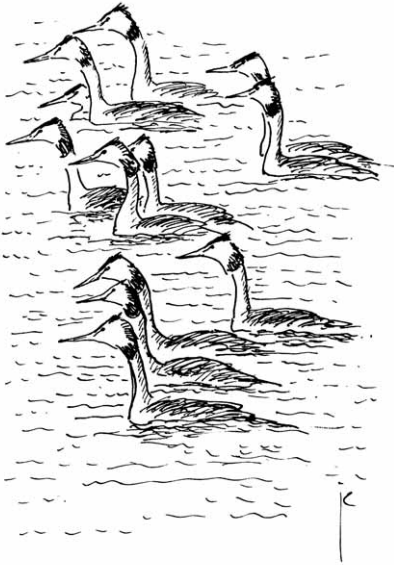


Flock-fishing in the Great Crested Grebe *Podiceps cristatus*

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Flock-fishing, i.e. when a tight group of birds moves in a coordinated way under more or less synchronous diving, is common in cormorants *Phalacrocorax* spp. and mergansers *Mergus* spp., but is said in the major handbooks not to occur in Great Crested Grebes *Podiceps cristatus*. The present communication reports repeated observations of such flock-fishing at a South Swedish lake during summer. Great Crested Grebes' dispersion in relation to diving activity within large aggregations on a nearby lake in late autumn – early winter is also described.

Key words: flock-fishing, Great Crested Grebe, autumn aggregations, South Sweden

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Introduction

Some species of piscivorous birds engage in flock-fishing (sometimes also referred to as mass feeding), e.g. several species of cormorant *Phalacrocorax* spp. (del Hoyo *et al.* 1992) and merganser *Mergus* spp. (Cramp 1977). However, flock-fishing in Great Crested Grebes *Podiceps cristatus* is neither mentioned in the major handbooks (Bauer & Glutz 1966, Cramp 1977) nor in Fjeldså's (2004) monograph on grebes, and only a couple of sources describe this behaviour in Great Crested Grebes (see Discussion). Fjeldså even makes the following statement (p. 67):

“Hoary-headed Grebe primarily feed on tiny and slow-moving prey. Such grebes are social feeders. Other grebes stalk their prey alone (solitarily). This means that birds leave loafing groups before they start to dive, and they also try to keep away from other diving water birds. This is even the case where 100s or even 1000s of Western or Great Crested Grebes assemble during the non-breeding season: the birds always spread out before they start feeding. The presence of other diving birds makes it difficult to stalk rapidly fleeing prey such as fish.”

Fjeldså (in litt.) confirms that he has never observed flock-fishing in Great Crested Grebes and neither did T. Piersma (in litt.) observe it during his studies of this species on IJsselmeer in the 1980s. Here I report on frequent observations of flock-fishing Great Crested Grebes at a Swedish lake, which seem to contrast to the fishing method as generally described for this species.

Study area and Methods

The observations reported below were largely a side effect of ongoing waterbird counts started in 1985 by the late G. Andersson at the 3.4 km² large, shallow, semi-eutrophic Lake Krankesjön in southern Sweden (55°44'N, 13°29'E; for a description of the lake, see Hansson *et al.* 2007). Grebes were observed with a 15–60x Zeiss spotting scope from two observation towers, one on the eastern and the other on the southern side of the lake. Observations of grebes were also carried out at the much larger (c. 12 km²) Lake Vombsjön, 6 km to the east of Lake Krankesjön, where up to 2000 Great Crested Grebes regularly gather in late autumn and early winter (Källander 2006).

Results

LAKE KRANKESJÖN

During the last few years, flocks of apparently non-breeding Great Crested Grebes have been observed in summer on Lake Krankesjön. Although flocks of Great Crested Grebes were seen in summer on the open water of the lake in both 2004 and 2005, it was not until 1 June 2006 that I observed flock-fishing. On that day, there were 117 grebes on the open water, 90 of which formed a dense fishing-flock very similar to those seen in Great Cormorants *Phalacrocorax carbo* or mergansers. Subsequently I saw such fishing-flocks during visits to the lake on 19 June and 1 July. On the first of these, the grebes formed two dense flocks of about 40 intensively diving individuals each. On the second occasion, there were two flocks that later joined to form a single flock of 80 birds. On 27 April 2007, most of 131 Great Crested Grebes on the lake were part of a fishing-flock, however less dense than those reported above. From 13 May until 20 July 2007 I observed flock-fishing grebes on 13 different dates and made some behavioural observations, which are reported below.

Fishing-flocks were dense and normally drawn out in the direction of movement. Diving showed a high degree of synchrony, which made it extremely difficult to count the birds involved. For instance, in one flock of 55 counted when resting and preening, the highest number recorded afterwards when the flock was diving, was 25, i.e. during fishing less than half the true number of birds was present on the surface at any one moment, and usually far fewer.

The fishing-flocks covered considerable distances. Thus, on 10 July a flock of 60 grebes travelled c. 2.5 km in 250 min, and on 20 July a flock of the same size moved a similar distance in about 180 min. This meant that the flocks roamed over much of the lake. A few times the flocks were engaged in more stationary fishing, presumably when they had located a school of fish or an especially profitable area. On these occasions diving was particularly intense.

While on the move the birds were diving nearly all the time. Thus, on 10 July, they only

spent 13 min swimming without diving and another 8 min with only low diving activity during the 250 min of observation (5% and 3%, respectively). During the same period, the flock made two pauses, each of c. 7 min, for preening, etc. (less than 6% of the time), but in addition to this single birds were sometimes seen preening during periods of lower diving activity. However, during observations from 19:00 (CET, summer time), the grebes were resting, the flocks were less dense and had at least partly dissolved.

As indicated above, the fishing-flocks of Great Crested Grebes showed great similarity to those of Great Cormorants: they were dense, mostly drawn out in the direction of movement (although fishing on a broad front was observed once), diving was highly synchronous and often very intense. Another feature in common with cormorant flocks was the frequent occurrence of attempts at intra-specific kleptoparasitism. These attempts seemed, however, always to be unsuccessful, probably because most of the prey caught was rather small. When attacked by a conspecific, a bird would make a quick rush along the water surface meanwhile swallowing the fish. Some attacks were rather fierce, just as in cormorants (Lekuona & Campos 2001, Källander 2006). There were also frequent interactions between the grebes that appeared to be aggressive rather than related to kleptoparasitism.

In all probability most of the flock-fishing grebes at Lake Krankesjön were non-breeding birds even though this could not be established with certainty. However, on a couple of occasions one or two grebes with a dependent young joined a flock as it moved. There were also some indications that single presumed breeders sometimes participated in the flock-fishing activities, but the composition of the flocks remains to be established.

LAKE VOMBSJÖN

Lake Vombsjön is used by staging Great Crested Grebes from late October to December. They normally form a few large aggregations of up to 600 birds, with individual distances between birds varying from less than a metre to several metres.

Although scattered birds throughout the aggregations periodically became active and dived, more intense diving was often restricted to parts of the aggregations. Occasionally groups of actively diving grebes moved together in the same direction under constant and relatively synchronous diving. Under such circumstances groups were sometimes quite dense, however not as dense as the fishing-flocks observed at Lake Krankesjön. In any case, the grebes did not disperse before they started to dive. Rather, during diving bouts distances between birds tended to decrease and birds also appeared to swim towards parts of an aggregation where diving intensity was high.

Discussion

Flock-fishing by Great Crested Grebes of the kind described above has been mentioned by Berndt & Drenckhahn (1974) and Vinicombe (1976). The former authors report two such observations, one involving 160, the other 50 grebes and call the phenomenon "Fischzug" (herding). Vinicombe's (1976) observations agree closely with those at Lake Krankesjön except that the flocks he observed were larger (150–250 birds): the grebes swam across the whole lake, more than half the flock was underwater at a given instance, and the flock was densely packed. Vinicombe thought the grebes were feeding on young Roach *Rutilus rutilus*. Roach is the most abundant fish species at Lake Krankesjön (Hansson *et al.* 2007) and it is likely that young Roach were the grebes' main prey also there. At two of five lakes in the Wilderness National Park, South Africa, A. Konter (in litt.) observed Great Crested Grebes flock-fishing in the same manner, his flocks numbering 55 and 35 grebes. A park official confirmed that the grebes used this foraging method regularly. Konter noted that the fish caught was small and speculated that the grebes were pursuing fish schools.

Rinnhofer (1983) followed a constantly diving flock of 50–70 Great Crested Grebes for 3 km as it swam along the Baltic coast. Judging from a photograph, however, the flock more resembled those at Lake Vombsjön than the very dense flocks at Lake Krankesjön. Berndt & Drenckhahn (1974)

call such diving in less dense flocks, where smaller groups dive together, "Gruppentauchen" (group diving) and the second author saw 500–800 Great Crested Grebes on Lake Selenter See dive "as on command."

Lakes Krankesjön and Vombsjön differ in at least one important respect. Lake Krankesjön is very shallow and much of its bottom is covered with submerged vegetation, whereas Lake Vombsjön is much deeper and lacks submerged vegetation almost completely. It is possible that fishing in a dense flock, 'herding' fish in the manner of cormorants and mergansers and driving fish out of shelter, is an efficient way of enhancing intake rate at shallow lakes such as Lake Krankesjön. At Lake Vombsjön, this feeding method is used by cormorants and Goosanders *Mergus merganser* but may not be profitable for Great Crested Grebes. The grebes at Lake Vombsjön feed on smaller fish than do cormorants and Goosanders (pers. obs.), but exactly how this might influence their foraging method is unknown.

The fact that grebes dive synchronously not only during forward swimming but also during more stationary foraging needs an explanation. One possibility is that the simultaneous appearance of many predators may confuse the fish and that a fish scared by one bird may increase the chances that it will be captured by another, i.e. a situation analogous to the suggested 'beater effect' in terrestrial ecosystems. Circumstantial evidence for this is the extremely synchronous diving, with sometimes all of 25 birds under water, observed during stationary foraging in Smew *Mergus albellus* (pers. obs.). The alternative explanation, of course, is that such synchronous diving is an indication that a fish school has been located and is being intensively exploited. In fact, the most common explanation of flock-feeding is that birds concentrate in patches where food is plentiful, but this is clearly not the only explanation of flock-foraging in some piscivorous species. The herding of fish by mergansers, cormorants and pelicans clearly enhances foraging success (Platteeuw *et al.* 1997, van Eerden & Voslamber 1995, Anderson 1991; but see Saino *et al.* 1995 for an exception in Great

White Pelicans *Pelecanus onocrotalus*). Whether something similar to a beater effect is also operating is a matter of discussion. Two experimental studies have suggested the presence of such effects in piscivorous predators. Götmark *et al.* (1986) found an increase in individual prey capture rate with increasing group size in Black-headed Gulls *Larus ridibundus*, while Major (1978) found the same in a schooling fish, *Caranx inobilis*. However, Cézilly *et al.* (1990) concluded from an experiment with Little Egrets *Egretta garzetta* that increased foraging efficiency in flocks was not an effect of beating. Although the question of whether a beating effect exists or not remains unsettled, some observations suggest that it does; perhaps it is more common than often realised (see Battley *et al.* 2003 for possible examples).

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SAMENVATTING

Sociaal vissen is een manier van voedsel zoeken waarbij vogels groepsgewijs prooien opjagen en vangen. Aalscholvers en zaagbekken vertonen dit gedrag geregeld, terwijl het bij andere viseters als de Fuut *Podiceps cristatus* zelden wordt gezien. Dit artikel beschrijft hoe Futen op een Zweeds meer vaak sociaal visten tijdens de zomermaanden van 2006 en 2007. De groepsgrootte lag daarbij tussen de 50 en ruim 100 vogels. Vermoed wordt dat de Futen op kleine Blankvoorns *Rutilus rutilus* joegen, maar het bleef onduidelijk waarom de Futen op dit meer zo vaak sociaal visten. (JP)

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