

The Biology and Husbandry of Tanagers in Captivity

by

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The Swamp

Tanagers are beautiful, colorful birds that are not well known either in the wild or in captivity. Taxonomically, the 242 species of tanagers, honeycreepers, dacnis, and others, comprising approximately 58 genera, are placed in the subfamily Thraupinae of the large family Emberizidae (buntings, sparrows, and finches). They are distributed primarily throughout tropical Central and South America. Generally small-bodied and quite vocal, tanagers inhabit forests or shrubby habitats, ranging from lowland to montane. They are truly the jewels of the canopy, often living in mixed-species flocks of various-colored birds. Some species are sexually dimorphic, whereas in many the males and females appear the same. They exhibit variation in bill shape and leg musculature associated with their different feeding habits — insectivorous, frugivorous, or nectivorous.

The status of birds in the wild can be evaluated by an overview of rare, threatened, or endangered species. Three species of tanagers and their allies were included in these categories in the International Council for Bird Preservation's (ICBP) 1997 Red List Book. That number has since changed. The latest list of threatened bird species, found in the Birds To Watch 2 (Collar et al. 1994), now includes 20 species of tanagers from 13 genera. Species at risk often have restricted distribution or use very limited habitats; 30 genera within this group show these patterns. It is likely then that additional species may be added to the lists of threatened birds.

Other realities of modern conservation are the sometimes extreme differences in philosophy, conservation ethic, and economic resources between countries. Therefore, another factor potentially affecting survival of species is whether they are found in only one country, or whether their distribution crosses political boundaries.

Approximately one-fifth of the Thraupinae (49 species) reside in only one country. How those countries approach conservation and development will determine the long-term prospects for these species.

According to the 1994 ISIS (International Species Inventory System), of the 11 genera of tanagers that have species listed in the Red List Book, three have at least one species in captivity. None of the listed species themselves are in captivity and only one of those three genera has been successfully bred in captivity over the past five years. There may be additional birds or breeding success in non-ISIS groups, particularly in private collections, but we have no way to quantify this. Thus, based on the current status of tanagers in captivity, the prospect of using captive propagation to bolster threatened populations is low.

With many declining populations in the wild and increased legislation and requirements for permits in both the countries of origin and the United States, it is no longer responsible nor easy to take these birds from the wild. This group of birds is in need of dedicated efforts to develop and sustain long-term breeding success.

Brookfield Zoo's tanager breeding program has been one of the most consistently successful among zoos in North America. Over the past 18 years, captive propagation of nine species of tanagers, one euphonia, and one honeycreeper has been attained. The information in this article comes from our own experience and research as well as from discussions with many colleagues.

Housing and Environment

At Brookfield Zoo, tanagers are exhibited in several different sized enclosures, ranging from small "picture-window" exhibits to the large free-flight aviary. In 1982, an off-exhibit facility, the "Avian Propagation Environment" (APE), was built. Tanagers have successfully bred in the APE, the free-flight aviary, in a double picture-window enclosure, and in "walk-ins" (a larger version of picture windows). Each of the exhibit types offers the birds a slightly different environment and each has both advantages and disadvantages.

Free-flight Aviary

Advantages: The aviary is heavily planted with a variety of tropical plants, including a large weeping ficus *Ficus benjamina* and Zulu fig tree *Ficus macrophylla*. A shallow stream, including a small waterfall and four pools of various depths, runs through the middle of the exhibit. The stream provides water for birds to drink and bathe. The pools allow small waterfowl to swim.

The public can only access the first 10 X 30 feet of the exhibit space.

Humidity varies with ambient conditions. A fogging system was installed in 1992 to reduce high summer temperatures and provide winter humidity. Using either preset humidity/temperature settings or manual controls, a cloud is dispersed in the upper levels of the exhibit through fine nozzles. Many birds enjoy bathing in this mist.

Disadvantages: The spacious aviary, with its live plants and trees, allow the birds to distance themselves from the viewing public in a simulated forest canopy. However, the size and height of the exhibit can be dangerous for fledglings. It is difficult to provide artificial nest cups at high levels, or to remove injured or sick birds from the exhibit.

Walk-ins and Picture Windows

Advantages: The walk-ins and picture windows vary in size but generally are quite similar. Both have at least one glass wall for public viewing and skylights to provide natural light. The birds in the picture windows and walk-ins are more visible. Observations of the behaviors of the breeding pairs, their food consumption and choice of

nesting material are uncomplicated, and landings of fledglings are much safer.

Disadvantages: The small size of the picture-window exhibits coupled with the large glass front hinders some breeding pairs. Unfortunately, the light level is not sufficient for most live plants to thrive. These enclosures are mainly used for exhibit purposes only.

The Avian Propagation Environment (APE)

Advantages: The APE is comprised of 25 cages of various widths, from three to eight feet, but all are eight feet in height. Originally, the cages were woodframed, but aluminum frames were installed in all cages in 1993. The cement floor is easily disinfected. An overhead misting system, operated manually, can increase humidity and simulate rain. The entire roof is skylights.

Skylights provide natural light but conduct heat in the summer; they also provide a natural photo period. Variable timers regulate the fluorescent lights and can be adjusted to vary the daylength. In the APE, the daylength is supplemented by artificial lights on timers for 10-13.5 hours of light, simulating daylength at 20° latitude. The APE has minimal disturbance from people and the environment is strictly controlled.

Disadvantages: The cages' low ceilings and the birds' lack of privacy from neighbors may hinder breeding in some species. It is also difficult to observe pairs without disrupting other individuals. As a less intrusive technique, we now use video cameras to monitor the birds, either taping for later review or viewing via live remote.

TABLE 1

Characteristics of Tanagers Housing at Brookfield Zoo

HOUSING EVALUATION	PICTURE-WINDOW EXHIBITS	WALK-IN EXHIBITS	FREE FLIGHT AVIARY	OFF-EXHIBIT FACILITY
DIMENSIONS	5'W 5'D 8'H	9.5'W 13.5'W 4.5'D 7'W 8'H 8'H	52'W 32'D 30'H	3-10'W 7'D 8'H
LIGHT SOURCE	Skylights and fluorescent bulbs	Skylights and fluorescent bulbs	Skylights and quartz flood lights	Skylights and fluorescent bulbs
VEGETATION	Limited live plants; plastic and silk plants	Limited live plants; plastic and silk plants	Variety of live plants	Live plants, mostly ficus
SUBSTRATE	Sand	Sand	Soil base with leaf litter	Cement floor
HUMIDITY	Mist with hose tri-weekly	Mist with hose tri-weekly	Overhead misting (fog) system	

TABLE 2

Summary of Nesting Preferences of Tanager Species at Brookfield Zoo (Greer 1988)

TANAGER SPECIES	NATURAL NEST	ARTIFICIAL NEST	NESTING MATERIALS	NEST LOCATION	NEST HEIGHT (ft.)
BLUE-GRAY	open cup	covered basket, planter	yarn, moss, hair, burlap	various	6+
BLUE-AND-YELLOW	open cup	---	twigs, grass, plant fibers	ficus tree	10-15
FLAME-FACED	---	hanging planter	yarn, moss, hair, burlap	under plant leaves	6 1/2
GOLDEN	---	covered basket, planter	moss, plant fibers, leaves	ficus tree	5-6
GREEN-AND-GOLD	open cup	hardware cloth basket	small twigs, hair, ficus leaves	various	6-7
PARADISE	---	hardware cloth basket	moss, ficus leaves, stripped bark	hung from ceiling	7
TURQUOISE	open cup	open & covered basket	moss, cotton, bark and fibers	in dense tree foliage	5-25+
GOLDEN-EARED	---	covered basket	moss	ficus tree	5
RED-THROATED ANT	open cup	open cup	twigs, grass, leaves	ficus & palm tree	4-20
ORANGE-BELLIED EUPHONIA	---	covered basket	bemp, raffia	tree	4
THICK-BILLED EUPHONIA	covered dome	covered basket	cotton, fibers, moss	skylights	25+
PURPLE HONEYCREEPER	---	covered basket	moss, grass, fibers, hemp	ficus	4-5
BLACK-FACED DACNIS	open cup	-----	hair, plant fibers	end of branch	25

Social Conditions

Most small, omnivorous tanagers, forest euphonias, and dacnis are often found in flocks that seem to form and disband irregularly at certain times of the year. This varies greatly by species (Isler 1987). Canopy-dwelling multi-species flocks have been studied and shown to contain as many as 16 species of tanagers (Robinson 1988). Brookfield Zoo has housed mixed flocks of tanagers in both the aviary and the walk-ins. In the aviary, the flock composition varies from year to year, but normally encompasses approximately 20-40 birds. To prevent interspecific competition, these flocks are limited to single pairs of each species. *Tangara* species work particularly well together due to their less aggressive dispositions. On the other hand, some *Ramphocelus* species are reputed to be somewhat aggressive

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toward other birds.

During nesting season, disturbances from other birds may limit breeding efforts more than tangible objects such as food, nest sites, and materials. Managers and keepers should be aware of the carrying capacity of enclosures. Highly inquisitive species or unpaired tanagers, even if they are nonaggressive, can hinder breeding. They steal nest material, intrude in territories, and harass breeding and non-breeding birds.

Having several species similar in appearance can also interfere with breeding efforts. If a true pair bond has not been established, either bird may begin soliciting the attentions of a similar-appearing birds. In nonaviary situations, pairs housed side-by-side may also interfere with breeding. Subtle aggressive postures viewed through cage wire can be as detrimental to breeding as overt aggression. As with all birds, tanagers must be comfortable in their environment before they will breed.

Diets

The tanagers are frugivorous, insectivorous, and/or nectivorous depending on the species; several complete balanced diets are offered. The frugivore diet is strongly preferred by the birds and has been formulated by staff nutritionists to meet all dietary requirements. A base mix of crushed Ziegler Bird of Paradise or other low-iron pellets and a vitamin/mineral premix is added to a mixture of diced apples, bananas, grapes, raisins, currants, and blueberries. The fresh fruit mix varies seasonally according to what is locally available. Additionally, a mix of chopped leafy vegetables is offered.

Species such as dacnis, euphonias, and honeycreepers depend on nectar more than other birds. Roudybush Nectar 3 is readily accepted even by those birds not considered nectivorous. It can be provided in either a tube suspended in the enclosure or in a small cup. Nectar is replaced twice daily to prevent spoilage.

A variety of insects, mealworms, fly larva, and fruit flies is offered in moderation during nonbreeding season. Due to the high fat content of larval wax worms, its use is limited. During

breeding season, the number of insects provided is increased to simulate an insect bloom, but again, it is important to regulate these amounts to prevent obesity. In the case of multiple clutches per season, it is important to supplement the females with calcium to maintain their health and the health of their eggs.

Medical Issues

In captivity, tanagers may live for a few to 15 or more years of age. High-quality sanitary conditions, appropriate fresh foods, and reducing disturbances, stress, and overcrowding all lead to more healthful conditions for these small birds. Tanagers and allies are susceptible to the typical array of avian diseases, parasites, and injuries. Two conditions in particular, aspergillosis and "iron storage disease," are considered high-risk for tanager mortality. For both conditions, prevention is easier and more effective than diagnosis or treatment.

Aspergillosis is caused by growth of fungus, usually *Aspergillus fumigatus*, and is characterized by masses of fungal hyphae in the air sacs and, sometimes, the lungs or other organs. It may be secondary to other diseases, especially one in which immunity is suppressed. It can be triggered by acute exposure to the fungal spores, usually through inhalation. For groups of birds susceptible to aspergillosis, a focused program of prevention and reduced exposure can dramatically cut the number of cases seen.

Symptomatic aspergillosis may include reduced appetite, labored or open-mouth breathing, tongue-flicking, and coughing. Marked weight loss and extremely high white-blood cell counts may also be detected. As soon as such symptoms are observed, a veterinarian should be consulted to assess the cause and to recommend a course of treatment. With small birds, Brookfield Zoo combines oral antifungal medication, such as Fluconazole or Itraconazole, and nebulizing with Amphotericin B with apparent success. There is a strong association between how quickly treatment is undertaken and the likelihood of recovery.

Aspergillus is widespread in the environment in soil and leaf litter.

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There is some seasonal variation in the number of fungal spores present, but any conditions that favor fungal growth should be avoided in these birds' housing.

An array of husbandry practices can reduce the prevalence of *Aspergillus* and the incidence of aspergillosis in bird facilities (McGill 1996). These include circulating abundant clean fresh air, eliminating damp organic substrates, and removing damp, rotting wood (as on cage frames, cage furniture or under-sink cabinets). Accumulating dust should be removed, even in remote sites such as the top surface of suspended ceiling panels. If surfaces with built-up dust or soil need to be disturbed (e.g., moving old ceiling panels, doing construction, or moving earth), take extreme caution to avoid contaminating the bird area. Dampen these surfaces to reduce airborne particles, filter the air between the work site and bird area, or remove birds from the area during the work. In areas that might be high risk (e.g., where there are sick birds, newly arrived birds, nestlings, or near damp or disturbed sites), it may be helpful to use high-efficiency particulate air (HEPA) or fine-air filters to reduce fungal spores (as small as 3 to 5 micron) in the air. A variety of room-size filter units are available in stores that serve allergy patients.

"Iron storage disease" is the accumulation of iron within the body tissues and organs, especially the liver (called hemosiderosis), that may cause pathological lesions or even liver dysfunction (Lowenstein 1986).

Fortunately, this condition can be virtually eliminated in tanagers through dietary management (Crissey and McGill 1988).

The symptoms of pathological iron storage are varied, but may include fluid in the abdomen, labored breathing, overeating, or general malaise. Treatment of small birds for this problem has not been very successful, particularly once symptoms have been observed.

All birds must have some iron in their diet for normal body functioning and egg-laying. However, there are poorly known factors of avian physiology, as well as the chemical content of the diet that may affect actual levels of iron absorption. Nonetheless, some simple guidelines are appropriate for developing diets for these small tropical frugivores: provide fresh wholesome foods, use low-iron prepared feeds for birds as a base mix with fruit and insects, and avoid meat (heme)-based proteins in diets (see Crissey and McGill 1988 for details).

Pair Compatibility and Courtship

Establishing a compatible pair is the first step toward any successful breeding program. In the past, birds were simply housed together with the hope that they would form a bond. Although often successful, it sometimes resulted in aggression (from threat gaping to actual fighting) or complete indifference to one another. Different combinations of individuals had to be tried before a suitable pair was eventually established.

Indifference or fighting between birds may result from accidental same-

sex pairing. Slightly fewer than one-half of tanager and honeycreeper species are dimorphic, but some species, such as the Turquoise *Tangara mexicana* and Blue-gray Tanagers *Thraupis episcopus*, are not so easily distinguished. Surgical sexing by laparoscopic examination has been used to identify sexual organs. A newer technique, and generally more preferred for these small birds, is genetic sexing through blood or live feather sampling by services such as Zoogen, Inc.® or private laboratories, can provide positive identification of sex in a matter of weeks.

Brookfield Zoo employed a method of pairing whereby the birds are allowed to choose a mate before being introduced to each other in the same enclosure. By housing a female next to more than one potential mate, we observe her behavior to determine to which bird she is more attracted. Generally, if a male and female constantly perch near each other (six-inch proximity or less), the male sings frequently, the male feeds the female through the wire and/or the female solicits the male, it is a good indication that the two would make a compatible breeding pair. All the above general courtship activities will continue once the pair is housed together.

According to Isler and Isler (1987), courtship displays usually involve males exhibiting their brightest or most contrasting feathers. The Scarlet-rumped Tanager *Ramphocelus passerinii*, for example, puffs up his colorful rump during courtship displays. The scarlet headcrest of the Red-throated Ant Tanager *Habia fuscicauda* erects during courtship. The precopulatory display of tanagers, (per Willis 1976b in Isler and Isler 1987), involves wing-fluttering, tail-lifting, and horizontal crouching. These displays, however, are brief and may not be witnessed very often. The courtship displays of the male are typically accompanied by songs, usually heard in the early morning. These range from the squeaky, squealed notes of the Blue-gray Tanager, to the pleasant, melodic song of the Red-throated Ant Tanager.

An enriched environment, especially one with plenty of dense foliage, stimulates tanagers to breed. The large

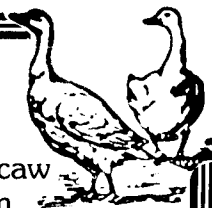
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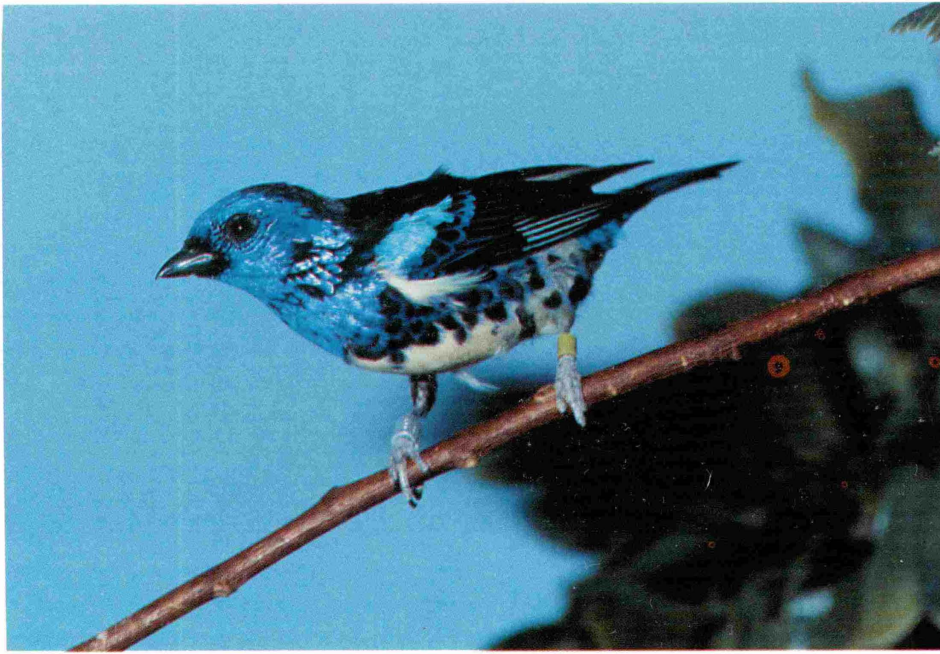
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Turquoise Tanager, *Tangara mexicana*.

aviary could be considered a permanently enriched environment, as very few of the physical characteristics change. The picture windows, walk-ins, and APE cages, however, can be changed from enriched enclosures, as during the breeding season, to less enhanced exhibits (without extra plants and nesting materials) during the rest of the year. In early spring, we provide an abundance of live insects which we have observed to help trigger breeding interest. Perhaps the strongest stimuli to breed, however, are the increasing daylight cycle and the availability of suitable nesting structures and materials.

Nests and Nest-building

In the wild, the majority of tanager species build cup nests, and at Brookfield Zoo this is generally true as well. The construction and placement of nests varies greatly from species to species. In the free-flight aviary, Turquoise, Green-and-Gold *Tangara schrankii*, Blue-gray and Redthroated Ant Tanagers have built their own cup nests. The nests of *Tangara* are compact and deep, hidden in dense clusters of leaves as high as the enclosure will allow. The exposed nests of the Red-throated Ant Tanager, on the other hand, are loosely constructed and shallow, such that the eggs sometimes can be seen from below. These may be built as low as four to six feet

off the ground, and are usually well-hidden in a crook of branches. The nests of euphonias are often domed with a covered side entrance.

Although the birds may construct their own nests, many use one of the artificial baskets placed in the exhibit. An assortment of baskets is used, although woven covered wicker baskets are chosen most often. This particular nest style has been used by Blue-gray, Golden *Tangara arthus*, Golden-eared *Tangara chrysotis* and

Turquoise Tanagers, as well as by Orange-bellied *Euphonis xanthogaster* and Thick-billed Euphonias *Euphonia lanirostris*, and Purple Honeycreepers *Cyanerpes caeruleus*. The baskets are placed in sites where the birds have shown interest.

As mentioned previously, the introduction of nesting materials during the breeding season usually elicits a strong impulse to nest-build. Materials offered vary with respect to which species we are breeding. Purple Honeycreepers, for example, prefer palm fibers, soft grasses and moss to line their nest baskets, while many of the *Tangara* species commonly use moss, ficus leaves, stripped bark, cotton, and animal (camel, horse, or dog) hair. In the aviary, many of these materials are always available; the exhibit is heavily planted and provides numerous natural plant materials. In some cases, materials are stolen from other nests, as seen in Scarlet-rumped and Blue-gray Tanagers, as well as the Thick-billed Euphonia. In other enclosures, nesting materials may be offered on the ground, in a pan, or more often, tied in bundles to branches.

Females take the lead role in actual nest construction, with the males typically escorting the females to and from the nest. The Turquoise Tanager, Blue-gray Tanager, and Orange-bellied and



Free Flight Aviary.

Thick-billed Euphonia males have been observed actively assisting the female by carrying and adding materials to the nest.

Incubation, Parental Care, and Chick Development

The female generally begins laying eggs a day or two after the nest has been completed. Clutches consist of two to three eggs for tanagers and four to five for euphonias, and are laid on consecutive days. Incubation usually begins after the second egg has been laid. The female alone incubates for 12 to 16 days while the male perches attentively nearby guarding her. In some species, like the Thick-billed Euphonia, the male may feed the female at the nest.

Although in most cases the female does not seem easily disturbed from her nest, we attempt to reduce traffic and excessive activity in or near the birds' enclosure during the incubation period.

Chicks generally hatch early in the morning. The parents are often found to be very excited, with the female peering into the nest frequently. As soon as a hatch is suspected or confirmed, an abundance of live insects is offered to the parents to feed, although they typically do not feed during the first 24 hours. According to Isler and Isler (1987), tanagers in the wild feed insects to nestlings more than any other food. At Brookfield Zoo, we offer tanager parents waxmoth larvae and "white" molting mealworms (coated with an insect diet powder). Some species require other food items to feed their young. Purple Honeycreeper parents feed nectar, fly larvae, spiders, and

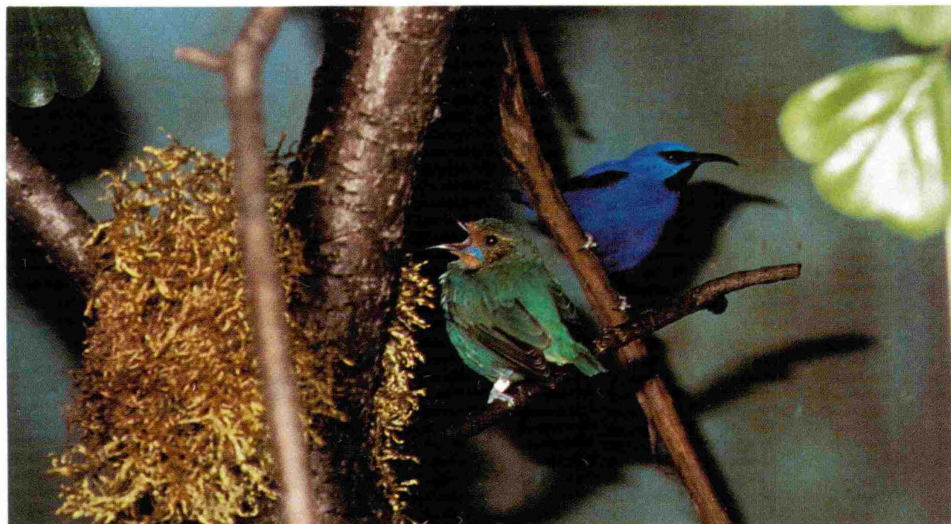


Photo by Mike Greer

Purple Honeycreeper male with young, Cyanerpes caeruleus.

fruit flies. Red-throated Ant Tanagers feed waxworms, and legless and wingless crickets. These food items are made available throughout the day.

Both parents are generally very attentive to their young and may be observed feeding them every 10 to 15 minutes for the first few days, and every 15 to 20 minutes over the next week. Tanager hatchlings are altricial: naked except for sparse natal down and abdomen distended with remnants of the yolk sac. The begging vocalizations of the young can be easily heard. The female alone broods the young. Nestling periods vary significantly among species.

According to Isler and Isler (1987), larger species which nest closer to the ground (e.g., the Red-throated Ant Tanager) typically have shorter nestling periods (nine to 10 days), while euphonias, whose young develop in enclosed nests, have longer nestling periods (18 to 24 days). Most other tanagers fledge in 12 to 16 days.

Tanager chicks continue to beg loudly and persistently from the parents for 10 to 18 days after fledging. The parents may turn their attention to renesting a week or so after the first brood fledges. In one such instance, we encountered Turquoise Tanager juveniles from a previous clutch helping to feed new fledglings in our aviary. Isler and Isler (1987) have found this is a fairly unique phenomenon, as only three *Tangara* species are known to display this helping behavior.

The period after fledging can be a

dangerous one, especially in a mixed-species aviary. The young are clumsy and curious, vulnerable to harassment from other birds (sometimes their own male parent), and can be quickly exhausted by moving around the enclosure. Fledglings are typically poor flyers, so we place additional thin branches in the enclosure to allow the chicks to exercise. If it is a glass-fronted exhibit, we apply a soapy film to the glass to decrease visual disturbances to the chick. Fledglings are handreared to weaning if they are thought to be at any risk.

Alternatives to Handrearing

To keep the fledglings in the aviary where they can learn from and be fed by the parents, we use a special "fledgling cage" (refer to Bent 1996). Constructed of 1 inch X 1/2 inch wire mesh, the cage (23 X 18 X 19 inches) has perches at varying heights to allow the chick to move from the top to the bottom of the cage with ease. The ceiling of the cage is slightly concave, which allows the chick to receive food from the parent when perched directly beneath it. This cage has been used quite successfully with Turquoise Tanagers and Purple Honeycreepers. It was tried with Golden Tanagers but failed; their behavior suggested that this species may need a larger mesh size through which to feed their young.

In some cases, problems arise early and it is necessary to remove the young from the parents to handrear.

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Such instances have included: the illness or death of one or both the parents; the repeated illness or death of the young from one pair, or parental behavior problems, such as aggression by the male (usually corrected by removing or separating the male from the female and young) or inexperienced parents (e.g., the parents under or overfeed the young).

In one instance, cross-fostering of young was implemented as a last resort for a pair of Paradise Tanagers *Tangara chilensis* whose young repeatedly died at an early age. A fertile egg from a pair of experienced Blue-gray Tanagers was exchanged for two Paradise Tanager eggs. The Blue-gray egg hatched and the chick was raised successfully to fledging by the Paradise Tanager parents. The Blue-grays likewise raised the only Paradise Tanager chick that hatched. Interestingly, the Paradise Tanagers later successfully raised a healthy chick of their own to fledging. It is important to note that cross-fostering, as just described, is advised only between similar species in situations where a breeding pair continually fails to raise their own young.

Handrearing

Brookfield Zoo has developed a program for handrearing tanagers. Our methods and guidelines have evolved to incorporate new knowledge and correct past errors. A few of our handrearing recommendations have even been adopted by other zoos for their breeding programs.

Chicks are handreared in a separate area furnished with all the basic requirements for such a facility, including a brooder for hatchling care, an air purifier to filter out airborne pollutants, and an electronic gram scale to weigh food items and developing chicks. Data recorded regularly include chick weights, feeding times, food items offered and consumed, number of fecals produced, begging response, and other relevant observations of chick activity, growth, and development.

We have handreared chicks after they have fledged, before they left the nest, and on a few occasions, directly after hatching. Handrearing new hatchlings requires paying extra attention to chick behavior, diet, weight

gain, and physical development. Sometimes information on the same or closely-related species from another institution provides the groundwork for a successful handrearing protocol. In other instances, very little is known at all about the species in captivity. We have had varying success with a number of species, but particularly with Red-throated Ant Tanagers, Turquoise Tanagers, and Purple Honeycreepers.

Red-throated Ant Tanager

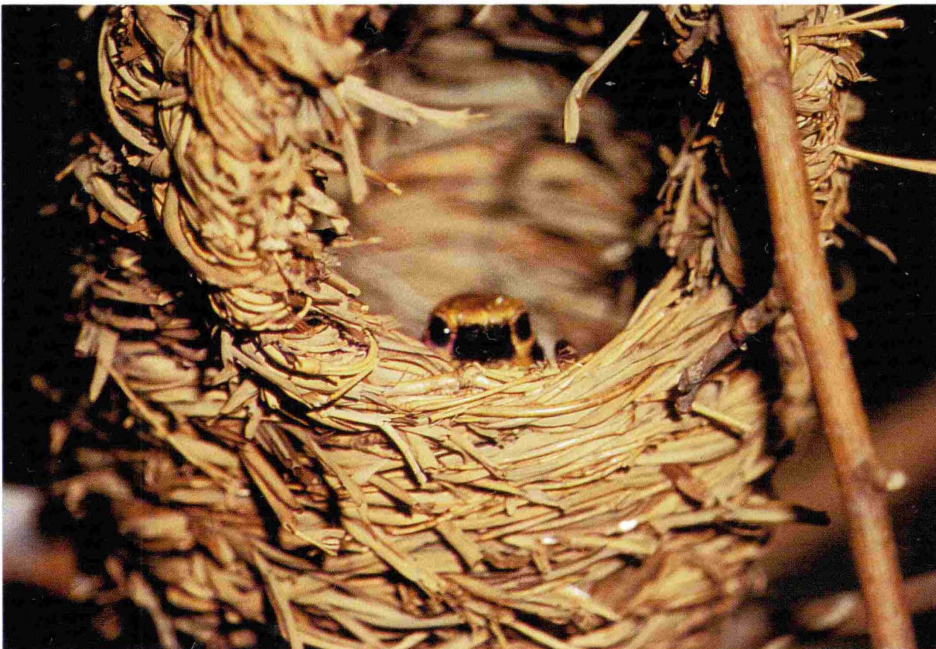
The Red-throated Ant Tanager was not held in captivity in zoos in North America prior to 1991. In 1992, Brookfield Zoo was the first zoo to handrear chicks of this species, beginning three days post-fledging. More recently, in June 1995, we successfully handreared an Ant Tanager chick from the egg (Schiller 1995).

The Red-throated Ant Tanager is primarily insectivorous, and hence the diet consisted of diced newborn mice (pinkies), waxworms, white mealworms, and the insides of gray cricket abdomens. We began with nine feedings each day, dropping one feeding when the chick gained weight too quickly, or when its appetite sharply decreased throughout the day. Approximately 10 days after hatching, the chick fledged. Its diet incorporated fruit pieces at 13 days of age. At approximately 33 days, the chick began eating on its own from a food pan. Two days later, we discontinued handfeeding. We were assured the chick was self-feeding when it gained weight over the next day without any supplemental feedings.

Turquoise Tanager

In 1989, we lost Turquoise Tanager fledglings presumably to salmonella infections, and therefore all subsequent nestlings from this pair were pulled for handrearing. In June 1995, we were forced to handrear a Turquoise chick from the egg. The male had died of possible pneumonia and chicks from two previous clutches had died at early ages. This hatchling weighed only 1.5 grams, but exhibited a 30% to 40% increase in weight during its first 10 days. The handrearing diet for the first eight or nine days was

Photo by Mike Greer



Golden Tanager in covered nest basket, *Tangara arthus*.

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limited to diced pinkies and wax-worms. Later, mealworms, cricket abdomens, and small bits of fruit were offered. Eventually, we discontinued feeding pinkie pieces (due to high protein content). The chick fledged from its container in the brooder at 14 days of age. At approximately 28 days of age, the Turquoise Tanager chick was almost fully self-feeding, and received no handfeeding after 35 days.

Purple Honeycreeper

Brookfield Zoo has had much success breeding Purple Honeycreepers. In 1992, a two-day old nestling was ejected from the nest. The chick's abdomen was severely distended and could have been an indication of disease. The chick was set up in our handrearing facility. It displayed a very good begging response and took nectar from a ball-tipped syringe quite well.

Although it only weighed 2.75 grams, it was strong enough to vocalize during feedings. Our veterinarian prescribed antibiotics, to be given in its nectar feedings, to correct for its distended abdomen. Fruit flies and wax-worms were soon introduced into the chick's nectar diet. At nine days of age, pin feathers were developing and the eye slits were opening. At 20 days of age the chick fledged; its weight had increased to over 8 grams. At that time, we were also feeding fly larvae and the matrix from Brookfield Zoo's frugivore diet. Two days after fledging, we observed the chick feeding on its own from a nectar tube placed in the brooder. At 39 days, remote viewing via camcorder revealed the bird was self-feeding, including chasing live fruit flies. At age 46 days, we discontinued hand-feedings. As with all of our handreared birds, we monitored the chick's daily consumption of food items for a few weeks after weaning.

Conclusion

Tanagers are a diverse and interesting group of birds to breed and study in captivity. At Brookfield Zoo, we have been able to maintain a sustained captive-breeding program. Our efforts have provided us with a better understanding of how these birds reproduce. We stress, however, that dedication,

patience, and perseverance are essential to breeding tanagers, honeycreepers, and their allies. Unfortunately, they have not received the same attention from private breeders and even zoos as waterfowl, cranes, or psittacines. Although most tanagers are not presently considered seriously threatened in the wild, even small-scale habitat destruction could have significant consequences for restricted populations (McGill 1988). Captive breeding can contribute to conservation by providing sustainable captive populations for exhibit, education, enjoyment, and can contribute to our knowledge of tanager biology before such information is critically needed.

Acknowledgements

We thank those dedicated professionals who have contributed their knowledge of tanagers, in the wild and captivity, to our breeding program. Also, to the efforts of past and present birdkeepers of Brookfield Zoo, especially Lucy Greer, Nancy Bent, Marcia Arland, Laura Alter, and Linda Schile-Bradley.

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