Does the diet of the Little Cormorant *Microcarbo niger* affect commercial fisheries?

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Abstract

The diet composition of Little Cormorants *Microcarbo niger*, during their breeding season, was studied in the Kannur District of Kerala during July–August 2012 to evaluate whether their diet conflicted with the commercial interests of shrimp, and fish farmers. Regurgitated samples (n=498) revealed that they mainly preyed upon shrimps (91%), to feed their nestlings. Other prey species included various species of fishes (*Mystus vittatus* 6%, *Aplocheilus* sp. 1%, *Puntius mahecola* 1%, and *Etroplus maculatus* 0.40%), and an amphibian tadpole (*Euphlyctus cynophlyctus* 1%). Slow-moving bottom dwellers like shrimps and *M. vittatus*, which are easy to catch, constituted most of the recorded prey. The size of prey species was 1–7 cm. Though shrimps constituted the higher percentage of their diet, their mean biomass (0.39 g) was less than that of other prey. Medium-sized shrimps ranging 1–4 cm were preferred. The higher percent of shrimps in their diet, recorded in the regurgitated samples, suggests a possible conflict with commercial shrimp farming. The small-sized fish (*M. vittatus*, and *E. maculatus*) these cormorants preying upon may have negligible economic value, but continued predation of a particular size class may later affect recruitment and thus the population structure of the prey species.

Introduction

An increase in the number of cormorants [Phalacrocoracidae] in Kannur District (Kerala), in the past two and a half decades, has led to a direct conflict with commercial fish farming (Roshnath 2014). In Europe, there has been an increase in the number of cormorants since 1980 (Van Eerden & Gregersen 1995). Thereafter, many studies on the diet of cormorants were carried out all around the world, and several corrective measures to prevent a conflict with commercial fisheries were undertaken (Humpheries *et al.* 1992; Keller 1995; Van Eerden & Gregersen 1995; Veldkamp 1995; Glahn *et al.* 1998; Engstrom 2001; Liordos & Goutner 2008). These studies constitute a baseline on the dietary preferences of cormorants.

The recent increase in the number of Great Cormorant *Phalacrocorax carbo* in Sweden has led to conflicts with commercial fishery (Engstrom 2001). Considering the species composition of their diet, and the consumption estimates of wintering cormorants in southern Germany, Keller (1995) concluded that these birds imposed a serious threat to commercial fisheries. However, a study in Greece (Liordos & Goutner 2008) suggested minimal competition between cormorants and commercial fishing.

Veldkamp (1995) collected indirect data on the prey captured by breeding cormorants (rearing young) by collecting their regurgitated stomach contents. He concluded that the predation of fish stocks by cormorants might, in some circumstances, reduce fish populations to very low levels, or even completely remove certain size-categories of fishes, but this was highly unlikely to result in local extinctions.

No study of this nature has been conducted in India, despite cormorants being widespread, and given the fact that commercial fisheries support a vast section of the human population. The present study attempts to address this issue.

Methodology

Study sites

Kannur District in northern Kerala lies along the coast of the Arabian Sea, experiencing a humid tropical monsoon climate. The diet composition of Little Cormorants *Microcarbo niger* was studied at the Valapattanam (Fig. 1) heronry (11.93° N, 75.36° E), located on a small mangrove islet in the Valapattanam River. The main mangrove species growing on the islet were *Bruguiera cylindrica, Acanthus ilicifolius, Aegiceras corniculatum, Kandelia candel*, and *Rhizophora mucronata*.

The diet composition of nesting birds was studied by analyzing their regurgitated pellets. It was assumed that the regurgitated samples approximated the dietary preference of the cormorants, although the one-to-five regurgitated samples that we collected per day constituted only a small proportion of their food intake. Harris & Wanless (1993) suggested that regurgitation could be used to describe the diet of chicks of water birds. The heronry at Valapattanam was observed from 0600 hrs to 1800 hrs, twice a week, during the breeding season. Fish, or other prey, which had fallen to the ground from a nest, and lay within a one-meter radius of it, were collected as samples. Information such as number, size, and mass of the prey was recorded from the samples. Prey taxa were identified with help of literature (Day 1875), and the percentage composition of different prey items was estimated.

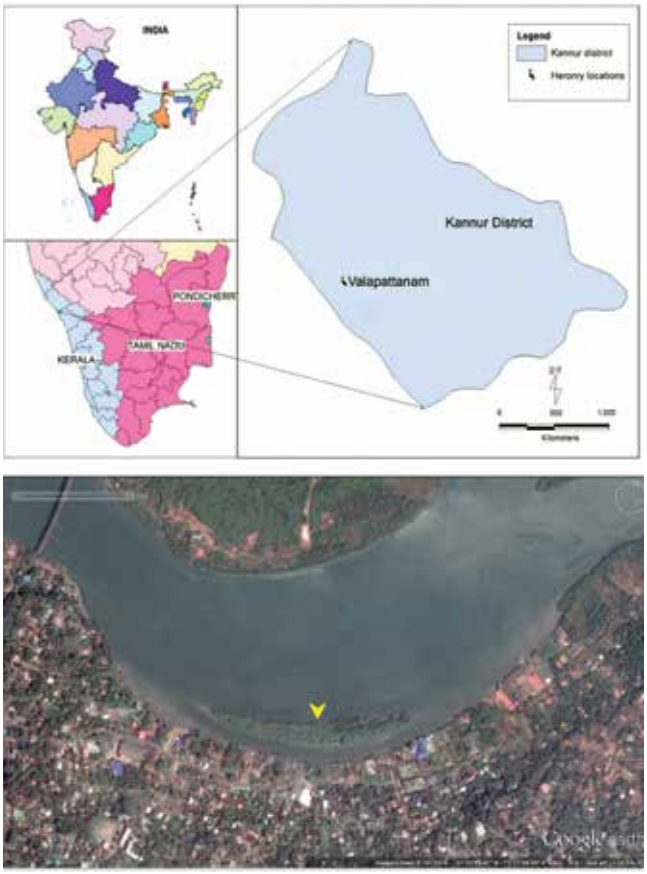

Fig.1: Google map showing location of Valapattanam Heronry in Kannur District (yellow arrow).

Results

A total of 498 regurgitated samples were collected from under the nests in the study site, and analyzed.

Prey composition

The composition of different prey items in the diet of Little Cormorants is shown in Fig. 2. The regurgitated samples (n=498) revealed that the major prey constituent was shrimp (91%). The fish species included *M. vittatus* (striped dwarf catfish), *Aplocheilus* species, *Puntius mahecola*, and *Etroplus maculatus* (orange chromide). Four amphibian tadpoles of *Euphlyctis cyanophlyctis* were also recorded. Bottom-dwelling organisms such as striped dwarf catfish, and shrimps (*Penaeus* species, and *Macrobranchium* species) were recorded more in the diet (Fig. 3). Parent birds fed shrimp fries (mean length 3.2 cm) to chicks in a bolus, each comprising 100–150 fries (Fig. 3). Our samples revealed that shrimps, along with striped dwarf catfish, and orange chromide, constituted 97% of their prey; these were economically important, and also species of human interest, thus causing a potential conflict with commercial fisheries, and humans.

The prey of the Little Cormorant ranged in length from one to seven centimeters: *Etroplus maculatus* (5–5.5 cm), *Puntius mahecola* (4 cm), *Mystus vittatus* (2–5 cm), and *Aplocheilus* species (2 cm); shrimp sizes ranged from 1 cm to 6.6 cm. The only amphibian recorded, *E. cyanophlyctis*, had an average length of 5 cm.

Prey taxa, mean length, and biomass are presented in Table 1. Though shrimp numbers predominated in the regurgitated sample, their mean biomass (0.39 g) was low (4.7% of the total 8.27 g). Among the different fishes, *P. mahecola* (2.88 g; 34.8%), and *E. maculatus* (2.37 g; 28.7%) had a high biomass. *E. cyanophlyctis* (1.27 g), *M. vittatus* (1.16 g), and *Aplocheilus* species (0.2 g) had low a biomass, and were less in numbers as well.

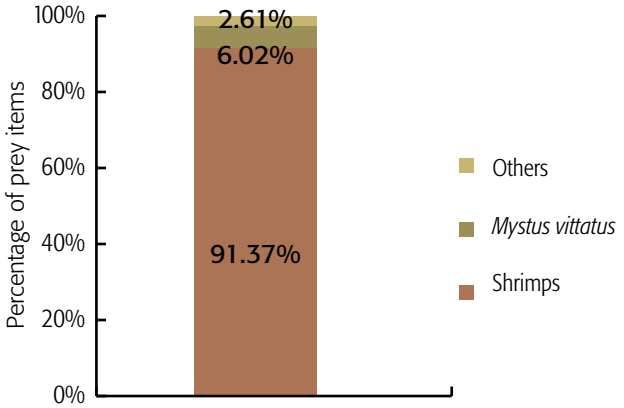

Fig. 2: Prey composition in the regurgitated samples of Little Cormorants in Valapattanam Heronry.

Fig 3: Regurgitated samples of Little Cormorants in Valapattanam Heronry in Kannur, Kerala (A. Regurgitated bolus, B. Contents of the regurgitated bolus after washing with water and straining, C. *Penaeus* sp., D. *Etroplus maculatus*, E. *Mystus vittatus*, F. *Puntius mahecola*, and G. *E. cyanophlyctis*).

Table 1. Mean length and mean biomass of prey species in the regurgitated samples of Little Cormorants in Valapattanam Heronry.

Prey	Mean length (cm)	Mean biomass (gm)
Shrimps	3.2	0.3
Mystus vittatus (fish)	4.5	1.1
Aplocheledea sp. (fish)	2.0	0.2
Euphlyctis cyanophlyctis (tadpole)	5.0	1.2
Puntius mahecola (fish)	4.0	2.8
Etroplus maculatus (fish)	5.2	2.3

Little Cormorants preyed largely (87%) on medium-sized shrimps (2–4 cm); only occasionally preying on larger shrimps (10%). They showed a significantly higher preference for medium-sized shrimps (χ^2=419.5; df=5; p=0.00; Fig. 4).

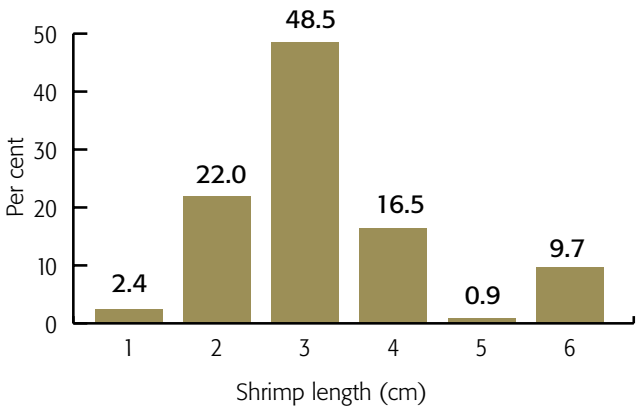

Fig.4: The frequency distribution of the number of shrimps and size in regurgitated samples of Little Cormorant in Valapattanam Heronry.

Discussion

For Little Cormorants, shrimps are easier to catch than other prey species, and are high in protein (Ravichandran *et al.* 2009). Hence it is not surprising that they predominate in their diet. A high source of energy and protein is needed during breeding season, by all birds, thus preying on shrimp accounts for rich food and efficient foraging. Our data may not accurately reflect the full diet of the birds since it is only based on a small proportion of their actual intake that was regurgitated. Besides, regurgitated samples may disproportionately indicate prey rejected by the birds. However, regurgitated samples give a rough idea of prey composition, given the difficulty in obtaining direct observations.

In recent years, there has been a large-scale conversion of natural water bodies into shrimp farms in the district, which might have resulted in shrimps forming the greater part of the cormorant's diet. The cormorants' preference for mid-sized shrimp may result in a possible conflict with commercial shrimp farmers.

Cormorants have been reported to prey on a variety of prey species, mostly of benthic, or inshore forms (Suter 1997; Gremillet *et al.* 1998; Veen 2012). They are opportunistic hunters feeding on diverse prey species including amphibians and arthropods. Their predation is directly proportional to the ease of catching prey, and may be inversely proportional to prey speed. The maximum swimming speed (m/s) of fish is roughly estimated to be ten times its body length in meters (Van Eerden & Voslamber 1995) and, consequently, the escape speed of small fishes will be slower than bigger-sized fishes. This may be one of the reason of cormorants preying on small-sized fishes. Also, smaller-sized prey can be stuffed in larger numbers into the crop, as compared to larger-sized prey. A larger number of small prey helps to feed all the nestling at the same time. Cormorants usually have two to three chicks, but in a few cases four to five fully grown nestlings were observed in the Mahe, and Stadium heronries during the 2013 heronry survey (Roshnath *et al.* 2013). Successful feeding of all the chicks, and their growth to fledgling stage indicated high food availability in the study area. The direct observation of prey species, when cormorant parents fed nestlings, was difficult as chicks insert their heads deep into the parent's gaping beak to induce regurgitation, which they swallow.

The apparent preference for medium-sized shrimps may be coincidental, due to the availability of shrimp fries of that particular size during the study period. Also, the start of shrimp rearing season, and breeding season of heronry birds coincide. Though shrimps constituted a higher percent of the cormorant's diet during its breeding season, dietary variations might occur in other seasons, due to changes in the available prey species.

Although preying of shrimps has a direct economic impact on commercial fisheries, other prey fish species (*M. vittatus*, and *E. maculatus*) have negligible economic value, considering their size. However, continued predation of a particular size class will later affect the population structure of the prey species.

To determine the actual fiscal loss to fisheries and shrimp farms, total fish production/standard stock has to be compared against the consumption by the birds. This information is very difficult to obtain and thus only a theoretical assumptions can be made, rather than calculations based on actual fish numbers and biomass. The present study suggests that there is a potential for conflict between cormorants and fish/shrimp farming in the study area. More in-depth studies are required to address the actual quantity of prey consumed, the total prey species composition, and the extent to which cormorants make inroads on populations of species that are important to commercial interests.

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