out in the "Ujście Warty" National Park (52°36'N, 14°47'E) in Western Poland, on the Warta River at its estuary into the Odra River. This area is under protection of the RAMSAR convention. Moreover, this area is a wildfowl refuge of international importance (Grimmet & Jones, 1989), where approximately 160 bird species breed (Bartoszewicz et al., 2000). Exemplary mean breeding pair densities of potential avian prey for crows in the study area are: Common Coot (*Fulica atra*), 50.7 pairs/km^2 (SE=20.0), Black-Headed Gull (*Larus ridibundus*), 85.1±14.7, Mallard

(*Anas platyrhynchos*), 4.6±0.9, and Garganey (*Anas querquedula*), 0.9±0.4 (unpublished data from years 1995-1999 and 2003 from yearly monitoring reports, see also BARTOSZEWICZ et al., 2000). Breeding density of Hooded Crows in the study area was 2.9±0.2 pairs/km^2 (ZDUNIAK, 2006).

The study site (16km^2) is located in the western, periodically flooded part of the Park. It is covered by a mosaic of herbaceous vegetation, dominated by the Reed-Canary Grass (*Phalaris arundinacea*) and arborescent vegetation, consisting exclusively of mature willows (*Salix* sp.) and willow shrubs. Additionally, in this area there are shallow lakes, old river-beds, ditches and dikes. The characteristic feature of the Park is its highly changeable and unpredictable water-table (for details about the study area see: CHMIEL et al., 2000; CHOIŃSKI, 2000).

During the breeding season (April-June) of 2003, 82 samples of food were taken from 38 nestlings in 15 nests. Samples were taken with the use of tartar emetic (for details see ZDUNIAK, 2005). Briefly, this involved the oral administration of a 1.5% solution of antimony potassium tartrate through a flexible plastic tube attached to a syringe. After administration of emetic, birds were placed on a foil in a warm and quiet place and observed for the vomiting reflexes.

Samples were collected 4 times from 8 nestlings (3 nests), 3 times from 8 nestlings (3 nests), twice from 4 nestlings (2 nests) and once from 18 nestlings (7 nests).

Food samples were analysed under a binocular scope and their contents were divided into the following categories: a) plants; b) insects (chitin, and in some cases whole parts of the body containing soft tissues); c) fish (fish bones, scales, parts of the cranium); d) amphibians (bones); e) birds (feathers, bones); f) bird eggs (eggshells, predominantly of the Common Coot *Fulica atra*); g) molluscs (parts of shells); h) crayfish (parts of limbs and carapace); i) undetermined material (partly digested soft tissues and fine fragments of bones and shells); j) others (leeches, mammal bones, stones). The material was defined according to appropriate guides (ADOLPH, 1927; GĄSOWSKA, 1962; FERENS, 1967; PUCEK, 1984), dried and weighed with digital scales to an accuracy of 0.001g.

We considered food samples from the same nest on different days as independent observations. This approach to the data analysis results from the fact that in the study area the access to different sources of crows' food is changing during the period of nestling feeding, which in turn is connected with changeable water conditions. Hence, we assumed that the composition of the diet of nestling Hooded Crows in one nest varies from day to day. Also in the study of BERROW et al. (1992a) the diet of Hooded Crows changed during the breeding season. Consequently, the diet of nestlings from the same nest during one nest visit was treated as one collective sample.

All calculations were conducted using STATISTICA for Windows package (StatSoft Inc., 2005). Data are presented as means with 95% confidence limits (95% CL).

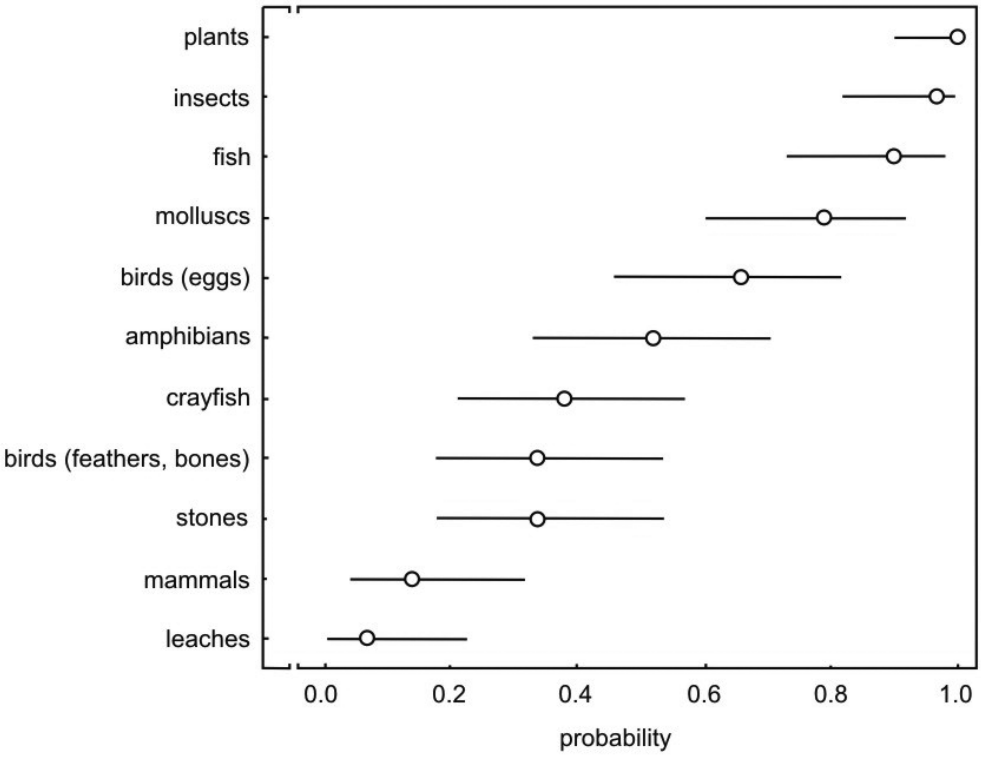

Fig. 1. – Probability of finding a particular diet component of nestling's food in a sample (n=29). Means are given with 95% CL.

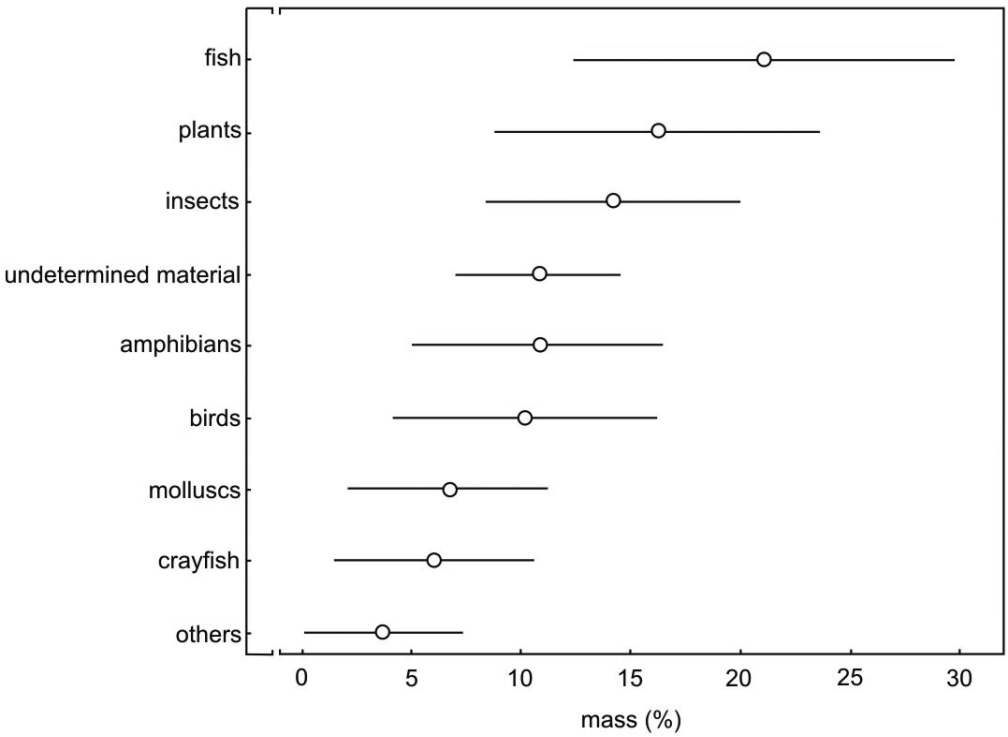

Fig. 2. – Contribution of components of nestling's diet in the dry mass of the samples (n=29). Means are given with 95% CL.

RESULTS

The greatest frequency of occurrence of particular diet component in a sample of nestling's food (n=29) was noted for plants (p=1.00, CL: 0.90-1.00) and insects (0.97, 0.82-1.00), followed by fish (0.90, 0.73-0.98) and molluscs (0.79, 0.60-0.92). Remaining components were far rarer (Fig. 1). Among these, eggshells were found with a frequency of 0.66 (0.46-0.82) and other avian remains (bones and feathers, mainly of Mallard chicks) with a frequency of 0.34 (0.18-0.54).

The contribution of particular components in individual dry mass samples (n=29) was very diverse (Friedman's ANOVA rang test, χ^2=41.54, df=8, p<0.001). Greatest mean contributions were noted for fish remains ($\bar{x}$=21.1%, CL: 12.3%-29.9%), plants ($\bar{x}$=16.3%, 8.8%-23.8%) and insects ($\bar{x}$=14.3%, 8.4%-20.1%). Other components had a lower contribution to the diet (Fig. 2), and all avian remains (eggshells, feathers, bones) constituted on average 10.2% (4.2%-16.3%) of the dry mass samples.

DISCUSSION

The results presented indicate that the diet of nestling Hooded Crows in flooded wetland habitats is very diverse. Even though the study area provides nesting habitat for numerous avian species that represent potential prey of the Hooded Crow (mainly Common Coot and Mallard; ZDUNIAK, 2006), bird remains found in the samples had a relatively low frequency of occurrence. The fact that birds are only a supplement in the crow nestlings' diet is also confirmed by the low contribution of avian remains in the dry mass of the samples.

Results obtained by other authors in areas less abundant in potential avian prey species also indicate a low contribution of bird remains in the Hooded Crow's diet. At sites located on the sea shore in Ireland (BERROW et al., 1992a) insects along with crustaceans, snails and bivalves were most common in pellets and stomachs of adult crows throughout the year**.** The frequency of avian remains in pellets was up to 6% representing less than 5% of the total dry mass of pellets. In contrast, avian remains were not found in the stomachs of any birds sampled at this time. During the breeding season, the volume of insects in the pellets varied between 10% and 20%, while remains of all vertebrates constituted between 7% and 20% of the samples by volume. Unfortunately, the authors do not give any details about the contribution of avian prey to the diet of crows.

According to PICOZZI (1975) insects were very frequent in the stomachs of adult crows during the breeding season (ranging from 18% to 80% of stomachs analysed). The percentage of samples with eggshells and feathers ranged from 4% to 10% and from 0% to 4% in the breeding season. In the agricultural landscape of Germany (DECKERT, 1980) insects was the main food of the Hooded Crow, whereas remains of birds or eggs constituted 0%-7% of stomach and pellet contents. The dominance of insects in the diet of the Hooded Crow was also reported by HORGAN & BERROW (2004), and HOUSTON (1977) considers

insects as a good source of protein for nestling crows. Results obtained in the Danube Delta (KISS et al., 1977), the only study conducted on a large river estuary rich in potential avian prey species, also confirm the low significance of birds as food for the Hooded Crow. Avian remains were found in 15.6% of the analysed stomachs, and major components of the diet were plants followed by fish, insects and small mammals. On the other hand TENOVUO (1963), reports that a blend of bird's eggs and insects constituted 80% of the volume of stomach contents in nestling Hooded Crows at sites located on the sea shore in Finland.

Our study showed that despite the richness of potential avian prey, birds are only supplementary to the Hooded Crow nestlings' diet during the critical breeding season. A previous study based on egg shells eaten by the Hooded Crow (ZDUNIAK, 2006) showed that, in the same study area, this nest predator is opportunistic and concentrates on the most abundant and most commonly available avian prey species. Therefore, our findings indicate that the influence of crows on the nests failures of avian prey species in regions similar to the study area should be considered marginal.

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