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CONTROL OF THE COYPU (*MYOCASTOR COYPUS*) BY CAGE-TRAPPING IN THE CULTIVATED PLAIN OF NORTHERN ITALY

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ABSTRACT - Between November 2002 and March 2003, thirty-five trapping sessions, carried out along 1.5-9 m wide irrigation canals scattered in six provinces of Lombardy region (northern Italy), allowed us to test for the effectiveness of coypu (*Myocastor coypus*) control operations in the central part of the intensively cultivated plain of the River Po. A total of 1534 coypus were captured, with a trapping success of 0.087 removed coypus/trap-days. Trapping sessions of about 33 consecutive days guaranteed the best cost/benefit ratio. Only few trapping sessions determined a significant decrease of local population size. In most of the trapping sites, removal of coypus probably enhanced immigration of animals from neighbouring areas. Among captured coypus, the sex-ratio was not significantly biased. The young/adults ratio (mean value = 0.33) significantly decreased in February and March 2003 with respect to previous months. The 11.6% of overall trapped females were pregnant. Adult coypus resulted sexually dimorphic for head-body length, tail length and weight, being higher for males, while young coypus did not show any significant variation between sexes. Some implications for the coypu management are also discussed.

Key words: Coypu, *Myocastor coypus*, control, biometry, northern Italy.

RIASSUNTO - ***Controllo numerico della Nutria* (Myocastor coypus) *mediante trappolaggio in aree coltivate della pianura Padana***. Nel periodo novembre 2002-marzo 2003 sono state effettuate 35 sessioni di trappolaggio lungo canali di irrigazione (1,5-9 m di larghezza) distribuiti in 6 province lombarde, al fine di valutare l'efficacia dell'intervento di controllo della popolazione di Nutria (*Myocastor coypus*). In totale sono stati catturati 1534 animali con un successo di trappolaggio di 0,087 nutrie/giorni trappola. Le sessioni di trappolaggio della durata di 33 giorni consecutivi erano quelle che garantivano il miglior rapporto costi/benefici. Un significativo decremento della popolazione locale era registrato solo per alcune zone di trappolaggio. La rimozione delle nutrie catturate sembrava favorire la rapida immigrazione di animali dalla aree limitrofe a quella oggetto di intervento. Il rapporto sessi era pressoché paritario sia tra gli adulti sia tra i giovani. Durante il periodo di studio il rapporto giovani/adulti (media: 0,33) decresceva significativamente in febbraio e marzo 2003 rispetto ai mesi precedenti. La percentuale media delle femmine pregnanti era dell'11,6%. I maschi adulti presentavano lunghezza testa-corpo, lunghezza della coda e peso superiori a quelli delle femmine adulte. Tali differenze non erano registrate per i giovani. Per incrementare l'efficacia del controllo numerico della specie è indispensabile un maggior

coordinamento operativo tra le province coinvolte. In aggiunta, per massimizzare il successo del trappolaggio e per assicurare una maggiore copertura territoriale dell'intervento di controllo, è vantaggioso spostare le trappole da una zona ad un'altra dopo 30-35 giorni di attivazione continuativa.

Parole chiave: Nutria, *Myocastor coypus*, controllo numerico, biometria, Italia settentrionale.

INTRODUCTION

The coypu (*Myocastor coypus*) has been worldwide introduced, mainly as consequence of escapes or voluntary releases from fur farms (Carter and Leonard, 2002). This rodent has rapidly colonized wetlands and marches, becoming one of the 100 World's Worst Invasive Alien Species (ISSG, 2000). In most of the countries supporting naturalized populations, the species is considered a pest, causing heavy damage to natural vegetation, crops and drainage systems (Morton *et al*., 1978; Willner, 1982; Rosoux, 1985; Verheyden and Abbas, 1996; Prigioni *et al*., 2005).

In Italy, range and abundance of coypu wild populations have considerably increased in the last 20 years and control campaigns have been legally promoted, mainly by use of cage-trapping followed by euthanasia, and/or direct shooting (Cocchi and Riga, 2001). In Lombardy region (northern Italy), the coypu is subjected to control since 1993 (regional decree 4641/93 and subsequent regional law 20/2002), even if with some lack of central coordination (Prigioni *et al*., 2003).

Long term programs aiming to the eradication or control of alien species are generally expensive and the coypu is not an exception. In Italy, the cost of its management has gradually increased, reaching in 2000 an estimated total amount of 3.77 million Euros/year, including the costs of refunded damage to crops and riverbanks and those of population control (Bertolino and Genovesi, 2005).

For these reasons, cost/benefit analysis and field researches aiming to assess the factors affecting the effectiveness of coypu control operations and their real impact at population level are needed. Nevertheless, in Italy only few similar studies have been performed, both in natural wetland areas (Reggiani *et al*., 1993; Bertolino *et al*., 2005;) and in cultivated areas (Prigioni *et al*., 2003).

In this paper we evaluate the effectiveness of coypu control by cage-trapping in an intensively cultivated area of northern Italy and collect information on morphometric characters and reproduction status (pregnant females) of trapped animals. Some recommendations are also made for improving control measures of coypu populations.

STUDY AREA

The study was carried out in the flat southern strip of the Lombardy region (northern Italy, Fig. 1). Here, the coypu range covers about 11500 km^2 of the left orographic bank of the River Po, including the lower

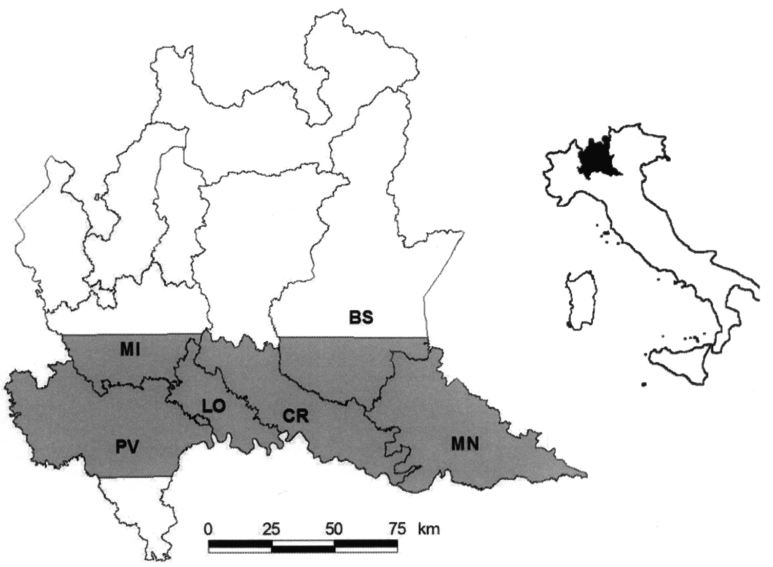

Figure 1 - Study area including partially or totally the territory of 6 provinces of the Lombardy region.

valleys of four main tributaries, the rivers Ticino, Adda, Oglio and Mincio (Balestrieri *et al*., 2002). The area is a wide plain, deeply modified by human activities. Land is intensively cultivated for cereals, mainly maize, wheat and, particularly westwards, rice. Riparian woodlands, formed mainly by willow (*Salix* spp.), alder (*Alnus glutinosa*), oak (*Quercus robur* and *Q. petraea*) and poplar (*Populus alba* and *P. nigra*), are restricted in size and fragmented along the main rivers, where poplar plantations are widespread. A complex network of irrigation canals allows coypus to colonize farmlands far from main rivers. The climate is temperate. During the study period the seasonal mean temperatures ranged between 5.5 °C in winter and 15.5 °C in autumn, and mean rainfall was 900 mm.

METHODS

Thirty-five sample areas, scattered in 6 provinces (Milan, Lodi, Pavia, Bergamo, Brescia and Mantua), were identified with the collaboration of provincial game officers and farmers which, trained about the goals of the research, notified those localities where coypus induced great damage to crops and/or riverbanks.

Trapping sessions were performed between November 2002 and March 2003, using 5-20 cage traps (mean = 12 traps, S.D. = 4.5) placed along the banks of irrigation canals 1.5-9 m wide, on well marked paths used by coypus for entering or leaving the water. Traps (35x35x80 cm) were baited with vegetables (e.g. apples, carrots, maize) and activated for 5 to 106 consecutive days (mean = 32.8 days, S.D.= 32.7). They were checked every morning. Captured coypus were killed introducing them into a sealed box saturated with chloroform. Non-target animals were immediately released at the site of capture.

For a sub-sample of 18 trapping sites where complete data were collected, to test for the decrease in number of trapped individuals during the trapping sessions, 18 linear

regressions were carried out between the weekly number of captured coypus and the weeks of capture. We considered the significant decrease of the number of trapped individuals as an evidence of the decrease of the local population size.

For the overall sample of trapping sites (N=35), the number of captured coypus at the end of each session (C) has been noticed and the following index of capture success (IS) has been calculated:

$$IS = \frac{\text{No. of removed coypus}}{\text{No. of traps x No. of days of capture}}$$

The relationship between the number of trapping days and the two parameters (C and IS), was tested for by two linear regressions, using the F test to fix the level of significance. To guarantee a suitable comparison, both C and IS were expressed as percentage, relating them to the total number of trapping sessions (number of coypus captured / total number of coypus captured x 100 and IS / sum of IS x 100).

Sex, weight, head-body length and tail length of trapped coypus were filed. Young were distinguished from adults by their smaller size (weight < 2 kg; Reggiani *et al.*, 1993). The number of pregnant females was determined by dissection. Body measures were compared between the sexes using the t test, whilst monthly frequencies of pregnant female, young/adults and males/females ratios were compared by the χ^2 test.

RESULTS

On the whole, 1534 coypus were captured, with an overall trapping effort of 17576 trap-days (IS=0.087). Of 18 trapping sessions, five (27.8%) showed a significant decrease of local population size, twelve (66.7%) did not determined any variation in the number of removed coypus during successive weeks of control, while in one trapping session the number of captured animals significantly increased (Tab. 1).

Considering the whole sample of trapping sites, the number of removed coypus increased with the length of trapping sessions, whilst IS significantly decreased, the two regression lines crossing at about 33 days of trapping (Fig. 2).

A total of 1168 coypus was measured and weighted. Adult coypus were sexually dimorphic both body measurements and weight being higher for males, while young did not show any significant variation between sexes (Tab. 2).

Sex-ratio was not significantly biased neither for adults nor for young, both considering the whole number of captured individuals (adults: $\chi^2 = 1.6$, d.f. = 1, NS.; young: $\chi^2 = 2.0$, d.f. = 1, NS), and the monthly number of removed coypus (adults: $\chi^2 = 5.7$, d.f. = 4, NS; young: $\chi^2 = 2.3$, d.f. = 4, NS). Mean young/adults ratio was 0.33. A significant monthly variation emerged (Fig. 3), the ratio keeping almost constant from December to January and sharply falling in February and March ($\chi^2 = 23.3$, d.f. = 4, P = 0.0001).

Pregnant females amounted to 11.6% of overall captured females, with a significant ($\chi^2 = 13.1$, d.f. = 4, P = 0.01) monthly alternation of low and high values (Fig. 4).

DISCUSSION

Coypus isolated populations can be successfully controlled with reasonable management costs (Bertolino *et al.*,

Table 1 - Regression analysis between the weekly number of captured coypus and the weeks of capture for 18 trapping sites. * the number of captured coypus significantly increases; NS= not significant.

Trapping sites	Trapping days	Number of traps	Captured coypus	R^2	F	P
San Genesio	106	17	57	0.43	9.98	0.0075
Molinara	92	20	128	0.25	3.79	NS
Redemello 1	92	20	141	0.33	5.53	0.0384*
Redemello 2	92	20	76	0.01	0.05	NS
Orzinuovi	92	20	29	0.58	15.02	0.0026
Zerbolò	89	20	124	0.64	19.62	0.0010
Croce Cantone	84	11	119	0.29	4.10	NS
Carpiano	62	20	46	0.22	1.93	NS
Dresano	57	10	71	0.86	37.95	0.0008
Zibido	31	5	18	0.01	0.01	NS
Belgioioso	26	20	30	0.39	1.29	NS
Rognano	26	20	19	0.69	4.59	NS
Pegognaga	24	8	32	0.47	1.79	NS
Montodine	22	10	31	0.12	0.43	NS
Rastarone	19	13	46	0.88	7.41	NS
Viadana	18	8	36	0.91	19.60	0.0474
Marzale	17	10	20	0.01	0.02	NS
Gaggiano	14	5	24	0.81	4.32	NS

2005). On the contrary, the high recolonization rate characterizing highly interconnected populations can severely affect the effectiveness of control operations, causing the excessive increase of trapping effort.

In our study area, overall capture success was aligned to the results reported for Italy (Velatta and Ragni, 1991; Scaravelli, 2002) and Europe (e.g. Norris, 1967).

We found that only few trapping sessions determined a significant decrease of local population size. In most of the trapping sites, coypus' removal probably enhanced immigration, the wide network of irrigation canals favouring almost immediate movements from neighbouring areas. Trapping sessions of about 33 consecutive days seem to represent the best compromise between cost (time) to bear and achievable benefit (removed animals).

Representations made by farmers and agricultural association, induced by increasing damage to the drainage system and crops, are actually the main spur which rouse provincial administrations to carry out spotty control operations. Our results suggest that this action leads to quite short term results, representing a palliative addressed mainly to public pressure reduction rather than to coypus effective control. Control campaigns need high costs, in terms of durable and consumable material and hours of work. In this terms, it could be advantageous to move traps

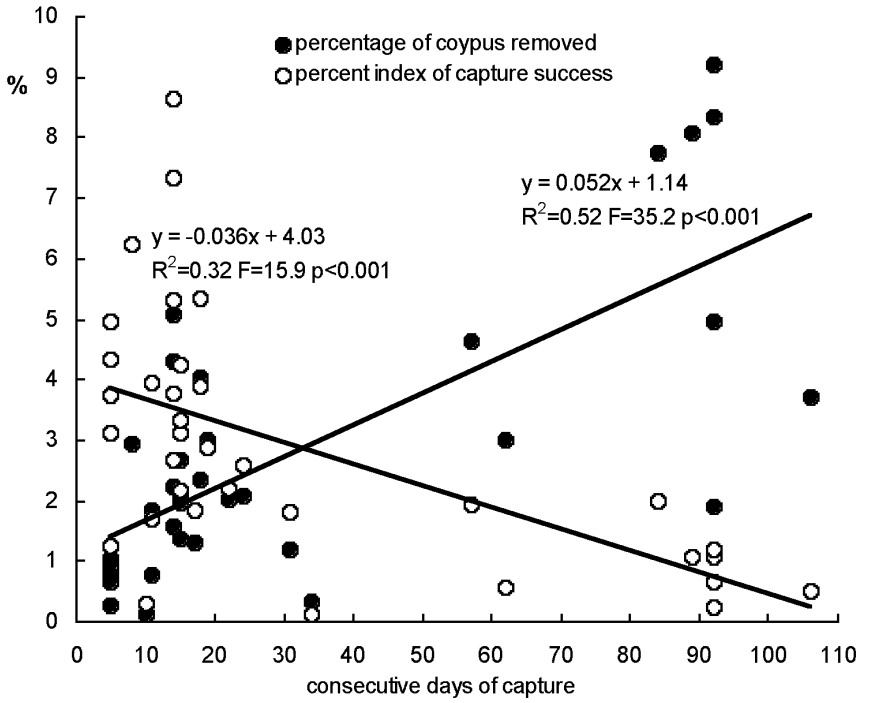

Figure 2 - Percent number of coypus removed and percent index of capture success (see methods) registered for 35 trapping sessions, plotted against the length of each session expressed as number of days of trapping. The results of the two regression analysis are reported.

Table 2 - Comparison of the measurements (length in cm, weight in kg) between males and females of captured coypus.

	Mean	S.D.	Mean	S.D.	t	P
ADULT	Male (N=467)		Female (N=413)			
Head-body length	48.9	12.5	46.0	9.6	2.9	0.003
Tail length	34.0	6.0	32.4	5.7	3.1	0.002
Weight	5.0	1.9	4.5	1.7	3.4	0.001
ADULT	Male (N=467)		Female (N=413)			
Head-body length	30.9	13.7	30.5	12.8	0.2	NS
Tail length	20.5	6.5	20.5	6.2	0.1	NS
Weight	1.3	0.5	1.3	0.5	1.1	NS

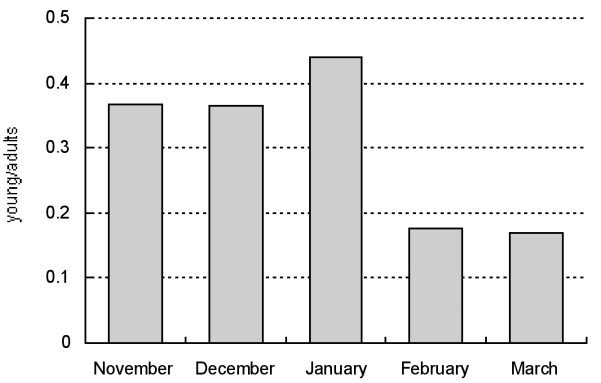

Figure 3 - Monthly young/adults ratio among captured coypus.

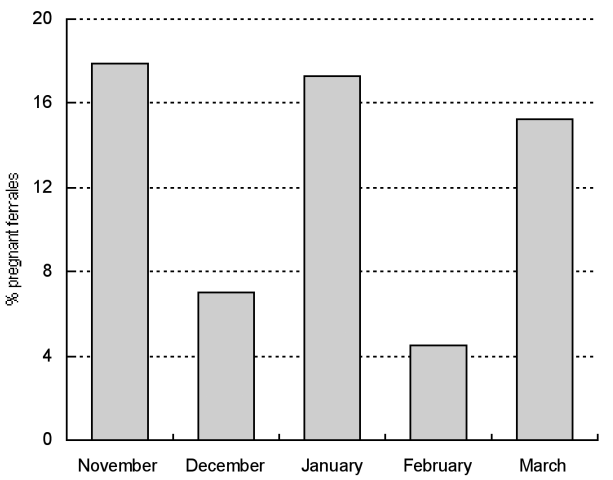

Figure 4 - Percent number of pregnant female (pregnant females/total females x 100) among captured coypus.

from a trapping site to another after 30-35 days of activation, in order to maximize both trapping success and territory covering (and farmers' satisfaction). Coypus control in the River Po plain represents a quite hard challenge and more coordinated efforts are needed. The first step could be the delimitation of sub-areas among which coypu movements could be limited, favouring long term results of systematic control operations involving the whole river plain.

The unbiased sex-ratio confirmed what obtained by Reggiani *et al.* (1993) in the Tevere-Farfa Natural Reserve (central Italy), contrary to other authors which reported a prevalence of males in litters (Gosling, 1986; Velatta and Ragni, 1991) and their higher probability of being trapped in areas characterized by high dispersion rates (Norris, 1967; Doncaster and Micol, 1989).

The development of sexual dimor-

phism with age confirmed what previously reported (Gosling *et al*. 1984), although our results showed lower differences in weight between adults (about 10%), with respect to other studies (Gosling, 1977; Woods *et al.*, 1992). The percentage of pregnant female in our sample (min-max: 4.5% in February 2003 and 17.9 in November 2003) was lower than that recorded in central Italy (Reggiani *et al.*, 1993: e.g. 45% in February 1991 and 72% in November 1990). Our results could be partially due to a higher rate of winter reproductive failure (Gosling, 1981) with respect to central Italy, accordingly to the observed fall of the young/adults ratio in February-March 2003.

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REFERENCES

Balestrieri A., Remonti L. and Prigioni C. 2002. Stato delle conoscenze sulla Nutria (*Myocastor coypus*) in Lombardia e problematiche di gestione. In: Petrini R. e Venturato E. (eds), Atti del Convegno Nazionale ”La gestione delle specie alloctone in Italia: il caso della nutria e del gambero rosso della Louisiana”. *Quaderni del Padule di Fucecchio*, 2: 141-148.

Bertolino S. and Genovesi P. 2005. Aquatic alien mammals introduced into Italy: their impact and possibility of control. International Workshop, Biological Invasions in Inland Waters. Florence, Italy.

Bertolino S., Perrone A. and Gola L. 2005. Effectiveness of coypu control in small Italian wetland areas. *Wildlife Society Bulletin*, 33(2): 714-720.

Carter J. and Leonard B.P. 2002. A review of the literature on the worldwide distribution, spread of, and efforts to eradicate the coypu (*Myocastor coypus*). *Wildlife Society Bulletin*, 30: 162–175.

Cocchi R. and Riga F. 2001. Linee guida per il controllo della Nutria (*Myocastor coypus*). Ministero Ambiente and Istituto Nazionale per la Fauna Selvatica, Bologna, Italia *Quaderni di Conservazione della Natura*, 5

Doncaster C.P. and Micol T. 1989. Annual cycle of a coypu (*Myocastor coypus*) population: male and female strategies. *J. Zool.*, London, 217: 227-240.

Gosling L.M. 1977. Coypu. In: Corbet G.B. and Harris S., The Handbook of British Mammals. Blackwell, London: 267-275.

Gosling L.M. 1981. Climatic determinants of spring littering by feral coypus, *Myocastor coypus*. *J. Zool*., London, 195: 281-288.

Gosling L.M. 1986. Selective abortion of entire litters in the coypu: adaptive control of offspring production in relation to quality and sex. *Am. Nat*., 127: 772-795.

Gosling L.M., Baker S.J. and Wright K.M.H. 1984. Differential investment by female coypus (*Myocastor coypus*) during lactation. *Symp. Zool. Soc. Lond.*, 51: 273-300.

I.S.S.G. 2000. 100 of the World’s Worst Invasive Alien Species: a selection from the global invasive species database. Page 11 in Special lift-out in Aliens, 12.

Morton J., Calver A.E., Jefferies D.J.M., Roberts K., Southern H.N. & Fry D.R. 1978. Coypu. Report of the Coypu Strategy Group. Min. Agric. Fish. &

Food, U.K.

Norris J.D. 1967. The control of coypus (*Myocastor coypus*) by cage trapping. *J. Appl. Ecol.*, 4: 167-189.

Prigioni C., Balestrieri A. and Remonti L. 2003. Efficacia degli interventi di controllo della Nutria (*Myocastor coypus*) in Lombardia. In: Prigioni C., Meriggi A. and Merli E. (eds), IV Congr. It. Teriologia, *Hystrix, It. J. Mamm* (n.s.) Supp. (2003): 131.

Prigioni C., Balestrieri A. and Remonti L. 2005. Impact of the coypu, *Myocastor coypus*, on aquatic vegetation in a freshwater habitat of NW Italy. *Folia Zoologica*, 54 (3): 269–277.

Reggiani G., Boitani L., D'antoni S. and De Stefano R. 1993. Biology and control of the coypu in the Mediterranean area. *Suppl. Ric. Biol. Selvaggina* XXI: 67–100.

Rosoux R. 1985. Essai d'une mise au point de technique de piégeage sélectif du ragondin dans le Marais Poitevin. Parc Naturel Régional du Marais Poitevin Val-de-Sévre et Vendée, 19 pp.

Scaravelli D., 2002. Problema *Myocastor*: considerazioni dall'esperienza ravennate. In: Petrini R. e Venturato E. (eds), Atti del Convegno Nazionale "La gestione delle specie alloctone in Italia: il caso della nutria e del gambero rosso della Louisiana". *Quaderni del Padule di Fucecchio*, 2: 25-28.

Velatta F. and Ragni B. 1991. La popolazione di nutria (*Myocastor coypus*) del Lago Trasimeno. Consistenza, struttura e controllo numerico. Atti II Conv. Naz. Biol. Selv., *Suppl. Ric. Biol. Selvaggina*, XIX: 311-326.

Verheyden C. and Abbas A. 1996. Impact du ragondin sur le milieu. In: Jouventin P., Micol T.,Verheyden C., Guédon G. (eds.), Le ragondin: Biologie et Méthodes de Limitation des Populations. Association de coordination technique agricole. Paris, 44–54.

Willner G.R. 1982. Nutria *Myocastor corpus*. In: Chapman, J.A. and Feldhamer G.A. (eds), Wild Mammals of North America, Baltimore & London, John Hopkins University Press, 1059-1076.

Woods C.A., Contreras L., Willner-Chapman G. and Whidden, H.P. 1992. *Myocastor coypus*. *Mammalian Species*, 398: 1-8.

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