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# Comparing fostering success between wild-caught and game farm bred captive red-legged partridges (*Alectoris rufa*, L.)

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ABSTRACT

As fostered game birds are better prepared for releasing in comparison to those intensively reared, fostering of wild and game farm red-legged partridges (*Alectoris rufa*) was studied on a semi-natural rearing farm using farm-hatched chicks. Parent pairs, barren pairs and single individuals from wild and game farm strains were used in a total of 208 attempts. Fostering was observed in both strains, but more successful attempts were in wild parent pairs (27 of 29 pairs, 93%) than in the game farm strain (12). In the game farm strain all fostering was done by barren pairs and single individuals; as none of the game farm pairs raised their own chicks it was not possible to test game farm parent pairs. Wild parent pairs also showed a high percentage of fostering at a second attempt one week after the first (25 of 27 pairs, 93%), suggesting that fostering is strongly related to parental care behaviour. A low proportion of barren pairs and singles adopted unrelated chicks (9%), with most of these (12 of 13 attempts) being farm-bred. When fostering was observed, adults displayed behavioural patterns related to parental care (brooding and calling) and spent 35% of time in proximity to chicks, compared to 19% and absence of parental care when fostering was unsuccessful. Successful fostering increased brood size four weeks after hatching by $4.4 \pm 2.3$ fostered chicks. This study suggests that fostering for releasing purposes is a feasible technique in semi-natural rearing systems. Wild strains of partridges and parent pairs should be chosen as foster parents.



## 1. Introduction

Although game farms are capable of providing large numbers of red-legged partridges for shooting and repopulation (Sánchez-García et al., 2009; Sokos et al., 2008), many reintroduction attempts have failed, mainly due to the intensive methods of commercial game farms. These methods often result in a loss of anti-predator behaviour in a high percentage of birds (Alonso et al., 2005; Dowell, 1990; Pérez et al., 2010; Rantanen et al., 2010), detrimental changes in morphological and physiological characteristics (Millán and Gortázar, 2001), disease (Villanúa et al., 2007) and abnormal social and reproductive behaviour (Alonso et al., 2008; Spanò and Csermely, 1985).

Some research into the use of semi-natural rearing systems has been undertaken over the last few decades with the aim of increasing the survival of hand-reared birds (Coll, 1991; Gaudioso et al., 2002), particularly through understanding the effects of parent-rearing and specific conditions of husbandry and handling on released birds (Sokos et al., 2008). Although it has been demonstrated that a semi-natural system improves the behaviour of released birds (Pérez, 2006), this requires long-term investment

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and is costly. One of the most important problems is the restricted number of poults produced during the reproductive period as few farm-bred pairs are able to raise their own chicks and average brood size is low in comparison to wild pairs (range 5–8, Lucio, 1990).

An alternative approach to increase the number of birds released into the wild would be fostering farm-hatched chicks or poults to adults (Buner and Aebischer, 2008). Fostering and adoption enable parental behaviour patterns to be passed on (Avital and Jablonka, 1994), such as food preferences, foraging techniques, mate choice, niche preferences and predator avoidance (Avital et al., 1998). Several studies carried out on related game birds, such as grey partridge (*Perdix perdix*), bob-white quail (*Colinus virginianus*), ring-necked pheasant (*Phasianus colchicus*) and chukar partridge (*Alectoris chukar*), have reported that captive and wild-living pairs are capable of successfully adopting hatched chicks and juveniles (Buner and Schaub, 2008; Ellis and Anderson, 1963; Gall et al., 2000; Slaugh et al., 1992). Young fostered chicks become imprinted and socialised by experienced parents, improving their chances of survival after release into the wild (Thomas, 1987).

However, fostering and adoption are not uniform patterns of behaviour (Avital et al., 1998). Some authors interpret fostering as a result of parental mistakes in the recognition of their own young due to the effects of non-adaptive residual hormone titre (Riedman, 1982), although some species are willing to adopt unrelated young after the recognition of their own brood (Williams, 1994). For species with precocial young such as game birds, fostering unrelated offspring would benefit stray or orphan chicks and foster parents would gain reproductive experience and might reduce the impact of predation on their own brood (Codenotti and Álvarez, 1996; Eadi et al., 1988; Pierotti, 1988).

For red-legged partridge, a game bird native to the Iberian Peninsula, France and Italy and introduced in the United Kingdom (Aebischer and Lucio, 1997), fostering farm-hatched chicks and poults to wild-living pairs and coveys has been a common repopulation technique carried out in Spain for over forty years (Lara and Arenzana, 1965). Unfortunately, little research is available and no general code of practice exists (Robles et al., 1998b). This may result in incorrect management decisions and raises ethical concerns, as failed fostering can lead to infanticide (Pierotti, 1991). It is also necessary to explore the feasibility of using farm-bred parents and farm-hatched chicks for fostering, as these hand-reared birds are often used by gamekeepers and managers in repopulation and recovery programmes (Nadal, 1992).

This study compared fostering of wild and farmed red-legged partridges under semi-natural conditions, based on the parental behaviour displayed by adults and the success of fostered chicks, using farm-bred parents and farm-hatched chicks in incubators. It was carried out from 2004 to 2009 on a semi-natural rearing farm. The aims of this research were (1) to study the fostering behaviour of wild and farmed partridges by evaluating fostering in parent pairs, barren pairs and single individuals and (2) to test the feasibility of using farm-hatched chicks as fostered chicks.

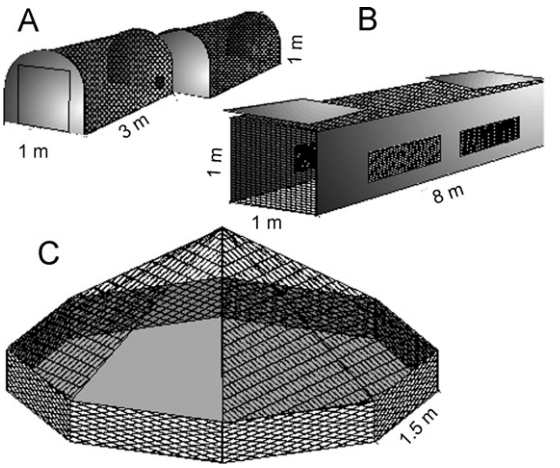


**Fig. 1.** Models of breeding cages.

## 2. Material and methods

### 2.1. Study site and rearing methods

The semi-natural rearing farm used here was in the 'Finca Coto Bajo de Matallana' (308 ha) a privately cultivated area in the province of Valladolid, north-west Spain (lat 41°53′45″N, long 4°52′50″W). This area has been able to sustain wild partridge populations, due to the game management carried out since early nineties (see Gaudioso et al., 2010), resulting in a density of 50–70 birds per 100 ha after the breeding season (September–October). The climate is Mediterranean dry continental (Papadakis, 1966) with hot dry summers, harsh winters and an annual mean rainfall of under 500 mm (AEMET, 2010).

The housing system was based on metal breeding cages, placed on earthen floors with natural vegetation (grass, shrub cover), allowing the birds to view the environment outside the cage and to establish visual contact with predators (Gaudioso et al., 2002; Robles, 1998a). The most common predators were fox (*Vulpes vulpes*), Iberian wolf (*Canis lupus signatus*), magpies (*Pica pica* L.), carrion crows (*Corvus corone* L.), feral dogs (*Canis lupus familiaris*, L.) and birds of prey such as goshawk (*Accipiter gentiles*), barn owl (*Tyto alba*), sparrow hawk (*Accipiter nisus*), western marsh-harrier (*Circus aeruginosus*), and short-toed eagle (*Hiraaetus pennatus*) (for densities, see Gaudioso et al., 2010).

Each cage had a water trough and a feeder with seed, cereals and legumes. Fresh water, specific chick feed and shelter were placed in all cages, which were cleaned regularly. In addition, an artificial nest described by Robles et al. (2001) was placed in all the cages after the pairing season. Three types of breeding cages were used in this study (Fig. 1), with areas of 6 $m^2$ (A), 8 $m^2$ (B) and 12 $m^2$ (C). Only wild-strain birds were placed in C cages.

### 2.2. Birds and handling

Two strains of red-legged partridges were used in this study: