

## Short Communication

### Trial release of Père David's deer *Elaphurus davidianus* in the Dafeng Reserve, China

Huijian Hu and Zhigang Jiang

**Abstract** The Critically Endangered Père David's deer *Elaphurus davidianus* became extinct in the wild in China in about 1900, and the only surviving animals were held in captivity at Woburn Abbey in the UK. During 1985–1987, individuals were returned to China, and subsequent growth of the captive population in enclosures at Dafeng Reserve necessitated a trial release of a small group of deer as a prelude to further releases. Seven individuals were released into the unfenced coastal region of the Dafeng Reserve in 1998. Behaviour, daily activity rhythm, habitat selection, activity range and body condition were recorded for six months after release. The deer exhibited initial changes in behaviour, but returned

to their pre-release patterns about four weeks after release, and by six weeks after release their body condition had improved compared to their previous condition in captivity. They left the Reserve and began to forage on farmland, causing conflict with local people. Further releases should be into areas with either a natural or artificial boundary in order to avoid unmanageable levels of conflict between the needs of the deer and those of farmers.

**Keywords** Behaviour, China, *Elaphurus davidianus*, trial release, habitat selection, Père David's Deer, reintroduction.

The ultimate goal of the captive breeding of threatened species is to reintroduce the captive-bred animals into wild habitats to either restore or reinforce the wild population (Sheldon, 1986; Stanley Price, 1991). For a successful reintroduction it is necessary to have prior knowledge of the spatial requirements, dietary specialization and environmental needs of the focal species (IUCN/SSC Reintroduction Specialist Group, 1998). Ideally this information should be obtained from detailed field studies in the species' natural habitat.

Père David's deer *Elaphurus davidianus*, known as *milu* in China, was once abundant in the region between the lower reaches of the Yangtze and Yellow rivers (Beck & Wemmer, 1983; Cao, 1985), but is now categorized as Critically Endangered on the 2000 IUCN Red List (Hilton-Taylor, 2000) on the basis of criterion D (population estimated to number <50 mature individuals). In the late 19th century the 11th Duke of Bedford gathered 18 Père David's deer to form a breeding herd at Woburn Abbey in the UK (Jones & Manton, 1983), and by about 1900 the species became extinct in the wild in China (Jiang & Li, 1999).

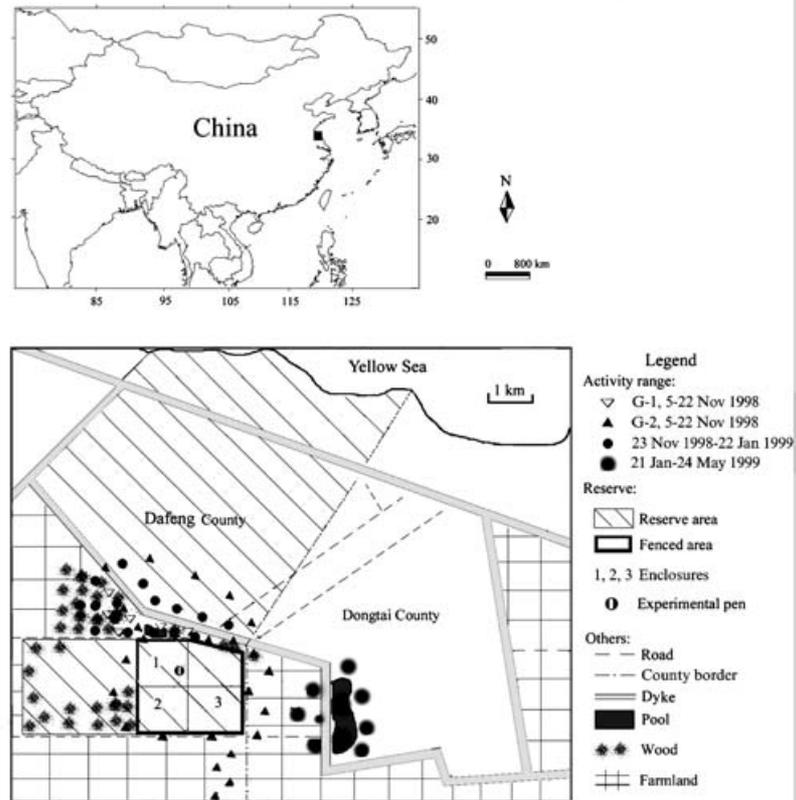
During 1985–1987 three groups of 20, 17 and 39 individuals were returned to China from the UK and kept in enclosures in Nanyuan, Beijing and Dafeng, respectively (Cao, 1992). Because the Père David's deer population in the enclosures in Dafeng Reserve showed signs of density-dependent growth, Jiang *et al.* (2001) suggested that the deer should be relocated to other, unfenced sites. A trial release of a few animals was deemed necessary to gather information as a prelude to future wider scale releases, including the ecological requirements of the species in the wild, the habitats occupied and any modifications to behaviour that occur after release.

Dafeng Reserve is located on the Yellow Sea coast of Jiangsu Province, China. The reserve is in the south-east corner of the Dafeng county, neighbouring the Dongtai county (Fig. 1). The reserve has an altitude of 2–5 m, and is generally flat. Within the Reserve there is a fenced area of c. 4 km<sup>2</sup>, within which there are three enclosures of 1 km<sup>2</sup>, and one experimental pen of 600 m<sup>2</sup> (Fig. 1). Outside the fenced area there is an area of 50 km<sup>2</sup> protected from the sea by dykes where future reintroduction of Père David's deer is planned; only 24 km<sup>2</sup> of this land are owned by the Reserve. In this area the soil consists of recently consolidated alluvial materials, and grassland dominated by *Imperata cylindrica* and *Calamagrotis epijos* (Jiang *et al.*, 2000). To the south of the area there are patches of woodland and farmlands.

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Received 25 July 2001. Revision requested 25 October 2001.

Accepted 20 November 2001.



**Fig. 1** Location of Dafeng Reserve in China (small square), and the movements and activity range of the released deer in the Reserve.

For 18 months prior to their release eight Père David's deer (one stag, three hinds and four subadults) were kept in the experimental pen, within which there is a 215 m<sup>2</sup> pond and a patch of woodland. One of the hinds was fitted with a radio collar, and the deer were released on 5 November 1998 into Dafeng Reserve. During the release one subadult became lost within the fenced area and did not go out into the Reserve. Upon release the seven deer divided into two groups. One group (G1) consisted of two hinds and two subadults, and the second (G2) consisted of the stag, one hind and one subadult. The two groups eventually merged on 23 November 1998, i.e. 18 days after release.

We used radio telemetry to locate the released deer. They were observed for at least two hours per day, between 06.00 and 18.00, during a 3-day period every week from 7 November 1998 to 3 April 1999. Scanning observations were made at 10-minute intervals over a two-hour period, and data were pooled across days within these periods, i.e. 06.00–08.00, 08.01–10.00, 10.01–12.00, 12.01–14.00, 14.01–16.00 and 16.01–18.00. Walking, foraging and rest were recorded with a behaviour recorder (SJ-1 Event Recorder; Jiang, 1999), and we also measured vigilance distance, the distance at which deer

start to appear alert (Josè *et al.*, 1996), using a range finder (Yardage Pro 400). In addition, we recorded *ad lib* the frequency of barking, fighting and attacking between adults and subadults. Before and after the release we photographed each deer and recorded its physical status in order to identify any changes in body condition. We used a Global Positioning System (Garmin 12XL), to determine the positions of fresh hoof prints, faecal pellets and bedding sites. Spatial data were digitized with the raster-based Geographical Information System Idrisi (Clark University, USA), and the range used by the released deer was determined by the Minimum Area Method (Lehner, 1996).

The released deer exhibited more social interaction than prior to their release. The hinds barked frequently after the 7th day. The two groups collectively called and responded to each other on the 17th day after release, and the groups merged the next day. As soon as the two groups came together, the stag left the group. Fighting, with rearing and kicking, occurred between the three hinds when the groups merged. Fighting between two non-dominant hinds continued for about one month, and one subadult attacked the other subadults as frequently as 14 times a day. The dominant hind intervened in fights between the other hinds.

After release, the deer moved three times to avoid human activity (Fig. 1). Before merging, G1 and G2 occupied different ranges, with both groups having settled in areas with woodlands, reed fields with salty marsh, ponds and brooks. After merging the hinds occupied the region previously occupied by G1. The hinds expanded their home range to *c.* 1 km<sup>2</sup> by 40 days after the release. During 21 January – 31 May 1999, due to the construction of an aqueduct along the old dyke, the deer moved eastwards and settled down in a new area. In this area they also expanded their home range to *c.* 1 km<sup>2</sup> in about 40 days.

Before release the deer generally foraged at three time periods: 06.00–08.00, 12.00–14.00 and 16.00–18.00 (Fig. 2a). In the three weeks following release the deers' daily activity rhythm was variable, possibly due in part to human activity around the area; the pre-release daily rhythm was re-established by 4 weeks after release (Fig. 2c–d). Vigilance distance increased from 30–40 m before release to 120–140 m during the first four weeks after release, and then declined to 60–70 m during the next four weeks.

The released deer rested in reeds and foraged in either farmland or reeds during daytime. At about 06.00 the deer would emerge from the woods, where they had stayed over night, and move into reed fields. They foraged and rested in these fields until about 16.00, and then they moved slowly, whilst foraging, back to the woods. Sometimes the deer foraged in wheat or vegetable fields. Six weeks after release the deer all appeared stronger and in better condition than at the time of release.

This trial release of seven Père David's deer offered us the opportunity to develop a better understanding of the behaviour and ecology of the species in the wild. The deer exhibited a greater range of behaviour, especially social behaviour, and their body condition improved. Although the release was carried out in a

populated area, it was hoped that the deer would stay within the coastal habitat, where there is no human activity. However, they did not do so, and foraged within the surrounding farmlands.

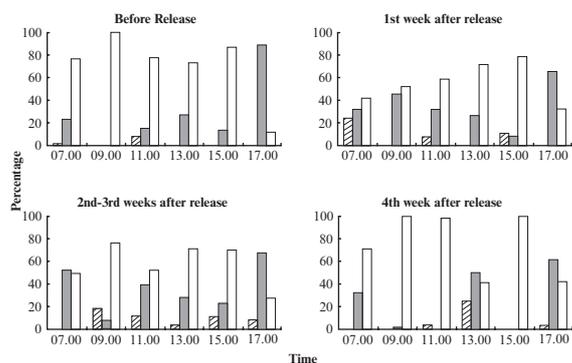
For future releases a habitat with either a natural or artificial boundary must be found, because otherwise there will be unmanageable levels of conflict between the needs of the deer and those of farmers. Future releases of Père David's deer should follow the IUCN reintroduction guidelines (IUCN/SSC Reintroduction Specialist Group, 1998), and could be modelled on the successful reintroduction of the Arabian oryx *Oryx leucoryx* in Oman (Stanley Price, 1989), in which the socio-economic impacts and the costs and benefits of the release programme were assessed prior to the first release of captive-bred animals.

## Acknowledgements

We thank Y. W. Ding, A. Xu, Y. Ren and H. Shen of the Dafeng Reserve for their help during the study. We also acknowledge the financial support of National Key Basic Research Project (G2000046805), the Chinese Academy of Sciences (KSCX2-1-03; KZ-95A1-105, C2999082) and the Natural Scientific Foundation of China (No. 39725005).

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**Fig. 2** Daily activity budget over time for seven Père David's deer before and after release. Hatched, grey and white bars represent the percentage of total activity time spent in locomotion, foraging and rest respectively.

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### Biographical sketches

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