

Intraspecific kleptoparasitism in flock-fishing Great Crested Grebes (*Podiceps cristatus*) and Great Cormorants (*Phalacrocorax carbo*) – a cost to participants?

HANS KÄLLANDER



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Abstract Intraspecific kleptoparasitism was studied in flock-fishing Great Crested Grebes *Podiceps cristatus* during May and June 2011 and in Great Cormorants *Phalacrocorax carbo* during September 2011 and August 2012 at Lake Krankesjön, South Sweden, for a total of c. 11 h for grebes and c. 6 h for cormorants. Only attempts to steal large fish (relative to a bird's gape) were recorded, because small fish mostly did not elicit kleptoparasitic attempts and those seen appeared never to be successful. Attempts to steal large fish were rare, 0.14 h⁻¹ grebe⁻¹ (N = 96) and 0.39 h⁻¹ cormorant⁻¹ (N = 163). In both species, the host lost its fish in about 20% of cases. Based on the observed low parasitism and success rates, it is concluded that kleptoparasitism was a minor cost of participating in flock-fishing.

Keywords: Great Crested Grebes, Great Cormorants, flock-fishing, intraspecific kleptoparasitism, success rate

Összefoglalás A megszerzett táplálék fajtárs által történő eltulajdonításának (kleptoparazitizmus) gyakoriságát vizsgálták a dél-svédországi Krankesjön-tavon a búbos vöcsöknél (*Podiceps cristatus*) 2011 májusa és júniusa között, valamint a kárókatonánál (*Phalacrocorax carbo*) 2011 szeptembere és 2012 augusztusa között. Az összesen 11 órás (búbos vöcsök), illetve 6 órás (nagy kárókatona) megfigyelési periódus alatt csak a szájnnyílásnál nagyobb méretű halak eltulajdonítására irányuló viselkedések számát regisztrálták. A fajtárstól történt tápláléklopási próbálkozások egy egyedre eső száma alacsony volt: a búbos vöcsöknél 0,14 h⁻¹ (N = 96), a kárókatonánál 0,39 h⁻¹ (N = 163) próbálkozás óránként. Mindkét fajnál a lopási kísérletek kb. 20%-ában a potyázók sikeresek voltak, és elvették fajtársuktól annak zsákmányát. Az adatok azt mutatják, hogy a kleptoparazitikus viselkedés ritkasága és a sikeres eltulajdonítás alacsony rátája miatt mindkét fajnál kicsi a társas halászatban résztvevő egyedek költsége.

Kulcsszavak: búbos vöcsök, nagy kárókatona, csoportos halászat, intraspecifikus kleptoparazitizmus, potyázási ráta

Hans Källander, Department of Biology (Ecology), Ecology Building, Lund University, SE-223 62 Lund, Sweden, e-mail: hans.kallander@telia.com

Introduction

Intraspecific kleptoparasitism in birds appears to be less common than interspecific kleptoparasitism or at least has attracted much less interest. It does occur in some colony-breeding species, such as terns and auks (Shealer *et al.* 2005, Lavers & Jones 2007), and in groups of Bald Eagles *Hali-*

aetus leucocephalus (Hansen 1986, Bennetts *et al.* 1990), Cattle Egrets *Bubulcus ibis* (Garrido *et al.* 2002) and gulls *Larus* spp. (Bertelotti & Yorio 2000, Galván 2003). It can also be seen in flock-fishing Common Mergansers *Mergus merganser* (Källander 2006) and Great Cormorants *Phalacrocorax carbo* (Lekuona & Campos 2001, Mahendiran *et al.* 2010), and one

would expect it to occur also in several other situations where birds feed in close association with each other.

Flock-fishing, especially in species feeding on schooling prey, is likely to result in higher individual capture rates than solitary fishing as suggested by its common occurrence among deep-diving piscivores, such as penguins, cormorants, mergansers, and others. That flock feeding increases individual capture rate has been shown experimentally for Black-headed Gulls *Chroicocephalus ridibundus* plunge-diving for fish (Götmark *et al.* 1986). Also in a predatory species of fish, individual success was higher when foraging in groups than solitarily (Major 1978). However, flock-fishing also presents opportunities for intraspecific kleptoparasitism, which could thus constitute a potential cost of this feeding method. The aim of the present study was to determine the frequency of intraspecific kleptoparasitism in flock-fishing Great Crested Grebes and Great Cormorants to see whether it would constitute a significant cost of flock-fishing. In addition, observations on the evasive behaviours of the hosts are presented.

Methods

The species

Great Crested Grebes usually fish solitarily (Bauer & Glutz 1966, Cramp 1977, Fjeldså 2004), but in certain rare conditions they have been found to form fishing flocks. Thus, at Lake Krankesjön, South Sweden (c. 55° 42' N, 13° 28' E), flock-fishing is a regular phenomenon in Great Crested Grebes during the breeding season and involves birds during incubation recesses (Källander 2008, 2011). Flock-fishing usually ceases

in early July but may sometimes continue until early autumn, when both adults and young of various age participate. The fishing flocks, which mostly contain anything from 15 up to a hundred grebes, roam widely across the c. 3 km² lake, both on the open water and along the its reed-fringed *Phragmites australis* margins. Particularly during periods of intense diving activity, probably indicative of the presence of a fish shoal, the flocks become very dense. In these situations, attempts at intraspecific kleptoparasitism sometimes occur.

Great Cormorants may fish in flocks numbering from a few individuals to many thousands (van Eerden & Voslamber 1995) in both limnic and marine habitats (Brown *et al.* 1982, Sellin 1986, Grémillet *et al.* 1998). At Lake Krankesjön, flock-fishing occurs predominantly during late summer – early autumn. Birds leave the night roost in the morning for a first fishing session. They then return to the roosting trees but fly out to fish again later during the day. During September 2011, numbers were usually around 30 to 80, but in August and September 2012 more than 200 cormorants were present.

Data collection

In 2011, data on the frequency of attempted kleptoparasitism in Great Crested Grebe flocks were collected at Lake Krankesjön during May – June. Fishing flocks engaged in at least moderately active diving were measured with a stopwatch during periods lasting 2 min 48 s – 44 min, for a total of slightly more than 11 h. Moderate diving was defined as roughly half of the individuals being under water at any one moment, while during intense diving often fewer than 20% of the birds were simultaneously pres-

ent on the surface. Cormorants were monitored continuously using the same method for 2 min 35 s – 40 min, for a total of 6 h 10 min during September 2011 and August 2012.

Additional data on kleptoparasites' success rate were collected during all years 2007–2012. Most observations of both Great Crested Grebes and Great Cormorants were made from either of two bird observation towers, one on the southern and another on the eastern shore of the lake, using a Carl Zeiss® Diascope 85 T*FL with a 20–60x ocular. Distances were often long, which means that attempts to steal small, quickly swallowed fish mostly could not be seen. However, data below on parasitism frequency refer to cases where a grebe or cormorant had captured a large fish (relative to its gape size) that took long to swallow. Because both species foraged in dense, coordinated flocks, it is unlikely that any such kleptoparasitic attempt was missed.

To deal with the problem of zero observations during some observation periods, the number of 'grebe hours' and 'cormorant hours' was calculated, i.e. the duration of each observation period times the number of birds in the flock. These numbers were then summed for each species over all observation spells and the total number of recorded kleptoparasitic attempts was related to these figures.

Results

Great Crested Grebe

Kleptoparasitic attempts were rare. Overall only 0.138 attempts h⁻¹ grebe⁻¹ were recorded (N = 96 kleptoparasitic attempts involving large fish). Also the kleptoparasites'

success rate was low. In 93 out of 119 kleptoparasitic attacks recorded, the bird that had captured the fish also managed to swallow it (80%), and in only five cases (4%) the fish was with certainty lost to a kleptoparasite. However, in as many as 21 cases (16%) there was uncertainty about who eventually got the fish. To these data should be added 35 instances when a grebe with a large fish left the flock either before being attacked, or at least without being pursued, and swallowed its fish without being harassed. On four occasions large fish were simply dropped after a grebe had spent considerable time unsuccessfully trying to swallow it. In no case were (the few) attacks on birds with small fish successful.

A few kleptoparasitic attacks were very fierce; on one occasion the parasite even climbed the back of the fleeing victim (as frequently seen in flock-fishing Common Mergansers and Great Cormorants, pers. obs.). Often a bird was attacked by several grebes, either simultaneously or in succession. Once the fight over a big Roach *Rutilus rutilus* lasted for at least five minutes after which the host gave up its attempts at swallowing it and dropped the fish which then wandered between several grebes until finally ignored.

Grebes used essentially two methods to evade attacks from kleptoparasites, to rush (or 'flight-rush', a combination of running and flying) or to dive, but true flights of up to 50 m were observed three times. Flight-rushes were from 5 – 6 m up to c.40 m long. Also the kleptoparasite sometimes flight-rushed after the host but more often it dived and shortly afterwards surfaced close to the host which then made a new attempt to escape.

Great Cormorant

Kleptoparasitic attempts were relatively rare with a mean of 0.386 attempts h^{-1} cormorant⁻¹ ($N = 163$ attempts). Cormorants that had captured a large fish occasionally flew outside the flock to swallow it without being harassed. Mostly, however, cormorants surfacing with a large fish were instantly attacked by one or more conspecifics and sometimes a long fight over the fish ensued. Out of 123 kleptoparasitic attempts, the attacked cormorant managed to swallow its fish in 92 (75%), in four the fish was with certainty lost to a kleptoparasite. However, in as many as 24 instances the outcome could not be ascertained (in the remaining three cases the fish presumably escaped). The success of kleptoparasites was also estimated for small and medium-sized fish (roughly 6 – 12 cm). Such attempts were very common when a flock was diving intensively, apparently following a shoal of young Roach. In 264 such attempts, a cormorant just once lost the fish (which probably escaped).

Discussion

The risk of losing a large fish to a conspecific kleptoparasite was low on a per bird basis among both Great Crested Grebes and Great Cormorants at Lake Krankesjön. Provided each individual suffered an equal risk of being attacked (observations indicate that juvenile cormorants may be more likely to lose fish (Lekuona & Campos 2003, J. Brun pers. comm.), this risk would amount to only one attack per individual and seven hours of active fishing in the Great Crested Grebe and about one attack per two and a half hours in the Great Cormorant. Consid-

ering that only about 20% of kleptoparasitic attempts were successful, a grebe would only risk losing its fish once every 35 hours of fishing and a cormorant once every 12 hours (at most, because in 35 instances in the grebe and several in the cormorants, a bird with a big fish left the flock and ingested it unattacked). The conclusion, therefore, is that intra-specific kleptoparasitism probably is a very minor cost of engaging in flock-fishing.

Both grebes and cormorants surfacing with small and quickly swallowed fish sometimes made a short forward leap, apparently to avoid being attacked, or they simply turned the back towards potential kleptoparasites. However, grebes with small fish were usually not attacked. In cormorants, when attacks on birds with small fish occurred, they were very brief and none was successful. This contrasts with the results of Lekuona and Campos (2001), who found that nearly half of the fish lost to kleptoparasites in Great Cormorants were less than 14 cm long and 4% were less than 8 cm. This difference between the two studies is intriguing. One possibility could be that the species of fish taken in their study were more difficult to swallow (because of spines or body form), but the data they present on handling times do not support this explanation. At Lake Krankesjön, the main identified prey of both species was Roach, although Common Bream *Abramis brama* was occasionally taken by cormorants.

As shown in several studies, a host's risk of being kleptoparasitized increases with prey size and/or prey handling time (e.g. Brockmann & Barnard 1979, Ratcliffe *et al.* 1997). However, a large prey is also more valuable to the host than a small prey and therefore worth defending more strongly, which may explain the low success rate

of the kleptoparasites found here. With the low success rate of kleptoparasites observed in the present study, one may ask why intraspecific kleptoparasitism occurs among these piscivorous species. The likely answer

may be that the cost of an attempt is relatively low to the parasite compared with the potential gain from securing a large prey, especially considering the low rate at which such prey were captured.

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