

Scavenging feeding by wintering Great Cormorants *Phalacrocorax carbo sinensis*

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The diet of the Great Cormorant *Phalacrocorax carbo sinensis* during the breeding season has been extensively described along much of its European breeding range (Cramp and Simmons 1977, Veldkamp 1991, Mellin and Martyniak 1991, Gere and Andrikovics 1992). Recently the diet during the non-breeding period has also been reported (Marteijn and Dirksen 1991, Suter 1991). Like all other Phalacrocoracidae species, Great Cormorants eat almost exclusively fish. However, there is a great deal of variation in the composition of their diet, which denotes the foraging opportunism of the species (Eerden and Munsterman 1986, Marteijn and Dirksen 1991). Knowledge of the feeding habits and diet of wintering Great Cormorants in the Mediterranean basin is based on scanty preliminary data, which nevertheless have shown fishes to be the main food (Negro et al. 1989, Handrinos 1993, Sara and Baccetti 1993, Boldreghini et al. 1993).

As part of a study of the winter ecology of Great Cormorants in a recently used wintering area of central Spain (Blanco et al. 1994), we obtained data about their diet by collecting pellets and regurgitated food remains from beneath the trees of a communal roost throughout the period of its occupation (October to March) during 1993-94. The communal roost was situated in a group of large White poplars *Populus alba* close to the Jarama river, and held a maximum number of 525 individuals which usually foraged in nearby gravel-pits and rivers. No other bird species used the roost.

During the collecting trials, we found numerous regurgitated remains and pellets containing bones and feathers from to at least twenty-nine domestic chickens *Gallus gallus* of different size, which we assume were obtained by the cormorants as carrion. Subsequent analyses revealed that most of the chicken bones were tarsometatarsi, tibiotarsi, femora, ulnae, radii, carpometa-carpi, digits and claws. Other bones were

found in very small numbers, suggesting that cormorants mainly ingested chickens in the form of wings and legs. In addition, we found two large bones and several large fragments of cartilage from unidentified large livestock species. Synthetic products, such as pieces of plastic, cloth and glass, together with organic remains, like orange peel and green vegetables, were also found in several pellets. These findings clearly indicate that several cormorants had foraged at some kind of dump deposit probably containing refuse from slaughterhouses or poultry farms, as well as domestic refuse. Several of the pellets contained both chicken bones and fish remains, the main food of cormorants in the study area (authors' Blanco *et al.* in press). All pellets containing chicken bones and all the remains were found only between February 4 and March 8, beneath a branch of the main roosting tree. Subsequent observations from a distance revealed that this perching site was repeatedly occupied by two adult males and one adult female, which were sexed by size and behavior (Munsterman and Eerden 1991). During the time interval in which we detected chicken carrion as cormorant food, we made six visits to the roosting site and collected all the pellets and remains. On all six occasions, we found chicken bones, which demonstrates that the cormorants returned repeatedly to the source of the chicken carcasses.

Great Cormorants are opportunistic piscivores. Other taxa, such as Crustacea, Cephalopoda, Gastropoda, etc., have been reported to form part of their diet (Dobben 1952, Sarà and Baccetti 1993). However, in most cases, these food types were probably not derived from active predation but from the gastric contents of fishes. Although Great cormorants have been reported to prey upon waterfowl, frogs and water voles (Cramp and Simmons 1977), recent extensive studies of the diet of cormorants have not detected any food other than fish (Marteijn and Dirksen 1991,

Mellin and Martyniak 1991, Suter 1991, Veldkamp 1991, Gere and Andrikovics 1992), suggesting that the capture of other prey can be considered exceptional. Our findings reveal that Great Cormorants wintering in central Spain can obtain some food by scavenging. The feeding habitat of cormorants in our study area comprises a complex of gravel-pits and rivers surrounded by transformed areas. After exploitation, some gravel-pits are refilled with debris and rubbish from different sources, which usually form a layer on the water surface. Cormorants usually forage in these gravel-pits and they have been observed close to the rubbish. Some carrion may be found floating on the water, allowing consumption by the cormorants. The proportion of carrion in the diet of the population of cormorants wintering in our study area of central Spain seems to be small. However, for some particular individuals and possibly during the period of time when carrion is available, it could constitute an important food resource.

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