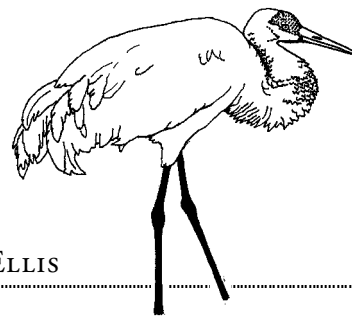


Special Techniques, Part D: Reintroduction Techniques

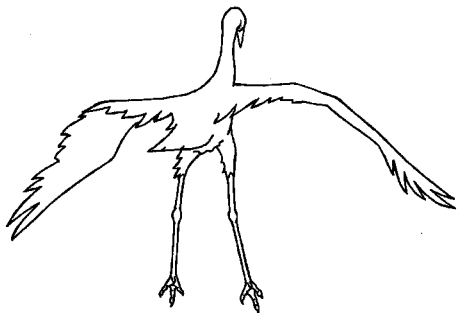


MEENAKSHI NAGENDRAN, RICHARD P. URBANEK AND DAVID H. ELLIS

The reintroduction of animals to augment remnant populations or establish new populations is sometimes essential to the preservation of threatened or endangered species. Release stock may be translocated (wild) adults or young, animals reared in captivity, or eggs from wild or captive flocks. Reintroduction techniques for fledged cranes were described by Konrad (1976), Derrickson and Carpenter (1983), Horwich (1986, 1989), Bizeau et al. (1987), Ellis et al. (1992a), Urbanek and Bookhout (1992), and Horwich et al. (1993). The only sizable use of eggs to start a wild crane population involved placing Whooping Crane eggs in Sandhill Crane nests at Grays Lake National Wildlife Refuge (NWR) (Drewien et al. 1989 unpubl).

Captive-reared cranes must be conditioned for survival in the wild. Herein, we discuss variations of **two basic rearing methods** that have been used to rear cranes in captivity for reintroduction. In **parent-rearing**, or surrogate parent-rearing, an egg or chick is placed in a pen with a pair of cranes. **Hand-rearing** involves either costumed humans aided by mounted crane heads or puppets, crane vocalizations, and other imprinting aids, or uncostumed humans using some imprinting aids.

Husbandry aspects of both hand-rearing and parent-rearing are detailed in Chapter 5. Adaptations of these techniques to rear birds for release are discussed here. A summary of previous release attempts is tabulated in Table 11D.1.



Release Methods

Abrupt Releases

Release of captive-reared cranes without acclimating them to the release site (herein termed abrupt releases; Table 11D.1) has consistently resulted in high mortality. The first release of sizable numbers of captive-reared cranes occurred in 1971, when 14 hand-reared Florida Sandhill Cranes were released in south-central Florida without acclimation (Nesbitt 1979). None of the 14 integrated into the wild flock, and within a few months all had died of exposure, starvation, or accident. A single parent-reared crane released in northern Florida, however, survived 3 years. Following the experiment with hand-reared cranes in Florida, abrupt releases of parent-reared Greater Sandhill Cranes were attempted at Grays Lake NWR in 1976 (n=1) and 1980 (n=11) (Drewien et al. 1982). Of seven young that survived to migrate south in 1980, none reappeared at Grays Lake the following spring. In 1984, 21 Greater Sandhill Cranes were released at Grays Lake after being held in a small pen on site for 4-6 days; only 9 (43%) survived to migrate (Bizeau et al. 1987).

Gentle Releases

In a gentle release, the cranes are held at the release site for two or more weeks, fed at the release site following release, and allowed to slowly acclimate to the release environment. Since 1981, more than a dozen gentle releases have been made using parent-reared cranes from Patuxent. In a nonmigratory situation, 15 of 27 (56%) Florida Sandhill Cranes survived their first winter (Nesbitt 1988). Annual survival rates around 70% have been achieved in Patuxent's extensive release program with Mississippi Sandhill Cranes (Ellis et al. 1992a).

TABLE 11D.1

A comparison of survival of captive-reared Sandhill Cranes after release to the wild.

REARING		RELEASE				SURVIVAL ¹		REFERENCE
METHOD ²	LOCATION	NO. ³	LOCATION	YEAR	METHOD ⁴	NO.	%	
Parent	Patuxent	12 ⁵	Idaho	1976, 1980	Abrupt	1	8	Drewien et al. 1982
Parent	Patuxent	1	Florida	1976	Abrupt	1	100	Nesbitt 1979
Parent	Patuxent	21 ⁶	Idaho	1984	Abrupt	4	19	Bizeau et al. 1987
Parent	Patuxent	27 ⁷	Florida	1986, 1987	Gentle	15	56	Nesbitt 1988
Parent	Patuxent	10	Florida	1991	Gentle	3	30	Nesbitt ⁸
Parent	Patuxent	103 ⁹	Mississippi	1980-1993	Gentle	69	67	Ellis et al. 1992a
Hand	Patuxent	17 ¹⁰	Florida	1971-1977	Abrupt	0	0	Nesbitt 1979
Hand-isolation	On site	1	Oregon	n.d. ¹¹	Acclimation	1	100	Hyde 1968:165-168
Hand-isolation	On site	17	British Columbia	1981	Acclimation	7-9	41	Leach 1987
Hand-isolation	On site	1	Michigan	1981	Acclimation	1	100	Isham ¹²
Hand-isolation	Release Site	2	Wisconsin	1982	Gentle or Acclimation	1	50	Archibald and Archibald 1993
Costume	ICF or On site	5	Wisconsin	1985	Gentle	4	80	Horwich 1989
Costume	On site	7	Texas	1988	Gentle or Acclimation	2	29	Nagendran 1992a
Costume	On site	16	Michigan	1988	Acclimation	15	94	Urbaneck and Bookhout 1992
Costume	Patuxent	28	Mississippi	1989-1991	Gentle	26	93	Ellis et al. 1992a
Costume	On site	12	Michigan	1989	Acclimation	9	75	Urbaneck and Bookhout 1992
Costume	On site	9	Michigan	1990	Acclimation	8	89	Urbaneck and Bookhout 1992

¹ Survival is credited if alive and free after migrating south (British Columbia, Oregon, Idaho) or after one year (all other studies).

² Hand refers to conventional hand-rearing with little effort to control exposure to humans. Hand-isolation refers to controlled exposure to humans, but no use of a costume and some exposure to puppets or other crane imprinting birds or models. Costume refers to rearing by costumed caretakers with puppets, tape recorded brood calls, live crane imprinting models, etc.

³ All cranes released were juveniles (less than 1 year old) except as indicated in footnotes.

⁴ Abrupt releases involve rearing elsewhere and releasing the birds less than two weeks after arrival at the release site. Gentle releases involve rearing at a propagation site, but holding the birds at the release site two or more weeks and providing food for them after release. Acclimated releases involve rearing colts all, or in part, at the release site.

⁵ One yearling released abruptly in August 1976; five yearlings, two 2-year-olds, and four 3-year-olds released abruptly 18 June 1980.

⁶ Nineteen yearlings and two 2-year-olds held on site in small, roofed pen for 4-6 days before release, 19 June to 3 July 1984.

⁷ Eleven juveniles and 4 yearlings released 4 April 1986 and 12 juveniles released 2 January 1987 after being brailed and held for 4-6 weeks in large, open release pen.

⁸ Shipped to Gainesville February 1991. Held there until 28 October when moved to release pen at Three Lakes Wildlife Management Area. Brails removed 25 November 1991 (S. A. Nesbitt, Florida Game and Fresh Water Fish Commission, Gainesville, Florida, personal communication).⁹

⁹ Included one yearling released winter 1980-1981.

¹⁰ In addition to the 14 juveniles released in 1971, 3 older cranes (some as old as 4 years) were released 1974-1977.

¹¹ Probably 1950's. Hyde does not give a date.

¹² M. Isham, Bellevue, Michigan, personal communication.

Captive Rearing by Crane Pairs

Chicks reared by their own parents, or by surrogates of the same species, show proper sexual imprinting. Parent-reared cranes learn some foraging skills from their parents. If their parents are shy, the chicks are also naturally wary of humans and do not need human avoidance conditioning during rearing. Because some pairs of captive cranes prove unsuitable for both incubating eggs and rearing chicks, approximately two pairs are needed for each endangered chick.

Parent-reared chicks are formed into cohorts within a few days of fledging. This socialization process is best done in large flight netted pens (15- to 30-m long). After 4-6 weeks in these pens, colts are moved to their release site. Release pens are unnetted and usually at least a hectare in size so the cranes remain wing brailed during the month-long acclimation period. This lengthy process has been very successful in nonmigratory situations, but is too protracted to be used with migratory birds.

Two-thirds (41 of 66) of the parent-reared birds released at the Mississippi Sandhill Crane NWR from 1981 through 1989 survived for at least one year (McMillen et al. 1987; Zwank and Wilson 1987; Ellis et al. 1992a). All Mississippi birds surviving more than a few months have successfully integrated into the wild flock. Parent-reared cranes have bred after release with conspecific wild cranes and raised chicks successfully (Zwank and Wilson 1987; Ellis et al. 1992a).

Rearing by Wild and Tame Crane Parents

In Hokkaido, Japan, flightless male Red-crowned Cranes have lured wild females into their enclosures (Konrad 1976). The resulting pairs produced chicks that fledged into the wild flock. Occasionally, captive Sandhill Cranes have lured in wild mates (Hyde 1957; G. W. Archibald, ICF, personal communication).

A variation of this technique was tried twice with cross-fostered Whooping Cranes at Grays Lake (Drewien et al. 1989 unpubl.). Because adult male Whooping Cranes in this experimental flock failed to return to the marsh with female mates, several attempts were made to capture and translocate adult females that had dispersed in the surrounding states. When these attempts failed to produce viable pairs,

two hand-reared females (one each in 1981 and 1989) were sent from Patuxent and introduced to the adult males. Both females were courted and while it appeared that bonds were forming, neither attempt resulted in eggs or in pairs that migrated together (Derrickson and Carpenter 1983; Drewien et al. 1989 unpubl.).

Another variation of pairing captive-reared and wild cranes occurred in northern China: White-naped and Red-crowned Crane chicks were hand-reared and gently released in the marshes at Zhalong (Jie et al. 1989 unpubl.). The birds were then returned to captivity to prevent their loss in the coming winter. In subsequent years, these semi-domestic birds paired with each other or with wild mates and nested in the marshes near their natal area. Young were generally kept in captivity with their parents the first winter. These birds joined the wild birds during the following year. Offspring resulting from these tame-wild matings were reportedly much more tolerant of human approach and consequently better able to live in a human-dominated environment.

A similar experiment is being conducted with Red-crowned and White-naped Cranes at the Khinganski Nature Reserve in northeastern Russia (Y. Andronov, Arkhara 676740, Amurkaja Region, Russia, personal communication). The purpose of this experiment is to modify the behavior of the wild population to make them more tolerant of the rapidly increasing human population. Suitable nesting and rearing habitat is still available, but the wild populations are avoiding areas with human activity. To date, semi-wild birds from captivity have successfully attracted wild mates, and wild pairs are also increasing their usage of disturbed areas in response to the presence of semi-wild birds.

Release of Cross-fostered Cranes

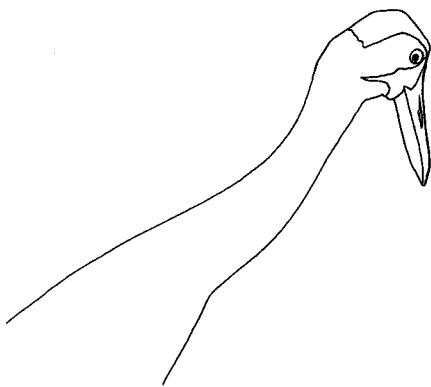
Between 1975 and 1988, an experiment was conducted to create a migratory flock of Whooping Cranes at Grays Lake NWR. Sandhill Crane eggs were exchanged for Whooping Crane eggs (289) from Patuxent and Wood Buffalo National Park in Canada. Because of high mortality and because none of these cross-fostered Whooping Cranes (reared by Sandhill Cranes) paired and bred successfully, the experiment was discontinued.

Advantages of this technique are that chicks reared by wild cranes are imprinted on cranes, fear humans, and display near normal crane behavior. Likewise, these chicks learn survival skills from their parents.

The primary disadvantage is that cross-fostered young appear to be sexually imprinted on their foster species. A cross-fostering study conducted in Japan (Nakayama 1970) and a more recent pilot study at ICF (Mahan and Simmers 1992) indicate that cross-fostered chicks prefer their cross-fostered parent species socially and sexually. Although cross-fostered young have been bred through intensive management in captivity, this appears to be impractical in the wild.

Hand-rearing by Uncostumed Humans

Hand-rearing is a more efficient way to rear large numbers of crane chicks for captivity (see Chapter 5). Survival rates are generally high for hand-rearing because disease can be more closely managed than for parent-rearing. Hand-reared chicks are usually more comfortable in captivity and will breed well. Conventional hand-rearing has not, however, proven successful for reintroduction purposes. Crane chicks reared in close contact with humans lack fear of humans, some prefer humans to cranes when under stress, and they adapt poorly in the wild (Nesbitt 1979; Table 11D.1). A modification of human-contact hand-rearing can be called **screen-rearing**. In this method the chicks are fed by humans who hide behind a screen so as to not be visible to the chick. However, the chicks have frequent exposure to humans during weighing, pen cleaning, and when medication is administered. Although these chicks are somewhat more wary of humans than chicks reared without the screen, they should probably not be considered release candidates. Like conventional hand-rearing, screen-rearing is suitable for birds to be retained in captivity.



Hand-rearing with Costumes

Advantages and Disadvantages

Using costume-rearing, it is possible to hand rear a crane chick yet imprint it on its own species. This technique increases the number of young cranes available for release each season, whereas with parent-rearing, each pair of cranes can only successfully rear one or rarely two young each season. Furthermore, costume-rearing can be accomplished at the release site thus promoting imprinting of chicks on their natal area, a process that is probably essential for migratory flocks.

Costume-reared cranes have experienced high post-release survival both in migratory and nonmigratory situations (Horwich 1986, 1989; Ellis et al. 1992a; Urbanek and Bookhout 1992; Archibald and Archibald 1993; Horwich et al. 1993; Table 11D.1). Early in the development of this rearing and release method, some of the cranes required assistance (they were moved to staging areas) to initiate proper migration. This problem was important when the cohort size was large, but by reducing the release cohort size to 4-5 birds, this problem has been solved. Overall, more than 80% of costume-reared cranes that were released using the gentle release technique successfully migrated and returned to the general release area. In a nonmigratory situation, costume-reared Mississippi Sandhill Cranes have experienced ca 90% survival to one year.

Costume-rearing requires a greater time investment than standard hand-rearing. Routine chores proceed more slowly and in less comfort. Exercising chicks while in costume demands more caution. The discomfort of the costume increases on hot summer days. The caretaker must also exercise greater care when tending chicks because the costume restricts vision.

Techniques

In the costume-rearing technique, the caretakers dress in an amorphous, **hooded costume**. The main purpose of the costume (Fig. 11D.1) is to conceal the human form so the chick will not become habituated to humans and seek human company after release. The costume covers a person from head to knee. The hood hides the human face behind a mask of cheese cloth, nylon window screen, or dark camouflage netting.



FIG. 11D.1. *Costumed caretaker with Siberian Crane chicks, northwestern Siberia, 1991.* PHOTO DAVID H. ELLIS

Hands are hidden within the arm pieces of the costume. The color of the costume should be the color of the adult crane. Horwich (1986) attached crane feathers to the arm pieces, although in later studies no feathers were used.

Although the crane costume bears little resemblance to a crane, the **crane puppet head**, which is manipulated by hand, should be realistic (Fig. 5.8). The puppet head and neck can be made from soft cloth (e.g., terry cloth or “fake fur”). Glass or plastic eyes can be obtained from a taxidermy supply house or craft store. Metal or wooden mandibles glued to a spring-loaded clothespin or a scissor base form a functional beak (Fig. 11D.2). The costumed parent feeds chicks insects as would an adult crane. The puppet can also be used to dig up worms, roots, and tubers. Alternately, **taxidermic crane heads** (Fig. 11D.3) or cast plastic heads may be used. These heads are more realistic and may help with imprinting cues. Because we have never made the beak on these heads to open and close, food items must be pierced, scooped up, or otherwise secured to the bill and offered to the chick. Chicks are very interactive with the head, be it puppet, mount, or casting.

Because parents brood call to their eggs during incubation, to promote imprinting, we play tape-recorded vocalizations of conspecific cranes to each egg for 5-15 min periods about 4 times per day beginning around 3 weeks, but at least as soon as the chick breaks into the air cell (ca day 27 of incubation). During the latter part of incubation, the brood call stimulates chick vocalization and movement, and may



FIG. 11D.2. *Rob Horwich, who developed costume rearing as an operational technique, demonstrates the puppet head. Advantages of this design are the ability to grasp with the bill and to wash the terry cloth cape.* PHOTO DAVID H. ELLIS



FIG. 11D.3. *Taxidermic heads made from Sandhill Cranes. The upper head is cast in plastic and will be fitted with a “fake fur” covering. The lower head has been altered (i.e., facial stripe area plucked and dyed, and elsewhere gray feathers have been bleached with human hair dye [Ellis and Ellis 1975]) to resemble a Whooping Crane.* PHOTO DAVID H. ELLIS

encourage the chick through the hatching process. The costumed parent can also use a portable audio tape recorder (suspended beneath the costume) to simulate the crane brood call. At Patuxent, the costumed caretaker vocally mimics the cranes' brood call so the tape recorders are used only before hatching.

The tape recorder can be used to produce not only the easily imitated Brood-call, but also Unison-calls, Guard-calls, and Alarm-calls for use in each appropriate context. For example, an Alarm-call can be played when a raptor flies overhead or when a chick is "attacked" by a non-costumed human. By far the most important call for rearing purposes is the Brood-call. Crane parents Brood-call to the eggs, and once the chick hatches its response to this call is remarkable. The Brood-call encourages the chick to approach its parent or the costumed human and feed, drink, or follow as indicated by the behavior of the parent.

Hand-rearing, especially costume-rearing, requires strict adherence to a rearing protocol. When the chicks hatch, the costumed parent feeds them with the puppet and teaches them how to feed on prepared food from a bowl. Teaching them to feed normally requires 10 to 15 min hourly for the first 3 to 5 days, but sessions may require up to 30 min and may continue for 2 weeks before the chicks are feeding independently.

Exposing chicks to an adult, conspecific crane used as an imprinting model promotes proper sexual imprinting (see Chapter 5) and may teach other behavior patterns. Imprinting probably involves several stages in cranes. The presence of a conspecific, live adult during these critical times increases the chances of proper imprinting. When possible, we also provide a taxidermic crane in brooding posture to each chick at hatching. The brooder model can contain a heat pad or be positioned beneath the heat lamp to provide warmth (Fig. 11D.4).

Because the chick's interactions with its live imprinting model are limited by the barrier, it may be important for chicks to interact with other members of their release cohort. Exercising chicks together from an early age under careful supervision may reinforce imprinting on their own species and it does allow formation of a release cohort in time for migration. In migratory situations, we also recommend that release cohorts contain no more than 2-5 birds (Urbanek and Bookhout 1992). Release cohorts larger than 5 colts are less prone to integrate into the wild flock. Cohorts can exceed 15 colts in nonmigratory situations.



FIG. 11D.4. *Taxidermic brooder model with heat lamp overhead used for costume rearing Mississippi Sandhill Cranes.*

PHOTO DAVID H. ELLIS

To make good release candidates, hand-reared chicks must fear and avoid humans. Chicks reared for release should be handled as little as possible. Handling is a uniquely human-like rather than crane-like activity, and excessive handling, especially of older chicks, may result in a bird that is less wary of humans. As a chick grows older, the necessity for handling decreases, and handling becomes an increasingly stressful experience.

Because the costume impairs vision, chicks must be handled with extreme caution and in a well-illuminated area. Routine health checks such as daily general physical examination, including eyes, nares, vent, weights, and preventive medication, should be done in costume, but health checks involving more negative experiences, such as drawing blood, should be done without a costume. At Patuxent, chicks are sometimes hooded during physical examination so that costumed caretakers or veterinarians may remove their own hoods and perform the examination without visual obstruction.

Chicks instinctively feed on insects and other small moving organisms soon after hatching. By 2 months of age, they also probe and feed on roots and tubers. Using the costume and head to introduce them to foods naturally occurring in the wild should help them find natural foods after release. If more than 5 young chicks (<6 weeks old) are taken afield at any given time, a second costumed parent will be necessary to prevent aggression related injuries. Most cranes adapt well to new food crops. Corn and sorghum can

be added to the pelleted diet when the chick is about 2 months old. Chicks trained to eat food grains and other foods found in their environment may adapt more quickly to release conditions.

Daily cleaning and feeding chores should be done in costume and in silence unless the rearing facility allows for chicks to be locked outside. If adequate costumed parents are available to lead and walk the chicks away from the facility, indoor chores may also be performed without a costume. Cleaning activities go much faster without a costume.

Human and predator avoidance conditioning is used to teach costume-reared chicks to develop an aversion to humans and mammalian predators. At ICF, chicks are at least 45 days old before they are subjected to their first "mock" attack by non-costumed humans. Younger chicks might injure themselves during such an "attack." Under field rearing conditions (i.e., where chicks are reared and released in the same remote area), it may be advisable to wait until the chicks can fly before they are intentionally frightened. Flighted chicks fly away after being frightened, but return a short time later to search for the costumed parent. Prefledged chicks, however, run and hide where the costumed parents might not be able to readily find and protect them.

At Patuxent, chicks are subjected to human avoidance conditioning beginning at about 20 days of age. Chicks and imprinting model adults are locked outdoors while an uncostumed human runs through the alley next to the chick pens and produces loud noises (e.g., raking a stick along the chain link pen wall, banging pots, and yelling). A hidden human simultaneously plays a tape recording of a crane Guard-call. Imprinting models (adults) often Guard-call. Chicks that show little or no reaction are physically jostled, then released.

This training is scheduled at 2-week intervals, but only certain "non-wary" chicks are repeatedly exposed. After the chicks are pooled in flight pens, mock attacks are staged wherein one or two humans chase after the chicks in their pen. Attack bouts cease after all chicks are wary.

Crane chicks sometimes appear to be instinctively wary of avian predators, but it may be helpful to use tape recorded adult Guard- (or Alarm-) Calls to instill or reinforce this fear. Under some conditions, it may be advisable to teach a fear of canids by using a trained dog to chase fledged birds. After release, young cranes quickly learn from wild cranes to avoid predators.

Facilities

For costume-rearing, the rearing site must be temporally or geographically isolated from human activity. Rearing crane chicks under **field conditions** near their future release site may help imprint the chicks on their natal area and enables the chicks to learn foraging and survival skills. Males tend to be more philopatric than females, returning to their natal area after the first winter (Drewien et al. 1989 unpubl.). If frequent contact is maintained with the release birds, the costumed human can approach the birds several months after integration into the wild and can readily recapture cranes if it is necessary to transfer them to another area, to replace a transmitter, or for some other purpose.

Cranes raised at the release site are returned to predator-proof pens at night. Solar powered electric fences can be used, and the constant presence of the costumed parent also provides good protection. Cranes reared in the field have demonstrated high survival rates after release into a migratory situation (Archibald and Archibald 1993; Urbanek and Bookhout 1992; Table 11D.1). With care, high chick survival rates can be achieved even in a wilderness environment.

In the absence of parents to brood chicks, shelters must protect chicks from predators and inclement weather. Urbanek (1990 unpubl.) described an economical design for a costume-rearing facility in the field (Fig. 11D.5). Heat lamps provide heat for chicks until they are feathered (see Chapter 5). Hot water bottles can be used in locations lacking power supply (Nagendran 1991 unpubl., 1992b unpubl.).



FIG. 11D.5. *The costume rearing facility at Seney National Wildlife Refuge, Michigan.*

PHOTO RICHARD P. URBANEK

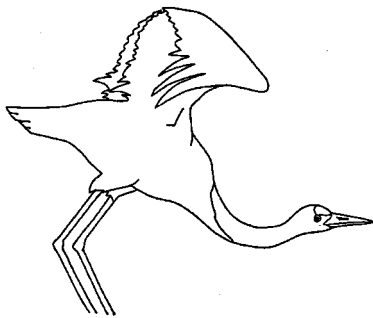
Release Procedures

Cohort Formation

When costume-reared birds are not reared at the release site and are introduced in a nonmigratory situation as in Patuxent's program for the Mississippi Sandhill Crane NWR, the chicks are kept at the chick rearing facility until they are 55-60 days old. Temporary juvenile cohorts are then formed in netted community pens. Slower maturing cranes may require 70-100 days before being formed into release cohorts. Once formed, each cohort should be penned adjacent to a small group of parent-reared (i.e., wild-acting), conspecific, adult "socialization models" to encourage fear and avoidance of humans.

Parent-reared chicks remain with their foster parents somewhat longer. If the parent-rearing pens are without nets, the flight capability of parent-reared chicks should be closely monitored after about 55 days. When capable of flight, the chicks should be brailed (Ellis and Dein 1991; see Chapter 11E) until about 140 days of age. When the colts are removed from their foster parent's pen, they are assigned to a release cohort, and released in a flight netted community pen.

When costume-reared chicks will be released into a migratory flock, cohort members may be assigned early in rearing, and reared together. By contrast, at Seney NWR, where the entire rearing and release process takes place on site, the cohorts are intentionally broken up and rearranged at the time of release to decrease familiarity among cohort members and to encourage association with wild birds. When rearing is carried out at an established rearing center, but where chicks must migrate, they are moved to the release area two or more weeks prior to migration to promote imprinting on the release site. These chicks are not brailed.



Release Site Selections

When chicks are ready for release to the wild they are moved to a release pen. The release pens at Mississippi Sandhill Crane NWR are 1.2 to 2.0 ha in size with a fence 2.4 m in height. Fences are buried 0.3 m below ground and an electrical wire placed near the top to safeguard against predators. Feeders provide supplemental food within the pens. Natural foraging habitat in the immediate area further encourages the wild cranes to remain in the release area and encourages the chicks to feed on natural foods during release. Release birds typically learn wariness of predators from wild cranes. Providing a pool in the release pen encourages the chicks to roost in water and reduces their risk of predation. When possible, roosting and foraging habitat should be provided within the release pen. Cranes need to remain protected in the pen until they acclimate to the area, associate with wild cranes, and establish site tenacity.

Whenever possible, the release site should be in an area occupied by wild cranes. Survival of released chicks improves when they feed and roost with wild cranes. In a migratory situation, the released chicks must learn the migration route through their association with these wild birds. Baiting wild cranes into the release area will encourage mingling. When the objective is to augment or establish a migratory population, studies so far suggest that release should occur on the northern breeding grounds (Urbanek and Bookhout 1992; Horwich et al. 1993) rather than on the wintering grounds (Nagendran 1992a).

Pre-release Procedures

Birds should be transported during cool weather and as quickly and efficiently as possible. We use ventilated boxes with a floor covered with wood shavings underlaid with carpet to absorb wastes and prevent slipping. To transport a Sandhill Crane, we use a box 60 x 90 cm and 120 cm high. Box size should be adjusted for each species. The chick should be able to turn around and stand upright. Commercial airline carriers may require boxes constructed of wood, but cardboard wardrobe boxes are excellent.

Before release, chicks should be **color-banded** and may be equipped with **radio transmitters** (Fig. 11D.6). Radio transmitters less than 50 g can be mounted on leg bands and fitted above the hock. Those greater than 60 g are mounted as a backpack. A good material for the backpack harness is Teflon ribbon (Ellis et al.



FIG. 11D.6. *Radio transmitter on leg band.*

PHOTO STEPHEN A. NESBITT

1992b; Olsen et al. 1992). Plastic color bands should be placed above the hock (Fig. 2.11) and can range from 1.9-7.5 cm in height. A monel or aluminum band may be placed above the hock or just above the foot.

Release Techniques

Nonmigratory cranes at the Mississippi Sandhill Crane NWR are brailed on one wing (Ellis and Dein 1991) for 4 weeks. Within a few days of removing the brails, the cranes begin to fly in and out of their pen. Chicks normally roost in the pen every evening for the first 10 days. This practice decreases their risk of predation. Within 2-4 months, the released cranes wear themselves from the food provided in the release pens.

Migratory cranes must be ready to leave a few weeks after fledging. Brailing, which sometimes results in temporary wrist stiffness and a degree of flight impairment, should not be used for migrants. At Seney NWR and in Siberia, we trained our chicks to return to a scarecrow-like costumed dummy (Fig. 11D.7). The costumed dummy was then used to introduce our chicks to wild cranes. At Seney, wild cranes, previously baited into the pen, quickly acclimated to the costumed dummy, and the dummy attracted the release cranes to the pen until they began following, feeding with, and roosting with wild birds outside the pen, after which time the dummy was removed. Providing corn, an important food of migrating cranes, attracts large numbers of wild cranes into the pen, facilitating integration into the wild. Because Seney cranes have been reared on-site, they adapt quickly to wild conditions and integrate with wild birds within a few weeks of release.

During 1988-90, 38 Sandhill Crane chicks were reared and released on Seney NWR. All survived the 18 to 60 days intervening between release and departure on their first migration (Urbanek and Bookhout 1992). The major problem at Seney NWR appears when too many costume-reared chicks are released in one area with too few wild cranes. Chicks in a release cohort prefer to remain in the company of each other after release. They create their own flock identity and are less likely to follow wild birds. This problem can be solved by dividing the release cohort into groups of no more than four or five birds and then releasing each group at a different site. Ideally, a release pen should be available at each site. However, success is possible by first releasing all the subgroups in a single pen and then translocating the small subgroups to other sites after these birds have completed their acclimation to wild conditions. This procedure was used to induce all members of a cohort of nine Sandhill Crane chicks to begin migration correctly from Seney NWR in 1990 (Urbanek and Bookhout 1992). Through the years, a few birds failed to leave the release areas in Wisconsin and Michigan with the wild cranes. These birds were retrieved by the costumed parent, boxed, and transported to another crane stopover area for re-release (Urbanek and Bookhout 1992).

For releases that must occur in the subarctic, the earliest captive-produced eggs of the season should be used. The chicks that result will be older than the wild chicks, so the released chicks have an extra week or two to integrate with wild cranes before departure.



FIG. 11D.7. *A scarecrow-like costumed dummy is used to lure costume-reared chicks (here a Sandhill Crane) into a feeding area where they may be recaptured or encouraged to mix with wild cranes, Seney National Wildlife Refuge, Michigan.*

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