ASSESSING THE FEASIBILITY OF RELEASE TECHNIQUES FOR CAPTIVE-BRED BURROWING OWLS

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Abstract.—We tested two methods of releasing endangered, captive-bred, Burrowing Owls (Athene cunicularia) in Saskatchewan, Canada. The first technique involved releasing pairs of captive-reared, adult owls. Twelve of 20 pairs remained together using this technique, whereas only six individuals paired with wild owls. Pairing/survival success was poor when owls were left in place for only 3 d prior to release; success improved when owls remained for 5 d or until chicks hatched. At least 1% of released adults died during the breeding season, compared to only 0.5% for wild owls. At least five released adults failed to migrate. None of the captive-reared adults returned to the study area in subsequent years, whereas 19% of banded wild owls returned during the same period. One of 62 offspring from released pair remained in brood in a subsequent year; this recruitment rate was not different than that of offspring produced by wild adults. The second release technique involved fostering captive-bred/hatched owlets into wild nests. We fostered 54 owlets at three different sites. Fostered chicks were accepted by wild owls; their growth, survival, and behavior did not differ from their wild siblings. Our results suggest that adults raised in captivity can breed successfully in the wild, but that we are seeing some decline in their ability to migrate successfully. Fostering captive chicks into wild nests showed some success, but also had some limitations.

Key words: alternate curricula; burrowing Owl; captive-bred; fostering; reintroduction; reed species; endangered species.

EVALUACION DE LA FACTIBILIDAD DE TECNICAS DE LIBERACION DE BUMOS CREADOS EN CAPTIVIDAD

RESUMEN.—Probamos dos métodos de reintroducción de individuos cautivos, de la especie en peligro de extinción en Canadá, el burrowing owl (Athene cunicularia). El primer test involucró liberar parejas de adultos criados en cautiverio; de 20 parejas permanecieron juntas usando esta técnica, mientras que 6 individuos formaron parejas con individuos silvestres. El éxito en la formación de parejas y el éxito de nidificación fueron bajos cuando los individuos cautivos permanecieron en el sitio de liberación por sólo 5 días antes de ser liberados; el éxito incremento cuando los individuos permanecieron por 5 días hasta el inicio de la eclosión. Al menos el 1% de los adultos liberados murieron durante la temporada de reproducción, comparado con sólo el 0.5% de los individuos silvestres. Al menos cinco adultos liberados no migraron. Ninguno de los adultos cautivos que fueron liberados regresó al sitio de cría en años subsiguientes, mientras que el 19% de los individuos silvestres que fueron liberados regresaron durante el mismo período. Una de las 62 crías producidas por las parejas libertadas regresó a criar en años subsiguientes; esa tasa de recontaminación no fue diferente a la de crías producidas por los padres silvestres. La segunda técnica de liberación involucró el dar en adopción pichones echadizos en cautiverio a parejas silvestres con nidos. Otros pichones fueron aceptados por las parejas silvestres. El crecimiento, sobrevivencia y comportamiento de los pichones...
Diploidos no se diferencian al ser hermanos alveíferos. Nuestra revisión sugiere que los alveíferos estudios en cautiverio pueden ser erróneamente o de mala calidad, pero permanecen dos accesos de la habilidad para estudios alveíferos. El polen se adopera a partir de alveíferos, así como para otros alveíferos limitaciones.

**Browsing Owl populations have undergone a severe decline in Canada for more than 25 years. In 1995, the committee on the Status of Endangered Wildlife in Canada (COSEWIC) changed the Browsing Owl's national status from threatened to endangered (Willisome and Haug 1995). This downward trend has not been limited to Canada; Browsing Owl populations have declined over most of their North American range (Sheffield 1997, Holroyd et al. 2001, Willisome and Holroyd 2001).

To attempt to counter the decline in Manitoba, over 350 trampled and captive-bred Browsing Owls were released between 1987 and 1996 (De Smet 1997). During that time, the provincial population fell from an estimated 35 nests to a single nest, and reintroduction efforts were halted. Browsing Owls have been essentially extirpated in Manitoba since 2000 (K. De Smet pers. comm.). In British Columbia, 166 captive-bred Browsing Owls were released into their former range between 1992 and 1997 (Leupin and Low 2001). Additional reintroductions were conducted in this area between 1997 and 2004 (J. Sergeant pers. comm.). However, these efforts have yet to establish a self-sustaining, wild breeding population of Browsing Owls. Reintroduction efforts were also attempted in Minnesota between 1986 and 1996, by lacking 165 prediagnosed chicks trampled (from South Dakota (Murrell et al. 2001). Reintroductions were discontinued because no nests were found after leaving their back sites, and none ever returned to breed in years following the release.

In 1997, experimentation with native captive-release proceeds began in Saskatchewan. Unlike the reintroduction efforts in Manitoba, British Columbia, and Minnesota, the primary aim in Saskatchewan was not to recover the dwindling wild population. Rather, the goal was to test protocols for captive-release in order to aid Browsing Owl recovery programs that are using or considering reintroductions as part of their conservation strategy. This project was made possible by the existence of captive Browsing Owls in facilities located in Alberta, Saskatchewan, and Ontario. Our project also benefited from ongoing studies of wild Browsing Owl populations in southern Saskatchewan (James et al. 1997, Willisome 2000, Todd 2001, Poulton 2005). By experimenting with traeves while simultaneously studying a wild Browsing Owl population in the same area, we were able to quantitatively assess the relative success experienced by released birds.

In this paper, we describe the results of two techniques for releasing captive-bred Browsing Owls (1) releasing pairs of 1-year-old, captive-bred adults at the start of the breeding season and (2) fostering captive-bred owls into wild nests.

**Study Area**

Our study was conducted within the moist mixed grassland ecoregion (Harris et al. 1985) of southern Saskatchewan, within the core of the historical Browsing Owl range in Canada (Willisome and Holroyd 2001). Our study area was intensively cultivated for cereal crop production (ca. 1905 of the overall land base) with small and highly fragmented native grassland prairies interspersed throughout the cropland matrix (Gauthier et al. 2002). The majority of Browsing Owl nests in our study area were located within savannah to hardwood-clover-cane pastures. Wild Browsing Owls have been continuously monitored in our study area since 1996 (James et al. 1997, Willisome 2000, Poulton 2005, Todd 2005).

**Technique No. 1: Releasing Pairs of Captive-reared Adults**

During the springs of 1995-2000 and 2002, we released pairs of captive-reared, adult Browsing Owls. These owls (140 SecureInCage® IV, 4 AirsecureSecureclear® (ASCW) were the offspring of non-releasable owls permanently housed at the Owl Foundation (Vancouver, BC Canada), the Alberta Birc (Frey Centre, Saskatchewan, AB Canada), and the Saskatchewan Browsing Owl Interpretive Centre (Moose Jaw, SK Canada). The number of owls released each year varied because we depended on the birds available from these facilities. Unfortunately, the small number of release birds returning precluded us from examining the effects of annual variation; we therefore pooled the data from 1997 through 2002 for our analyses. The release protocol consisted of choosing pairs of non-related males and placing them within 10 cm of each other. Enclosure consisted of wooden frame (26 cm X 12.5 cm X 12.5 cm) covered with plastic 1 cm X 1 cm mesh. Each enclosure was placed over the entrance of a nest box (Fig. 1) and the bottom frame was buried approximately 10 cm underground to stabilize the enclosure and to discourage digging by owls and potential intruders. Once released, enclosure was removed, allowing access to the unmodified nest boxes protected by
owl nests from financial predators, while allowing us access to nest chambers to monitor reproductive parameters and to capture juveniles for banding and radiotelemetry (Wel- lcome et al. 1997, Poulsen et al. 1998). Because Burrowing Owls often nest in clusters (e.g., Danforth et al. 1995), release sites were selected where there were always at least one such site nearby in the vicinity. In addition, we selected release sites that had been occupied by wild owls within the previous 3 yr, assuming that sites that were recently inhabited by wild owls would provide appropriate rearing conditions.

The length of time owls were held in place varied among nests to attempt to increase pitting success. In 1995–96, enclosures were left in place for 5 days and nights; in 2000, enclosures were left in place for 5 days and nights, and in 2002 the enclosures were removed only after the clutch had been initiated. While this change in experimental protocol was not ideal, we believe our results were astoundingly above predicted parameters, other than pitting success, appeared to be unaffected.

While inside the enclosures, owls were provided with Fowl (1–4 lab mice/owl/d) and monitored daily for nest initiation. After the clutches were removed, we continued to provide supplemental food until wild-caught prey items were found inside the nests (clusters).

As each release test, we recorded clutch initiation date, clutch size, hatch date, number of eggs hatched, and number of nestlings fledged. The relationship between clutch-initiation date and clutch size was compared between wild and released owls using Student’s t-tests to compare the slopes and elevations of the regression lines (Zar 1996). Approximately 20 d posthatch, we captured all nestlings and banded them with uniquely numbered aluminum and colored leg bands.

In 1997, 1998, and 2000, we monitored the post fledging survival and dispersal of the offspring using 6-g necklace-style radio transmitters (Holohil Systems Inc., Carp, Ontario, Canada). During these 3 yr, we also used transmitters to follow the dispersal and survival of wild juveniles as part of an ongoing study (Todd 2003, Todd et al. 2005); making it possible to compare survival rates and postfledging dispersal activities between wild-caught juveniles and those raised by captive-bred adults. Distance from nest and percent (alive or dead) of all juveniles was determined every 0.5–1 d from the time of transmitter attachment (35–40 d posthatch) until migration or death of the individual. Differences in postfledging activities between wild and released owls were assessed using nested ANOVA. Transmitters were not used on adult owls; therefore, adult survival (released and wild owls) could only be established from observations made throughout the summer and from the opportunistic recovery of leg bands or carcasses.

We used chi-square tests to compare rates (e.g., mortality rates, fledging success, return rates) between wild and released owls. For all statistical tests, differences were considered significant at p < 0.05.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>PAIR</th>
<th>REPEATED</th>
<th>TOGETHER</th>
<th>ENCLOSURES FROM</th>
<th>PAIRING BETWEEN</th>
<th>SUCCESSFUL</th>
<th>ENCLOSURES FROM</th>
<th>SUCCESSFUL</th>
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<tbody>
<tr>
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<td>8</td>
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<td>2002</td>
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<td>4</td>
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<td>0</td>
<td>9</td>
<td>15</td>
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<tr>
<td>Total</td>
<td>36</td>
<td>12</td>
<td>45</td>
<td>6</td>
<td>31</td>
<td>72</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Includes ruffled preened pairs not released outside.

Technique No. 2: Fostering Captive-reared Nestlings into Wild Breeds. During July and August of 1997-00, we fostered captive-reared nestlings from the Saskatchewan Burrowing Owl Interpretive Centre into wild nests. The Interpretive Centre was located within our study area, and in close proximity to wild owls so as to minimize nest site loss and nest abandonment rates to the public during transfers. To facilitate potential final interactions between siblings (Wellcomber 2000), we fostered chicks only into wild broods of compatible ages and had chick body mass similar. The number of owls fostered depended on the number of owls produced in the captive facility, and the selection of wild nest was limited to those nests of a comparable age to the fostered chicks. In 2001, we fostered chicks at fledging age, and used radio-transmitters to compare the survival of fostered nestlings with that of a wild sibling from the same brood. Each fledging was banded, was measured, and fitted with a transponder radio-transmitter. The status and location of each radio-tagged preened chick was then recorded every 2-3 d until migration or death.

In 2002 and 2000, we fostered owls at three different ages: 5-6 d prehatch, 7-8 wk prehatch, and 8-9 wk posthatch. Nestlings that were too small to be stimulated were marked on their legs and then fostered with a prey item, motorized shaker to distinguish them from wild siblings until we could catch a leg band. To reduce the burden on the wild parents and nestlings, we provided supplemental food (sunflower seeds) to each foster brood. To improve the time that nestlings were left in place for 5 d (1997-98), we took owls to the nest and then fledged them with a prey item. Mares (1977) calculated this method of order between owls and nestlings produced a 20% of prehatch, which was then used to monitor growth rate and body mass gain. We used a paired t-test to compare the growth rate of fostered chicks with comparison preened, wild siblings over the first 24 h after release. To minimize the amount of disturbance to the nestlings, we stimulated the nestlings for 5 minutes, and fed the nestlings on 24 h of foraging growth because we left this was most to determine whether the introduced chicks were accepted and fed by the foster parents. We were unable to use radio-transmitters to monitor juvenile survival in 2002 and 2003; therefore, a repeated estimations could only be made by repeated nest visits and visual observations of fostered owls. In 2002, we also used miniature video cameras (see Purdue 2003 for details on video footage assembly) as three release nests to determine if there were any apparent behavioral differences. (e.g., foraging, eating, emerging from burrow, predation avoidance) between fostered and wild chicks, and to determine if fostered chicks were accepted by wild parents and nestlings. Fostered chicks were identified on-camera from the mark on their feathers.
released). However, the formation of the six "extra" pairs (required the presence of unpaired wild owls in the study area. If this release technique were being used to repopulate an area from which wild owls had been extirpated, pairing of released birds with wild birds obviously would not have occurred.

Of the remaining 22 released owls, 17 abandoned their release sites and were never seen again, three remained alone near the release site and did not breed, and two were killed immediately following release. Of the four "stress" females, one died successfully, one failed to breed, and two abandoned their release sites. Of the remaining 10 of the 32 (19%) release-adults were subsequently found dead. Sources of mortality included avian predation (N = 3 deaths), vehicle collision (N = 1), starvation (N = 2), and known causes (N = 6). As transmitters were not used on adults, deaths were discovered postmortem by finding remains, and therefore, the mortality rate represents a minimum value. The apparent mortality rate of wild adult owls in this area during the breeding season averaged only 3.7% (range = 0-14.7; N = 251790 between 1992-98; T. Wellman unpubl. data). We can only speculate that the increased mortality rate we observed (¿2 = 38.5, P < 0.001) in released owls may be related to the time spent in captivity, perhaps hindering their ability to detect or avoid hazards (Griffin et al. 2000). A similarly high mortality rate (34%, range 16-54%: Leupin and Low 2001) was observed in 1-y-old Burrowing Owls released in British Columbia after being held in captivity their first winter.

Being held captive for their first winter may also hinder the released adults' ability to migrate successfully (e.g., Zaza et al. 2001). In British Columbia, five of 16 1-y-old, captive-bred and released birds did not migrate, and remained at their release sites throughout the winter (3-epi and Low 2001). In our study, at least five of the 42 released individuals that survived throughout the summer failed to migrate in the fall. Overwintering in Saskatchewan is not a viable option for Burrowing Owls, because months of snow cover and intense cold make features and prey unavailable. It is unclear whether the other released subadults in this project migrated successfully; however, over the course of our study 19 (19 of 101) of wild adult Burrowing Owls returned to breed in a subsequent year (L. Todd and R. Paulson unpubl. data), whereas none of the 42 released adult owls ever returned (¿2 = 9.1, P = 0.003). Based on the return rate of the wild adult owls, we expect to find between three and 12 released adults returning (Achauer test, P > 0.05).

There are many possible explanations for our inability to locate released owls in subsequent years. Because the owls were in captivity and were prevented from migrating in their first year, perhaps they lose the ability or willingness to migrate. Alternatively, because many of the owls were hatched and raised in Ontario and Alberta and then released in Saskatchewan, they may have migrated south for the winter but then were unable to navigate back to Saskatchewan. Experiments with other species have shown that some displaced birds will migrate back to their location of birth regardless of where they were displaced (e.g., Mowld 1964). The above explanations assume that the birds did not migrate successfully, but it is also feasible that the owls did migrate successfully but continued to experience higher than normal mortality during migration and on the wintering grounds. There are few data on the between-year dispersal patterns of Burrowing Owls (e.g., Duxbury 2004), it is possible that our released adults simply relocated. Further studies are required to provide a definitive answer to this question.

Clutch size and productivity. Wild Burrowing Owls exhibit a seasonal decline in clutch size, whereby clutches laid earlier in the season are generally larger than those initiated later (Wellman 2000). Clutch size of released pairs followed this same trend (Fig 7). Neither the slopes (intercept = -0.64, P > 0.50) nor the elevations (intercept = 0.75, P > 0.40: Zar 1996) of the regression lines of seasonal clutch size decline differed between wild and release pairs. Similarly, fledging success (calculated as the proportion of eggs producing a fledgling) did not differ between wild and release pairs (release + release pairs = 0.42, P = 0.32; release-release pairs compared to wild-wild pairs: ¿2 = 2.81, P = 0.09: Table 2).

Post-fledging survival and recruitment of release pairs offspring. In 1997, 1998, and 2000, we afforded a radio-transmitter to an offspring from each of eight different release nests (five in 1997; one in 1998, and two in 2006). Radio-transmitters were also placed onto juveniles from wild nests (12 in 1997; 32 in 1998, and 15 in 2000) to compare survival and dispersal behaviors of offspring of wild versus
Figure 2: Seasonal decline (common regression equations: $Y = 10.13 - 0.06x$, $r^2 = 0.34$, $R = 0.60$, $P < 0.001$) in clutch sizes for wild and captive-released Burrowing Owls. There is no difference in the slope ($b = -0.64$, $P = 0.5$) or elevation ($a = 0.75$, $P = 0.4$) of the regression lines between wild and released owls.

captive-bred adults. Three of the eight (37.5%) juveniles from released parents died before migration; 18 of the 57 (32.6%) juveniles raised by wild parents died over that same period ($r^2 = 0.11$, $P = 0.74$). Avian predators were the main cause of mortality for both wild and release juveniles. The similarity in mortality rates and causes suggest that the offspring of captive-bred adults were not affected negatively by their parents' captive upbringing.

Each year we attempted to determine the band status of all Burrowing Owls within our study area. Between 1997 and 2005, 5.5% (35 returns from 658 banded owls) of all wild fledglings returned. Seventy-four fledglings from release nests were produced throughout the 5 yr of this captive release project (Table 1), 62 of which were allowed to attempt migration and potentially return to breed in a subsequent year. Based on the return rate of wild juveniles, we would have expected zero to six juveniles from release nests to return to breed. With such a low wild recruitment rate, it is difficult to assess whether juveniles from release nests are any less successful than those from wild nests. Statistically, the rates are comparable ($r^2 = 0.14$, $P = 0.30$) and we argue that, because at least one owl did migrate and return, these juveniles do have the potential to contribute to the subsequent years' breeding population.

Post-fledging activity of release pair offspring. We found no significant differences in the dispersal activities of juveniles raised by wild or captive-bred parents (Table 2). The offspring of released adults also departed the breeding grounds at the same time as wild owls were migrating, further strengthening the argument that these owls are capable of migrating successfully.

Technique No. 2: Fostering Captive-hatched Nestlings into Wild Broods. Survival and behavior of fostered juveniles. Between 2001 and 2005, we fostered 54 captive-hatched juvenile Burrowing Owls into wild nests; 42 as fledglings (6 wk old), six as week-old nestlings, and six as newly-hatched nestlings (3-4 d old). In 2001, we used radiotrackers to monitor the survival and movements of nine fledglings. In 2002, we did the same with the other 39 owlets. These data are only for nests that fledged at least one young successfully (e.g., not depredated) and only from nest mates, where we were able to determine accurately the number of eggs laid and the number of young fledged.

<table>
<thead>
<tr>
<th>Year</th>
<th>Released-Reared</th>
<th>Released-Wild</th>
<th>Wild-Wild</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>38% (10/26)</td>
<td>100% (7/7)</td>
<td>82% (60/73)</td>
</tr>
<tr>
<td>1998</td>
<td>80% (12/14)</td>
<td>61% (57/94)</td>
<td>72% (8/12)</td>
</tr>
<tr>
<td>1999</td>
<td>100% (18/18)</td>
<td>41% (15/37)</td>
<td>80% (57/64)</td>
</tr>
<tr>
<td>2000</td>
<td>58% (15/26)</td>
<td>80% (19/23)</td>
<td>72% (8/12)</td>
</tr>
<tr>
<td>Total</td>
<td>61% (43/70)</td>
<td>90% (19/21)</td>
<td>72% (218/295)</td>
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and fostered juveniles. Mammalian predators killed three fostered juveniles, avian predators were responsible for two deaths, and one died of unknown causes. Both wild juvenile deaths were attributed to avian predators. Higher mortality experienced by fostered juveniles compared to their wild siblings may have been a result of the age at which they were fostered. Burrowing Owls chicks emerge from their burrows as early as 19-12 d posthatch, at which time they first become exposed to the anti-predator behavior and alarm calls of their parents. Because fostered chicks were released into natal nests at fledging age, they missed up to 4 wk of learning anti-predator behaviors under natural conditions.

In 2002 and 2003, we fostered owlets at three different ages: six at 2-4 d posthatch, six at approximately 5 wk posthatch, and 35 at 6 wk posthatch. In 2001, we were unable to use transmitters to follow the fate of these fostered owlets; however, we observed no indication of predation of any of the nests through weekly nest visits (N = 5-7) until the end of August.

In 2002 and 2003, we measured the change in body mass of the six 3-wk-old fostered chicks 24 h after release, and compared this body mass change to a comparably-aged wild sibling in the same nest. We found no difference in body mass gain between wild and fostered chicks (paired t-test, t = 0.46, P = 0.67). We also measured body mass change in the six nestlings that were 2-4 d old, and found that their growth rates were not different than their wild siblings within the first 24 h of release (paired t-test, t = 1.4 \pm 0.16; P = 1.5 \pm 0.13; Mann-Whitney U-test, U = 8.5, P = 0.45). These results suggest that

parents fed fostered chicks in the same manner as their wild siblings. Videotaping at three nests confirmed these results, as we observed no apparent differences in the behavior of foster and wild chicks, or in the behavior of the adults toward foster or wild chicks. All three foster chicks were observed receiving food from parent owls within 1 h of release. In addition, foster chicks emerged from their natal burrow with the brood of their wild siblings (i.e., as a group), and responded to predator alert calls from parents in the same manner as wild chicks (i.e., reeking as a group).

The ability to produce Burrowing Owls in captivity is unlikely to be a limiting factor for a recovery program because the species breeds so readily in captivity. However, the release of these captive-reared owls is typically a slow and uncertain process in recovery programs. We acknowledged that opportunistic use of the facilities of a variety of captive breeding facilities resulted in inexactness in our methodology, but we believe that our results provide an important first assessment of factors that may be influential for the release of captive-reared Burrowing Owls. Our findings suggest that releasing pairs of captive-breeding adults had some limited success—reproductive parameters were similar to wild adults and at least some of their offspring were capable of migrating and joining the breeding population in subsequent years. A significant limitation of this technique was a lack of evidence that captive-bred owls released as adults could migrate successfully and later return to the breeding grounds. We suggest that if this technique is used, enclosures should be left on until clutch

<table>
<thead>
<tr>
<th>VARIABLE</th>
<th>OFFERING OF WILD ADULTS</th>
<th>OFFERING OF RELEASED ADULTS</th>
<th>P</th>
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<tbody>
<tr>
<td>Age at initial disposal (d posthatch)</td>
<td>50.7 ± 1.8 (35-69, N = 24)</td>
<td>49.6 ± 3.8 (30-69, N = 5)</td>
<td>0.88</td>
</tr>
<tr>
<td>Date of initial disposal</td>
<td>54 July 1 ± 1.4 (13 Jul-10 Aug, N = 23)</td>
<td>4 August ± 3.8 (24 Jul-11 Aug, N = 5)</td>
<td>0.20</td>
</tr>
<tr>
<td>Closer used antiseptic burrow (m)</td>
<td>63.2 ± 0.4 (24-146, N = 3)</td>
<td>60.6 ± 0.2 (1.8-35, N = 7)</td>
<td>0.11</td>
</tr>
<tr>
<td>Number of satellite burrows used</td>
<td>5.0 ± 0.5 (1-7, N = 24)</td>
<td>4.2 ± 1.2 (0-7, N = 7)</td>
<td>0.44</td>
</tr>
<tr>
<td>Fattest distance (m)</td>
<td>950.0 ± 259.9 (10-5596, N = 14)</td>
<td>577.7 ± 21.3 (110-239, N = 5)</td>
<td>0.22</td>
</tr>
<tr>
<td>Age at migration (d posthatch)</td>
<td>104.7 ± 2.7 (27-104, N = 24)</td>
<td>104.7 ± 0.6 (78-116, N = 6)</td>
<td>0.73</td>
</tr>
<tr>
<td>One of migration</td>
<td>21 Sept ± 2.1 (9 Sept-6 Oct, N = 26)</td>
<td>26 Sept ± 3.4 (17 Sept-3 Oct, N = 6)</td>
<td>0.20</td>
</tr>
</tbody>
</table>
initiation, and part of the protocol should include recapaculating capybara-breeds adults that fail to migrate prior to winter.

Feeding capybara-breeds chicks into wild nests with similarly aged young also had some success. The foster parents, but this technique also has limitations. This technique would require that nest boxes be used if very young chicks are fostered (to at least the age of the siblings and to place the nestlings into the nest chamber). Foster parent would have to be provided with supplemental food to compensate for the extra burden placed on the wild brood. There is a limit to the number of 'extra' chicks that can be fostered into wild nests, and of course, there would have to be wild nests in the area into which to foster the capybara chicks.

Regardless of the release method, an important consideration before any large-scale reintroduction effort is attempted is to determine the cause of the decline in the wild population. Obviously, if factors negatively affecting the wild population have not been adequately addressed, releasing capybara-breed individuals may do little to halt the decline.

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LITERATURE CITED


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