Dense foraging flotillas of Eurasian Coots *Fulica atra* explained by predation by Ganges Soft-shell Turtle *Aspideretus gangeticus*?

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van den Hout P.J. 2006. Dense foraging flotillas of Eurasian Coots *Fulica atra* explained by predation by Ganges Soft-shell Turtle *Aspideretus gangeticus*? Ardea 94(2): 271–274.

Overwintering Coots *Fulica atra atra* were observed in January 2006, in Keoladeo National Park, India. Here they fed on aquatic plants, which they exploited in strictly-maintained dense flotillas; these flocks behaved like a super-organism. This observation adds to a description of Ali & Ripley (1969), who do not explicitly discuss the cause of raft formation by Coots, but only mention the occurrence of Coot predation by Greater Spotted Eagle *Aquila clanga*. Having observed a Coot being drowned by a Ganges Soft-shell Turtle *Aspideretus gangeticus*, I suggest that predation risk by these turtles should be taken into account as a possible cause for this herding behaviour. When on the water, Coot flocks now and then suddenly scattered; this suggested disturbance by a hidden aquatic predator, all the more because no raptor attacks were witnessed on these occasions. Coots visited the water exclusively for foraging, and, in contrast to their usual behaviour, roosted on islands. This indicates that they considered the water as a dangerous environment, despite the fact that on land the risk of predation by eagles may be greater. My observations suggest that, by foraging in very dense groups, Coots and other waterbirds exploited the rich food resources in Keoladeo whilst minimising the risk of predation.

Key words: Coot, *Fulica atra*, Ganges Soft-shell Turtle, *Aspideretus gangeticus*, Greater Spotted Eagle, *Aquila clanga*, predation risk, anti-predation behaviour, flocking

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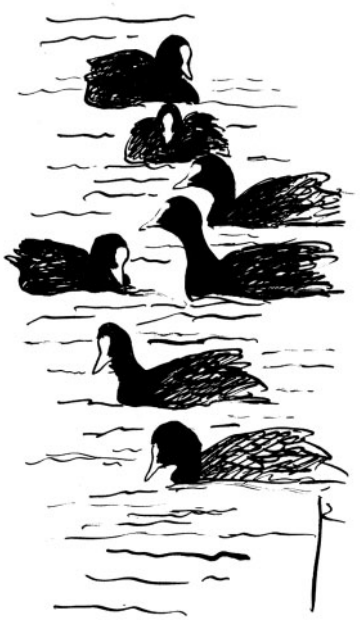

The nominate species of the Eurasian Coot *Fulica atra atra* is widely spread over Europe and Asia (del Hoyo *et al.* 1996). In winter, Coots typically forage in vegetated shallow lakes and ponds. They are omnivorous, feeding mainly on the vegetative parts or seeds of aquatic and sometimes terrestrial plants (Ali & Ripley 1969, Cramp & Simmons 1980, del Hoyo *et al.* 1996). In contrast to their behaviour in the breeding season, wintering Coots generally devote little time to aggression and are gregarious when roosting or foraging (Gibbons *et al.* 1993). Taking plant food, flocking Coots proba-

bly suffer only moderate interference costs, and may even optimise cropping rates by carefully timed visits, as reported in geese (Prins *et al.* 1980, Prop & Loonen 1989). Nevertheless, the most important reason for Coots to flock may be their vulnerability to predators (Randler 2005), as their agility is limited and they occur in open habitats (Glutz von Blotzheim *et al.* 1973, Cramp *et al.* 1993). Studies on several aquatic predators demonstrated a decreased probability of attack as group size of prey increased (Neil & Cullen 1974, Treherne & Foster 1982).

The nature and level of predation on Coots varies, of course, and this may be reflected in regional differences in habitat use. Wintering Coots in Western Europe, when disturbed, retreat to open water, which is apparently a safer habitat than land. Likewise, flocks tend to roost on open water (Cramp & Simmons 1993, Bijlsma *et al.* 2001), and when feeding, if not on water, they mostly do so near the water's edge, ensuring escape routes towards the water (Glutz von Blotzheim *et al.* 1973, Irwin & O'Halloran 1997). These may all be adaptations to terrestrial predators such as Red Foxes *Vulpes vulpes* and raptors. Although Coots on the water occasionally may be caught by Goshawk *Accipiter gentilis* (van Hattum 2002, van den Brink 2003, Jaschke 1996), the risk of predation is presumably negligible compared to when on land.

One would expect the pattern to be reversed when predation pressure on water is higher than on land, and this is what seems to occur in at least one locality in Northern India. In January 2006, in the Keoladeo Ghana National Park, Bharatpur, India (27°13´N, 77°32´E), a 29 km^2 natural floodplain of the Gambhir and Banganga River (Middleton 1992), I observed Coots foraging in extremely dense flocks (ranging from about 200 to at least 500 individuals) on submersed water plants (probably mainly Floating Haert *Nymphoides cristatum* and Water Snowflake *N. indicum*; B. Middleton, pers. comm.) which they took mainly from just below the water surface (Fig. 1A). Intake rates were not quantified, but were substantial. The Coots, which were abundant in Keoladeo, roosted exclusively on the small vegetated islands that were scattered over the floodplain, and avoided the water except for foraging. When switching from resting to feeding, Coot flocks plunged themselves into the water almost simultaneously, immediately followed by flotilla formation or the merging with an existing flotilla. It was as if invisible ropes tied the birds together (Fig. 1B). From time to time such a raft abruptly broke up into a massive centrifugal burst of splattering birds (Fig. 1C). In similar terms, Ali & Ripley (1969) describe the 'pattering din set up by such a close-packed herd' of Coots. They do, however, not discuss the cause of this behaviour explicitly but only report to have seen these responses after a gunshot or an attack by an eagle. Elsewhere they note that wintering Coots may suffer greatly from predation by Greater Spotted Eagles *Aquila clanga* (Ali & Ripley 1968). Nevertheless, although Greater Spotted Eagles were around in Keoladeo, and are known to swoop low over Coot rafts to scatter them in order to isolate and capture a prey individual (Ali & Ripley 1968), in neither of the many cases in which I spotted this fleeing behaviour of a Coot raft, Coots were under eagle attack. Yet, as I did not have full view of the sky at all times I cannot exclude the possibility that soaring eagles elicited the fleeing response. Nevertheless, the behaviours – flocking and fleeing – could also be explained by the threat of a hidden aquatic predator, a possibility Ali & Ripley did not mention. A good candidate is the Ganges Soft-shell Turtle *Aspideretus gangeticus*. These turtles were regularly spotted resting on mud banks. One late afternoon I spotted a Coot being slowly drowned by what was very likely such a turtle (Fig. 1D). Although the Coot managed to resurface several times, again and again it was dragged under, until at last it disappeared for good, parting from life with a few bubbles.

The Ganges Soft-shell Turtle, with a carapace length of up to 70 cm, is known to be largely carnivorous (Daniel 1983), and researchers working in the Keoladeo National Park confirmed predation on adult Coot by Ganges Soft-shell Turtle (B. Middleton, pers. comm.). In fact, in Keoladeo two

Figure 1. (A) Coot flotillas in Keoladeo National Park, India; (B) Coots simultaneously leave an island roost to resume feeding; (C) a disturbed Coot flock, with birds fleeing in all directions; (D) Coot being drowned by a Soft-shell Turtle.

big Ganges Soft-shell Turtles were observed to pull down an apparently injured Nilgai *Boselaphus tragocamelus* (Singh 2000). This is a large, horse-like built antelope (shoulder height 120–150 cm, and weight 109–288 kg; Prater 1971), and while it struggled many other turtles gathered, biting off chunks of flesh from the flanks of the animal (Singh 2000). Moreover, Soft-shell Turtles have been recorded taking waterfowl, millipedes, fish and flapshell turtle (*Lyssemys* sp.) alive and scavenging on dead fish and mammals (Singh 2000).

I propose that the Soft-shell Turtles cannot be ignored as a possible serious predator when judging the sense of raft formation in Coots. Furthermore, Coots treated the aquatic environment as dangerous, in contrast to relatively safe islands on which they roosted, despite the fact that on land eagles may cause the greatest risk of predation.

When feeding on the water in very dense flocks the Coots may look like very large unprofitable organisms to the turtles. In any case, individual risks of predation would be 'diluted' in such flocks (e.g. Hamilton 1971, Foster & Treherne 1981, Godin 1986). Correspondingly, Eurasian Teal *Anas crecca* were often observed merging in the Coot flotillas in shallow water, whereas Northern Pintails *Anas acuta*, like Coots, formed very dense foraging flocks as well. All these waterbirds only roosted on islands of dry land.

I am very grateful to Beth Middleton for sharing her – and her colleagues' – observations with me, and to Inge van Vijfeijken for being such a great travel partner. During the writing of this manuscript I was tightly coached by Theunis Piersma. I also benefited from the comments of Jouke Prop and Rob Bijlsma. I enjoyed the feedback by Mardik Leopold, Marc Lavaleye and Kees Camphuysen on the story.

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SAMENVATTING

In januari 2006 observeerde ik overwinterende Meerkoeten *Fulica atra atra* in het Keoladeo National Park, India. De vogels foerageerden hier voornamelijk op waterplanten. Dat deden ze in opvallend dicht opeengepakte groepen. Dit gedrag werd in 1969 ook beschreven door Ali & Ripley, echter zonder dat de oorzaak van dit gedrag werd besproken. Weliswaar beschreven deze auteurs predatie van Meerkoeten door Bastaardarenden *Aquila clanga*, het groepsgedrag van Meerkoeten als zodanig is daarmee echter niet verklaard. De waarneming van een Meerkoet die verdronken werd door een grote zoetwaterschildpad (Ganges Soft-shell Turtle *Aspideretus gangeticus*), doet vermoeden dat predatie door deze schildpadden dit groepsgedrag wel eens zou kunnen veroorzaken. Het idee van een zich onder de waterspiegel ophoudende predator werd nog versterkt door waarnemingen van groepen op het water foeragerende Meerkoeten die met veel lawaai van opspattend water uiteenstoven, zonder dat van een aanval door een arend sprake was. De Meerkoeten bezochten het water uitsluitend om te foerageren, wat aangeeft dat ze dit als een gevaarlijke omgeving beschouwden. Ze rustten daarentegen op de verspreide eilandjes in het gebied, ondanks het feit dat ze daar vermoedelijk kwetsbaarder waren voor arenden dan op het water. Door in hechte groepen op het water te foerageren, waarbij de groep als een soort superorganisme functioneert, lijken Meerkoeten en andere watervogels in staat de rijke voedselbronnen in Keoladeo te benutten zonder daarbij een al te hoog predatierisico te lopen.

Corresponding editor: Jouke Prop
Received 1 May 2006; accepted 14 June 2006