Appendix 2. Details of Methods (release techniques, ages, bird selection, and transmitter attachment) and Result (distribution of core areas).

METHODS

Release techniques and ages

Soft release of first-year birds

Egg-fostering was accepted in all cases. The frequency and amount of food provided were regulated according to the food requirements of the chicks, and 800–3,900 g of Japanese horse mackerel (*Trachurus japonicus*) and loach (*Misgurnus anguillicaudatus*) were provisioned in plastic tubs in each enclosure one to four times per day (Matsumoto et al. 2017). When they were soft-released, the foster parents had their flight feathers cut or were equipped with wing brails to prevent them from leaving the enclosure (Matsumoto et al. 2017).

Hard release of first-year birds

We transferred the first-year birds from captive-bred parents to Hyogo Park of the Oriental White Stork (HPOWS) to foster parents in this park, similar to the soft-released first-year-old birds.

Soft release of one- to three-year-old birds

The frequency and amount of food provided during the fledgling period were maintained similar to those during the release of the first-year birds. For the second step, the choice of the cage was determined by the availability of cages and the release plan. In the individual cage, approximately 500–600 g of living or thawed horse mackerel, rainbow trout (*Oncorhynchus mykiss*), crucian carp (*Carassius* spp.), and loach were provided in plastic tubs once or twice daily. After the first step, the timing of the transfer of cages was prior to the next breeding season for parents of subject bird, approximately half a year after the birth of subject birds from October to November. In the shared and training cage, the same prey species and feeding frequency as those in the individual cages were provided, with the food amount being calculated as 650 g multiplied by the number of birds in the cages. For the third step, the size and environment in the enclosure were the same as those used for the soft release of the first-year-old storks. The feeding frequency, amount, and prey species were the same as those when multiple birds were reared in the shared and training cage. We soft-released the birds when it was easy for them to find prey animals because of rice reaping in paddy fields.

Selection of birds for release

Release of first-year birds

To prevent pedigree bias in the reintroduced wild population, the release of birds from a different pedigree group at the release site each year was crucial.

Release of more than one-year-old birds

Four steps, including training, were undertaken to select birds for release. In the first step, suitable individuals were selected considering the kin bias and sex ratio of the reintroduced population. Individuals with unsuitable pedigree, history, age, and physical defects were omitted for future reproduction of all captive storks, comprising approximately 100 birds.

In the second step, individuals that passed the first step, comprising approximately 20 birds, were evaluated for the behavior necessary for survival in the wild, such as flight, walking, foraging, reproduction, and sociality. These individuals were then selected for further training. Juveniles were not considered in their reproductive behavior.

The 9–26 birds that were selected had three types of training, namely flight, foraging, and socialization, including interaction with different individuals, in a training cage. The cages contained wetlands and streams.

For the training, two to twelve individuals were reared together in a training cage. For flight ability assessment, obstacles were set up at four different heights (195, 145, 120, and 90 cm), and the flight time, frequency, and obstacle avoidance were recorded. Storks with incomplete flight ability were not selected for release. For the conspecific response, birds from different families and sexes were trained to live together in the same cages, and their responses to threats and attacks, cooperative behavior, and reproductive behavior were evaluated. The birds were observed for 6–7 h per day for a total of 40–50 h per bird to select the candidates. If it became difficult for individuals to live with other individuals in the cage, such as those that attacked other individuals or became extremely weak, we immediately stopped training and excluded them from the candidates. To promote foraging ability, we released live fish into a stream during one of two feeding events per day. All the individuals caught fish by themselves.

Transmitter attachment

The custom harness to attach the transmitter consisted of a neck loop and a body loop underneath the wings and in front of the legs (Appendix 3). We first attached Teflon ribbons that were 90 and 50 cm long (width 19 mm, mass 17.8 g) to the front and rear ends of the transmitter, respectively. A neck loop with a diameter of 15 cm was then constructed. The neck loop was placed over the head and neck of the bird. The transmitter sat at the back of the bird and was held in place while the body loop was constructed. We adjusted the body loop to avoid being too tight when we attached the front and rear ends of the Teflon ribbons using thread or an aluminum tube with a length of 18 mm, a short diameter of 3.5 mm, a long diameter of 7.2 mm, and a mass of approximately 1 g. The negative effects of harness attachment, abrasion, and drag caused by the harness not fitting the bird’s body shape (Cappelle et al. 2011, Lameris et al. 2018) were addressed by adjusting the length of the front and back ribbons. Long-term harness tracking reduces the survival and reproduction of birds (Lameris and Kleyheeg 2017, Lameris et al. 2018). However, because it is difficult to carry out long-term monitoring using visual observation for highly mobile storks, transmitter attachment using harnesses was chosen.

RESULTS

Distribution of core areas

Three soft-released first-year-old birds (179, 480, and 481; Appendix 4) had a relatively large core area far and close to the release site, based on both the kernel density estimate (KDE) and minimum convex polygon (MCP). The other four birds (212, 213, 476, and 477; Appendix 5) had small core areas close to the release site. For the KDE, bird 179 had two core areas, one each in the Chugoku and Kyushu regions (Appendix 4). Bird 480 had three core areas, with one in the Kinki region and two in the Kyushu region. Furthermore, bird 481 had two core areas, that is, one each in the Kinki and Kyushu regions. For the MCP, birds 179, 480, and 481 had one core area from Kyushu to Chugoku. For the KDE, bird 212 had two core areas, while the other three birds only had one core area (Appendix 5). For the MCP, birds 212, 213, 476, and 477 had one core area. Birds 212 and 213 acclimatized together during the pre-release period. Birds 212 and 213, based on both the KDE and MCP, had a core area at the same location.

The hard-released firstyear-old bird 214, based on both the KDE and MCP, had a core area in the Shikoku region far from the release site (Appendix 6).

Soft-released one- to three-year-old birds, based on both the KDE and MCP, had core areas close to the release sites (Appendix 7). For the KDE, birds 381, 382, and 399 had one core area, and bird 391 had two core areas. However, for the MCP, all individuals had one core area. Birds 381 and 382 acclimatized together during the pre-release period. Birds 381 and 382, based on both the KDE and MCP, had overlapping core areas.

All hard-released one- to three-year-old birds, based on both the KDE and MCP, had core areas close to the release site (Appendix 8) and one core area.

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