Conservation of the Black-Tailed Prairie Dog

Saving North America's Western Grasslands

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CHAPTER 13

Establishment of New Prairie Dog Colonies by Translocation

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Prairie dogs have disappeared over large portions of their former geographic range (Chapters 12 and 16). Their ability to reclaim lost ground is limited because long-distance dispersers, which usually travel less than 7 kilometers (4 miles) (Garrett and Franklin 1988; Chapter 3), usually do not survive and reproduce unless they find other occupied colony-sites or recently vacated ones. Timely restoration of prairie dogs in abandoned areas distant from existing colonies will require help from wildlife managers.

A translocation is the transfer of an individual from a source colony-site to either another colony-site or a new recipient-site without any prairie dogs. The first translocations of black-tailed prairie dogs occurred in the late 1970s, and these initial attempts used many of the methods developed for translocations of Utah prairie dogs in the early 1970s (Coffeen and Pedersen 1993).

In this chapter we discuss the role of translocations for the conservation of prairie dogs. We start by describing a good source population, and then explain our methods for livetrapping prairie dogs and caring for them before translocation. We describe a good recipient-site and explain methods to make recipient-sites better. We document that large numbers of translocated prairie dogs survive better than smaller numbers, and that the ratio of adults to juveniles, and of males to females, also affects the success of translocations. We investigate whether translocations are more successful if prairie dogs are moved as family groups, and Debra Shier investigates this same issue in her Box to our chapter. Finally, we demonstrate the benefits of short-term monitoring of translocated prairie dogs, and point out that continued management of recipient-sites is usually unnecessary within about one year after translocation.

BOX 13.1 Translocations Are More Successful When Prairie Dogs Are Moved as Families

Debra M. Shier

My research at the Vermejo Park Ranch, New Mexico, indicates that translocations of prairie dogs are more successful when individuals are moved together as family units (Shier 2004). Prairie dogs moved as complete coteries (N = 484 adults [at least one year old] and juveniles into five colonies, 87–100 per colony) survived and reproduced better than prairie dogs moved without consideration of coterie membership (N = 489 adults and juveniles into five colonies, 88–103 per colony).

Before translocations, I determined membership of coteries in April and May by observing behavioral interactions and sleeping patterns of eartagged, dye-marked individuals at large source-colonies. I then transferred family members into the same or adjacent man-made burrows at five recipient-sites with no other resident prairie dogs. Nonfamily members were transferred from three source-colonies into man-made burrows at five other recipient-sites with no other resident prairie dogs (five individuals per burrow). All transfers occurred in the summers of 2001 and 2002. I estimated survivorship by re-trapping all eartagged prairie dogs that were still at the recipient-sites in the spring following release. I estimated female reproductive success by measuring the percentage of females that weaned a litter, litter size at weaning, and the number of weaned juveniles per female (either lactating or non-lactating).

Adult and juvenile prairie dogs translocated as complete families survived better than prairie dogs translocated without attention to family (Figure 13-Box.1, left side), and they also experienced higher reproductive success (Figure 13-Box.1, right side). Further, prairie dogs from large families (at least 12 members, N = 129 from 10 families) survived better than prairie dogs from smaller families (fewer than 12 members, N =169 from 21 families): 55% versus 32%. Finally, prairie dogs translocated as families excavated more burrow-entrances during the first year: 229 (average, N = 5 colonies) versus 55 (N = 5 colonies).

Why do my results differ from the results of Dustin Long et al. (Chapter 13), who found no evidence to support the notion that translocations are more successful when prairie dogs are moved as families? At least three factors probably are important: methods for assessing survivorship and reproduction, timing of assessments, and size and composition of translocated families. Regarding methods and timing, Long et al. and I studied the same individuals translocated into the same recipient-sites in New Mexico, but we estimated survivorship at different times via different methods. Specifically, Long et al. estimated survivorship from visual counts of aboveground, unmarked individuals at two months after the release of translocated prairie

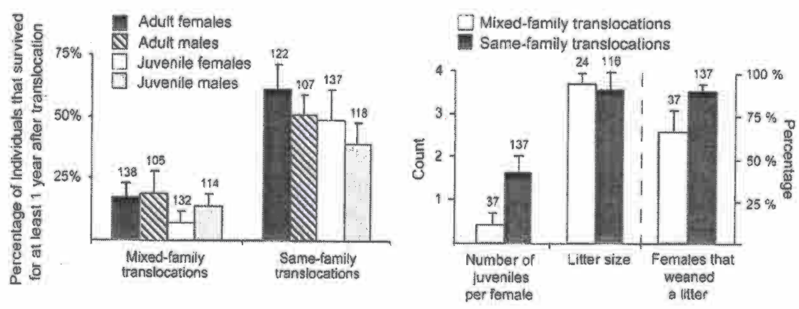

Figure 13-Box.1. *Left side:* survivorship of same-family translocations (into five recipient-sites) versus survivorship of mixed-family translocations (into five recipient-sites). Bars indicate averages, and the line above each bar indicates 1 standard error (SE); the number above each SE line indicates the number of individuals released. *Right side:* annual reproductive success (ARS) of females of same-family translocations (into five recipient-sites) versus ARS of females of mixed-family translocations (into five recipient-sites) as measured by: number of emergent juveniles per female (either lactating or non-lactating), litter size, and percentage of females that weaned a litter. Bars indicate averages, and the line above each bar indicates 1 SE; the number above each SE line indicates the sample size (either the number of females or the number of litters produced).

dogs, but I determined exact survivorship by livetrapping all eartagged individuals and their offspring at 12 months after release. Regarding size and composition of translocated same-family groups, Long et al. livetrapped an average of 5.0 individuals from one burrow, or two adjacent burrows, for their incomplete same-family groups in South Dakota (range = 3–11) (Bly-Honness et al. 2004); by contrast, I livetrapped an average of 11.3 individuals for my complete same-family groups in New Mexico (range = 5–29).

Determination of family compositions probably is not feasible for large-scale translocations (e.g., involving more than about 1,000 individuals), or when other people supply the prairie dogs. Because only members of the same coterie use the same burrow-entrance (Hoogland 1995), one practical solution might be to keep individuals from the same and adjacent burrow-entrances (i.e., presumed family members) together, and then translocate them into the same area of the same recipient-site (see also Robinette et al. 1995; Dullum 2001; Truett et al. 2001a; Roe and Roe 2003, 2004). This method should improve survivorship and reproductive success of translocated individuals, but the additional effort and cost will be minimal.

What Makes a Good Source Population?

The source population is the colony, or group of nearby colonies, that provides prairie dogs for translocations. As explained below, four factors that affect the suitability of source populations are disease, genetics, legal constraints, and removal versus sustainable harvest.

Disease

The disease of greatest concern when translocating prairie dogs is plague. Transmitted by fleas, plague usually is fatal to prairie dogs, and sometimes to humans as well (Chapter 11).

For reasons that are unclear, plague is absent throughout the eastern one-third of the prairie dog's geographic range (Chapter 11). Translocations involving prairie dogs from states such as North Dakota, South Dakota, Nebraska, Kansas, and Oklahoma are therefore less likely to be affected at the outset by plague. For translocations involving prairie dogs from outside the plague-free zone, three procedures can help to assess whether plague might be problematic in a particular geographic area (Truett et al. 2001a): monitoring of potential source and recipient colony-sites, analysis of carnivore blood samples for presence of antibodies to plague, and queries to state agencies that track plague. To reduce the transfer of plague, we recommend quarantine and application of Carbaryl to captured prairie dogs (see below).

Prairie dogs also can contract tularemia (also known as rabbit fever), which infects many other species, including humans, and usually spreads via ticks (Thorne 1982; La Regina et al. 1986). *Francisella tularensis*, the bacterium that causes tularemia, can be lethal for prairie dogs. Because it responds to antibiotics, tularemia among humans is rarely fatal (Texas Department of Health, undated). Further, no human cases of tularemia have arisen from contact with prairie dogs (Texas Department of Health 2002). We know of only two outbreaks of tularemia among prairie dogs, both localized. One occurred in a crowded colony in a city park in South Dakota (E. S. Williams, Wyoming State Veterinary Laboratory, personal communication, 2002), and the other occurred in a captive colony in Texas (Texas Department of Health 2002).

In spring 2003, a viral disease known as monkeypox was introduced into the United States from Africa via other rodents. The most likely culprits were Gambian giant rats imported from Ghana (CDC 2003). In a pet store in Illinois, monkeypox evidently spread from caged Gambian giant rats to prairie dogs in adjacent cages (Gerberding and McClellan 2003). Several persons have contracted monkeypox from their pet prairie dogs. Monkeypox can be fatal for both prairie dogs and humans (CDC 2003), but no human mortalities in the United States from monkeypox have occurred to this point. To deter the spread of monkeypox among captive and wild prairie dogs, the United States Department of Health and Human Services (2003) recently has issued a ruling that prohibits the capture and translocation of prairie dogs. This ruling has far-reaching implications for the restoration of prairie dogs. Exemptions are sometimes available for scientific purposes—for example, for translocations of prairie dogs to improve habitat for black-footed ferrets. If the risk from monkeypox subsides, then capture and translocation of prairie dogs probably will become permissible once again.

Genetics

Prairie dogs show genetic variation within and among populations (Chesser 1983; Foltz et al. 1988; Daley 1992; Roach et al. 2001; Trudeau et al. 2004; Jones et al. 2005). No definitive analysis of range-wide genetic variability of prairie dogs is available, however, and no plans for preserving population- or area-specific genetic variation have emerged. Capturing prairie dogs from the nearest available source-colonies helps to preserve geographically distinct genetic combinations that might exist, and it is also easier and less expensive (Truett et al. 2001a).

Legal Constraints

Because prairie dogs have been regarded as pests for so long and because they and their fleas can transmit plague, many state and local regulations prohibit or discourage translocations (Mulhern and Knowles 1997; Truett et al. 2001a; Chapter 17). As noted above, the recent appearance of monkeypox among captive prairie dogs has precipitated more restrictions for translocations.

Removal Versus Sustainable Harvest

Prairie dog colonies scheduled for partial or total elimination can make good source-colonies—that is, removing individuals from such colonies can promote plans to reduce one colony and to restore another. Landowners who anticipate that all prairie dogs will be removed via livetrapping at source-colonies invariably will be disappointed, however.

Alternatively, wildlife managers and landowners sometimes might want to preserve source-colonies. To prevent overharvest and eventual extinction of valuable source-colonies, annual removal of prairie dogs should not exceed the population's maximal sustainable yield (MSY), which will vary with numerous factors (Chapter 10). Our experience suggests that removal of less than about 25% of adult (at least one year old) and juvenile residents in late summer does not jeopardize the source-colony's long-term survival.

How Should We Capture Prairie Dogs?

Methods for capturing prairie dogs for translocations include livetrapping, flooding the burrows, and vacuuming individuals from burrows (Truett et al. 2001a). Livetrapping probably is the most common method, but the other two methods are locally popular. Regardless of method, we recommend that capture take place only during summer and early fall to minimize mortality. Specifically, we recommend postponing capture until juveniles have been coming aboveground for at least six weeks (i.e., until late June or early July, for most colonies). Mortality among individuals captured too early (e.g., May or early June at most colonies) is high, especially for juveniles—probably because they are not yet fully weaned (Hoogland 1995; J. L. Dullum, personal communication, 2002). Further, we recommend cessation of capture by about October at most latitudes. Otherwise, freezing of the soil in late autumn and winter will impede the excavation of new burrows by translocated prairie dogs at recipient-sites.

Livetrapping

Wire mesh livetraps suitable for prairie dogs measure approximately 15 centimeters (cm) × 15 cm × 60 cm (6 inches [in] × 6 in × 24 in), and can be either single-door or double-door, collapsible or non-collapsible (see also Chapter 2). Collapsible livetraps require less space for transport, but are more prone to damage by domestic livestock. Commercial livetrap vendors include National (Tomahawk, Wisconsin), Tomahawk (Tomahawk, Wisconsin), Havahart (Lititz, Pennsylvania), and Tru-Catch (Fruitdale, South Dakota).

We place livetraps within 1–2 meters (3–7 feet) of burrow-entrances and bait them with mixed grain or whole oats. From our experience, we offer the following observations and suggestions for successful livetrapping (see also Hoogland 1995; Truett et al. 2001a):

- Efficiency of livetrapping varies directly with the density of prairie dogs and with the number of available livetraps.

- Individuals at colony-sites with little or low-quality forage enter livetraps more readily than individuals in areas with abundant, high-quality forage. Livetrapping prairie dogs during late spring and early summer, when green vegetation is most abundant, can be especially difficult.
- Prairie dogs that live in colonies where residents recently have been shot, poisoned, or otherwise harassed are more difficult to livetrap than those in undisturbed colonies (Chapter 10).
- Success improves when prairie dogs have an opportunity to acclimate to livetraps. For several days prior to setting for capture, we place closed livetraps, or livetraps that have been tied open, near burrow-entrances. Either way, we recommend spreading bait in and around the livetraps during the period of acclimation.
- Success of livetrapping increases with experience of the researcher. Recognition of burrow-entrances from which prairie dogs are likely to emerge, optimal spacing of livetraps, and techniques for baiting all improve with practice. Helpful hints include using level spots for placement of livetraps, so they will not move when a prairie dog enters; keeping livetraps in good working order, especially regarding the release mechanism; stringing a thin trail of bait from the burrow-entrance up to the livetrap, and then placing a small handful of bait on and behind the treadle.
- Success with livetrapping often increases to a peak within the first week, and then declines as susceptible individuals are removed. Only rarely do more than 25% of set livetraps capture prairie dogs.
- Overheating in sunny, hot weather is the most common cause of mortality during livetrapping, so frequent checking of livetraps—about every 30 minutes or so—is crucial when temperature exceeds about 21°C (70°F). Frequent checking is not as important during cooler weather (less than about 10°C [50°F]), unless prairie dogs in livetraps get wet from rain or snow—so that hypothermia might result. Hypothermic individuals usually revive quickly after drying under warm conditions (e.g., in a heated van).
- Checking of livetraps is easier—and the possibility of losing a prairie dog to overheating, for example, is therefore lower—if placement of livetraps is deliberate and methodical (in groups of five, for example), and in areas of high visibility.
- We prefer to remain at the colony-site and to carefully watch livetraps when they are open—so that we can act quickly if the weather suddenly changes, and so that we can intervene if American badgers or other predators try to harass captured prairie dogs.

Flooding Burrows

Some workers flush prairie dogs from burrows with water (Truett et al. 2001a). This method is most suitable when copious water from a hydrant or water truck is available. Flooding burrows might drown prairie dogs, however, and unweaned juveniles in spring are especially vulnerable (Dustin Long, unpublished data; see also Coffeen and Pedersen 1993).

Details of the flushing procedure vary among workers. Mark McKee (Bonham, Texas, personal communication, 2002) sends a burst of water into an occupied burrow-entrance for several seconds, then reduces the flow and reaches into the entrance with his hand to catch an emerging prairie dog. Lynda Watson of Lubbock, Texas, uses a similar method (Axtman 2002), but others use a noose to catch the emerging prairie dogs (e.g., see Coffeen and Pederson 1993). One of us (DL) catches 10–30 prairie dogs per hour via flushing.

Vacuuming Prairie Dogs from Burrows

Workers sometimes vacuum prairie dogs from burrows with a customized truck fitted with a flexible tube that inserts into burrow-entrances (Figure 13.1). Gay Balfour of a company called "Dog Gone" sometimes captures more than 100 individuals per day by this method. He pads walls of the truck's receiving chamber with thick foam to minimize injuries to prairie dogs as they are pulled through the tube and ejected against the chamber walls. While watching Balfour in action, one of us (JCT) observed a rate of mortality of about 5% (of about 100 captured), but another of us (DBS) observed a lower rate (22/1,263 = 1.7%). The vacuum method works better in warm weather than in cooler weather, presumably because subterranean prairie dogs remain closer to burrow-entrances in warm weather.

Care of Captured Prairie Dogs Before Translocation

When caring for captured prairie dogs before releasing them into recipient-sites, we have the following four major concerns.

Treatment for Fleas

Immediately after capturing prairie dogs, we treat them with a powder called Carbaryl (Rhone-Poulec, Research Triangle Park, North Carolina) to kill fleas, which transmit plague (Marinari and Williams 1998; Truett et al. 2001a;

Figure 13.1. Capturing prairie dogs with a vacuum truck. Walls of the truck's receiving chamber are padded with thick foam to deter injuries to prairie dogs as they are pulled through the tube and ejected against the chamber walls. Operators open rear door and climb inside for retrieval. Photo by Joe Truett.

Chapter 11). The prairie dogs can be dusted with Carbaryl while they are in livetraps or holding-cages, or by gently shaking them in bags containing Carbaryl.

Holding-Cages

Prairie dogs can be retained in livetraps for transport, but we usually transfer them to holding-cages so that we can immediately reuse the livetraps. Havahart rabbit hutches (60 cm × 60 cm × 45 cm [24 in × 24 in × 18 in]) work well as holding-cages. We are careful to protect prairie dogs in holding-cages from prolonged exposure to direct sunlight, precipitation, and either high (more than 21°C [70°F]) or low (less than 4°C [39°F]) temperatures. Via wire or chains, we suspend holding-cages 0.5–1.0 meters (2–3 feet) off the floor and separate them from adjacent cages by at least 60 cm (24 in). To facilitate cleaning of holding-cages and to deter infestation by fleas, we do not provide nesting material. We stock cages with a continuous supply of water and food (laboratory rodent chow, alfalfa pellets, or low-sodium cattle-cake). Instead of water, we sometimes offer carrots and lettuce.

Requirements for a holding-cage include a floor mesh with holes small enough (less than 1.3 cm × 2.0 cm [0.5 in × 1 in]) to prevent legs and feet from

as one year after all the prairie dogs have died (Chapter 11). Following infusion of vacated burrows with an insecticide-dust called Deltadust (Bayer Environmental Science, Montvale, New Jersey), however, one of us (DBS) has successfully reestablished prairie dogs within burrows where the occupants had succumbed to plague only several weeks previously.

Burrow-entrances at deserted colony-sites disappear over time, but wildlife managers sometimes can detect long-abandoned colony-sites by looking for surface anomalies such as low burrow-mounds, patches of distinctive vegetation, and collapsed burrows (Oakes 2000). Prairie dogs are good at locating and reopening old burrows, and for this reason even long-abandoned colony-sites often are suitable for reintroduction. Historical records and information from local long-time residents can offer good leads for locating former colony-sites (Oakes 2000). We caution, however, that previously inhabited colony-sites are sometimes unsuitable because of tall vegetation.

Prairie dogs also can thrive in sites that do not have evidence of previous occupancy. Biologists have developed criteria for identifying habitat suitable for prairie dogs from analyses of variables such as slope, type of soil, and type and height of vegetation (Truett et al. 2001a; Chapter 16). Prairie dogs generally select deep and well-drained soils of sandy-loam to loamy-clay texture, with slopes less than 10% (Koford 1958; Reading and Matchett 1997; Chapter 16). Soils that are difficult to penetrate with a powered auger probably will pose problems for translocated prairie dogs as well, so we search for a different recipient-site when we encounter ground that seems especially unyielding. Vegetation should be low enough (less than 15 cm [6 in] or so) so that prairie dogs can easily detect predators in all directions. The dominant perennial grasses at release-sites should be resilient to grazing, or they soon will disappear. Grazing-sensitive black grama, for example, disappeared within about three years at one site following colonization by prairie dogs (Joe Truett, unpublished data). Blue grama and buffalo grass, by contrast, are more suitable at release-sites because they are short and resist heavy grazing. Even with grazing-adapted species, however, reduction in vegetative cover invariably occurs over time at colony-sites (Chapter 5).

Preparation of Recipient-Site Before Releasing Prairie Dogs

Recipient-sites, each at least 1–2 hectares (2–5 acres), must have burrows either from previous occupancy by prairie dogs, or from man-made burrows excavated with a powered auger. In our research with the Turner Endangered Species Fund, most of our release-sites have not had burrows from previous occupancy. As explained below, we have discovered two tactics that dramatically improve the success of translocations into release-sites with no natural burrows: mowing tall vegetation, and use of acclimation-cages with man-made burrows. With these ploys, we have translocated more than 7,000 prairie dogs over the last seven years, and have established more than 100 new colonies.

Mowing Tall Vegetation

Recipient-sites are more suitable when all vegetation is shorter than 15 cm (6 in). When necessary, we therefore use a tractor-powered mower to cut vegetation for 50 meters (164 feet) beyond the outermost man-made burrow-entrances of all recipient-sites (Truett and Savage 1998). Via burning or heavy grazing by livestock (Cable and Timm 1988; Ford et al. 2002), vegetation at some recipient-sites is already sufficiently short.

Acclimation-Cages for Man-Made Burrows

To coerce translocated prairie dogs to remain at their new colony-sites, we use a method that involves acclimation-cages in combination with man-made burrows. Otherwise, most translocated prairie dogs would quickly disperse (Truett et al. 2001a). Each acclimation-cage consists of an underground nest-chamber and an aboveground retention-basket connected by flexible, corrugated plastic tubing with a diameter of 10 cm (4 in) (Figure 13.2). This construction allows movement of prairie dogs between the nest-chamber and retention-basket, but deters escape during the period of acclimation. We construct nest-chambers either as full-cylinders to be installed with a powered auger, or as half-cylinders to be installed with a backhoe (Figure 13.2).

The type of nest-chamber (full- or half-cylinder) for acclimation-cages depends on equipment available for installation and personal preference. Rates of abandonment and rates of predation by American badgers seem to depend more on depth, rather than type, of nest-chamber. We recommend a minimal depth of 1.2 meters (4 feet) for each nest-chamber.

Within the mowed areas of each recipient-site, we deploy the acclimation-cages 10–20 meters (33–66 feet) apart in grid fashion. In areas at high risk from plague, we infuse nest-chambers with Deltadust. If livestock are nearby, we repel them by installing a temporary battery-powered electric fence around the mowed recipient-site.

Note that we use acclimation-cages only in combination with man-made burrows. If burrows in good condition remain at a recipient-site from recent

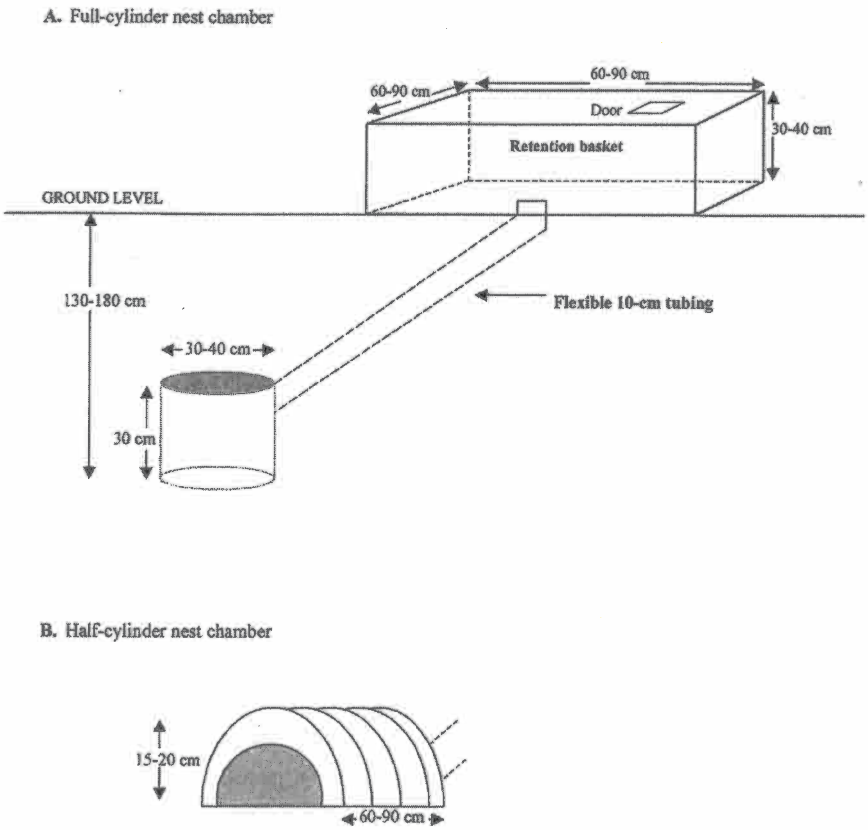

Figure 13.2. Acclimation-cage used to coerce translocated prairie dogs to remain at a recipient-site. Each acclimation-cage consists of an underground nest-chamber and an aboveground retention-basket, connected by flexible plastic tubing with a diameter of 10 cm (4 in). Materials for the construction of full- and half-cylinder nest boxes include non-perforated plastic tubing with a diameter of 10 cm (4 in), particle-board, and 1-cm × 1-cm (0.25-in × 0.25-in) hardware cloth. The retention-basket, used with both full- and half-cylinder nest-chambers, consists of 2.5-cm × 5.0-cm (1-in × 2-in) welded wire, and has a hinged access door in the top, and a 10-cm × 10-cm (4-in × 4-in) hole in the bottom for the plastic tubing. (A) The full-cylinder nest-chamber is installed with a powered auger and trencher. (B) The half-cylinder nest-chamber is installed with a backhoe. The half-cylinder nest-chamber usually takes less time to install than the full-cylinder nest-chamber, but disturbs more soil. Prairie dogs readily use both types of nest-chamber. Details for construction and installation are available from authors.

occupancy by prairie dogs, we do not use either underground nest-chambers or retention-baskets. Rather, we simply release translocated individuals directly into existing burrows.

We use a few simple procedures to deter flooding of nest-chambers during heavy rains. We do not install acclimation-cages in areas likely to collect surface runoff, for example. Further, the tubing that connects the nest-chamber to the surface is non-perforated, and we position the upper end of each tube so that it projects 15–20 cm (6–8 in) above the surface. Packing soil around the protruding end gives it the appearance of a natural burrow-entrance and burrow-mound.

Depending on the size of translocated prairie dogs, we put four to ten individuals inside each acclimation-cage. We provide food in retention-baskets as sodium-free cattle-cake, which eliminates the need for food dispensers. We provide water in large dispensers attached to the exteriors of retention-baskets (Figure 13.3). Water-rich foods such as carrots, cabbage, and lettuce are acceptable substitutes for water dispensers. About a week after introducing prairie dogs into acclimation-cages, we remove the retention-baskets and the electric fence.

How Many Individuals, and What Ratios of Adults to Juveniles and of Males to Females, Are Best for Translocations?

To initiate new colonies, we usually translocate 60–100 prairie dogs (see also Robinette et al. 1995; Dullum 2001). With a few notable exceptions, small translocated groups (fewer than ten prairie dogs) do not survive as well as larger groups.

Under natural conditions, juvenile prairie dogs do not disperse except under extraordinary circumstances (Hoogland 1995). Consequently, because dispersal of translocated prairie dogs away from release-sites can be problematic, biasing translocation groups in favor of juveniles might seem advantageous. Juvenile-biased groups have at least three disadvantages, however:

- Juveniles are less likely than adults to survive until the following year (Chapter 3).
- If they survive, juveniles are less likely than adults to mate and rear offspring in the following year (Chapter 3).
- Juveniles are less likely than adults to excavate new burrows. A translocated group of only juveniles (29 males and 31 females) in New Mexico dug only

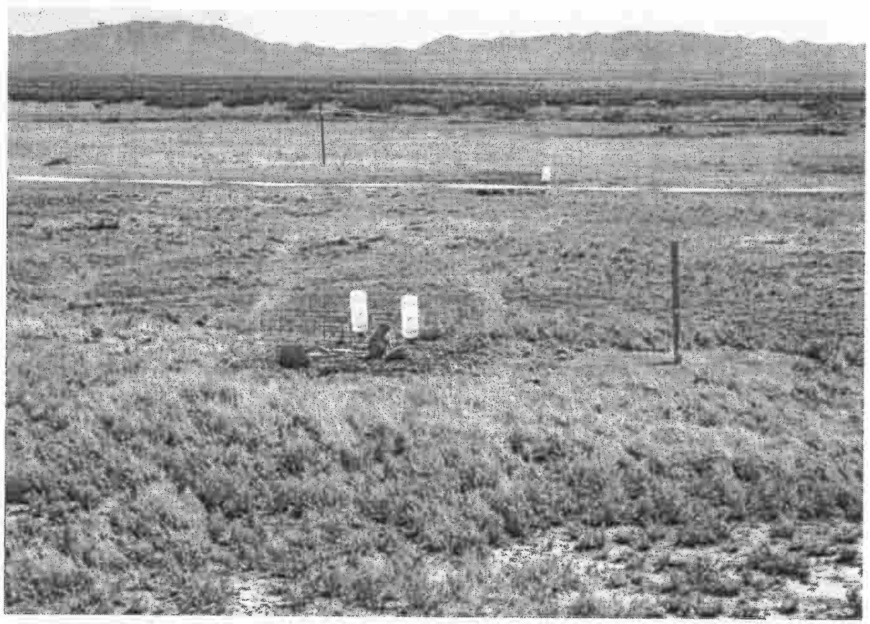

Figure 13.3. Prairie dog within retention-basket of acclimation-cage. We remove retention-baskets about one week after release of translocated prairie dogs into the recipient-site. Photo by Melissa Woolf.

two new deep (longer than 2 meters) burrows within the first three months, for example. At nearby release-sites, by contrast, several similar-sized translocation groups containing both adults and juveniles invariably excavated numerous deep burrows within three months.

Copying a tactic used in certain translocations of Utah prairie dogs (Coffeen and Pedersen 1993), we translocated 12 adult male black-tailed prairie dogs into two recipient-sites (6 males per site) in New Mexico in December 2000, with hopes that they would excavate burrows for use by mixed-sex groups released later. Over the next seven months the translocated males dug only two shallow (less than 2 meters long) burrows, both at the same recipient-site. After all 12 males had died or dispersed, we translocated groups containing adults and juveniles of both sexes into the same two sites (at least 12 individuals per site). Within 30 days after these latter translocations, more than 20 new burrow-entrances appeared at each site. With these somewhat anecdotal results, we abandoned the notion of using adult males as "advance diggers" at recipient-sites.

Under natural conditions, the ratio of adult females to adult males is usually about two to one, and the ratio of juvenile females to juvenile males is usually about one to one. Following the first emergences of juveniles from the natal burrows, the ratio of adults to juveniles varies greatly, but usually is slightly adult-biased (King 1955; Tileston and Lechleitner 1966; Halpin 1987; Garrett and Franklin 1988; Hoogland 1995). Previous investigators have translocated groups for which ages and sex ratios approximate those that usually occur under natural conditions (Lewis et al. 1979; Robinette et al. 1995; Dullum 2001). We recommend this strategy as well, but we recognize that the ability to vary ages and sexes within translocated groups depends in large part on the ages and sexes of the prairie dogs captured. For reasons regarding survivorship and excavation of new burrows, we recommend that the number of juveniles within translocated groups always should be less than the number of adults.

Are Translocations More Successful if Prairie Dogs Are Moved as Family Groups?

Social animals might survive better if translocated as family groups (Kleiman 1989; Ackers 1992). Because only members of the same coterie usually forage in the home territory (Hoogland 1995), some workers have attempted to keep families together for translocation by capturing prairie dogs from the same small area (Robinette et al. 1995; Dullum 2001; Truett et al. 2001a; Roe and Roe 2003, 2004). Our recent research suggests, however, that keeping coteries together has little influence on success of translocations.

Using the translocation methods described above, Kristy Bly-Honness et al. (2004) in South Dakota and Dustin Long (in preparation) in New Mexico have compared survival at two months post-release of same-family groups versus mixed-family groups. Each same-family unit in South Dakota contained prairie dogs livetrapped at one burrow-entrance, or at two entrances in close proximity, over several days. Each same-family unit in New Mexico was captured by Debra Shier (2004; Box to Chapter 13) after observations of marked individuals to determine composition of coteries. Mixed-family units in both states contained a random mix of several prairie dogs, livetrapped from distant locations at the same colony-site. Minimal survivorship (i.e., the maximal number of individuals observed over several visual counts) was almost identical two months after translocations for same-family versus mixed-family groups in New Mexico (Table 13.1). In South Dakota during the first two months post-release, mixed-family groups survived (nonsignificantly) better than same-family groups (Table 13.1). At 12 months after translocation, mixed-family groups in South Dakota had (nonsignificantly)

Table 13.1. Minimal percentage of prairie dogs still at the recipient-site two months after translocations at two locations for two types of social groups (Bly-Honness et al. 2004; D. Long, unpublished data). Minimal percentage equals maximal percentage observed over several visual censuses.

Location / *Social group*	*Number of release-sites*	*Minimal percentage (%) of translocated individuals still alive at two months after release (average and range)*
South Dakota		
Same-family	4	43 (31–68)
Mixed-family	6	54 (35–67)
New Mexico		
Same-family	3	44 (30–56)
Mixed-family	3	42 (30–52)

higher survivorship than same-family groups, and the ratios of juveniles to adults for mixed-family and same-family groups were almost identical (Table 13.2).

Our censuses at 2 and 12 months after translocations indicate that mixed-family groups survive and reproduce as well as same-family groups. For certain translocations in New Mexico, however, Debra Shier (2004; Box to Chapter 13) found that same-family groups survived and reproduced significantly better during the first year than did mixed-family groups. More research is necessary to determine why same-family groups sometimes survive and reproduce better than mixed-family groups. In the meantime, we will continue to translocate prairie dogs as mixed-family groups, because this method is easier and more economical.

Another key variable that might enhance translocations is time held in captivity prior to release. Our preliminary results indicate that mixed-family groups held together in captivity for at least 14 days during quarantine survive better after release than do mixed-family groups not held in extended captivity. More data are necessary to confirm or reject this provocative, unexpected trend.

Benefits of Short-Term Monitoring and Management

Post-release monitoring of translocated prairie dogs not only measures success of various strategies, but also allows early detection, and correction, of certain

Table 13.2. Adult survivorship and juvenile recruitment at 12 months after translocation for prairie dogs in South Dakota. Same-family groups were translocated as complete families (4–10 individuals per family); mixed-family groups contained prairie dogs from different families (4–10 individuals per group). The percentage of translocated individuals still alive after 12 months is the maximal percentage observed over several visual censuses. We estimated juvenile recruitment by dividing the number of juveniles at the recipient-site by the total number of both adults and juveniles at that site.

Translocations (July 2001)		*Minimum number alive 12 months later (July 2002)*			*Percentage (%) of translocated individuals still alive after 12 months*	*Percentage (%) of residents at release-site that were juveniles at 12 months after translocation*
Release sites	*Number released*	*Adults*	*Juveniles*	*Total*		
Same-family #1	69	49	29	78	71	37
Same-family #2	69	17	15	32	25	47
Same-family #3	71	17	26	43	24	60
AVERAGE	70	38	29	51	40	48
Mixed-family #1	71	26	21	47	37	45
Mixed-family #2	73	31	23	54	42	43
Mixed-family #3	67	43	46	89	64	52
AVERAGE	70	33	30	63	48	47

problems. We have used periodic visual censuses (Knowles 1986b; Severson and Plumb 1998) to assess survivorship and to look for evidence of predation.

During a typical visual census of prairie dogs, some individuals are obscured by vegetation or burrow-mounds, and others are underground (Chapter 6). Estimates of the "observability index"—that is, the percentage of resident prairie dogs that is visible to human observers—ranges from 55% (Severson and Plumb 1998) to 57% (Biggins et al. 1993) to 86% (Knowles 1986b). The average of these estimates is 66%. At about two months after translocation, we usually see about 40%–45% of the individuals that we released. After adjusting for the average "observability index," these numbers indicate that about 61%–68% of our translocated prairie dogs are still resident at their release-sites after two months.

Censuses at three months after translocation have been similar to censuses at two months, for three reasons. First, most escapes and subsequent dispersals usually occur during the first few days after prairie dogs are released into the acclimation-cages, or during the first few days after the removal of retention-baskets. Second, as noted below, translocated individuals sometimes seem disoriented after the removal of the retention-baskets, and thus are more susceptible to predation, but this confusion usually persists for only several days. Third, by the end of two months the prairie dogs usually have excavated many new burrow-entrances, and thus presumably are safer from predation. We usually do not continue monthly censuses beyond the third month, partly because the onset of colder weather reduces aboveground activity.

Our colonies started via translocations usually produce juveniles at rates approximating "normal" in the first year following establishment. Censuses in June 2002 at six South Dakota colonies established via translocation in summer 2001, for example, showed an average of 0.94 juveniles per adult (range = 0.59–1.53). This average compares favorably with the average of 0.72 juveniles per adult (range = 0.36–1.23) observed over 14 consecutive years at the Rankin Ridge colony at Wind Cave National Park in South Dakota (Hoogland 1995, Table 16.1; Chapter 3).

Some of our 100+ colonies initiated via translocation into previously unoccupied recipient-sites have fared poorly—usually because of dispersal or predation—and a few (less than 10%) eventually have failed completely. When initial translocations fail, the released prairie dogs usually survive/remain long enough to excavate new burrows and thereby improve the suitability of the recipient-site. Where such improvement occurs, we commonly translocate additional prairie dogs to recipient-sites with poor initial survivorship. Follow-up translocations are easier and less expensive than initial translocations because the underground nest-chambers are already in place. If enough new burrows excavated by the first translocated individuals are present, then the reattachment of retention-baskets is sometimes unnecessary for the second wave of translocated individuals. We do not perform follow-up translocations if we discover an unacceptable feature of the recipient-site (e.g., evidence of plague) that we did not detect before the first translocations.

In most cases the greatest threat to translocated prairie dogs is predation by enemies such as American badgers, coyotes, ferruginous hawks, golden eagles, and prairie rattlesnakes. Badgers and coyotes are especially troublesome. Badgers sometimes remove retention-baskets or rip open nest-chambers and kill the occupants, for example. Badgers usually do not, however, harass nest-chambers buried at least 1.2 meters (4 feet). Badgers also capture prairie dogs within newly excavated, shallow burrows.

Prairie dogs sometimes seem disoriented for the first few days following the removal of retention-baskets. When disturbed aboveground, they are slow to find entrances to nest-chambers, and consequently are highly susceptible to predation, especially by coyotes. This vulnerability lasts only several days, because the translocated prairie dogs soon learn the precise locations of burrow-entrances.

If successful, badgers and coyotes commonly return to recipient-sites. Over several days, mortality from returning predators can be heavy. If acceptable and legal, removal of returning enemies can reduce predation on translocated prairie dogs. The recommended open terrain at recipient-sites facilitates shooting of problematic badgers and coyotes. Flooding with water promotes the capture of badgers that have usurped prairie dog burrows.

Long-Term Management Following Translocation

The best defense against plague within colonies initiated by translocation is to select source-colonies and recipient-sites with no known history of this ruinous disease. If any sign of plague appears after translocations, then killing fleas via infusions of burrows with Deltadust might halt the disease and thereby save most translocated prairie dogs and their descendants (Seery et al. 2003; Hoogland et al. 2004; Chapter 11).

In addition to killing fleas that transmit plague, Deltadust also kills other arthropods within prairie dog burrows (e.g., other insects; arachnids such as mites, ticks, and spiders). Because of this negative side effect, we only recommend using Deltadust when the colony initiated by translocation is especially important (e.g., key focal colony; Chapter 16).

As noted above, predators—especially American badgers and coyotes—pose the greatest threat to colonies initiated by translocations. Predation is more likely when tall, dense vegetation grows within or near new recipient colony-sites. Without removal of such vegetation—via grazing by livestock and native ungulates, for example, or via human intervention such as repeated mowing—attempts to promote survival of translocated prairie dogs (e.g., by controlling predators, or by providing supplemental food) usually will be futile. Beyond the first year, translocated prairie dogs and their descendants usually survive and reproduce well without any additional intervention—except for infusions of burrows with Deltadust if plague erupts, or mowing if vegetation grows too tall.

Summary

- The best colonies for obtaining prairie dogs for translocation show no evidence of plague and are near the release-sites.

- Livetrapping is the most common method for capturing prairie dogs for translocation; other methods include flooding burrows with water and vacuuming individuals from burrows.
- Before translocation to a release-site, prairie dogs should be treated for fleas with Carbaryl, and then quarantined for at least 14 days to check for plague and other diseases.
- The best recipient-sites for reintroducing prairie dogs have intact burrows from recent occupancy by prairie dogs, and no history of plague.
- When no burrows from recent occupancy are available, preparation of recipient-sites before release of translocated prairie dogs involves excavation of burrows with a powered auger, mowing tall vegetation, and installation of acclimation-cages. Each acclimation-cage consists of an underground nest-chamber and an aboveground retention-basket, connected by nonperforated, flexible plastic tubing. This construction allows movement of prairie dogs between the nest-chamber and retention-basket, but deters escape during the period of acclimation. Retention-baskets are removed about one week after release.
- To initiate new colonies, we recommend translocations that involve 60–100 prairie dogs, for which ages and sexes approximate those under natural conditions (i.e., more adults than juveniles, and more adult females than adult males). We recognize, however, that the ability to vary ages and sexes within translocated groups depends in large part on the ages and sexes of the prairie dogs captured.
- Under some circumstances, prairie dogs translocated together as same-family groups survive and reproduce better than prairie dogs translocated as mixed-family groups. Often, however, mixed-family translocations seem to fare as well as same-family translocations, and the former are always easier and more economical. More research is necessary to better understand the possible importance of keeping families together for translocations.
- Post-release monitoring of translocated prairie dogs measures success of various strategies, and allows early detection, and correction, of certain problems. We use periodic visual censuses after translocations to assess survivorship and to look for evidence of predation.
- American badgers and coyotes pose the greatest threat to colonies initiated by translocation. Predation is most intense in the first two months or so, when the prairie dogs are acclimating to their new colony-site and excavating new burrows. If they endure the first two months, translocated prairie dogs and their descendants usually survive and reproduce well without any additional intervention from wildlife managers—except for infusions of

burrows with Deltadust if plague erupts, or mowing if vegetation grows too tall.

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