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Habitat use by coypu *Myocastor coypus* in agro-systems of the Argentinean Pampas

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Habitat use by coypu *Myocastor coypus* (Molina, 1782) was studied in agro-systems of the Pampas grasslands, Argentina. We analysed two dimensions of the habitat: perpendicular and parallel to the water source. The perpendicular dimension covered three distinct areas: border of the stream, interface, and crops, while the parallel dimension involved the use of different crop types. We worked at two study sites, Mechongué (winter 1995 – summer 1996) and Luján (winter 1997). At Mechongué, we conducted four seasonal samples using an indirect method of counting faeces to estimate abundance of coypu. Along the perpendicular dimension, coypus used the border significantly more than the interface and the crops. The relative use of the border increased over the study period. Parallel to the water source, crops were avoided and pastures were preferred. At the Luján study site, we observed the behaviour of coypu by recording activity and use of cover types at different distances from the stream. Coypu spent most of their active time foraging (80.5%). Ninety-two percent of the bouts took place less than 4 m from the pond. Coypus did not move more than 10 m away from the pond and did not use the crops. These results disagree with the claim that coypus are a risk to croplands in their native range.

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Introduction

The coypu or nutria *Myocastor coypus* (Molina, 1782) is a semi-aquatic rodent indigenous to the Southern half of South America, with a wide distribution in Argentina (Colantoni 1993). This large rodent (6 kg) lives in social groups in complex burrow systems and has an herbivorous diet (Gosling 1993, Merler *et al.* 1994).

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The coypu was introduced into several regions around the world early this century, including North America, Europe, the Middle East, Africa and Japan (Gosling 1993). In some of these regions, especially in Europe, it is considered a pest for several reasons, one of them being the damage caused to crops. In England, this was one of the reasons to promote a successful eradication campaign (Gosling and Baker 1987). In Italy and Germany, local agricultural producers complain about the undesirable consequences of coypu activity on crops (Reggiani *et al.* 1993, N. Sachser, pers. comm.). In France, the coypu has been classified as a 'pest' since 1979 and several studies demonstrated the damage this species has caused to agro-systems (reviewed by Jouventin *et al.* 1997).

In Argentina, local farmers also claim that coypus are a potential threat for croplands (N. Coviella, G. Porini, pers. comm.), even though there are no systematic studies that demonstrate the impact of coypus on crops in their native range. This species constitutes an important natural resource to rural populations because of the high value of its fur (Bó *et al.* 1992, Quintana *et al.* 1992); however, ecological studies on coypu are scarce. Large coypu populations inhabit the humid grasslands of the Pampas region, where coypu harvesting is profitable (Colantoni 1993). This region constitutes the main agricultural zone of the country (Marchetti and Morello 1991). Given the insufficient knowledge about the ecology of coypu in its native range, we aimed to investigate habitat use of this species in a representative area of the Pampas grasslands. Our objective was to study the use of space by coypu in relation to its potential damage on farmlands. We considered two spatial dimensions of coypu habitat: perpendicular and parallel to a water source. In the perpendicular dimension, we distinguished three cover types: the border of the stream, the fringe of vegetation that is usually not subject to management (the 'interface'), and the crops. In the parallel dimension, we compared the use of different crop types. We studied two coypu populations in two sites located more than 350 km from each other.

Study area and methods

Study at Mechongué

The main study was conducted in a rural area in Mechongué, Balcarce (38°S, 58°10' W), Argentina, between August 1995 and March 1996. Balcarce is a productive area with fertile soils suitable for temperate crops. The climate is temperate, with a mean temperature of 12.2°C in winter and 29.5°C in summer, and an annual rainfall of 850–900 mm (Servicio Meteorológico Nacional, pers. comm.). At the end of 1995, an exceptional drought affected the crops during the study period (Asociación Argentina de Consejos Nacionales de Experimentación Agrícola, pers. comm.).

The study area was located in a farm where agricultural crops are alternated with pastures in 11-year cycles, during which each field has 7.5 years of crops followed by 3.5 years of pastures. The study area comprised 162 ha and was crossed by a 3050-m stream that did not suffer flooding during the study period. Two habitat dimensions were taken into account: parallel and perpendicular to the stream. A 'field' was the spatial unit considered in the direction parallel to the watercourse. Perpendicular to the stream, three cover types were considered: (1) Border: fringe of the bank closest

Table 1. Characteristics and use of fields in August and November 1995, and January 1996. March was not included because of the small sample size. [(a)] Ball pasture: *Dactilis glomerata*; Fodder: *D. glomerata, Trifolium pratense, Bromus unioloides*; Maize: *Zea mays*; Natural pasture: mixture of non-cultivated grasses and forbs; Oat: *Avena* spp.; Potato: *Solanum tuberosum*; Sunflower: *Helianthus annuus*. [(b)] Relative use assigned to each field: '<', '=', '>' mean that the field was used less, according to, and more than its availability.

Field	Size (m^2)	Field type [a]		Faeces relative abundance		
		August	November– January	August	November	January
1	10283	Potato	Maize	0.02	0.12 (< [b])	0.12 (<)
2	20210	Natural pasture	Natural pasture	0.84	0.81 (=)	0.54 (>)
3	20831	Oat	Sunflower	0.01	0.28 (<)	0.33 (=)
4	5130	Oat	Maize	0.15	0.44 (<)	0.22 (<)
5	5872	Fodder	Fodder	0.33	0.22 (<)	0.11 (<)
6	5801	Ball pasture	Ball pasture	2.66	0.97 (>)	0.38 (=)
7	24926	Fodder	Fodder	0.45	0.50 (=)	0.44 (<)

to the stream with semi-aquatic vegetation (mainly Cyperaceae and Juncaceae, dominant species was *Eleocharis bonariensis*) or without vegetation. Maximum width: 10 m. (2) Interface: fringe of vegetation without management between the border and the crop, with a mixture of riparian and grassland vegetation (dominant species was *Stipa* sp.). Maximum width: 96 m. (3) Crop: the cultivated land. Width considered: the first 3 m. Field characteristics are summarised in Table 1.

To obtain an estimate of coypus density, we assumed a conservative ratio of one coypu per active entrance (the actual relationship between the number of burrow entrances and population size is not known). At the beginning of the study (August 1995) we counted all active burrow entrances along the stream. An entrance was considered to be active when coypus or signs of their activity (ie faeces, footprints) were observed at the entrance.

Use of habitat was estimated using an indirect method based on sampling faeces (Putman 1984). Coypus deposit faeces in the water or at random on the soil, without apparent social significance (Gosling 1993). Thus, the probability of finding faeces in a sampling site is a good estimate of the relative use of this site, provided it remains dry as occurred in our study.

A preliminary sample was conducted in August 1995 by counting all faeces found along a 1×3050-m transect placed in the boundary between the interface and the crops. Faeces density is presented as number of faeces / m^2.

Three samples were taken between November 1995 and March 1996 covering all crop stages (sampling dates: 2/11/95-5/11/95, 31/12/95-2/1/96, and 29/2/96-2/3/96). In each sample period, 100 transects were randomly distributed along the stream perpendicular to the watercourse. We sampled four points in each transect: one point at the border near the water, two points placed at random in the interface, and one point in the crops at 3 m from the interface-crop boundary. At each point, we counted and collected all faeces found within a circular sampler of 70 cm diameter. Habitat use is expressed as the proportion of samplers or transects with faeces.

We performed a two-factor ANOVA for repeated measures to analyse the use of different cover types among seasons. The dependent variable was the proportion of samplers with faeces (arcsine transformation was applied to meet the assumptions of the test). Fields were the 'subjects' repeatedly sampled across cover types and seasons. We used a chi-square test to determine whether coypus used the fields in accordance to their availability, and whenever significant differences were obtained, multiple comparisons were performed (Marcum and Loftsgaarden 1980). Spearman rank-order correlation coefficients were calculated to compare rankings of preferences between sampling periods. March data were not included because of small sample size.

Study at Luján

Between July and August 1997, we conducted another study to obtain a behavioural measurement of activity budget, use of microhabitats, and movements of coypus in the perpendicular direction to the water source. This study was conducted on the campus of the University of Luján, Luján (34°40'S, 59°10'W), Argentina. The climate is temperate, with a mean temperature of 9.1°C in winter and 23.8°C in summer, and a mean annual rainfall of 944 mm (Goldberg *et al.* 1995).

The study area (13.5 ha) was crossed by a stream that formed a small pond where coypu burrows were located. As in Mechongué site, this area had three cover types in relation to distance to water: (1) Border: fringe of semi-aquatic vegetation (mainly *Lemna* sp., *Hydrocotyle* sp., *Carex* sp., *Juncus* sp.) around the pond that continued along the stream course. Total area of 0.03 ha and 1–7 m wide. (2) Interface: fringe of non cultivated vegetation (grasses: mainly *Bromus* sp., *Poa* sp., *Dactilis* sp., *Cynodon* sp., and *Lolium* sp.; forbs: mainly *Carda* sp., *Cardus* sp., *Taraxacum* sp., *Cichorium* sp., *Cotula* sp., and *Trifolium* sp.). Total area of 3 ha. (3) Pasture: a cultivated pasture of *Lolium* sp. located more than 30 m from the pond. Total area of 8.5 ha.

A total of 94 hr of observations were conducted from 06.00 hr to 23.00 hr. Time budget and use of habitat were recorded by using 8 × 30 binoculars during the day and an image intensifier at night, from a 4-m high blind placed 30 m away from the pond. Animals were not marked but previous observations indicated that at least four different individuals used the pond. We registered the behaviour of focal animals using the continuous recording method (Martin and Bateson 1993), and the following data were collected: duration of activities (grazing, swimming, resting, grooming, social interactions, vigilance), and animal location in relation to cover types and distance to water. Time budget is expressed as the percentage of time engaged in each activity over total time of observation. Distance to water is taken as the longest distance that the coypu walked away from the pond in each activity bout.

We analysed the amount of time devoted to each type of activity using the Kruskal-Wallis test. We compared the number of activity bouts observed at six distance interval classes with the random expected frequencies generated by a Poisson distribution.

Results

At both study sites, we walked along the first metres of croplands looking for patches of short vegetation or 'lawns' that could have been produced by intense grazing of coypu. We did not find changes in the height of crops that could be attributed to foraging activity of coypus.

Habitat use at Mechongué. A total of 340 active burrow entrances were counted at the beginning of the study. Assuming one coypu per active entrance, we estimated a density of 10.5 coypus per hectare.

Significant differences were found in the use of cover types by coypus in relation to the distance to water (Table 2), with the highest density in the border, and decreasing in the interface and crops (Fig. 1). The use of the three cover types significantly decreased from November to March, while the interaction between season and cover type was not significant (Table 2).

Tests to compare the relative use and availability of the six fields with different crops were conducted in November, January, and March. Significant differences in the use of fields were found in November ($\chi^2 = 21.3$, df = 5, $p < 0.001$) and January ($\chi^2 = 16.5$, df = 5, $p < 0.02$), but not in March ($\chi^2 = 3.4$, df = 5, $p > 0.05$). The latter result was probably due to the small sample size obtained during March. A similar pattern of use of fields was found in November and January (Table 1). Fields

Table 2. Two-factor ANOVA for repeated measures comparing the use of cover types among seasons. Field is the repeated measure.

Source of variation	df	MS	*F*	*p*
Cover	2	0.74	17.77	< 0.01
Cover by field	8	0.04		
Season	2	0.11	4.33	= 0.05
Season by field	8	0.02		
Seasons by cover	4	0.02	1.08	> 0.35
Season by cover by field	16	0.02		

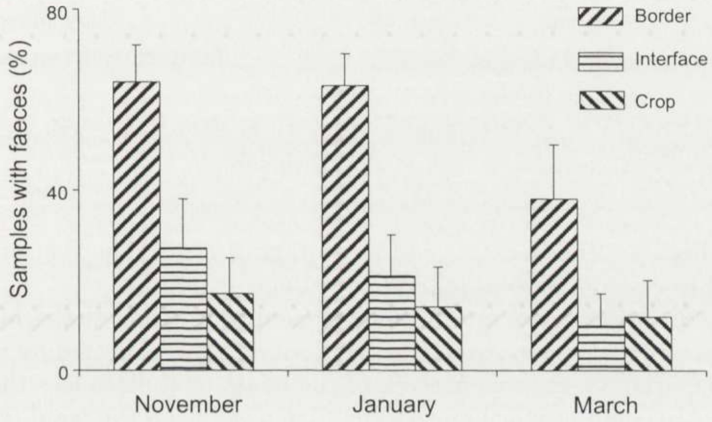

Fig. 1. Use of cover types (samplers with faeces ± SE) for the three sampling periods at Mechongué site.

containing crops (maize and sunflower) were used less than or equal to their availability. The use of pastures (natural and ball pasture) matched or exceeded their availability. Fodder showed a low level of use. In August, a similar trend was found, although the type of data prevented us from testing the significance of this differential use.

Significant positive correlation coefficients were obtained between the patterns of use of the fields between August and November ($p < 0.05$) and between November and January ($p < 0.05$, Fig. 2). This result indicates that coypus showed a stable ranking of field utilisation that was independent of changes in field type and plant growing condition.

Habitat use at Luján. We observed 39 activity bouts of coypus, which showed a mean duration of 11 minutes (range: 1–32 minutes). Time allocation significantly differed among activities ($H = 32.70, p < 0.0001$). Coypus spent most of the time foraging (80.5%). Swimming time (10.7%) was associated with

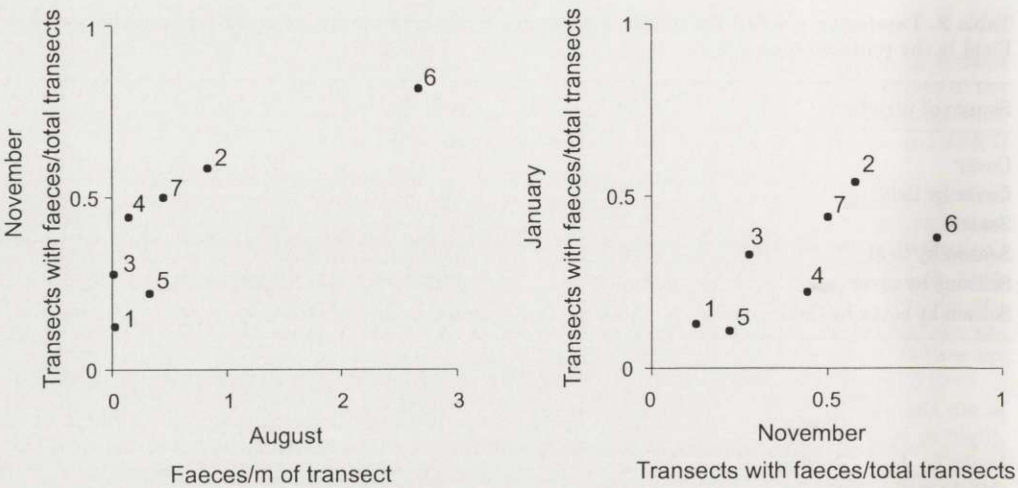

Fig. 2. Positive correlation use of the fields by coypus between August and November 1995, and between November 1995 and January 1996, at Mechongué site.

movements between the burrows and the foraging areas. The rest of time (8.8%) was devoted to resting, grooming, and occasional scanning.

With regard to the use of space, coypus spent more time at the locations near water and less time at the locations far from water, than expected by random (G = 26.05, $p < 0.0001$). Ninety-two percent of the bouts took place less than 4 m from the pond. Coypus did not move more than 10 m away from the pond (Fig. 3). Thus, coypus did not visit the *Lolium* sp. pasture, which was located more than 30 m from

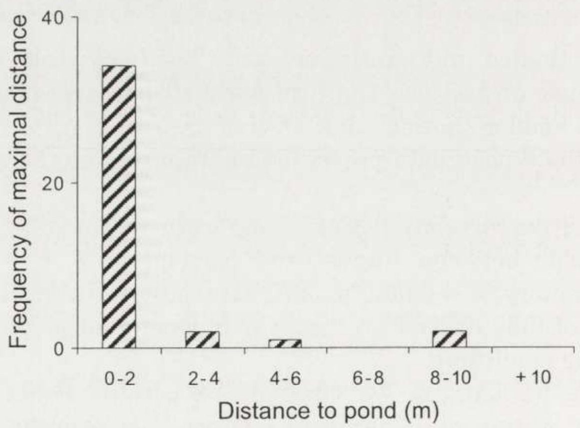

Fig. 3. Maximal distances that coypu moved from water in each foraging bout at Luján site.

the pond, and spent most of their time out of burrows using the border and the first metres of the interface.

Discussion

Habitat use in relation to distance to water

Both studies at Mechongué and Luján sites showed that coypus remained close to the water source. The observational study indicated that coypus normally used only the first few metres of terrestrial vegetation. Previous studies on similar environments (ie excluding marshlands) also showed that feeding activity usually occurred in or near the water (Gosling 1993). In a long-term study using radio--tracking techniques, Doncaster and Micol (1989) found that coypus remained within 40 m from the nearest water source, and that 86.3% (673/780) of the radio-locations were measured within 10 m from the water.

Coypus decreased the intensity of use of terrestrial vegetation, specially crops, along the study period at the Mechongué site. This temporal pattern could be explained as a response to the exceptional drought registered during the study.

Habitat use in relation to crop type

Crop type was an important factor associated with the differential use of the fields at Mechongué. While pastures were the most used fields during the study, seed crops were the least. These results are in agreement with data collected in a complementary study of coypu diet composition (M. Borgnia, M. Galante and M . H. Cassini, in prep.). Random samples were taken from faeces collected in November 1995, and January and March 1996 in order to conduct microhistological analysis. These three sample periods covered the phenology of maize and sunflower. No evidence of sunflower was observed in the faeces, while maize represented less that 0.5% of the diet in the three sample periods. Similar results were obtained from microhistological analysis of faeces collected at Luján study site (M. Borgnia, M. Galante and M. H. Cassini, in prep.). Less than 4.0% of the diet was composed by *Lolium* sp., even if non-cultivated *Lolium* sp. was found growing closer to the water, in the interface.

Both in winter and spring-summer coypus avoided the same fields, although crops varied between seasons within these fields. This result indicates that the location and/or the management of the fields would be other important components of habitat selection.

Habitat use and impact on crops

Coypus are considered a pest for agricultural systems in introduced countries (Gosling 1981, Jouventin *et al.* 1997). For example, Abbas (1988) studied impact of coypus in a 1-ha field visited by 10–15 individuals, and concluded maize was highly susceptible to damage by coypu. We analysed the impact of coypu on maize at

Mechongué, studying both habitat and diet preferences (M. Borgnia, M. Galante and M. H. Cassini, in prep.). We did not find evidence of coypu damage on this crop, even when the density of coypus appeared to be similar to that observed in the study of Abbas.

The different status of coypu regarding its impact on agro-systems in its native range in comparison to that reported in introduced countries can be discussed in terms of differences in resource availability and/or in ecological interactions in invaded areas. Agricultural lands of our study region normally have a non--cultivated fringe of vegetation near the watercourse that offers suitable food for coypus. This fringe of spontaneous vegetation growing in the border and interface might not be available in other agro-systems where intensive land cultivation reaches the watercourse border, eg canals of irrigation systems in European farmlands. In our study sites, there appeared to be enough vegetation on the banks of the stream to support a large number of coypus. Another difference with introduced countries is the fact that coypus may have developed ecological interactions that are different from those established in its native range, eg coypus may focus on crops because their native vegetation is missing.

Many introduced species behave as invasive pests where they become established, while being valuable assets in their indigenous regions. For example, European rabbits that are a pest to agro-systems in most places where they have been introduced (eg Diuk-Wasser and Cassini 1998), however they are protected in their indigenous Iberian region because they constitute the principal prey resource for the endangered Iberian lynx (eg Jaksic and Soriguer 1981).

In conclusion, the pattern of habitat utilisation by coypu suggests that this species does not behave as a pest of agricultural crops in its native range: (1) coypus remained close to water and visited crops only occasionally, and (2) they showed a stable distribution pattern along the stream which did not depend on changes in crop type and condition among seasons. Damage to agro-systems in regions of introduction comes not only from crop consumption, but also from tunnelling into drainage and irrigation systems and over-utilisation of native flora (Kinler *et al.* 1987, Gosling 1993, Reggiani *et al.* 1993, Jouventin *et al.* 1997). In Argentina, no systematic studies of these type of damages have been conducted.

We acknowledge the limitations of this work, mainly the relatively short sampling periods. Nevertheless, it is the first systematic study of habitat use in agro-systems within the native range of coypu. Moreover, it is the first attempt to test the validity of the assumption that native coypus are a pest for agricultural crops. The results of this study might be valuable for local wildlife agencies when making decisions regarding the control or exploitation of this species.

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References

Abbas A. 1988. Impact du ragondin (*Myocastor coypus* Molina) sur une culture de mais (*Zea mays* L.) dans le marais Poitevin. Acta Oecologica/Oecologica Applicata 9: 173–189.

Bó R., Quintana R., Merler R., Minotti P., Malvarez A. and Villafañe G. 1992. Problems in the conservation of mammals in the lower Delta Region of the Paraná River. Evaluation of the current situation using a combined methodology. Noragric Occasional Papers Series C Development and Environment 11: 143–152.

Colantoni L. O. 1993. Ecología poblacional de la nutria (*Myocastor coypus*) en la Provincia de Buenos Aires. Fauna y Flora Silvestres 1: 1–25.

Diuk-Wasser M. A. and Cassini M. H. 1998. A study on the diet of minor grisons and a preliminary analysis of their role in the control of rabbits in Patagonia. Studies on Neotropical Fauna and Environment 33: 1–4.

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

Goldberg S., Cirera I., Parella M., Benitez A., Bulos L. and Troncoso A. 1995. Caracterización climáticaa y agroclimática de la cuenca del Río Luján. Proceedings of Jornadas sobre la Cuenca del Río Luján, Luján, Argentina: 13–19.

Gosling L. M. 1981. The role of wild plants in the ecology of mammalian crop pests. [In: Pests, pathogens and vegetation. J. M. Thresh, ed]. Pitman Books Ltd., London: 341–364.

Gosling L. M. 1993. Family Myocastoridae. [In: The Handbook of British Mammals. G. B. Corbet and S. Harris, eds, Third Edition]. Blackwell Scientific Publications, Oxford: 267–275.

Gosling L. M. and Baker S. J. 1987. Planning an monitoring an attempt to eradicate coypus from Britain. Symposium Zoological Society of London 58: 99–113.

Jaksic F. M. and Soriguer R. C. 1981. Predation upon the European rabbit (*Oryctolagus cuniculus*) in Mediterranean habitats of Chile and Spain: a comparative analysis. Journal of Animal Ecology 50: 269–281.

Jouventin P., Micol T., Verheyden C. and Guédon G. 1997. Le ragondin: biologie et méthodes de limitations des populations. Acta, Paris: 1–155.

Kinler N. W., Linscombe G. and Ramsey P. R. 1987. Nutria. Wild Furbearer Management and Conservation in North America 27: 327–343.

Marchetti B. and Morello J. 1991. Sustainable development in Argentina. Centro de estudios avanzados de Universidad de Buenos Aires, Buenos Aires: 1–116.

Marcum C. L. and Loftsgaarden D. O. 1980. A nonmapping technique for studying habitat preferences. Journal of Wildlife Management 44: 963–968.

Martin P. and Bateson P. 1993. Measuring behaviour (second edition). Cambridge University Press, Cambridge: 1–222.

Merler J., Bó R., Quintana R. and Malvarez A. 1994. Habitat studies at different spatial scales for multiple conservation goals in the Paraná River Delta (Argentina). International Journal of Ecology and Environmental Sciences 20: 149–162.

Putman R. J. 1984. Facts from faeces. Mammal Review 14: 79–97.

Quintana R., Bó R., Merler J., Minotti P. and Malvarez A. 1992. Situación y uso de la fauna silvestre en la Región del Bajo Delta del Río Paraná (Argentina). Iheringia, Serie Zoologica 73: 13–33.

Reggiani G., Boitani L., D'Antoni S. and De Stefano R. 1993. Biology and control of the coypu in the Mediterranean area. Supplementi Richerche di Biologia della Selavaggina 21: 67–100.

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