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INTERACTIONS BETWEEN COYPU (*MYOCASTOR COYPUS*) AND BIRD NESTS IN THREE MEDITERRANEAN WETLANDS OF CENTRAL ITALY

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ABSTRACT - We evaluated the possible predation on eggs and the disturbance to waterbird nests by coypus by monitoring the breeding success of four bird species and a sample of dummy and natural nests by photo-cameras. The monitoring of waterbirds activity showed that 14.8% of *Fulica atra* and 9.5% of *Gallinula chloropus* nests failed, possibly as a consequence of disturbance by coypus. In 2009, 7.4% of ground dummy nests and 10.8% of water dummy nests showed signs of coypu activity with eggs either preyed or removed. Camera surveys confirmed that coypus used the nests as resting platforms, thus destroying or sinking the eggs. This study showed that in areas with high coypu density the disturbance to bird nests floating amid the vegetation or built in open water may be severe.

Keywords: Impact, invasive species, nest destruction, nutria, Myocastoridae, photo-camera survey, waterbirds

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The coypu (*Myocastor coypus* Molina, 1782) is a large semi-aquatic rodent native to South America that has been introduced to all continents except Oceania and Antarctica (Carter and Leonard 2002). In Europe the species is widespread from the Iberian Peninsula to Russia (Bertolino and Genovesi 2007; Salsamendi et al. 2009). This rodent is considered a pest in many countries because of its negative impact on ecosystems, crops and irrigation systems (Carter and Leonard 2002; Bertolino and Genovesi 2007). Locally, coypus can cause significant economic damage by feeding on crops and by burrowing and undermining riverbanks and embankments (Bounds et al. 2003; Panzacchi et al. 2007; Bertolino and Viterbi 2010). The impact on aquatic ecosystems is mainly due to their feeding behaviour. Coypus are generalist herbivores that feed on a large variety of plant materials and, occasionally, on crustaceans and freshwater mussels (Woods et al. 1992; Guichón et al. 2003; Prigioni et al. 2005).

The overexploitation of marsh and riparian vegetation (Willner et al. 1979; Boorman and Fuller 1981; Bertolino et al. 2005) may pose an indirect threat to marshland birds, reducing the availability of suitable habitats for nesting and breeding. Although some authors have hypothesized that the direct impact of the coypu on nesting birds may be severe (Scaravelli 2002; Tinarelli 2002), studies on coypu feeding activity never showed evidence of its feeding on eggs or nestlings (Willner et al. 1979; Borgnia et al. 2000; Guichón et al. 2003; Prigioni et al. 2005). Remains of eggs are difficult to detect when analyzing stomach content or faeces; furthermore, egg predation or nest destruction may be occasional and thus difficult to record. However, coypu may represent a direct threat to aquatic birds by interfering with brooding birds and using floating nests as resting sites.

The main purpose of our study was to assess the actual impact of the coypu on waterbirds by monitoring both natural and artificial nests directly and by photo-cameras. The study was carried out in three different protected wetlands of the Latium region (central Italy). Macchiatonda Reserve (MR) is a 250 ha wide swampy area on a coastal plain. Lago di Vico Reserve (LVR) is a protected area of 4,109 ha including a lake; here the monitoring involved a reed bed on the lake shore. Nazzano-Tevere-Farfa (NTFR) is a 700 ha wide reserve at the confluence of the rivers Farfa and the Tiber; the study area included a marsh and some islands in the River Tiber.

In 2008 and 2009, the breeding activity of four waterbird species - the mallard (*Anas platyrhynchos*) with 27 nests in 2008 and 28 in 2009, the Eurasian coot (*Fulica atra*) with 13 and 14 nests respectively, the common moorhen (*Gallinula chloropus*) with 10 and 11 nests, and the great crested grebe (*Podiceps cristatus*) with 11 and 7 nests - was monitored at NTFR. In total 121 nests were visually checked by a field worker every two days from an adequate distance to avoid disturbance. The fate of the nests was recorded, as well as the presence around the nests of potential predators, including coypus.

In 2009 we conducted a first experiment with artificial nests to collect more information on nest predators. Dummy nests were made using local vegetation moulded into a cup shape on a 20x20 cm flexible metallic mesh. Each artificial nest contained two brown domestic hen eggs and a plasticine egg. Two different nest types were used, *i.e.* ground and water nests. Ground nests were placed onto a 40x40 cm large board covered with a layer of grease on which predators left footprints (Angelstam 1986). Water nests were directly anchored to the aquatic vegetation. Predators were identified by either the signs left on the plasticine eggs or the tracks found on the board. A total of 128 dummy nests (74 located on the water amid the vegetation and 54 on the ground, 9 of which were placed on small islands in the River Tiber) was set out in the three areas and checked every 7 days over a period of 28 days.

In 2010, both dummy (without the plasticine egg) and natural nests were monitored by photo-cameras to identify nest predators. Four transects in MR and 3 transects in NTFR, each with 10 dummy nests, were controlled by digital cameras (model BMC Scout Guard). At MR, the camera at 19 nests failed - the sample was thus composed only of 21 dummy nests. Each camera was attached to the trunk of a tree located near the nest, or on a pole sunk in the water, and checked after 1 week. Likewise, 10 Eurasian coot nests in NTFR were monitored by digital cameras to provide 24-hour surveillance. A natural nest was checked as soon as it was first discovered. After having set up the cameras, each nest was inspected only when it showed signs of predation, when it was given up by the parents or after weaning, so as to limit disturbance.

In total, 131 natural nests and 179 artificial

Table 1 - Number of natural (N) or artificial (A), water (W) or ground (G) nests surveyed at three Nature Reserves of Latium.

Study area	2008		2009		2010	
	N	A	N	A	N	A
MT	-	-	-	14W+15G	-	21W
LVR	-	-	-	30W+30G	-	-
NTFR	34W+27G	-	32W+28G	30W+9G	10W	30W

nests were monitored from 2008 to 2010 (*Tab. 1*).

In 2008-2009, the monitoring of waterbirds breeding activity showed that 4 out of 27 (14.8%) Eurasian coot nests and 2 out of 21 (9.5%) common moorhen nests failed, apparently because of the continued presence of coypus that were repeatedly observed while swimming near the nests. No evidence of failure due to the presence of coypu was collected for mallard and great crested grebe nests.

In 2009, 7.4% of ground dummy nests and 10.8% of water dummy nests in the three study areas (NTFR - water nests: 3.3%, island ground nests: 22.2%; LVR - water nests: 20.0%, ground nests: 3.3%; MR - water nests: 7.1%, ground nests: 6.7%) were preyed and reported signs of coypu presence, i.e. teeth marks on the plasticine eggs or footprints on the greasy board under the nest. Since in most cases signs of other possible predators were also present, we could not attribute egg predation with certainty to the coypu.

In 2010, cameras documented the presence of coypu near 4 out of 21 (19%) dummy nests in MR and 3 out of 30 (10%) in NTFR. The animals were recorded while moving around or resting on the nests, but not while eating the eggs (*Fig. 1*).

In NTFR, 50% of the 10 Eurasian coot nests that were camera-monitored failed due to the damage caused by coypu. Photographic records generally showed the animals jumping on the nests and paying no attention to the eggs as a possible food source (*Fig. 2*). The animals used the nests as a platform for resting, both during the day and the night, thus crushing or sinking the eggs when present. Sometimes, eggs were eaten by other predators, such as rats and carrion crows, before the coypu rested on the nests.

Artificial nests are only a simulation of the real world and there is evidence that the overall proportion of artificial nests preyed by different species may be higher (Burke et al. 2004), equal (Söderström 1999), or even lower (Davison and Bollinger 2000) than that of natural nests. Interestingly, in our study, the results of the monitoring of waterbirds breeding activity (2008-2009) and dummy nests (2009-2010) were quite concordant, both ranging between 10 and 20% of failure caused by coypu. Because of the small sample size, the high percent failure of Eurasian coot nests followed by cameras in 2010 needs further evaluation.

Identifying nest predators is critical to understand the level of predation pressure that waterbirds may suffer from. As regards our initial question, by using the camera survey of both dummy and natural nests, we documented that coypu frequently used the nests as resting platforms. Coypus were not attracted by the eggs and did not eat them, but rather jumped on the nests repeatedly, resting during the day as well as at night.

Figure 1 - A photo sequence of a coypu resting on an artificial nest and disregarding the eggs.

As a result, the eggs were often destroyed or sunk by the coypu resting on them.

A detrimental impact of rodents, such as introduced rats, on native nesting birds has been well documented, especially on islands (Pascal et al. 2008; Capizzi et al. 2010). In this study, by using cameras surveying both dummy and natural nests, we showed for the first time that although coypus are not egg predators, they may be nest destroyers, with a potentially high impact on the reproduction performance of waterbirds.

The bird species here considered are rather common and not concerned with conservation issues. In fact, we preferred to survey these species rather than species at risk which would have not enabled us to monitor an adequate sample of nests. However, we argue that in areas with high coypu density a similar impact on other bird species that build floating nests amid the vegetation

Figure 2 - A photo sequence of two coypu resting on a Eurasian coot nest and disregarding the eggs.

and in open water may be expected.

Coypus are found in a variety of aquatic habitats, including marshland, ponds, lakes, rivers and streams, as well as in artificial habitats like channels and rice fields (Woods et al. 1992; D'Adamo et al. 2000; Bertolino and Ingegno 2009). These habitats are often important breeding areas for birds and the possible disturbance caused by the coypu has to be investigated and taken into consideration when evaluating the necessity for control campaigns.

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