# Tanagers, Honeycreepers, and Euphonias

*Ramphocelus carbo, Ramphocelus bresilius, Euphonia violacea, Tangara mexicana, Tangara chilensis, Tangara fastuosa, Tangara arthus, Tangara cyanicollis,* and *Cyanerpes cyaneus*

# Husbandry Guidelines

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# Foreword

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# Index

Pathology Review
1.8 European Passerine Collection Plan

# Species accounts

## 2. Silver-beaked tanager *Ramphocelus carbo*

**Section 1: Natural History Data**

2.1 Taxonomy
2.2 Morphology
2.3 Physiology
2.4 Longevity
2.5 Zoogeography/Ecology
2.6 Diet and Feeding Behaviour
2.7 Reproduction
2.8 Behaviour

**Section 2: Species Specific Captive Management**

2.9 Compatibility
2.10 Feeding
2.11 Breeding
2.12 Management Notes
2.13 EAZA Passerine TAG Population Management

## 3. Brazilian tanager *Ramphocelus bresilius*

**Section 1: Natural History Data**

3.1 Taxonomy
3.2 Morphology
3.3 Physiology
3.4 Longevity
3.5 Zoogeography/Ecology
3.6 Diet and Feeding Behaviour
3.7 Reproduction
3.8 Behaviour

**Section 2: Species Specific Captive Management**

3.9 Compatibility
3.10 Feeding
3.11 Breeding
3.12 Management Notes
3.13 EAZA Passerine TAG Population Management

## 4. Violaceous euphonia *Euphonia violacea*

**Section 1: Natural History Data**

- 4.1 Taxonomy
- 4.2 Morphology
- 4.3 Physiology
- 4.4 Longevity
- 4.5 Zoogeography/Ecology
- 4.6 Diet and Feeding Behaviour
- 4.7 Reproduction
- 4.8 Behaviour

**Section 2: Species Specific Captive Management**

- 4.9 Compatibility
- 4.10 Feeding
- 4.11 Breeding
- 4.12 Management Notes
- 4.13 EAZA Passerine TAG Population Management

## 5. Turquoise tanager *Tangara mexicana*

**Section 1: Natural History Data**

- 5.1 Taxonomy
- 5.2 Morphology
- 5.3 Physiology
- 5.4 Longevity
- 5.5 Zoogeography/Ecology
- 5.6 Diet and Feeding Behaviour
- 5.7 Reproduction
- 5.8 Behaviour

**Section 2: Species Specific Captive Management**

- 5.9 Compatibility
- 5.10 Feeding
- 5.11 Breeding
- 5.12 Management Notes
- 5.13 EAZA Passerine TAG Population Management

## 6. Paradise tanager *Tangara chilensis*

**Section 1: Natural History Data**

- 6.1 Taxonomy
- 6.2 Morphology
- 6.3 Physiology
- 6.4 Longevity
- 6.5 Zoogeography/Ecology
- 6.6 Diet and Feeding Behaviour

## 7. Seven-coloured tanager *Tangara fastuosa*



## 8. Golden tanager *Tangara arthus*

## 9. Blue-necked tanager *Tangara cyanicollis*

**Section 1: Natural History Data**

9.1 Taxonomy
9.2 Morphology
9.3 Physiology
9.4 Longevity
9.5 Zoogeography/Ecology
9.6 Diet and Feeding Behaviour
9.7 Reproduction
9.8 Behaviour

**Section 2: Species Specific Captive Management**

9.9 Compatibility
9.10 Feeding
9.11 Breeding
9.12 Management Notes
9.13 EAZA Passerine TAG Population Management

## 10. Red-legged honeycreeper *Cyanerpes cyaneus*

**Section 1: Natural History Data**

10.1 Taxonomy
10.2 Morphology
10.3 Physiology
10.4 Longevity
10.5 Zoogeography/Ecology
10.6 Diet and Feeding Behaviour
10.7 Reproduction
10.8 Behaviour

**Section 2: Species Specific Captive Management**

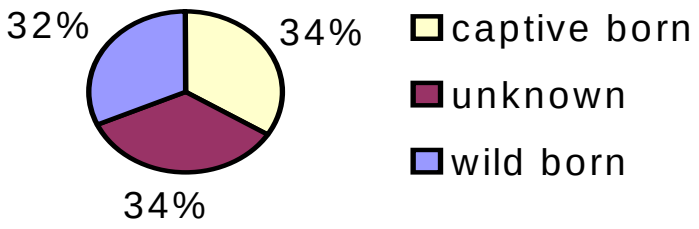
10.9 Compatibility
10.10 Feeding
10.11 Breeding
10.12 Management Notes
10.13 EAZA Passerine TAG Population Management

## References

**Appendix I:** Some Nectar Producing Plants
**Appendix II:** Examples of Commercial Food Products Available
**Appendix III:** European Laboratories that Offer DNA Feather Sexing
**Appendix IV:** Reference Ranges for Physiological Data Values
**Appendix V:** MEDARKS Post Mortem Form

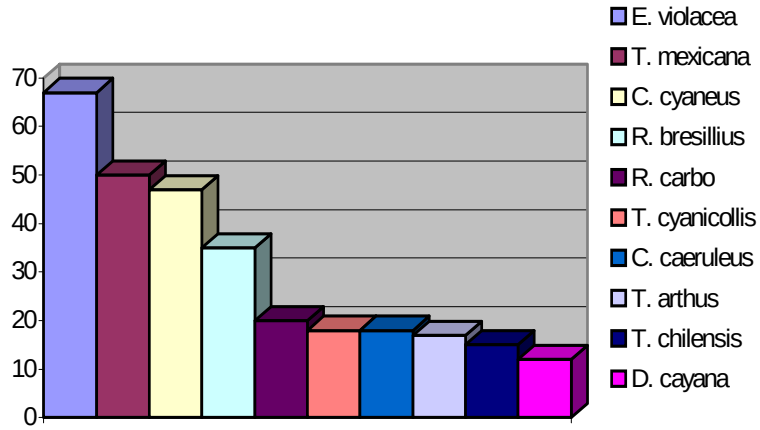
# Introduction

Almost all tanagers are strikingly coloured, attractive birds and thus are kept by many private aviculturists as well as in zoos. Many tanagers in zoos are found in big tropical houses or free flight aviaries where their colours seem to be even more beautiful. Tanagers have a history of being 'difficult' birds to breed, as figures in the EAZA TAG survey 2002 (Brouwer *et al*., 2002) confirmed. There were 32 species of tanagers held in 32 zoos at the end of 2001, of which only 15 zoos have had some breeding results between 1997 and 2001. European populations of tanagers are therefore still highly dependant on wild caught birds.

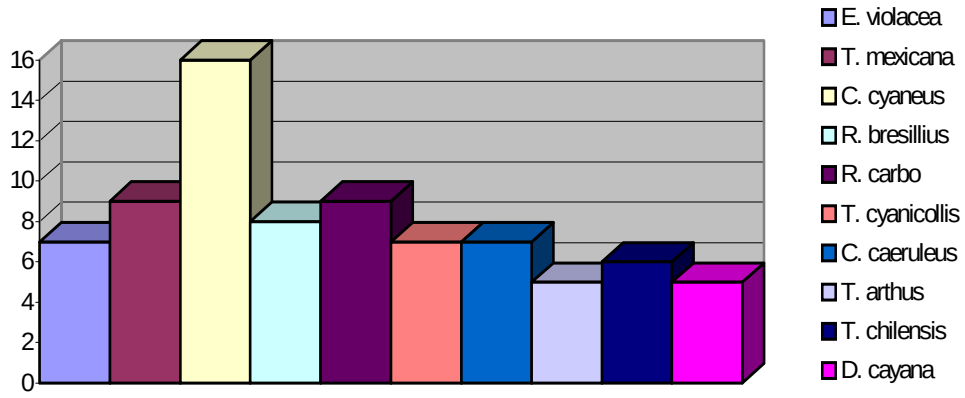



Origin of tanagers (ISIS, 2003)

According to the EAZA TAG Survey 2002, many tanager species (42.9%) are held in only one EAZA zoo. The largest population of tanager is the Violaceous euphonia *Euphonia violacea* with 67 individuals, but 5 zoos in Europe only hold this species, whereas 16 zoos hold the Red-legged honeycreeper Cynaerpes cyaneus.




Number of individuals of the 'ten most kept' tanagers reported in the EAZA TAG Survey 2002.




Number of zoos keeping 'the ten most commonly kept tanagers' in the EAZA region according to the EAZA TAG Survey 2002.

These guidelines have been developed to help improve husbandry and breeding of tanagers including honeycreepers and euphonias, as now breeding seems to be a sporadic event in most European zoos. Only one tanager species currently held in a European zoo, the Seven-coloured tanager (*Tangara fastuosa*) is listed as threatened by BirdLife International (2002). However *in situ* tanager populations face increasingly more threats including habitat destruction, habitat loss and capture for the pet-trade because of their attractiveness.

These husbandry guidelines address nine species of tanagers: *Ramphocelus carbo, Ramphocelus bresilius, Euphonia violacea, Tangara mexicana, Tangara chilensis, Tangara fastuosa, Tangara arthus, Tangara cyanicollis,* and *Cyanerpes cyaneus.* These species were chosen either because they were already in the European Regional Collection Plan or because they have relatively large populations in European zoos. The development of these guidelines really came off the ground after the Tanager Husbandry Workshop, held on the 16 February 2003 in Burgers Zoo, Arnhem, where participants shared their experiences in keeping and breeding tanagers. A questionnaire was sent out to approximately 20 zoos, of which four responded. Other resources were literature, especially "The Tanagers" by Isler and Isler (1987), "Softbills" by Vince (1996), husbandry guidelines compiled by A. Oiler (Brookfield Zoo), ISIS, and personal communications. The JSMG Management Guidelines for the Welfare of Zoo Animals structure is mainly used for these guidelines.

The guidelines are divided in two parts: a general section covering husbandry issues that are more or less the same for all tanagers and a section with species accounts addressing the different tanagers species separately, although information may overlap as well for individual species.

There is still much that can be learned to further improve tanager husbandry, therefore comments, recommendations and more information is welcome to revise these guidelines in the future and enhance our understanding of breeding tanagers in captivity.

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# 1. General tanager captive management

## 1.1 Enclosure

### Boundary (roof and wall)

Boundaries that can be used for enclosures are wire mesh, netting, glass, and solid walls. None of these have been found to be problematic for tanagers. Care should be taken with a glass boundary when releasing new birds in the exhibit or when chicks fledge; the glass should initially be covered, with percentage covering gradually reduced so that the birds remain aware that a boundary still exists. It may also be necessary to cover a glass wall when catching birds. Screens mounted above windows can be pulled down to cover a window when needed (Oiler, 1999).

Size of wire meshing should be small enough so the birds cannot become entangled, cannot escape and vermin species cannot enter. Materials such as fine mesh nylon netting, “Zoomesh” (a stainless steel cloth-like material), and the coiled 3-dimensional “Phantom mesh” are all appropriate wall boundaries. A solid wall on one side seems to give the birds a feeling of privacy. If the enclosure is small, solid walls on two or three sides are recommended. A solid wall or double mesh with a space of several cm in between the two mesh layers should be used to separate enclosures if larger meshing is used and carnivorous birds are in adjacent enclosures.

Outdoor aviaries should be partially covered to offer protection weather protection.

Escape of tanagers from enclosures should be prevented; having a double door system (possibly including one set of rubber strips or rope curtains) in free-flight aviaries is useful. No door to an enclosure should open directly outside, or to an indoor area in which recapturing a bird is very difficult.

### Substrate and Foundation

Tanagers are mainly kept in tropical houses with many plants needing soil to grow and to flower. Since tanagers need well-planted surroundings, soil is a good substrate for them. Disadvantages of soil are that it is hard to clean and disinfect, and fungal spores do well in soil. Sand and concrete on the other hand are hygienic but not as aesthetic as soil, and tropical plants cannot be grown on them. When using sand or concrete, one should provide plants in pots. This might be the preferred solution in off-exhibit areas.

Outdoor aviaries should have a solid (e.g. concrete) foundation to discourage pests such as rats, mice, snakes and foxes that can consume the tanager collection. Indoor aviaries should also be pest-proof.

### Indoor/Outdoor

There are currently no data to indicate whether tanagers actually remain healthier or breed better if given access to outdoor aviaries in appropriate weather. Presumably tanagers will only benefit from the opportunity to be outside, however tanagers should always have access to an indoor area. Even if the indoor area is viewed as only sometimes used, the same considerations for enclosures generally (lighting, dimensions, perching, temperature) should be applied.

The opening for the tanagers to fly between outdoors to indoors should be well above the ground. It is helpful to be able to close this opening from another location so as not to disturb the birds in the event that they need to be held in only one section. It may be necessary to train the birds to use the indoor section, and if temperatures are dangerously low they should not be given free choice to go outside. Providing food, adequate lighting and warmth, as well as suitable perching at equal or greater height than the perching outside should encourage the tanagers to use the indoor section more easily.

Vegetation

Tanagers, including honeycreepers and euphonias, are neotropical birds found in areas of woody growth, either in semi-open habitat that is a mix of woody plants, or in forests (with forest defined to include all sorts of areas with substantial contiguous woody plant cover; Isler, 1988). Tanager enclosures in captivity should likewise have an abundance of vegetation in which the birds can find shelter and hide from the public and each other. *Ficus* spp., e.g. Weeping fig *Ficus benjamini* and the Zulu fig tree *Ficus macrophylla*, are fast-growing hardy plants that are quite suitable tanager cover. Vince (1996) offers some ideas on plants suitable for aviaries, and lists some poisonous plants not to use.

Fruiting and flowering plants and trees, particularly tropical varieties, can additionally provide food enrichment. A list of some nectar-producing plants is provided in Appendix I. Vegetation may also serve as nest supports and to hide nests. Hanging baskets of vegetation and potted plants are useful additions to tanager enclosures, and are frequently used as nesting sites.

Suitable nesting materials can also be derived from the vegetation e.g. palm "hair", moss, grasses, coconut twigs/fibres and leaves (see also section on nest construction and materials, and nesting sections in the species accounts).

Perching

Even in a well-planted aviary care should be taken to ensure that the birds have sufficient suitable perching. Perches should be essentially horizontal, and of diverse diameters and textures to exercise the feet and to avoid pressure sores. The circumference of some of the perches should be approximately 1/3 larger than the tanager's foot closed around the perch. Having sufficient perching at various heights in the enclosure can considerably reduce agonistic interactions. Flight paths between perches should be unobstructed in small enclosures in which the tanagers have little room to manoeuvre.

Temperature and humidity

As discussed during the EAZA Passeriformes TAG Tanager Husbandy Workshop 16 February 2003 most tanagers do best at temperatures of at least 20ºC, and 17°C is the minimum temperature at which almost all tanager should be held without heating available. *Ramphocelus* spp., some *Thraupis* spp. and mountain tanagers can tolerate lower temperatures, but all require conditions free of damp, drought and frost.

Many tanagers will "sun" bathe under a heat lamp if offered the opportunity. Heaters on which the tanagers could perch should have guards to keep the tanagers from burning their feet.

Tanagers that have just been imported from the wild are adapted to higher temperatures and should gradually be acclimated (see quarantine section).

Tanagers can become heat-stressed if temperatures become too high. Efforts should be made to keep the temperature no higher than 29ºC; extra ventilation and fogging/misting systems are helpful in reducing heat-stress.

Humidity should be reasonably high, similar to humidity levels tanagers encounter in their natural environment. Automatic misting/fogging systems are useful in regulating humidity. Tanagers enjoy bathing in the spray and on foliage that has been misted.

Lighting

Tanagers in the wild generally inhabit fairly well-lit microclimates within areas of woody growth (Isler, 1988). The range of the light spectrum used by tanagers is not known. Researchers at Brookfield Zoo are studying the influence of ultraviolet light on mate selection in tanagers. (P. McGill, pers. comm.).

There is also little known regarding affect of photoperiod on reproduction of tanagers. Stuttgart Zoo changed from a 14 h dark-10h light cycle to 12h dark-12h light cycle during the winter (supplementing the natural light available year-round with artificial light during the shorter days) and it had a positive effect on the birds (G. Schleussner, pers. comm.). Day length should not be less than 12 hours (e.g. during the winter), and increasing day length in keeping with a seasonal cycle may be important in stimulating reproduction of tanagers (Oiler *et al*., 1998).

Providing too much light could possibly be as detrimental as too little light, but there has been no research done in this area.

A low-level of lighting should be available during the night to allow the tanagers to move around the exhibit safely.

Dimensions

Tanagers are kept in many different enclosures, ranging from small breeding enclosures to large free-flight aviaries, and it seems that they do not have any preference for a particular size. Diversity and complexity of furnishings as well as enclosure size are important in meeting tanager requirements. A larger number of birds obviously require a larger enclosure however, and when acquiring new birds, always keep in mind that an enclosure has a limited carrying capacity. The number of birds that can be housed is dependant on how territorial a species is as well as on enclosure size and features. Single-pair enclosures are advised for breeding all tanagers but *Euphonia* spp., however in some extremely large enclosure is may be possible for multiple pairs of the other more social species to breed (see species accounts).

An enclosure measuring 3.0 m x 1.5 m x 2.0 m ($9m^3$) is considered a small enclosure and the minimum size to secure the welfare of a breeding pair (outcome of the EAZA Passeriformes TAG Tanager Husbandry Workshop 16 February 2003, Arnhem). Tanagers often prefer to nest in the highest levels of enclosures (see species accounts). Enclosure heights of 3 m or more (over human head-level) may offer the tanagers a greater feeling of security but will make nest checks more difficult.

## 1.2 Feeding

As far as is known, all tanagers consume a combination of fruit, insects and/or nectar in their diets (Isler, 1988).

Generally, it is not considered difficult to supply tanagers with a suitable diet in captivity. However, while we know that most tanagers in captivity live far less long than their potential life span, we do not know that much about health issues, and it may well be dietary problems occur more often than we suspect. Because there is nothing known concerning nutritional requirements of tanagers, we can only use information on requirements of other avian groups (primarily available for poultry) to make educated guesses at what is "reasonable" for tanagers. Tanager manangers are strongly urged to consider potential toxicities, shortages and interactions of dietary components when formulating the entire diet and when choosing commercial food products.

Some dietary concerns issues will be flagged up below, but these are not exhaustive, and hopefully if tanager managers work together to improve tanager husbandry we will gain insight into tanager dietary issues. A summary of feeding recommendations discussed in this section are provided at the end of the section.

Diet changes should be made gradually**,** even when just switching from one manufacturer (e.g. of commercial softbill diets) to another.

### Fruits and Vegetables

Fruits ranging from tomatoes and bananas to star fruits and pears can be given, provided that they are of good quality, fresh and properly ripened. Apples are available all year round and are usually inexpensive, but only dessert apples should be used, as cooking apples can be too acidic. Bananas are also an inexpensive, good food for softbills. Sometimes bananas are described as toxic; in large quantities, under-ripe and overripe bananas can cause digestive disturbances or even death in very small birds. Tomatoes are often popular and can be especially useful for tempting newly purchased birds to feed; the red colour seems to attract tanagers. Pears, mangoes, pomegranates, cherries, peaches and edible berries are suitable for softbills. Avocados are also favoured by some aviculturists; but have high levels of lipids and Vitamin E. The leaves and stem of the avocado plant are also potentially toxic (Vince, 1996).

Dried fruits are often relished by tanagers. Dried fruits are high in calories and therefore can be advantageous in situations in which tanagers require much energy, but the iron content needs to be evaluated as well. Vince (1996) recommends soaking dried fruits for two hours before rinsing and feeding them while Vriends (1977) recommends a 24-hour soaking period.

Feeding citrus and other high Ascorbic acid (Vitamin C) containing-fruits, e.g. citrus, papaya, strawberries, and canteloupe, should be limited as there is a possibility that ascorbic acid will increase uptake of iron. Feeding some Vitamin C is advisable however, as it is not known whether tanagers can make their own Ascorbic acid or require it through the diet.

Green food, e.g. lettuce and endive, are often much appreciated by tanagers, and in some cases may help to discourage tanagers from eating the leaves of plants in their exhibit. Spinach should be fed in moderation because of its high levels of Oxalic acid, which can interfere with calcium uptake. Vince (1996) recommends feeding no more than 5% spinach by volume.

Sprinkling *Spirulina* on fruits retards spoilage of the fruit.

Fruit can be fed diced, halved, and even whole. Fruit can be placed in shallow bowls above the ground, or stuck on branches or skewers. It can also be placed in receptacles (e.g. wire-mesh, nets) that tanagers have to pick through to obtain the fruit. Some tanager keepers feed fruits mashed, using the outer part of a fruit (for example the skin of an apple half) as the food dish. This allows fine mixing of fruits and possibilities to add vitamin/mineral supplements.

Insects and Other Invertebrates

Many insects can be used to feed tanagers; individual birds have their own preferences. Commonly fed insects include wax moth larvae, mealworm beetle larvae (the newly moulted ones are particularly suitable as rearing food for small chicks) ant pupae (also very suitable rearing food for small chicks), small crickets and grasshoppers, *Drosophila* (fruit flies) and maggots. It is possible to keep an active (fruit fly) culture in an enclosure. Mediums for culturing fruit flies are commercially available (see Appendix II).

Other invertebrates may also be well eaten by tanagers; euphonias at Brookfield Zoo often feed their offspring snails that they find in the enclosure (A. Oiler, pers. comm.). Annelids (e.g. earthworms and night crawlers) generally have a sufficient amount of calcium, but nutritional content can vary depending on substrate kept on (Bernard and Allen, 1997). Spiders are often consumed by tanagers.

Commercially bred live food may carry pathogens that could infect the birds (D. Bolton, pers. comm.). Commercially-bred invertebrates may also be of little value nutritionally, depending on what they have been fed. Insects (including insect larvae) are often deficient in calcium. It is much better to breed live food in-house; as this allows more control over pathogens and also provides possibilities to enrich the invertebrates with minerals and vitamins, enhancing the quality of the invertebrates as food items. A calcium-rich diet formulated for crickets that has also been used successfully for mealworms is shown in Table 1 below.

Care should be taken with feeding live food in choice of items fed and method of feeding to prevent an infestation (e.g. ants) in the enclosure, or outside the enclosure boundaries. Live food, including crickets, can be fed in an aquarium-type container that allows the birds to enter but does not allow the insects to escape (see also food-related enrichment).

**Table 1.** Example of a high (8%) calcium diet formulated for crickets (Bernard and Allen, 1997).

| **Ingredient** | **Percentage by weight** |
|---|---|
| Corn grain (ground) | 8.3 |
| Alfalfa meal. Dehydrated (17% CP) | 10.0 |
| Soybean meal, dehulled, solvent extracted (48% CP) | 28.7 |
| Wheat, ground | 27.0 |
| Calcium carbonate (38-40% Ca) | 20.0 |
| Dicalcium phosphate (21% Ca, 18% P) | 2.0 |
| Salt | 0.5 |
| Mineral premix [a] | 0.25 |
| Vitamin premix[b] | 0.25 |
| Soybean oil | 3.0 |

a : Contains per kg- 144g Ca; 0.04g P; 4.3g Mg, 0.6g K; 84.2g Fe; 83.3g Zn; 81.1g Cu; 119g Mn; 0.32g I, and 0.08 Se

b: Contains per kg- 28,000,000 IU vitamin A; 2,800,000 IU Vitamin D; 132,000 IU vitamin E; 0.6g vitamin K1; 7.1g thiamine; 2g riboflavin; 35.6g niacin; 9.5g d-pantothenic acid; 2g pyridoxine; 1.5g folic acid; 99mg biotin; 6mg vitamin B12; and 190g choline.

Nectar

Nectar is a substantial part of honeycreeper, dacnis and euphonia diets and seems to be a preferred item by many tanagers. The concern that tanagers given nectar on a regular basis will ignore other foods and develop a deficiency of important nutrients was raised at the EAZA Passeriformes TAG Tanager Husbandry Workshop 16 February 2003. However, most tanagers in the wild eat nectar if available, and several tanager keepers who regularly provide nectar to tanagers reported that they have not encountered problems. Nectar is an excellent "enrichment food" and can be very useful in luring tanagers into a trap cage to capture them in larger enclosures.

There are several commercial nectar replacement formulas available (see Appendix II for examples), and no evidence to date that any are superior to others in terms of results. However this may also be because health problems of tanagers are so poorly understood, and choice of which nectar replacement formua to use deserves thorough consideration.

Most of the commercial nectar replacement formulas indicated by the manufacturers as being suitable for tanagers are developed for lories. Vitamin A levels in many of these formulas are much higher than levels shown to be to suitable for loriekeets, for which problems were observed on diets with 10,000 IU/kg (McDoanld, 2004). Vitamin A levels are also much higher than recommendations for other avian species for which scientifically based recommendations are available, e.g. cockatiels (4-6,000 IU/kg with 10,000 IU/kg being toxic, Koutsos and Klasing, 2002) and poultry (1,500 IU/kg for chickens to 5,000 IU/kg for turkeys). While Vitamin A requirements of tanagers are not known they probably are not very high, as natural foods of tanagers (fruits and insects) are generally low in useable Vitamin A (McDonald, 2003).

Excess Vitamin A can result not only in vitamin A toxicities but also deficiencies in the other fat-soluble vitamins (D, E and K) as well as carotenoids (McDonald, 2003). Excess dietary vitamin A can interfere with the uptake of these nutrients, even if there appears to be adequate dietary supplies. Vitamin A may enhance uptake of iron (McDonald, 2003), also a consideration in diet formulation, as tanagers are somewhat susceptible to iron-storage disease (Kincaid and Stotskopf, 1987; Crissey and McGill, 1991).

Regular replacement of nectar (at least two or three times a day) is necessary to prevent moulding. Nectar can be fed in small tubes or dispensers that should be well-cleaned after each use.

Lists of nectar-producing plants are provided in Appendix I.

Commercial Softbill Diets

Several commercial softbill diets are available in most countries (see Appendix II for examples). There are not enough data at this time to make recommendations concerning which are most suitable for tanagers. Again, little

is known concerning tanager health issues, and dietary problems may occur more often than we suspect. A low-iron (definitely below 100 ppm, and preferably below 70 ppm iron) softbill diet should be used as tanagers are somewhat susceptible to iron-storage disease (Kincaid and Stotskopf, 1987; Crissey and McGill, 1991). The profile for other minerals and vitamins should be reasonable given what we know for other species.

Calcium Supplementation

The two nutritional components usually supplemented in tanager diets are calcium and proteins. Calcium is a prerequisite for the development and growth of a healthy skeleton. It is also used to help blood clot and in the manufacture of eggs shell, and is necessary for correct functioning of the heart, muscles and nervous system. Deficiencies can cause muscle weakness, brittle or rubbery bones, or poor bone growth. Chicks are especially susceptible to such disorders, thus adding a calcium (and vitamin $D_3$) supplement to rearing food is highly recommended. Harris (1987) reported that calcium deficiencies were observed in breeding female tanagers. Signs were shelless or thin shelled eggs, leg splaying, infertility, long egg laying periods (over one to two hours).

The visible effects of calcium deficiency on health of animals has given rise to the belief that a lot is necessary, particularly in growing animals. However too much Calcium can be a detrimental as too little, and both dietary excesses of Calcium and Vitamin $D_3$ may result in a Calcium: Phosphorous imbalance. Calcium levels of 0.7% were toxic to both budgedairs and blue and gold macaws (Roset *et al*. 2000, Phalen pers. comm. in McDonald and Stanford, 2003). Given the information now available, Calcium should preferably be between 0.5-0.7%, and should definitely not constitute more than 1% of the diet. Calcium should be supplied in a 1:1 to 2:1 ratio with phosphorus (Fowler, 1978).

Calcium sources often used for birds include powdered dicalcium phosphate and calcium carbonate, bone meal, powdered milk, cheese and eggs. Calcium sources vary in the amount of calcium they supply, with Calcium carbonate being 38-40% Calcium by weight, and Dicalcium phosphate being 21-27% Calcium (and 18% Phosphorous). Calcium carbonate sourced from oyster shell can be highly contaminated with iron (McDonald, 2002), which could be detrimental to tanagers as they are somewhat susceptible to iron storage disease (Kincaid and Stotskopf, 1987; Crissey and McGill, 1991).

Vitamin D levels have not been established for pet and aviary birds, but Vitamin D recommendations for poultry ranges between 200 to 900 IU/kg, and many species are likely to be more sensitive to Vitamin D intoxication than poultry (Roset *et al*. 2000). Insufficient UVB lighting is correlated with vitamin D deficiencies in some animals, and may influence Vitamin D formation in tanagers, a condsideration if tanagers are kept indoors without adequate UV-B lighting.

Protein Supplementation

The entire body requires proteins. Approximately 5% of body proteins are replaced daily in a normal bird; injury and activity increase the rate of turnover. A balanced diet should contain both animal and vegetable proteins. The relative amounts consumed will depend on whether the bird primarily eats

fruits, insects, nectar or meat. Studies have shown that live foods commonly used in captivity contain approximately 20% protein. Insectivorous species generally consume 20 to 25% protein. Omnivores thrive on slightly lower protein levels of 15 to 20% since lower-protein foods such as fruits and leaves form the foundation of many of their diets. Consumption of protein increases as omnivores begin to feast on the seasonal abundance of insects at the beginning of the breeding season (Vince, 1996).

Although captive omnivores are often given live food year-round, in the presence of a good diet, they are not believed to need it, except duing the reproductive seaon. Live food may stimulate breeding activity and is important food duirngchick rearing. An excess of live food, especially larval wax worms, which have a high fat content and can cause life-threatening obesity and/or malnutrition, can be detrimental if other items in the diet that are nutritionally important are ignored (Vince, 1996; Oiler *et al*., 1998). Tanager keepers often only offer tanagers insects in moderation during the non-breeding season.

Tofu is a good source of protein; it is inexpensive, easily available, easy to feed, and many tanagers seem to like it. A low-fat protein source given to tanagers at Vienna Zoo is a mixture of ground beef heart and "cheese". The cheese is made by boiling sour milk until it coagulates and removing the liquid. Vitamin supplements can easily be added to the beef-cheese mixture (R. Pfistermueller, pers. comm.). Pinkies (young hairless mice or rats) are also sometimes fed (in pieces) to tanagers.

Coloration

It is not known to what extent colours of tanagers are dependant on diet, but many birds can lose the vibrancy of their red, yellow or orange plumage after successive moults in captivity**.** Green coloration can become bluish**.** Natural pigment occurs in foods that are high in carotenes (orange to red-coloured hydrocarbons found in many plants). The yellow carotenoid pigment (xanthophylls) is found in foods such as egg yolk and dark green vegetables while red pigment (beta carotene) can be found in carrots, tomatoes, paprika, red peppers, sweet potatoes and red berries. It is important to ensure that tanagers have adequate pigment-containing dietary items or other pigment supplementation for feather coloration, particularly for several weeks preceding the moult and a short time afterward. Growing feathers will then receive the colouring agents needed to achieve their proper colour via the blood supply (Vince, 1996). Levels of nutrients should be considered in use of pigmentation supplements, as some contain extremely high, probably over the long term detrimental, levels of vitamin A (see Nectar section for discussion on Vitamin A). Excess Vitamin A may inhibit uptake of pigmentation caratenoids (McDonald, 2004). Tanagers at many facilities are regularly fed blue-green algae *Spirulina*, which is believed to help tanagers to keep their bright colours. Spirulina is also an excellent way to provide birds with Vitamin A, as it is a provitamin that will only be converted if needed.

Food-related Enrichment

Tanager feeding aggregations often move from one fruiting/flowering tree to another in the wild (Isler and Isler, 1987). Various fruiting trees and other fruiting plants can similarly be dispersed through the enclosure; either grown in the ground or in pots or branches hung where the birds will use them. Tanagers

will eat (parts of) flowers and peck out pieces of whole fruits. Passionflowers and cherry blossoms are two examples of acceptable flowers. *Ramphocelus* tanagers have been reported to drink the juice from the base of new banana leaves. Tanagers often also eat the fresh young green leaves of *Ficu*s plants. Many tanagers in the wild eat berries of neotropical mistletoe, although these berries are poisonous they do not seem to affect on tanagers. The tanagers mash the berries using their mandibles, separating the seed and/or skin, which are then dropped (Isler and Isler, 1987). If providing mistletoe, keep in mind that mistletoe from the tropics is quite different from mistletoe found in temperate zones. Other dietary items offered can also be dispersed throughout the enclosure. Care should be taken not to overfeed tanagers with additional fruits when fruiting trees are abundant in the enclosure.

Increasing difficulty in procuring a food item is a common environmental enrichment technique used for animals, including many bird species, which can be appropriate for tanagers. Insects could be offered from a dispenser with holes in it, allowing the insects to emerge in a random fashion. The tanagers should have the opportunity to catch the insects before the insects fall to the ground, as tanagers do not usually feed on the ground. Insects could also be offered covered by a substrate or pieces of bark in a deep-sided feeding dish. Hanging fruits on skewers and branches or in nets/other receptacles are also common methods of adding food enrichment.

Food Presentation

Generally food for tanagers should be offered above the ground. Multiple food sources should be offered at different places and different heights in the enclosure if there is competition for food. Food dishes should be unreachable by vermin (e.g. mice) to reduce spread of disease. Faecal contamination of food and water in indoor enclosures should also be reduced as much as possible to help reduce disease spread (e.g. atoxoplasmosis). Foods fed in outdoor areas should be offered in covered feeders or in a covered part of the enclosure to prevent faecal contamination by endemic species.

Water

Water consumption depends on environmental conditions, physical activity and diet. Dry and highly nutritious pelleted foods tend to heighten a bird’s thirst. Although fruits and insects provide much moisture, access to fresh drinking water is essential for most species and should not be denied for more than an hour, especially in hot weather (Vince, 1996). The drinking water source should be protected from faecal contamination (e.g. no over-hanging perches) in order to reduce risk of disease transmission.

Bathing water is also necessary for softbills to maintain peak condition. The depth of the water depends on the species, for small or sick birds, 1.2 cm is best. The uropygial (preen) gland is located at the base of the tail and secretes oil that is spread over the feathers during preening. Preening with this oil waterproofs the plumage, making it more durable and possibly helping to prevent skin infections. Most birds bathe regularly, preen and maintain a waterproofed plumage. If bathing water has not been available or has not been used, the natural waterproofing will be diminished or lost. A misting system is highly beneficial in all aviaries, encouraging many birds to bathe more

frequently than they otherwise would (Vince, 1996). Tanagers will also bathe in foliage that has been sprayed.

Summary recommendations

Feed only in moderation:

Dried fruits (with high iron levels)
Avocados (high in fats and Vitamin E)
High Ascorbic acid containing fruits and vegetables
(e.g. citrus, papaya, strawberries, canteloupe)
High Oxaleic acid containing vegetables (e.g. spinach)

Vitamin A: Maximum 6,000IU/kg, watch pigment supplements and nectar replacers

Vitamin E:
200 mg/kg

Vitamin D:
Maximum 900 IU/kg

Iron: 80mg/kg (watch water source, heavy metals, commercial softbill diets, fruits and vegetables high in Ascorbic acid, Vitamin A and Oxaleic acid,)

Calcium: Maximum 1% of diet weight, feed 1:1 to 2:1 Calcium: Phosphorous ratio.

Protein:
20-25 % during breeding season, 15-20 % during non-breeding season

## 1.3 Social structure

Basic Social Structure

Social considerations for tanagers much depends on the exhibit size and whether the tanagers are in a breeding situation or not.

A large exhibit e.g. a walk-through free-flight aviary, will allow more species to be held, while only one breeding pair can be held in a “small” enclosure.

The most basic social group is a (breeding) pair, together with its offspring as appropriate. Most species of tanagers are often aggressive towards conspecifics or similarly coloured species, and it is difficult to keep multiple pairs in one exhibit, especially in the breeding season, with the exception of euphonias. The size and the furnishing of the exhibit will determine the number of pairs of different (not similarly coloured) species can be held. When the young become older, they or their parents will need to be removed from the enclosure to prevent aggression between the parents and their immature offspring.

Changing Group Structure

(Re) introduction of individuals and fledglings often causes problems. One of the main death causes of tanagers is trauma. Introduction cages can greatly facilitate (re) introductions. A bird can be held in a small introduction cage (minimal recommended size 88 cm x 60 cm x 60 cm, for no more than two birds) for a few days before being released into an exhibit. This allows the newcomer to acclimate to its new surroundings slowly. It also gives the birds in the exhibit a chance to interact with the new bird before the bird is released (Oiler, 1999).

When introducing a male and female it is probably better to put the male in the introduction cage and allow the female to move freely in the exhibit because males tend to be more aggressive. However if there is potential competition from other species in the exhibit the female should initially be placed in another introduction cage. Introduction cages are also very useful for introducing a fledging bird to its post-nest environment in a safe manner (See Parent Incubation and Rearing).

Tanagers usually form same-species or mixed-species flocks during the non-breeding season in the wild. Tanagers are also reported to be less aggressive during the non-breeding season in captivity, however many species breed throughout the year in captivity, thus formation of non-breeding flocks is not usually a possible housing option. Species-specific recommendations are made in the species accounts.

Sharing Enclosures with Other Species

Tanagers may often be housed with many other species without harmful incidents if the exhibit is adequate to hold multiple species, meaning that the enclosure can fulfil the needs of all individuals. Birds that have been housed with tanagers include fruit pigeons, roul rouls, spoonbills, macaws, ducks, hummingbirds, ibises, and if exhibit constraints will allow it, even other tanager species. Tanagers have also been housed with some reptiles, e.g. turtles and iguanas and mammals, e.g. sloths and agoutis (Oiler, 1996). Care should be taken with predatory/territorial species, and also possibilities of cross-taxonomic disease transmission.

It is advised not to hold similarly coloured tanager species together in the exhibit because it may stimulate territorial/aggressive behaviour (outcome EAZA Tanager Workshop 16 February 2003, Arnhem, Oiler *et al*., 1998). Pairs of a tterritorial species should not be held in adjacent enclosures without solid walls between the enclosures, as this can disturb breeding activity and be extremely stressful for the tanagers. Likewise, similarly colored territorial tanager species should not be held in adjacent enclosures without solid walls between the enclosures.

## 1.4 Breeding

Pair Formation

Males tanagers display by singing and exhibiting their brightest or most contrasting feathers, which are sometimes hidden in relaxed plumages. Males often feed the female. Females solicit copulation: pre-copulatory female behaviours include wing fluttering, tail lifting and horizontal crouching. Copulations are usually seen throughout the nest-building phase (Isler, 1988).

Only a few tanagers (e.g. euphonias) are non-territorial and can nest in groups, therefore having the best possibilities to select a partner. For most species, successful pair formation without accidents is probably best achieved using a method whereby the birds are allowed to choose a mate before introducing them in the same enclosure. A female can be housed next to more than one potential mate, and her behaviour observed to determine to which male she is more attracted. Perches near and away from all males should be available to the female and males should be able to perch close to the female as well as away from her as shown in Figure 4. Signs of pair compatibility include: the male

and female constantly perching near each other (14 cm proximity or less), frequent singing by male, male feeding the female through the wire, and/or female solicitation (Oiler *et al*., 1998).

If a pair seems to be well suited to each other but breeding activity does not occur once the pair is housed together, moving them to another enclosure appropriate for tanagers may stimulate breeding activity.

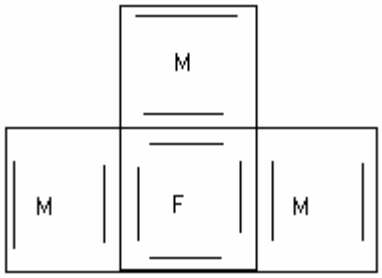


Fig. 4 Arrangement of cages for pair-formation method

If only one male and one female are available, it is best to put the male in an introduction cage so the birds can get used to each other before full contact is possible (Oiler, 1996).

Breeding Environment

Although tanagers may breed in large free flight aviaries, it is generally agreed by tanager managers that keeping pairs in small breeding cages (minimally 3.0 m x 1.5 m x 2.0 m) allows more intensive management and gives the best breeding results. Some zoos keep tanagers in both large free flight aviaries as in small breeding cages, with the free flight aviaries viewed as being consumers and small breeding cages being producers that can restock losses in the free flight aviary (G. Schleussner, pers. comm.).

Hau (2001) describes tropical birds as more responsive to environmental cues than most temperate birds to regulate reproduction. Some tanager breeders at the Tanager Husbandry Workshop in Arnhem advocated keeping tanagers in a relatively 'poor' environment during the non-breeding season and in a 'rich' environment (with an abundance of light, insects, plants, fruits, mists, etc.) just before and in the breeding season to stimulate breeding activity. Harris (1987) reported that moving tanagers from a more sterile environment where they could rest and fatten up to a heavily planted avairy usually triggered breeding activity within a week.

Nest Construction and Materials

The female takes leadership in nest construction, but males often help. Most tanagers build cup nests, but some, e.g. *Euphonia* spp. build dome nests. Tanagers generally require some experience in nest building to construct a good nest (Harris, 1987). Nests are usually placed in dense clusters of leaves, but tanagers living in mossy forests may place their nests in dense clusters of moss (Isler, 1988). Harris (1987) noted that tanager nests at Woodland Park were placed either in a dense bambusa plant or in the crotch of a Dracaena. Tanagers in other facilites have used a variety of different sites.

If good opporrtunities to construct a nest are available, tanagers will often choose this option (G. Schleussner, pers. comm.). Artificial nest sites, e.g. half or fully open fronted boxes, wicker nests, planting hanging baskets, and hardwire cloth baskets (e.g. 12.5 X 12.5 X 5 cm) are generally well accepted however (Harris, 1987; Vince, 1996).

Suitable nesting materials can often be derived from the vegetation; e.g. palm "hair", moss, grasses, coconut twigs/fibres and leaves. Nesting sites and materials may be provided if there are not enough natural nesting materials/sites in the exhibit. Sphagnum moss, hay and cotton are sometimes used as nesting materials.

Nesting materials, type of nest used and height of placement of nests used per species are included in species accounts in these guidelines.

Nest Observation and Chick Monitoring

Once the young have hatched the birds should be observed until it is certain the parents are bringing food to the nest throughout the day. If the nest is accessible, and there is any concern about proper parental care or development of the young, the hatchlings can be weighed regularly (e.g. every other day) to monitor development. Most tanagers accept daily nest checks without problems. If parental care is not adequate, supplemental feeding of hatchlings in the nest may be an option. If parental care is non-existent, or supplementation is insufficient or not an option, hatchlings can be pulled for hand rearing (Oiler *et al*., 1998, A. Oiler, pers. comm.).

A small video camera can be mounted with a view of the nest to monitor nest activity. This allows keepers to observe the birds without disturbing them, and from another, possibly more convenient, location. If the monitor is viewable by the public it can also offer a useful educational tool. Oiler (1999) noted that tanagers usually ignore unobtrusive video cameras set up on tripods within their cages. Multiple cameras mounted to view different nests or different locations can be connected to a single, inexpensive monitor. A control panel can then be used to schedule scanning of the various cameras (Wilkinson, 2002). Smith (2002) found equipment for video monitoring to be surprisingly inexpensive: the entire surveillance system to monitor a pair of hornbills, including two cameras, a monitor and all the necessary cables, was US$ 90. Adding a recorder (preferably 24-hour) to the system enables viewing of recorded tapes later.

Parent Incubation and Rearing

Parental skills tend to improve among tanagers, it seems that parenting requires some learning in this avian group.

The female generally begins laying eggs a day or two after the nest is completed. Tanagers generally lay two to three eggs. The euphonias and chlorophonias, smaller tanagers which nest higher up than other tanagers and are the only ones to fashion closed nests, generally lay four to five eggs and have longer incubation and nestling periods (Isler, 1988). Only the female incubates, and incubation generally begins after laying of the second egg (Oiler *et al*., 1998). Males attend their mates, sometimes feeding them (Isler, 1988).

Chicks generally hatch in the morning, and the parents may appear very excited, with the female frequently peering into the nest. Only the female broods the young (Ciarpagnini, 1971; Vince, 1996; Oiler *et al*., 1998).

Chicks may not be fed the first day, however it is advisable to offer some nestling food once hatching has occurred. Tanagers, particularly inexperience parents, may offer the chicks inappropriate food items if these are available. Therefore it is better to initially only provide highly digestible, soft-bodied insects such as wax moth larvae, white (moulting) mealworms, maggots and ant pupae. Extra soft fruits, e.g. ripe papaya, pear and apple, are often taken by tanagers during chick rearing. Moro (Birdlistserv 13 June 2004) noted that Houston zoo has had success fledging young using a diet that includes soaked Mazuri parrot breeder pellets. The parents generally bring food to the young every 10 to 15 minutes the first few days, and every 15 to 20 minutes in the next week, therefore insects need to be almost continuously available, particularly during the first week.

Chicks are born featherless and with the eyes closed. Around five days of age the eyes open and pinfeathers begin developing on the wings, abdomen and chest. The chick begins flapping its wings and preening itself by day 10 or 11, and most species fledge between 14-17 days of age. Adult plumage is usually acquired within one year or less (Oiler, 1999).

Problems with the parents, or just the father, throwing the young out of the nest just before fledging regularly occur among tanagers. It is not known why this occurs, some suggestions are that the parents (or just the male) are over-stimulated by the large amount of live insects they receive to feed the young and want to breed again.

If only the male is aggressive towards the young, it may be possible to remove him and let the female finish rearing chicks. If both parents have a history of being aggressive towards offspring just before fledging (which occurs in most species at approximately two weeks of age) it is advised to use small "fledgling" cages. This allows parents to feed the young through the wire and the young to gain strength and learn to fly without accidents, and to familiarize themselves with the surroundings. Oiler (1999) suggested using a mesh size of 1 in x ½ in (2.4 cm x 1.2 cm) for the fledging cage. The fledging cage should include perches that are close enough to the ceiling that the parents can land on the cage and easily feed the young through the meshing. Perching at different heights throughout the cage should allow the young to easily move from the bottom and top of the cage. A fledgling cages used in a mixed species enclosure at Brookfield Zoo is ca. 117 cm in diameter, and 147 cm high. Cages smaller than 88 cm x 60 cm x 60 cm are never advised for tanagers (Oiler, 1999), and a cage of this size would not allow a young tanager to develop its flight abilities very well.

It is often also advisable to use such a fledging cage if young will fledge in a large mixed- species enclosure where the young would be very vulnerable to harassment by other birds; even roul rouls sometimes kill fledgling tanagers. The young can be released from the fledgling cage once they are flying well and have had a chance to become familiar with the environment. Enclosures should contain perching possibilities (thin branches at different levels, including near the ground) throughout the cage when the young fledge or are released, as fledgling tanagers are clumsy fliers. In some cases it may be better to drain pools or lower the water level as well.

Because tanager fledglings can be very skittish and prone to accidents when just learning to fly, extreme care during feeding and no cleaning of the

enclosure was found to be necessary for several days post fledging at Woodland Park Zoo (Harris, 1987).

Tanager young continue begging for 10-18 days post-fledging. Harris (1987) reported that extra food pans were offered to tanagers for two to four weeks post fledging. In cases where chicks were difficult to wean first the additional insect feedings and later supplemental food pans were gradually removed until the parents fed the chicks only the adult diet.

Renesting

Most tanagers nest at least two times in succession, often beginning a couple of weeks after the first brood has fledged. Immature tanagers have sometimes been observed helping to feed nestling siblings, however some tanager parents may become aggressive to their offspring when they begin breeding again, requiring removal of the young (Oiler *et al*., 1998). The young should be watched once removed to ensure they are eating on their own.

Harris (1987) reported that several female tanagers at Woodland Park Zoo had died due to "burnout" after or during the laying of a third clutch, and therefore tanagers were no longer allowed to nest a third time in succession. She found that if a pair was in good condition and carefully monitored, it could be allowed to rear two sets of consecutive clutches with a rest period (in a relatively "poor" environment where the parents could rehabilitate) between sets, for a total of four clutches per year. Generally the tanagers were dissuaded from breeding from December to February, as winter chicks appeared to be less vigorous and smaller than chicks hatched during other times of the year.

Artificial Incubation

London Zoo reported to have artificially incubated eggs of *T. icterocephala* in a forced air incubator at 37.5ºC and RH 60% (J. Ellis, pers. comm.) Vince (1996) recommends a dry-bulb temperature 38.1ºC, with a wet-bulb temperature of 30 to 31.1ºC and RH 58%, and provides an incubation protocol suitable for softbills, including tanagers.

Brookfield Zoo artificially incubates tanager eggs in a Humidaire Model #20. at 37.5ºC (99.5ºF) with a wet bulb reading of 30.0-30.5ºC (86-87ºF). The incubator has an automatic rocking tray, which cycles one time per hour. The eggs are rotated manually 180º one time per day. Eggs are misted three times per day by hand, using warm, softened water (Oiler, 2000).

Hand Rearing

It is best to hand rear more than one chick at a time so that imprinting does not occur. When rearing a single chick it could be useful to provide a mirror after the chick opens its eyes (Oiler, 1999). It is advisable to put fledged chicks in (initially restricted) contact with adults as soon as possible. Oiler (1999) reported that a hand-reared chick introduced to its parents while still in a fledging cage was fed by the parents as well as by the keepers. Vince (1996) provides a hand rearing protocol for softbills (including tanagers).

## 1.5 Record Keeping

While husbandry research in zoos is becoming more important, so is maintaining good records about individual animals. Most zoos are currently using ARKS developed by the International Species Information System.

Information that is useful to record in addition to the standard ARKS data includes:

- Diet
  Dietary components, amount of food and method of feeding.
- Egg production and reproduction
  Placement of nests (e.g. height, indoor/outdoor, plant species used), copulation dates and times of copulation, egg-laying dates and fate of eggs.
- Weight
  The best determinant of survival capability is probably weight, therefore weighing of chicks and adults is recommended, either regularly or at least on occasions that the birds are otherwise in hand.
- Behaviour
  Aggressive behaviour, intra- and inter-specific interactions.
- Medical history
  Diseases, diagnosis, medication
- Death causes
  Post mortem reports.

The necessity of maintaining good records cannot be overemphasized. By reviewing past records, changes can be made to improve protocols for the future (van Benthem, 2002).

## 1.6 Handling

### General Handling

Hold bird in one hand, with head between first two fingers and remaining fingers gently enclosing the bird (Oiler, 1999).

### Catching and Restraining

Birds in small exhibits are easily netted with small hand-held nets.

Birds in big free-flight aviaries are best caught by luring them with their favourite food items into trap cages. A string attached to the trap cage door enables the keeper to trap from a remote location (Oiler, 1999). Feeding the birds regularly in the trap cages speeds up the process of catching. Mist nets, composed of a fine filament mesh, can also be effective for catching birds in a large enclosure, but experienced personnel are needed to use this technique (G. Schleussner, pers. comm.). The mist nest should be set up in the flight path of the tanagers that are targeted, and it may be helpful to bait the net as well. Care should be taken when extracting birds from a mist net, as the birds can easily become entangled in the net (Oiler, 1999).

### Transportation

All tanagers should be transported individually, since they tend to be easily stressed. Tanagers can be shipped in small wooden, ventilated crates. Any area with screening should be covered with burlap to maintain privacy and a comfort level for the birds. Perches should be provided within each crate. If the bird is exceptionally nervous, a smaller space is better. Extra protection may include carpeting or other types of padding on walls and ceiling to prevent any injuries from occurring. A small amount of food (approximately ¼ cup of

chopped fruit and 10 mini mealworms) should be included. Extra grapes or other watery fruits can sustain a bird on a long transport. All dishes must be well secured to the inside of the crate (Oiler, 1999).

When tanagers are transported on commercial airlines, IATA guidelines for crates and shipping must usually be followed.

Tanagers should not be transported at temperatures of less than 15ºC.

Individual Identification and Sexing

All tanagers kept in a free-flight aviary should be given coloured bands to identify individual birds (outcome of the EAZA Passeriformes TAG Tanager Husbandry Workshop 16 February 2003). Chicks have to be ringed around the fifth day with a ring size of ~ 3 mm (see species accounts for ring sizes) if a closed metal ring is used, otherwise ringing with a open ring when a tanager fledges may be easier. While rings are important in individual identification they do carry a risk of injury to the tanager should the ring become caught in vegetation (e.g. coconut or palm fibre).

Sexing most tanagers by sight can be rather difficult, since most species are monomorphic. Keep in mind that mistakes because of subspecific differences have been made in sexing individuals in species in which females (and juveniles) are similar to males but duller in colour: individuals presumed to be females were actually males of a different sub-species.

Other options to sex tanagers include endoscopy and DNA feather or blood analysis. Preference goes to DNA sexing since this causes the least amount of stress to the birds and is very reliable. DNA sexing using blood requires only a single drop, and using feathers can be done as soon as the chick acquires its first non-down feathers. See Appendix III for a list of DNA sexing laboratories across Europe.

Anaesthesia

Administration of anaesthesia for events such as endoscopic sexing or surgery is necessary. Generally isoflurane gas in considered being the best anaesthetic to use with birds. However, several deaths of Brazilian tanagers *Ramphocelus bresilius* have occurred during use of isoflurane at Frankfurt Zoo, and it was decided not to use this anaesthesia with this species anymore as it was concluded that the gas contributed to death of the birds (S. Stadler, pers. comm.).

## 1.9 Health and welfare

Tanagers are generally short-lived in captivity, but if well cared for can often reach 10-12 years of age. One dacnis is now 20 years of age (A. Oiler, pers. comm.). Mortality of captive-reared chicks in North America is quite high in the first month, and higher than that of wild caught conspecifics during the first year. Thereafter mortality is similar between these two groups of birds (A. Oiler, pers. comm.). Mortality in Europe may follow the same pattern, but few data are available.

Quarantine

National and/or international legislation may apply to quarantine of tanagers in a given zoo, and such legislation must be followed.

Even if quarantine in an external station is required prior to arrival at the receiving facility, "in-house" quarantine for a minimum of three weeks is recommended, during which time three faecal examinations for parasites and Salmonella should be carried out at one-week intervals.

Standard quarantine procedures (e.g. use of foot baths, care of tanagers by personnel not in contact with other birds in the collection, use of facilities with easily cleaned and disinfected floors and walls and separate filtration and drainage) should be applied. The quarantine period is inherently stressful to tanagers, however there are some measures that can be taken to reduce stress.

- Provide enough room: the minimal recommended size for temporary holding is 88 x 60 x 60 cm, for no more than two (compatible) birds. The higher the cage is off of the ground, the better. Screening the sides of the enclosure/cage with (semi) -solid cloth may help the tanager(s) feel more at ease.
- Perches should be essentially horizontal, and of diverse diameters and textures to exercise the feet and to avoid pressure sores. The circumference of some of the perches should be approximately 1/3 larger than the tanager's foot closed around the perch. Having sufficient perching at various heights in the enclosure can considerably reduce agonistic interactions if more than one tanager is quarantined in a cage/enclosure. Flight paths between perches should be unobstructed in small enclosures in which the tanagers have little room to manoeuvre.
- Food and water should be offered off the ground, preferably in the upper half to third of the cage/enclosure.
- The diet provided by the tanager's previous institution/quarantine station should initially be given; other items can additionally be given. Vince (1996) recommends initially feeding equal parts diced fruit and bread or sponge cake soaked in nectar than squeezed dry. If the birds are stable for several weeks, diet conversions can begin. Diet conversions (changes) should be made gradually, with no more than a 10% increase in the new dietary components and 10 % decrease in the previous diet components per day. If consumption drops off, or a tanager looses weight the diet conversion should be halted one step before problems were encountered for a period of several days before proceeding further in the conversion.
- Tanagers recently imported from the wild should initially be housed at 25°C (Vriends, 1977). The temperature may be gradually reduced (but not below 20°C for most species), over a period of several weeks, e.g. 1 week/ °C.

Physiological References

ISIS (2002) provides physiological reference ranges regarding a number of physiological parameters and weights (mass) for 12 tanager species, of which four (Silver-beaked tanager *Ramphocelus carbo*, Violaceous euphonia *Euphonia violacea*, Turquoise tanager *Tangara mexicana* and the Red-legged honeycreeper *Cyanerpes cyaneus*) are included in these guidelines. The values for the Silver-beaked tanager are included in Appendix IV to illustrate the type of information available to ISIS members.

Death causes

The main causes of death reported by 12 European facilities included: Aspergillosis, Atoxoplasmosis, Avian Tuberculosis, Coccidiosis, and trauma. Most data came from Antwerpen Zoo, which showed arrival dates and dates of

death. Out of 130 individuals confiscated by the Belgian government and given to the zoo, 28.5% died within the first one month after arrival, even more shockingly 73.1% of all tanagers died within the first year after arrival, with a median of 69.5 days. Birds are often weakened and/or stressed after being shipped from South America to Europe, thus being more susceptible to pathogens. Traders give imported birds an excessive amount of medications that many aviculturists and veterinarians think must have negative effects on birds (outcome EAZA Tanager Husbandry Workshop 16 February 2003, Arnhem).

The most common disease problems encountered in North America in recent years include Atoxoplasmosis, Aspergillosis, and Metabolic Bone Disease (A. Oiler, pers. comm.).

## Diseases

### Aspergillosis

Aspergillosis is fungal disease, predominantly affecting the lower respiratory tract and in most cases is caused by *Aspergillus fumigatus*. It is usually considered a secondary disease, occurring when birds are immune-depressed because of stress or another disease, however exposure to high level of spores can also trigger an acute form of the disease. There is no reliable test to establish whether living birds have contracted this disease or another disease with similar symptoms, and often this disease is not seen until it is too late.

Symptoms include open-mouthed, laboured and sometimes noisy breathing, and the tanager may experience a change in voice if the syrinx becomes affected. An infected tanager may look dejected, cough frequently, flick its tongue, and be much less active than usual. Marked weight loss and an extremely high white blood cell count may also be symptoms (Oiler *et al*., 1998; M. Mensink, pers. comm.).

Once the bird has lost considerable weight there is little chance of saving it. If autopsy shows that one bird died of Aspergillosis then all other birds in the aviary/exhibit should be monitored carefully for of the symptoms, especially open-mouthed breathing. The more quickly treatment is initiated the better the chance of recovery. Oiler *et al*. (1998) reported apparent success with a treatment involving a combination of an oral antifungal medication (e.g. Fluconazole or Itraconazole) and nebulizing with Amphotericin B at Brookfield Zoo, however as the disease cannot always be confirmed in living birds it may be difficult to confirm that Aspergillosis was indeed the cause of illness (M. Mensink, pers. comm.).

Growth of mould in tanager environments should be avoided in an effort to keep the number of airborne fungal spores to a minimum. Poor ventilation, dampness, old food, accumulations of droppings or decaying vegetation encourage growth of *Aspergillus* spp. and other fungi; if the birds are already weakened by disease, stress or malnutrition they may succumb (Vince, 1996).

### Atoxoplasmosis

*Atoxoplasma* spp. are coccidian parasites that exhibit a life cycle involving both the reticuloendothelial system and intestinal epithelium.

Diagnosis in living birds has been historically difficult, relying primarily on identification of the organism in a buffy-coat. Organ impression smears are more reliable, but can only be made from tissue of dead birds.

A recent study has found a high percentage of *Atoxoplasma*-positive results from clinically healthy tanagers, suggesting that *Atoxoplasma* is prevalent sub-clinically within captive tanager collections. Young and/or stressed tanagers are the most likely to develop clinical disease. Transmission risk of *Atoxoplasma* infection from wild passerines has not been established, however care should be taken when housing tanagers in outdoor enclosures (Adkesson *et al.*, 2002).
Prophylactic treatment with an anti-coccidian agent, such as Sulfaclozine-Na-Monohydrate (e.g. EB3®) or Toltrazuril (e.g. Baycox®), when chicks are ringed in the nest and when they fledge, as well as all tanagers when they are transported to another collection or to a new enclosure is undertaken at various facilities to reduce Atoxoplasmosis-related mortality. Staff at Brookfield Zoo is now experimenting with treatment of tanager parents at some stages of the nesting cycle to see if this will reduce transmission of the disease to the young.

Avian tuberculosis
Adult birds infected with *Mycobacterium avium* usually develop a chronic wasting disease associated with a good appetite. Other clinical symptoms may occur, including recurrent diarrhoea, poluria, polydipsia, anemia and dull plumage. Immature individuals frequently develop subclinical conditions. Definitive diagnosis is made by biopsy of affected tissue with histopathology and culture.
Euthanasia, rather than treatment of infected birds, is generally recommended because of zoonotic concerns: all *M. avium* isolates that have been tested are totally resistant to the anti-tuberculosis drugs routinely used in humans (Ritchie *et al*., 1994). *Mycobacterium avium* infections are considered to be "open", allowing infected birds to continuously shed large numbers of organisms into the environment. Contact birds should be removed from the contaminated area, and quarantined for a period of time, at least three months. Body condition (weight) should be monitored during the quarantine period, and Ziehl-Neelsen stains of faecal samples examined regularly (e.g. every two weeks). Birds that remain negative and are in good physical condition following the quarantine procedure can be considered likely to be free of the disease (M. Mensink, pers. comm.).
*Mycobacterium avium* is highly resistant to environmental extremes and can survive in the cage or aviary environment for periods ranging from months to years. Shedding from an infected host occurs primarily in the faeces, causing contamination of the soil or water supplies within the aviary. *Mycobacterium* has been found to remain infectious in soil for up to seven years. The substrate of a contaminated area should be removed, and all structures in the contaminated area thoroughly disinfected. Only disinfectant compounds tested against *Mycobacterium* are recommended for use in disinfection, and instructions for use need to be carefully followed (Ritchie *et al*., 1994, M. Mensink, pers. comm.).

Coccidiosis
Tanagers imported from the wild often carry coccidia, thus caution should be exercised when adding birds to the collection. Coccidia infections in passerine birds may be asymptomatic or may be associated with diarrhoeal syndromes (sometimes with blood in droppings), emaciation, general ill health and

systematic disease. It is often not possible to classify coccidial oocysts when examining fresh faecal material because sporulation may take several days to occur. Toltrazuril (e.g. Baycox®), sulpha drugs or amprolium are usually effective against Coccidida. Maintaining clean surroundings to reduce the birds' exposure to the infective oocysts and reducing stress may help control infections, but will probably not eradicate the organism from an aviary (Ritchie *et al*., 1994).

Iron storage disease

Iron storage in the liver can occur either through a high uptake of iron or because of an inflammatory process occurring somewhere else in the body (Cork, 2000). Iron is toxic to liver cells if accumulated in high concentrations. This toxicity can lead to death of cell neurons and eventual fibrosis. Clinical signs of chronic low level iron overload include reduced feed intake and reduced growth. Signs of chronic but high level toxicity include hepatotoxicity and hemorrhagic necrosis of the GI-tract. Low blood pressure, metabolic acidosis and cardiac failure are symptoms of acute toxicity. Some bird families seem to be particularly susceptible to iron storage disease. The greatest levels of stored iron as well as the most frequent pathologies are seen in passerines (mynahs/starlings, tanagers and birds of paradise) and toucans (Crissey and McGill, 1991).

Dietary components that can increase iron absorption include Vitamin A, Ascorbic acid (Vitamin C), sugars such as lactose, glucose and fructose and some amino acids. Those that may compete with iron for absorptive binding sites include other minerals (Co, Zn, Cd, Cu and Mn). It is important to control iron in the diet such that the iron requirement is met but the levels are held moderate. Dietary iron levels should be less than 80 mg/kg for iron storage disease sensitive birds .To do this, selection of food items offered becomes important. Items, including a nutritionally complete manufactured diet, should be selected based not only on iron content but also, for a complimentary nutrient content which meets all the nutrient requirements of the bird (Crissey and McGill, 1991).

Metabolic Bone Disease

Metabolic Bone Disease is a term describing a group of diseases usually caused by dietary mismanagement. Metabolic Bone Disease is characterized by metabolic defects affecting morphology and function of bones. It is most often caused by prolonged deficiency of calcium and/or Vitamin D, or a diet with improper calcium : phosphorous ratio (1:1 to 2:1 being considered proper). It is diagnosed by evaluating clinical signs, radiographic findings and the diet. Metabolic Bone Disease in growing birds is manifested as rickets and is characterized by bowing of the legs, stunted growth and swollen joints, spontaneous fractures, inability to perch and poor plumage. Mature birds develop osteomalacia or demineralisation of the bone (Fowler, 1978). The same symptoms can be caused by renal dysfunction, thus this possibility should also be explored.

Stress

Tanagers tend to be stressed relatively easily, particularly when they first come into captivity. The main causes for post-acclimation stress are enclosure mates;

visitors do not seem to have much effect on tanagers. Tanagers should be in optimal condition to breed; stress reduces fitness and thereby can reduce breeding success. Stress also lowers the immune response, making tanagers more susceptible to many diseases. It is therefore important to minimise stressful situations. When putting tanagers in an exhibit with other birds keep in mind that tanagers need seclusion from the other birds, and ample feeding sites so that competition for food does not occur. Providing at least one solid wall appears to give them a sense of privacy.

Candida

Candida infection in the beak and throat areas has also been reported in tanagers.

Pathology Review

Information on death cause of tanagers is scantly. This is in part because dead tanagers are often not found before they are too autolytic for a reliable post mortem investigation. It is important establish death causes of tanagers within an institution and among institutions in order to further refine tanager management. Rapid post mortem investigation and use of the same pathology report format in different institutions would be of great benefit. The MEDARKS post mortem investigation form (Appendix III) is considered the most suitable form.

1.9 European Tanager Collection Plan

The EAZA Passerine Regional Collection Plan currently includes 6 tanager/ honeycreeper species.

- *Cyanerpes cyaneus* Red-legged Honeycreeper
- *Ramphocelus carbo* Silver-beaked Tanager
- *Tangara cyanicollis* Blue-necked Tanager
- *Tangara arthus* Golden Tanager
- *Tangara chilensis* Paradise Tanager
- *Tangara fastuosa* Seven-coloured Tanager

Numbers of individuals of tanager species in European zoos fluctuate greatly, and it may be that some species currently in the collection plan will no longer be included and others will be added when the collection plan is reviewed.

Species account

# 2. Silver-beaked tanager

## Natural history data

### 2.1 Taxonomy

Class: Aves
Order: Passeriiformes
Family: Emberizidae
Subfamily: Thraupinae
Genus: *Ramphocelus*
Species: *Ramphocelus carbo*
Common name: Silver-beaked tanager
Sub-species: *Ramphocelus carbo unicolor*
*Ramphocelus carbo capitalis*
*Ramphocelus carbo magnirostris*
*Ramphocelus carbo carbo*
*Ramphocelus carbo venezuelensis*
*Ramphocelus carbo connectens*
*Ramphocelus carbo atrosericeus*
*Ramphocelus carbo centralis*
(Peters, 1970)

### 2.2 Morphology

Weight

28 g (23.5-37.5g).

Length

16-17 cm.

Coloration

Adult male: black tinged crimson, becoming deep crimson on throat and breast; wings and tail brownish black (sepia). Lower mandible a conspicuous, bright silver colour. Female: colour varies greatly regionally, between dark and light races and intermediates. Dark races e.g., *R. c. carbo* greyish brown (Fuscous); belly and rump paler and tinged scarlet. Light races e.g., *R. c. connectens:* upperparts (except rump) and chin brown (between raw and burnt amber); underparts and rump pale tawny. Some intermediates are rosy rufous below. Bill a uniform greyish-silver color, much less prominent than that of the male. Subadult male: resembles female but underparts extensively tinged scarlet (Isler and Isler, 1987).

Vocalizations

Songs of *Ramphocelus* species are rich and whistled, usually consisting of one and two-syllable notes repeated at a regular pace in long sequences. Calls typically include both a sharp moderate-pitched alarm note and a drawn out high-pitched contact note. A variety of other calls are used less commonly in displays (Isler and Isler, 1987).

Calls: multiple individuals of a group often deliver a rapid, moderate-pitched harsh or sharp chak or chick, probably given in alarm or hostility. Also a high-pitched *zweeet* or *tseeet* that is probably a contact note. Calls frequently. Dawn song: a variety of somewhat harsh and squeaky phrases sounding like *WHEET-zur eeet? zur eat? WHEET-zur eow WHEET-it zeer WHEET-it zur-ir*; primarily moderate-pitched; at times the song is broken by a pause or a harsh *CHAK* ; notes and phrases are delivered at the rate of 1/sec or faster. Day song: *CHICK chit-ti-wee* (the last phrase sibilant and sometimes repeated), sometimes shortened to *CHICK*, repeated monotonously; moderate-pitched; delivered at the rate 20-25 phrases/min (Isler and Isler, 1987).

## 2.3 Physiology

No information.

## 2.4 Longevity

Individuals have lived up to 17 years in captivity (Pingry, 2000).

## 2.5 Zoogeography/Ecology

Distribution

East of Andes from COLOMBIA southward through ECUADOR and PERU to Santa Cruz, BOLIVIA, and eastward through VENEZUELA (except the llanos) to THE GUIANAS and through BRAZIL to Amapá, Pará, Maranhão, Piauí, w Bahia, Minas Gerais, w São Paulo, and w Paraná, BRAZIL, PARAGUAY; TRINIDAD (Isler and Isler, 1987).

Elevation range

From sea level to 1900 m; mostly below 1200 m (Isler and Isler, 1987).

Habitat

Prefers secondary growth and bushy habitats in semi-open situations at forest edge, along rivers and lakes, and roadways and in savannahs, cultivated areas and abandoned plantations. Also occurs in open woodland, but rarely penetrates dense forest (Isler and Isler, 1987).

Population

No information.

Conservation Status

Not globally threatened (BirdLife International, 2002).

Not listed in CITES appendices.

## 2.6 Diet and feeding behaviour

Food Preference

Diets observed in the wild contained approximately 5% nectar, 45% fruit and 50% insects.

In Trinidad the Snows recorded this tanager eating 40 species of fruit. Favoured *Melastomes* (64% of all fruit-eating records), especially *Miconia* (11 spp.) and *Clidemia* berries. Also ate fruits of epiphytes (8%) *Cercopia* (6%), and *Ficus* (2%). Took nectar from 3 species of trees and 2 species of vines; broke into the base of the flowers of the vine *Dioclea guianensis* presumably to get at the nectar (Snow and Snow, 1971). In Brazil, pierced large flowers of the *Noreantea* vine to obtain nectar (Sick 1985, in Isler and Isler, 1987).

Stomach contents: vegetable matter (14); animal matter (7); both (10).

Contents included *Cecropia* fruit, seeds, caterpillars, coleopterans (incl. snout and leaf beetles), spiders, *Orthopterans*, ants, and *Hemipterans*. Additional stomach contents included berries of the families *Solanaceae* and *Loranthaceae*, cactus fruit (*Cereus* sp.), and flying termites (Isler and Isler, 1987).

Feeding

Usually forages from the ground to about 12 m up, occasionally higher into the canopy of 25 m fruiting trees. In Trinidad, about half of 541 foraging observations were at 3 m or less off the ground; typically foraged higher when feeding at flowers (Snow and Snow, 1971). May also forage higher when accompanying mixed-species flocks (Pearson, 1971 in Isler and Isler, 1987). In Trinidad, of 588 observations, 50% involved insect-foraging, 45% fruit-eating and 5% were at flowers (Snow and Snow, 1971). In Peru, of 15 observations, 8 were eating fruit and 6 involved insect-searching (Remsen data, in Isler and Isler, 1987). Typically searches for insects by peering at foliage. In Trinidad, insect-searching was 77% on foliage, 13% on grass and weeds, 7% in aerial sallies, and the remaining on seed heads, twigs, and branches. Hopped over foliage fairly rapidly, sometimes darting forward. Its usual prey seemed to be insects that rely on movement to escape (Snow and Snow, 1971). Observed at army ant swarms in Brazil (Oniki and Willis, 1972 in Isler and Isler, 198). Swallowed most fruits whole, but occasionally pecked pieces out of large fruits or crushed them to reduce their size. In Brazil, clung upside down to pendant *Cecropia* catkins and nibbled at the tiny fruits beginning with those at the tip of the catkin and working methodically upwards towards the base (Silva, 1980 in Isler and Isler, 1987 ). In Trinidad, mandibulated bromeliad fruit to eat pulp and seeds and dropped the spiny skin (Isler and Isler, 1987).

## 2.7 Reproduction

Sexual Maturity/Age at First and Last Breeding

Begin breeding at one to two years of age in the wild; in captivity have bred from one to 11 years of age (Pingry, 2000).

Seasonality

Silver-beaked tanagers breed all year round, but it may differ per region (Isler and Isler, 1987).

Nest

Typically selects a nesting site 1-2.5 m above the ground in a low dense bush (records are from a few cm to 7.6 m). The female alone builds a deep compact

cup nest that is usually composed of dead leaves and fibres and is sometimes finished on the outside with green leaves. Nests are often re-used in Suriname (Isler and Isler, 1987).

Eggs/Laying/Clutch Size

Two (rarely 1 or 3) eggs, laid on consecutive days, are blue or greenish blue, sparingly marked with blackish brown and grey and /or lilac, especially at the large end (Isler and Isler, 1987).

Incubation

The female incubates for 12 days (Isler and Isler, 1987).

Hatching

No information.

Development and Rearing

Both parents feed the young; the nestling period is 12-14 days (Pingry, 2000).

## 2.8 Behaviour

Activity

Lives mostly in groups of 4-8 individuals. Occasionally up to 30 or more join a feeding aggregation at a fruiting tree. Individual pairs do not appear to defend a territory. Typically travels in conspecific groups; sometimes associates with mixed-species flocks. Flies from tree to tree with long rhythmic flight; group members follow the leaders closely. Flicks wings and tail when about to fly. In display, points bill skyward showing the bright lower mandible. Also assumes erect and crouch postures and silently gapes in hostile situations.

The Silver-beaked and Brazilian tanagers are parapatric and have both bred in Minas Gerais, Brazil (Isler and Isler, 1987).

# Species Specific Captive Management

## 2.9 Compatibility

National Zoo (USA) held silver-beaked tanagersin a group of 33, with some breeding, and the National Aquarium in Baltimore held several pairs together in a large aviary with no problems. Silver-beaked tanagers are most frequently held in family groups or single pairs (A. Oiler , pers.comm.). Thisspecies can also be held in non-breeding flocks in (mixed-species) exhibits. Pairs that form within the flock can then be removed to separate enclosures for breeding. May sometimes chase other birds in the enclosure.

## 2.10 Feeding

Basic diets

A Silver-beaked tanager diet recommended by Vince (1996) is: “50% fruit, 33% proprietary softbill pellets, 10% chopped, hard-boiled egg, 5% vegetables and greens, 2% live food. The fruits and vegetables should be diced into cubes of between 0.5 cm and 1.2 cm. If offered chunks or slices most tanagers will still be able to eat them. The finished diet should be loose and moist to the

touch. Avoid large amounts of fruit juice, or the mixture will become an inedible sludge".

## 2.11 Breeding

Nests

Probably an important factor in breeding success is to have a diversity of nests, nest sites and nest materials. A pair should be given an aviary with plenty of bushes and vegetation. Nest materials used in captivity include hay, leaves, rootlets, moss, straw, small twigs, palm fiber, vine, lamb's wool (Oiler, 1996).

Number of Nest Sites

When providing artificial nests sites, it is best to have more than one nest site available for one pair, allowing the birds to choose which nest to use.

Nest Location

Most nests in captivity are found in dense vegetation with seclusion from visitors and cage mates. Silver-beaked tanager nests are usually located in the middle-height of the exhibit. Nests have been placed on the terminal branch of a ficus plant, in a corn plant, in the base of pandanus leaf, at the top of hibiscus, high on a planter wall, in a palm frond funnel, in philodendron vines, and along the trunk of a spiky palm tree (Oiler, 1996).

Nest Density

If there are multiple tanager species in the exhibit, it is advised to have a distance of at least 6–7 m between the nests to prevent accidents due to territorial and/or aggressive behaviour.

Egg Laying and Incubation

While two (rarely 1 or 3) eggs are typically laid in the wild, a female at Birdland (UK) regularly laid four eggs and hatched all four but did not rear them (S. Blackwell, pers. comm.).

Development and Rearing

(See 2.7)

## 2.12 Management Notes

Sexing

Silver-beaked tanagers are dimorphic as adults. Sexing by appearance is possible at approximately 9 months to a year of age. The males are darker and more brightly coloured; females are more pale brownish to greyish. The lower mandible of adult males is a striking silver colour and makes the mandible look very large, while the female and immature males have a uniform, darker bill, and the lower mandible is smaller in appearance.

Ring Size

3.2 mm. Chicks can be ringed at five days of age if a closed ring is used.

Temperature Tolerance

Silver-beaked tanagers are one amongst the few tanagers that can tolerate temperatures lower than 17°C, since temperatures in their natural surrounding are often colder. Silver-beaked tanagers should always have a good-quality, damp, draft and frost-free shelter available (Vince, 1996). A minimum temperature of 14°C is recommended until more information is available.

## 2.13 EAZA Passerine TAG Population Management

Population Status

Breeding of the Silver-beaked tanager in Europe has not been very successful or consistent so far, and the European population still depends on wild-caught birds. Only 20 Silver-beaked tanager in 9 zoos were reported in the EAZA TAG Survey 2002 (Brouwer *et al.*, 2002), of which 3 zoos have bred this species between 1January 1997 – 31 December 2001. This means that each zoo held an average of 2.2 birds and that 33.3% of the zoos had some breeding results in the previous five years.

- Alphen*
- Athinai
- Bourton-on-the-Water*
- Budapest
- Chester*
- Rotterdam
- Stuttgart
- Walsrode
- Zürich

* Zoos that bred *R. carbo* between 1January 1997 and 31 December 2001.

The Silver-beaked tanager is a robust, attractive tanager with a relatively extensive geographical range. It is included in the EAZA Passerine Collection Plan and there are sufficient numbers in Europe to establish a viable population.

# 3. Brazilian tanager

## Natural history data

### 3.1 Taxonomy

Class: Aves
Order: Passeriformes
Family: Emberizidae
Subfamily: Thraupinae
Genus: *Ramphocelus*
Species: *Ramphocelus bresilius*
Common name: Brazilian tanager
Sub-species: *Ramphocelus bresilius bresilius*
*Ramphocelus bresilius dorsalis*
(Peters, 1970)

### 3.2 Morphology

Weight

31 g.

Length

18 cm.

Coloration

Male: upperparts carmine red; rump and underparts red (spectrum red); wings and tail blackish. Female: upperparts fuscous, tinged reddish on forehead and lower back, becoming red (spectrum red) on uppertail-coverts; chin and throat ochraceous brown (between drab and clay colour), becoming reddish brown (ferruginous) on breast and redder on undertail-coverts; wings and tail dark greyish-brown (Isler and Isler, 1987). Male has brighter coloured beak than female.

Vocalizations

Calls include a hard *jep, jip, ist* and *sst-sst*. Song is a melodious tri-syllabic trill, leisurely repeated, *djüle- djüle- djüle*. Small groups make a harsh chattering noise. In captivity uttered a single wheeeee (probably a contact note) and *chuck* or *chup* notes (probably alarm or hostile notes). Dawn song (?): long series of *wheeeee* or *wheee-eeee* notes. Whisper song (?): phrases of *chup chuh-wheeee* were combined with call notes in a melodious humble that lasted about 10 min (Isler and Isler, 1987).

### 3.3 Physiology

No information.

### 3.4 Longevity

No information.

## 3.5 Zoogeography/Ecology

Distribution

Coastal BRAZIL from Paraíba south to Santa Catarina (Isler and Isler, 1987).

Elevation range

Mostly near sea level; less commonly to ca. 800m, perhaps higher (Isler and Isler, 1987).

Habitat

Primarily encountered near water. Occurs in bushes and trees in marshes near the ocean and low scrubby growth along rivers, streams, ponds, and edges of swampy woodland. Also found in open woodlands, parks, and large gardens (Isler and Isler, 1987).

Population

No information.

Conservation Status

Not globally threatened (BirdLife International, 2002).
Not listed in CITES appendices.

## 3.6 Diet and feeding behaviour

Food Preference

Prefers pulpy fruits, especially pitangus berries, *Eugenia* species. Stomach contents: vegetable matter (2); animal matter (2); both (1). Contents included seeds, fruit pulp, insects, and a small quantity of white sand (Isler and Isler, 1987).

Feeding

No information.

## 3.7 Reproduction

Sexual Maturity/Age at First Breeding

Presumably sexually mature at one to two years, as in *R. carbo* (see 2.7).

Seasonality

Breeding dates: Brazil (state uncertain) October and December; (São Paulo) November; (Rio de Janeiro) November (Isler and Isler, 1987).

Nests

*R. bresilius* build an open cup, woven of grasses and vines or other fibres. Nests are placed in bushes and low trees or hidden among clumps of marsh grass (Isler and Isler, 1987).

Eggs/Laying/Clutch size

Eggs (2-3) are greenish blue, sparingly marked with black and grey (Isler and Isler, 1987).

Incubation Period

The female incubates alone for 13 days (Isler and Isler, 1987).

Hatching

No information.

Development and Rearing

Young are fed by both parents (Isler and Isler, 1987). Young fledge at 14 days of age (T. Wiersma, pers. comm.).

## 3.8 Behaviour

Activity

Pairs and small groups fly among low vegetation, but they usually stay hidden in dense bushes during the heat of the day. Tend to aggregate in austral winter (Isler and Isler, 1987).

# Species Specific Captive Management

## 3.9 Compatibility

Brazilian tanagers are highly territorial to conspecifics or similar–appearing species. They are also sometimes aggressive to other smaller species. Non-breeding birds can be held with species larger than them, but breeding pairs will sometimes even take young from nests of larger species (Walraven, 1972).

## 3.10 Feeding

Basic Diets

A Brazilian tanager diet recommended by Vince (1996) is: “50% fruit, 33% proprietary softbill pellets, 10% chopped, hard-boiled egg, 5% vegetables and greens and 2% live food. The fruits and vegetables should be diced into cubes of between 0.5 cm and 1.2 cm. If offered chunks or slices most tanagers will still be able to eat them. The finished diet should be loose and moist to the touch. Avoid large amounts of fruit juice, or the mixture will become an inedible sludge”.

## 3.11 Breeding

Nests

Probably a factor in breeding success is to have a diversity of nests, nest sites and nest materials. A pair should be given an aviary with plenty of bushes and other vegetation. Rope and coconut fibres, leaves, grass blades, moss, and hay have been used as nesting materials (T. Wiersma, pers. comm.; Vriends, 1977). Will sometimes use pre-constructed nest cups (e.g. 10 cm in diameter, 7 cm deep; T. Wiersma, pers. comm.). Vriends (1977) suggests offering a simple pigeon nest or a canary nest made of rope fibres.

Number of Nest Sites

When providing artificial nests sites, it is best to have more than one nest site available for one pair, allowing the birds to choose which nest to use.

Nest Location

Most nests in captivity are found in dense vegetation with seclusion from visitors and cage mates. Brazilian tanagers reportedly prefer to build their nest in small bushes or in grass clumps (Vriends, 1977).

Nest Density

If multiple species are in the exhibit, it is advised to have a distance of at least 6–7 m between the nests, to prevent accidents due to territorial and/or aggressive behaviour.

Egg Laying and Incubation

Vriends (1977) reported clutch sizes of 2-4 eggs in captivity, and noted that the male will sometimes sleep in the nest with the female during incubation.

Development and Rearing

(See 3.7)

## 3. 12 Management Notes

Sexing

Sexing of Brazilian tanagers by appearance is possible at approximately nine months to one year of age, when the males begin having more brightly red-coloured feathers (see 3.2 for full description). Juvenile males look like adult females.

Ring size

3.2 mm. Chicks can be ringed at five days of age if a closed ring is used.

Anaesthesia

Generally isloflurane gas in considered being the best anaesthetic to use with birds. However, several deaths of *Ramphocelus bresilius* have occurred during use of isoflurane anaesthesia at Frankfurt Zoo, and it was decided not to use this anaesthesia with this species anymore (S. Stadler, pers. comm.).

Temperature Tolerance

Brazilian tanagers can tolerate lower temperatures than many other tanagers, but should always have a good-quality, damp, draft and frost-free shelter available (Vince, 1996).

Coloration

The bright red of males tends to fade in captivity; this phenomenon occurs among some males more than others (S. Vansteenkiste, pers. comm.). Vriends (1977) remarked that a vitamin and Calcium rich diet was important in maintaining colour, and recommended providing pine branches for colour feeding, as Brazilian tanagers will pick at the resin.

## 3.13 EAZA Passerine TAG Population Management

### Population Status

Breeding of the Brazilian tanager in Europe has not been very successful or consistent so far, and the captive population still depends strongly on wild caught birds. A total of 35 Silver-beaked tanager were reported in 8 zoos in the EAZA TAG Survey 2002 (Brouwer *et al.*, 2002), of which 4 zoos bred this species between 1 January 1997 – 31 December 2001. This means that each zoo held on average 4.4 birds and that 50% have had some breeding results in the previous five years.

- Antwerp
- Berlin-Tierpark
- Frankfurt*
- Leipzig
- Rotterdam*
- Stuttgart*
- Walsrode
- Zürich*

* Zoos that bred *R. bresilius* between 1 January 1997 and 31 December 2001.

The Brazilian tanager is not yet in the Regional Collection Plan, but due the high number of individuals in European zoos and the relatively high breeding success, it was decided that it should be included in these guidelines.

# 4. Violaceous euphonia

## Natural history data

### 4.1 Taxonomy

Class: Aves
Order: Passeriformes
Family: Emberizidae
Subfamily: Thraupinae
Genus: *Euphonia*
Species: *Euphonia violacea*
Common name: Violaceous Euphonia
Sub-species *Euphonia violacea rodwayi*
*Euphonia violacea violacea*
*Euphonia violacea aurantiicollis*
(Peters, 1970)

### 4.2 Morphology

Weight

12.5 – 17.0 g (15 g average) Isler and Isler, 1987; males 12-15 g, females 13-18 g (Oiler, 2000).

Length

10 cm.

Coloration

Males have an orange-yellow cap extending to centre of eye; throat buffy orange-yellow; underparts orange-yellow; large white tail spots.
Females have a yellowish forehead; underparts bright yellowish olive-green becoming yellow on centre of belly (Isler and Isler, 1987).

Vocalizations

Song: shifts quickly among clear pleasant sounding musical notes, e.g., *di-sweet!* or *peep!*, short trills, and raspy, thin, unpleasant phrases such as *chi-chi* or *tzer*; typically, song elements are distinct (not jumbled together) and many are imitative of other species (Snow 1974, Sick 1975 in Isler and Isler, 1987); elements vary widely in pitch, are given rapidly (more than 1 note/sec.) without pause, and may continue for a minute or two without stopping. The call-song is also heard often and consists of song elements delivered slowly, 1 element/4-5 sec. Sings frequently, sometimes from concealment. Alarm calls: a loud, somewhat harsh, moderate pitched *che-ep* and a loud chatter or rattle (Isler and Isler, 1987).

### 4.3 Physiology

No information.

## 4.4 Longevity

No information.

## 4.5 Zoogeography/Ecology

Distribution

VENEZUELA in n Amazonas, Bolívar, Delta Amacuro, e Monagas, and e Sucre; TRINIDAD AND TOBAGO; THE GUIANAS; and BRAZIL north of the Amazon river from nc Roraimo and extreme e Amazonas eastward to Amapá and south of the Amazon river from e Amazonas (lower Rio Madeira) eastward to Maranhão; thence southward inland through Piauí, Goiás, Minas Gerais, São Paulo, and Paraná to Paraguarí and Itapúa; PARAGUAY, and Misiones, ARGENTINA; and the coastal states of BRAZIL from Paraíba southward to n Rio Grande do sul (Isler and Isler, 1987).

Elevation range

Lowlands; to 1100 m in Venezuela (Isler and Isler, 1987).

Habitat

Inhabits open woodlands, low-lying (incl. *varzea*) and gallery forest, forest edge and clearings, and tall secondary growth. Also occurs in isolated trees and shrubs near forest or woodland, such as in savannah, cultivated areas, and areas of human settlement. Appears to require large wooded tracts to survive in se Brazil. Moves about seasonally to favourite feeding sites (Isler and Isler, 1987).

Population

No information.

Conservation Status

Not globally threatened (BirdLife International, 2002).
Not listed in CITES appendices.

## 4.6 Diet and feeding behaviour

Food Preference

Forages at all levels in trees and shrubs. In Trinidad, the median foraging height was about 6 m off the ground and 97% of 206 observations involved fruit-eating. Of these, 62% were fruits of epiphytes and parasites, including the bromeliad *Aechmaea nudicaulis* (18% of all fruit eaten), cactus *Rhipsalis* (16%), and mistletoe (14%).The *Euphonia* typically hung down to take many epiphytic fruits; hovered briefly to pick *Rhipsalis* fruits that are attached to hanging stems. Swallowed some fruits whole and chewed others to remove the skin. Pecked out pieces or crushed larger fruits. Nibbled at catkins of *Piper*. Also said to eat bananas, and in Brazil took nectar from the *Psittacanthus* mistletoe and extracted the bodies of terrestrial snails. Stomach contents: seeds and fruit pulp (Isler and Isler, 1987).

Feeding

In Paraguay when eating 7 – 10 mm fruit of *Allophyllus edulis:* plucked fruit, sometimes leaning way over acrobatically, and took it to a horizontal perch.

Held the fruit against a branch to peck out pieces leaving the seed, or rolled the fruit around in its bill, opening and closing its bill in tiny arcs to peel the pulp away from the seed. Sometimes impaled the fruit on its bill while peeling it (Isler and Isler, 1987).

## 4.7 Reproduction

Sexual Maturity/Age at First Breeding

Violaceous euphonias reach sexual maturity within one year (Oiler, 1999).

Seasonality

Violaceous euphonias breed from November through August; the ratio of day/night hours seems to influence timing of breeding (Oiler, 2000).

Nests

Violaceous euphonias build a ball-shaped domed nest with side entrance; nests are made from dead leaves, grass, rootlets, and moss and lined with ferns and grass. Nests are usually well protected, often hidden between leaves of tree orchids, in niches among epiphytes or vines on tree trunks, or on the ground among leaves on roadside banks in forest. Appropriates unused nests of other species such as the Rusty-margined flycatcher (Snethlage, 1935).

Eggs/Laying/Clutch Size

Eggs (3-5, usually 4), laid on consecutive days. The eggs are dull white to pinkish-white, marked with shades of bright or dark red, mostly at the large end (Isler and Isler, 1987).

Incubation Period

Incubation period is 12-14 days; incubation by the female only, starts before the last eggs are laid (Oiler, 2000).

Hatching

The chicks normally hatch early morning. The pip-hatch interval is less than 24 hours (Oiler, 2000).

Development and Rearing

Hatchlings weigh approximately 1.0-1.5g. They are altricial, with no down present. Both parents feed the chicks starting from the day of hatch. The parents regurgitate fruit, nectar, spiders and some insects to the young. The parents also consume faecal sacs produced by the young (Oiler, 2000).

Physical development and growth characteristics (Oiler, 2000):

| | |
|---|---|
| Feather tracts begin to appear | Day 5 |
| Eyes open | Day 8 |
| Back, breast and tail feathers begin | Days 11-13 |
| Leave the nest | Day 21-22 |
| Flying | Day 21-22 |
| Self-feeding | Day 24-30 |

Juvenile males begin developing male plumage by 4-5 weeks of age.

## 4.8 Behaviour

### Activity

Pairs, single birds, and small groups usually travel by themselves but sometimes join feeding aggregations or associate with other small tanagers. Flies swiftly from one feeding site to another, but often rests in treetops between feeding sessions. In Brazil, roosts in dense tangles of mistletoe (*Psittacanthus* sp.), several individuals to the plant.

The euphonias and chlorophonias share two characteristic that are unique amongst all tanagers, firstly their stomach appears to be specially adapted for eating fruits such as mistletoe berries, and secondly, they build domed nests with side entrances (Vince, 1996).

### Social Behaviour

Violaceous euphonias use vocal mimicry, incorporating the call notes- especially the alarm calls- of many birds into their own calls and songs (Isler and Isler, 1987).

# Species Specific Captive Management

## 4.9 Compatibility

Multiple pairs of this species can nest in the same enclosure, provided that the enclosure is reasonably sized. Young can be left with the parents/group if the enclosure is very large (G. Schleussner pers. comm.). The parents will become intolerant of older young when the next clutch of chicks is hatching in small enclosures (Oiler, 2000).

Violaceus euphonias are very non-aggressive, and are compatible with many other species including dacnis, various tanagers, and larger birds such as kingfishers, doves and sunbitterns (Oiler, 2000).

## 4.10 Feeding

### Basic Diets

A Violaceous euphonia diet recommended by Vince (1996) is: “50% fruit, 33% proprietary softbill pellets, 10% chopped, hard-boiled egg, 5% vegetables and greens, 2% live food. The fruits and vegetables should be diced into cubes of between 0.5 cm and 1.2 cm. If offered chunks or slices, most tanagers will still be able to eat them. The finished diet should be loose and moist to the touch. Avoid large amounts of fruit juice, or the mixture will become an inedible sludge”.

## 4.11 Breeding

### Nests

Both sexes normally build the nest, which is ball-shaped dome with a side entrance that may have a small overhang. They sometimes also use hanging cup nests, large covered finch baskets, or platforms provided by the keepers. Nesting materials include: fine tendrils, fine twigs, mosses, leaves, cotton, animal hair (e.g. wool), bark strips, fibres (e.g. palm, twine and burlap) and grasses (Vriends, 1977; Oiler, 2000). Probably a factor in breeding success is

to have a diversity of nests, nest sites and nest materials. A pair should be given an aviary with plenty of bushes and other vegetation (Vince, 1996). G. Schleussner (pers. comm.) reported that Violaceus euphonias at Stuttgart Zoo tend to use the same nest repeatedly.

Number of Nest Sites

When providing artificial nest sites, it is best to have more than one nest site available for one pair, allowing the birds to choose which nest to use. If available try an abandoned flycatcher nest.

Nest Location

Violaceous euphonias build their nests in crotches of trees, cavities in rock or wood, planted hanging baskets or vines. Usually nests are well hidden behind foliage (Vince, 1996). Oiler (2000) noted that Violaceus tanagers often nest in clumps of branches somewhat sheltered from disturbance, and some pairs build on the top of large palm leaves. Violaceus euphonies at Stuttgart Zoo often nest on "the ankle" of palm leaves, close to the tree trunk (G. Schleussner, pers. comm.).

Nest Density

If there are multiple tanager species in the exhibit, it is advised to have a distance of at least 6 – 7 m between the nests, to prevent accidents due to territorial and/or aggressive behaviour.

Incubation

(See 4.7)

Development and Rearing

(See 4.7)

## 4.12 Management Notes

Hand Rearing Diet

Combination of blended nectar and papaya plus insects without exoskeleton.

Sexing

Violaceous euphonias are dimorphic as adults, and can be sexed by appearance at around two months of age, when males start acquiring a more brightly coloured plumage (see 4.2).

Ring Size

2.5 mm. Chicks can be ringed at five days of age if a closed ring is used.

## 4.13 EAZA Passerine TAG Population Management

Population Status

The population size and trends of *Euphonia violacea* in the wild are not well known. Breeding of Violaceous euphonia in Europe has not been very successful or consistent so far, and the European population is still dependant on wild caught birds. A total of 67 specimens in 7 zoos were located in the EAZA TAG Survey 2002 (Brouwer *et al.,* 2002), of which 2 zoos bred the

Violaceous euphonia in the period 1 January 1997 – 31 December 2001. This means that each zoo held on average 9.7 birds and that 28.6 % have had some breeding results in the previous five years.

- Antwerp
- Arnhem
- Cambron-Casteau
- Leipzig
- Stuttgart*
- Walsrode
- Vienna*

* Zoos that bred *E. violacea* between 1 January 1997 – 31 December 2001.

The Violaceous euphonia has not yet been included in the current European Passerine Collection Plan, but is the most numerous tanager in Europe, and possibly will be included when the plan is reviewed. Violaceus euphonias are particularly suitable tanagers for zoos, because they can be held in groups and the chicks do not have to be removed from the enclosure if enough room is available. Violoaceus euphonias rarely interfere with other species in mixed species enclosures. Because they build dome nests they are also less susceptible to nest predation than many other tanagers (G. Schleussner, pers. comm.).

Just two European zoos have bred this species in recent years, however distribution to other zoos may increase breeding success, since most animals are held in Stuttgart Zoo and Vienna Zoo.

# 5. Turquoise tanager

# Natural history data

## 5.1 Taxonomy

Class: Aves
Order: Passeriiformes
Family: Emberizidae
Subfamily: Thraupinae
Genus: *Tangara*
Species: *Tangara mexicana*
Common name: Turquoise tanager
Sub-species:

*Tangara mexicana mexicana*
*Tangara mexicana boliviana*
*Tangara mexicana brasiliensis*
*Tangara mexicana media*
*Tangara mexicana vieilloti*
(Peters, 1970)

## 5.2 Morphology

Weight

*T. m. brasiliensis* 26g, others 20g (17-23.5) (Isler and Isler 1987), 15 - 23 g (Oiler, 1999); average 26g (Pingry, 2000).

Length

Average 14cm (Pingry, 2000).

Coloration

Nape, back, and area around bill black. *T. m. boliviana*: mostly blue violet spotted black especially on upper breast and flanks; belly, undertail-coverts, and underwing-coverts yellow. *T. m. mexicana*: underparts pale yellow; lesser coverts turquoise. *T. m. brasiliensis*: pattern similar but grayish blue with white underparts (Isler and Isler, 1987).

Vocalizations

Outside of se Brazil, utters thin, high-pitched *tic* notes that are often rapidly repeated or trilled. In se Brazil (*T. m. brasiliensis*), delivers notes that are high-pitched and strident a repeated *tzri, tsic* (rendered in Portuguese), like a squeak of a bat (Isler and Isler, 1987).

## 5.3 Physiology

No information.

## 5.4 Longevity

A bird in captivity has lived to be over 12 years of age (Pingry, 2000).

## 5.5 Zoogeography/Ecology

Distribution

*T. m. vieilloti*: TRINIDAD. *T. m. media*: VENEZUELA from e Sucre southward through Delta Amacuro to se Bolivár and thence westward through n Bolivár to n Amazonas and adjacent COLOMBIA in e Vichada. *T. m. mexicana*: THE GUIANAS and Amapá, BRAZIL. *T. m. boliviana*: the Amazon Basin from COLOMBIA in w Meta and the Rio Guaviare southward through e ECUADOR and e PERU to Santa Cruz, BOLIVIA, and eastward in BRAZIL to the Rio Negro and Rio Madeira. *T. m. brasiliensis*: coastal BRAZIL from extreme s Bahia southward to Rio de Janeiro (Isler and Isler, 1987).

Elevation Range

Lowlands mostly below 500 m; to ca. 1000 m in Venezuela and Peru (Isler and Isler, 1987).

Habitat

Lives in trees in a wide variety of semi-open habitats: forest and woodland edges, tree-studded clearings, tall second growth, shaded plantations, and parks and gardens. Also found inside Varzea forests (forested areas that are seasonally flooded by river systems), open woodland and ribbons of gallery forest that weave through sc Brazilian savannahs. In densely forested regions, favours edges of rivers and oxbow lakes and may benefit when forests are disturbed (Isler and Isler, 1987).

Population

No information.

Conservation Status

Not globally threatened (BirdLife International, 2002).
Not listed in CITES appendices.

## 5.6 Diet and feeding behaviour

Food Preference

Foraged for insects (47% of 433 feeding records) about as often as fruit (53%). Took about 26 species of fruit, favouring *Miconia* berries (31% of all fruit eating observations); also ate fruits of *Cecropia* (13%), *Ficus* (10%), and *Ilex* (8%). Stomach contents: vegetable matter (3); animal matter (1). Contents included fruit and small insects (Isler and Isler, 1987).

Feeding

Forages at all levels except on the ground; shows some preference for higher levels when searching for insects. Perches to pick fruit and berries, swallows small fruit whole and mashes or pecks out pieces out of larger ones. Typically sought insects on undersides of branches mostly 1.3 cm in diameter or less. Also searched foliage and flower and seed heads (Isler and Isler, 1987).

## 5.7 Reproduction

Sexual Maturity/Age at First Breeding

Turquoise tanagers in captivity reach sexual maturity within one year (Oiler, 1999) and begin reproducing between one and two years of age in the wild (Pingry, 2000). Birds between one and 12 years of age have produced young.

Seasonality

There is not much seasonality in the breeding cycle. Breeding has been recorded throughout almost all year; from February in Surinam and Colombia to November in Brazil (Isler and Isler, 1987).

Nests

The female, attended closely by her mate (who feeds her and offers her nesting material), builds the deep, compact, cup-shaped nest, constructed of moss and fibres and covered with lichens and leaves. Two nests in Trinidad were built 6 and 7.5 m off the ground, one in the upright fork of a mango tree. Turquoise tanagers are said to place nests on tree branches usually at great heights in Surinam. In se Brazil one nest was set in the fork of 4 branches in the crown of a dense shrub (Isler and Isler, 1987).

Eggs/Laying/Clutch Size

Eggs (2-3) are usually greyish, marked with white or green and brown or purple. Eggs measure approximately 19 x 14 mm (Isler and Isler, 1987; Oiler, 1999).

Incubation Period

Turquoise tanagers have an incubation period of 12-14 days. The female incubates alone (Oiler, 1999).

Hatching

No information

Development and Rearing

One individual at Brookfield Zoo weighed 1.5 g at hatch and another weighed 2.0 g. Chick weight increases from ~1.5 g to ~16 g between day 1 and day 14 (Oiler, 1999).

Eyes are completely closed upon hatching; they open at about 5 days of age. Also at this time pinfeathers begin developing on the wings, abdomen and chest. By day 7, the chick begins to vocalize. By day 10 or 11, the chick begins preening itself and flapping its wings; tail feathers begin to come in at this time as well. Chicks usually fledge between days 14-16 and are independent by 30 days of age (Oiler, 1999).

During the breeding season in Trinidad, pairs apparently break away from their foraging flock to build their nests and to incubate, but rejoin flocks when eggs hatch. Young at two nests were attended and fed by all flock members from the time they hatched until independence (Isler and Isler, 1987).

## 5.8 Behaviour

Activity

Turquoise tanagers are highly social intra-specifically. They live in close-knit groups of 3-7, sometimes up to 10 individuals, that typically remain apart from mixed-species flocks, but join feeding aggregations at fruiting trees. In s Peru,

is a transient speces in permanent mixed-species canopy flocks and joins temporary tanager flocks (Isler and Isler, 1987).
Travel restlessly through treetops and across open spaces. Individuals follow each other closely, calling continually in flight; several together make a twittering sound. Active while foraging but perches quietly atop tall trees between feeding sessions (Isler and Isler, 1987).

# Species Specific Captive Management

## 5.9 Compatibility

A group of 3 breeding pairs of Turquoise tanagers is held at one zoo, and the young help rear successive clutches. Groups should have a large aviary. Some individuals, particularly males, may kill same-sex conspecifics in captivity when introduced in smaller cages. Reintroducing same-sex individuals that were previously held together than separated can also result in fatality (A. Oiler, pers. comm.). Pair members may become quite aggressive to each other, particularly after reintroduction to each other, after young have fledged or after a failed nesting attempt. The aggression may subside naturally or it may be necessary to temporarily (one or two weeks) separate the pair (Oiler, 1999).
Four (2.2) Turquoise tanagers were held together until a pair formed, this pair was then removed (J. Lammers, pers. comm.).
Young can usually remain with the parents for extended periods, possibly even helping to feed the next clutch or two (Eelman, 1995). Parents may become aggressive to fledged young after a new clutch hatches however, and it may be necessary to take the older young out of the enclosure (Oiler, 1999).
Turquoise tanagers can be extremely aggressive to similarly-coloured other tanager species, and have hybridised with Silver-throated and Golden tanagers at Brookfield zoo, therefore it is not advised to have unmated birds of these species together. Turquoise tanagers also frequently chase other birds, even birds larger then themselves, in the enclosure, especially when in breeding condition (Oiler, 1999).

## 5.10 Feeding

### Basic Diets

A Turquoise tanager diet recommended by Vince (1996) is: “50 % fruit, 33 % proprietary softbill pellets, 10 % chopped, hard-boiled egg, 5 % vegetables and greens, 2 % live food. The fruits and vegetables should be diced into cubes of between 0.5 cm and 1.2 cm. If offered chunks or slices most softbills will still be able to eat them. The finished diet should be loose and moist to the touch. Avoid large amounts of fruit juice, or the mixture will become an inedible sludge”.

## 5.11 Breeding

### Nests

Probably an important factor in breeding success is to have a diversity of nests, nest sites and nest materials. A pair should be given an aviary with plenty of bushes and other vegetation. Turquoise tanagers may build their own nests, but

have also used open and covered baskets, and half-open-fronted canary nestboxes as nesting structures (Oiler, 1999). Nest materials used have been: twigs, silk and plastic leaves, fibre (filter) floss, animal hair, palm fibre, cotton, moss, excelsior, hemp, pine needles, twine, bark and dried leaves (Oiler, 1996).

Number of Nest Sites

When providing artificial nests sites, it is best to have more than one nest site available for one pair, allowing the birds to choose which nest to use.

Nest Location

Turquoise tanagers nests in the wild have been found at great heights and usually in dense vegetation. In captivity nests are usually located in the top of the exhibit if nesting possibilities are available there. Most nests in captivity are found at the highest and most concealed site, with seclusion from visitors and cage mates. Providing dense vegetation and possibilities to nest high in the exhibit may provide appropriate conditions for Turquoise tanagers to breed.

Nests have been made in real and plastic ficus trees, in a Morton Bay fig tree, in the base of bromeliads and orchids, on the side of a hanging plant and on a fig vine (Oiler, 1999).

Nest Density

If there are multiple tanager species in the exhibit, it is advised to have a distance of at least 6 – 7 m between the nests to prevent accidents due to territorial and/or aggressive behaviour.

Egg Laying and Incubation

(See 5.7)

Development and Rearing

(See 5.7)

## 5.12 Management Notes

Sexing

This species is monomorphic. Sex determination techniques are discussed in section 1.6.

Ring Size

2.9 mm. Chicks can be ringed at five days of age if a closed ring is used.

## 5.13 EAZA Passerine TAG Population Management

Population Status

Breeding of Turquoise tanagers in Europe has not been very successful or consistent so far, and the European population is still dependant on wild caught birds. Fifty Turquoise tanagers located in 9 zoos were reported in the EAZA TAG Survey 2002 (Brouwer *et al.,* 2002). Turquoise tanagers bred in 3 of these zoos between 1 January 1997 – 31 December 2001. This means that each zoo held on average 5.5 birds and that 33.3 % had some breeding results in the previous five years.

- Alphen
- Antwerpen
- Berlin-Tierpark
- Budapest
- Krefeld
- Leipzig*
- Osnabruck*
- Straubing
- Stuttgart*

* zoos that bred *T. mexicana* between 1 January 1997 and 31 December 2001.

The Turquoise tanager is not in the EAZA Passerine Collection Plan, but it was decided to include this species in these guidelines because it is the second most numerous tanager in EAZA zoos.

# 6. Paradise tanager

## Natural history data

### 6.1 Taxonomy

Class: Aves
Order: Passeriiformes
Family: Emberizidae
Subfamily: Thraupinae
Genus: *Tangara*
Species: *Tangara chilensis*
Common name: Paradise tanager
Sub-species: *Tangara chilensis paradisea*
*Tangara chilensis coelicolor*
*Tangara chilensis chlorocorys*
*Tangara chilensis chilensis*
(Peters, 1970)

### 6.2 Morphology

Weight

*T. c. paradisea* 17 g (16.0-17.0 g);
*T. c. chlorocorys* and *T. c. chilensis* 23 g (17.0-27.0 g), (Isler and Isler, 1987).

Length

12-13 cm (Isler and Isler, 1987).

Coloration

Crown and ear-coverts yellow-green; nape, upper back, vent, and undertail-coverts black; throat violet. *T. c. chilensis*: lower back and rump scarlet. *T. c. paradisea*: lower back flame scarlet, rump orange yellow. Colours, especially of lower backs and rumps, are less intense in subadult plumages (Isler and Isler, 1987).

Vocalizations

Utters a sharp moderate-pitched *chak* and a high-pitched thin upward-inflected *zeee*; each may be given alone or repeated; or the 2 types of notes may be given together, e.g., *chak zeee, chak zee-a-zee,* or *zeee chak-chak-chak.* Dawn song: the phrase *chak-zeee* given regularly, about 1 phrase/2 sec. Also delivers a thin high-pitched *sizit* given singly or in rapid chipping series (which may be a song); also uttered when taking flight (Isler and Isler, 1987).

### 6.3 Physiology

No information.

### 6.4 Longevity

No information.

## 6.5 Zoogeography/Ecology

Distribution

*T. c. coelicolor* and *T. c. paradisea*: from Meta and Vaupés, COLOMBIA, and nw BRAZIL from the upper Rio Negro eastward through s VENEZUELA (Bolívar and Amazonas) and THE GUIANAS (except coastal region) to BRAZIL north of the Amazon River from e Amazonas (Manaus area) to Amapá. *T. c. chlorocorys* and*T. c. chilensis*: east of the Andes from Caquetá and Amazonas, COLOMBIA, southward through ECUADOR and PERU to Santa Cruz, BOLIVIA, and eastward through sw Amazonas and Rondônia, BRAZIL, to extreme se Amazonas and wc Mato Grosso (Isler and Isler, 1987).

Elevation Range

Lowlands to ca. 1100 m; locally to 1400 m (Isler and Isler, 1987).

Habitat

Lives in lowlands, inhabits the canopy of terra firma and low-lying (incl. varzea) forest and secondary growth woodland; also frequently encountered at forest edge, in shaded plantations, and in clearings with scattered trees. Occurs locally in scrubby forest with poor soil conditions on lower Andean slopes in Peru (Isler and Isler, 1987).

Population

No information.

Conservation Status

Not globally threatened (BirdLife International, 2002).
Not listed in CITES appendices.

## 6.6 Diet and feeding behaviour

Food Preference

Eats melastome fruits including *Miconia* and fruits of *Aralia*. Stomach contents: vegetable matter (10); animal matter (1); both (1). Contents included fruit pulp and insects. Additional stomach contents included seeds, fly larvae, short-horned grasshoppers, and spiders (Isler and Isler, 1987).

Feeding

*T. chilensis* joins feeding aggregations at fruiting trees. Within forest, forages primarily in the upper canopy (25-50 m above the ground), rarely under 12 m. Feeds lower in fruiting trees and tall shrubs at forest edge and in clearings. Hops along bare branches, looking underneath; also peers into bromeliads and nearby foliage. In Peru, all of 13 insect-foraging observations involved leaning down to glean the undersides of branches and lianas 2.5 cm or less in diameter; in one instance, a fleeing insect was pursued (Isler and Isler, 1987).

## 6.7 Reproduction

Sexual Maturity/Age at First Breeding

No information.

Seasonality

No information.

Eggs/Laying/Clutch Size

Lays 2 eggs. Eggs are white or greenish white. Marked lilac and purplish red, especially around the large end (Isler and Isler, 1987).

Incubation Period

Paradise tanagers have an incubation period of 14 days (Maarleveld, 2002).

Hatching

No information.

Development

No information.

## 6.8 Behaviour

Activity

Highly gregarious. Groups of 3-15, mostly 5-10, individuals travel independently, but are often encountered in company of other birds. Appears to be the leader of temporary tanager flocks, but seems to move in and out of canopy mixed-species flocks rapidly. Observed bathing in water collected in *Cecropia* leaves (Isler and Isler, 1987).

# Species Specific Captive Management

## 6.9 Compatibility

Oiler (pers. comm.) noted that single birds could be allowed to flock in smaller or larger aviaries where individuals can select their own partner, and that multiple pairs can be housed together if the enclosure space is adequate. Oiler also noted that this species is very difficult to breed. Schleussner (pers. comm.) found this to be a highly territorial species; a pair could not be held together with conspecifics or similarly colored other tanagers even in an extremely large enclosure.

## 6.10 Feeding

Basic Diets

A Paradise tanager diet recommended by Vince (1996) is: “50% fruit, 33% proprietary softbill pellets, 10% chopped, hard-boiled egg, 5% vegetables and greens, 2% live food. The fruits and vegetables should be diced into cubes of between 0.5 cm and 1.2 cm. If offered chunks or slices most softbills will still be able to eat them. The finished diet should be loose and moist to the touch. Avoid large amounts of fruit juice, or the mixture will become an inedible sludge”.

## 6.11 Breeding

Nests

Probably an important clue to breeding success is to have a diversity of nests, nest sites and nest materials. A pair should be given an aviary with plenty of bushes and other vegetation. Artificial nest structures used by Paradise tanagers

that were reported in Oiler (1996; 1998 *et al*.) included moss and hardware cloth baskets and covered baskets; nest materials included ficus leaves, stripped bark, coconut fibres and jute strings. Bakker *et al*., (1986) noted that self-made nests are rather deep.

Number of Nest Sites

When providing artificial nests sites, it is best to have more than one nest site available for one pair, allowing the birds to choose which nest to use.

Nest Location

In captivity nests are usually located in the middle to the top of the exhibit, if nesting possibilities are available there. Most nests in captivity are found in dense vegetation with seclusion from visitors and cage mates. Dense vegetation and possibilities to nest high in the exhibit may provide appropriate conditions for Paradise tanagers to breed. Nests have been situated along the trunk of a hardwood tree (Oiler, 1966). Nests have also been built in a flowerpot holding an orchid (Bakker *et al.*, 1986).

Nest Density

If there are multiple tanager species in the exhibit, it is advised to have a distance of at least 6 – 7 m between the nests, to prevent accidents due to territorial and/or aggressive behaviour.

Egg Laying and Incubation

(See 6.7)

## 6.12 Management Notes

Sexing

This species is monomorphic. Sex determination techniques are discussed in section 1.6.

Ring Size

2.9 mm. Chicks can be ringed at five days of age if a closed ring is used.

## 6.11 EAZA Passerine TAG Population Management

Population Status

Breeding of Paradise tanagers in Europe has not been very successful or consistent so far, and the European population still depends on wild caught birds. Only 15 specimens located in 6 zoos were reported in the EAZA TAG Survey 2002 (Brouwer *et al.*, 2002), of which 2 zoos have bred the Paradise tanager in the period 1 January 1997 – 31 December 2001. This means that each zoo held on average 2.5 birds and that 33.3 % had some breeding results in the previous five years.

- Berlin-Tierpark
- Dvur-Kralove
- Frankfurt
- Rotterdam
- Stuttgart*
- Wuppertal*

* Zoos that bred *T. chilensis* between 1 January 1997 and 31 December 2001.

Paradise tanagers are extremely attractive, and highly gregarious in the wild. Establishing a viable captive population would require extensive concentration on breeding management.

# 7. Seven-coloured tanager

# Natural history data

## 7.1 Taxonomy

Class: Aves
Order: Passeriiformes
Family: Emberizidae
Subfamily: Thraupinae
Genus: *Tangara*
Species: *Tangara fastuosa*
Common name: Seven-coloured tanager
Sub-species: monotypic

## 7.2 Morphology

Weight

23.2 g (21.1- 24.8 g, London Zoo data, in ISIS).

Length

13 cm.

Coloration

Strikingly colourful tanager. Turquoise-green head, chin and mantle. Black lores, area around bill and throat. Bright blue breast becoming darker ultramarine on belly. Paler turquoise-blue wing-coverts. Dark-blue edging to wing feathers. Broad orange edging to tertials. Black back extending over shoulder. Bright orange rump and lower back. Dark tail edged blue. Large black bill. Female duller but similarly patterned (BirdLife International, 2000).

Vocalizations

Delivers a *it-it-it-it* in a dispute between males (Isler and Isler, 1987).

## 7.3 Physiology

No information.

## 7.4 Longevity

No information.

## 7.5 Zoogeography/Ecology

Distribution

Ne BRAZIL in Pernambuco and Alagoas (Isler and Isler, 1987).

Elevation Range

Lowlands to at least 850 m (Isler and Isler, 1987).

Habitat

Inhabits forest (incl. Varzea forest) and bushy secondary growth (Isler and Isler, 1987).

Population

The Seven-coloured tanager has an extremely small and declining range. It is known to currently occur at a minimum of four localities. Current population size is 2,500-10,000 and declining. The biggest threats are habitat loss and degradation (BirdLife International, 2000).

Conservation Status

Listed as Endangered according to BirdLife International 2002.
Listed in CITES Appendix II.

## 7.6 Diet and feeding behaviour

Food Preference

Diet includes seeds and fruit (BirdLife International, 2000).

Feeding

Seven-coloured tanagers forage in the forest canopy and edge, but also occur in 1-2 m high secondary growth (BirdLife International, 2000).

## 7.7 Reproduction

Sexual Maturity/Age at First Breeding

No information

Seasonality

Seven-coloured tanagers breed in the austral spring and summer, i.e. October-March (BirdLife International, 2000).

Eggs/Laying/Clutch Size

No information.

Incubation Period

No information.

Hatching

No information.

Development and Rearing

No information.

## 7.8 Behaviour

Activity

Associates with mixed-species flock. Seen in the topmost branches of a large tree. The Seven-coloured tanager is very restless and curious, in literature it is said that they cannot live with other smaller breeding birds because they would kill the hatchlings of the other birds (Isler and Isler, 1987).

# Species Specific Captive Management

## 7.9 Compatibility

Highly territorial to conspecifics; largely incompatible until a pair-bond is established. Aggression occurs between males, females and mixed sexes held in twos, and in flocks. Non-paired conspecifics need to be held apart. Pairs are unsettled by calls of conspecifics in other enclosures, even if these are out of sight (J. Ellis, pers. comm.). This tanager will take chicks of smaller passerines (Ingels, 1971). A male seven-coloured tanager bred with a female *Tangara guttata* (Ingels, 1971).

## 7.10 Feeding

### Basic Diets

A Seven-coloured tanager diet recommended by Vince (1996) is: “50% fruit, 33% proprietary softbill pellets, 10% chopped, hard-boiled egg, 5% vegetables and greens, 2 % live food. The fruits and vegetables should be diced into cubes of between 0.5 cm and 1.2 cm. If offered chunks or slices most softbills will still be able to eat them. The finished diet should be loose and moist to the touch. Avoid large amounts of fruit juice, or the mixture will become an inedible sludge”.

## 7.11 Breeding

### Nests

Probably an important factor in breeding success is to have a diversity of nests, nest sites and nest materials. A pair should be given an aviary with plenty of bushes and other vegetation. Artificial nests 12-15 cm in diameter and 12-15 cm deep have been used at London Zoo. Nest materials used included animal hair, shredded paper, both dried and fresh grasses, and bamboo leaves (J. Ellis, pers. comm.).

### Number of Nest Sites

When providing artificial nests sites, it is best to have more than one nest site available for one pair, allowing the birds to choose which nest to use.

### Nest Location

Nests at London Zoo are located at the highest possible point of the aviary. Most nests in captivity are found in dense vegetation with seclusion from visitors and cage mates. Dense vegetation and possibilities to nest high in the exhibit may provide appropriate conditions for Seven-coloured tanagers to breed.

### Nest Density

If there are multiple tanager species in the exhibit, it is advised to have a distance of at least 6 –7 m between the nests, to prevent any accidents due to territorial and/or aggressive behaviour.

### Egg Laying and Incubation

(See 5.7)

Hatching

No information

Development and Rearing

No information

## 7.12 Management Notes

Sexing

This species is monomorphic. Sex determination techniques are discussed in section 1.6. Both sexes sing, therefore vocalizations are not a reliable indicator of sex (J. Ellis, pers. comm.).

Ring Size

2.9 mm. Chicks can be ringed at five days of age if a closed ring is used.

Enclosure

Seven-coloured tanagers at London Zoo inhabited only the top third of the aviary. It is a species that is easily stressed, and only settles in well in spacious enclosures with ample height (J. Ellis, pers. comm.).

## 7.11 EAZA Passerine TAG Population Management

Population Status

London Zoo is the only zoo that currently holds (and has bred) Seven-coloured tanagers. According to the EAZA TAG survey 2002 (Brouwer *et al.*, 2002) 1.0.2 specimens are at London Zoo. This tanager was more common in European collections in the past, and was described as being “regularly available” by Vriends (1977).

Species Management Programmes

*Tangara fastuosa* is in the European Passerine Collection Plan, and is being monitored by John Ellis (Zoological Society London).

# 8. Golden tanager

## Natural history data

### 8.1 Taxonomy

Class: Aves
Order: Passeriiformes
Family: Emberizidae
Subfamily: Thraupinae
Genus: *Tangara*
Species: *Tangara arthus*
Common name: Golden tanager
Sub-species: *Tangara arthus arthus*
*Tangara arthus palmitae*
*Tangara arthus sclateri*
*Tangara arthus aurulenta*
*Tangara arthus occidentalis*
*Tangara arthus goodsoni*
*Tangara arthus aequatorialis*
*Tangara arthus pulchra*
*Tangara arthus sophiae*
(Peters, 1970)

### 8.2 Morphology

Weight

22 g (18.7- 27.5g).

Length

13 cm.

Coloration

Yellow ochre, becoming orange yellow to yellowish cinnamon on head; patch behind eye black (Isler and Isler, 1987).

Vocalizations

In Venezuela, delivers several varieties of abrupt staccato moderate-pitched phrases such as *CHID-it, CHID-id-id-it*, or *CHID-id-id-it chup*; usually pausing 2-6 sec. Between phrases; during longer pauses (20 or more sec.) utters single sharp moderate- to high-pitched *tsick* notes. In Colombia and Bolivia, calls include a penetrating high-pitched *seeeet* and a short *tsk* (Isler and Isler, 1987).

### 8.3 Physiology

No information.

## 8.4 Longevity

No information.

## 8.5 Zoogeography/Ecology

Distribution

*T. a. arthus*: VENEZUELA in the coastal ranges from Miranda and Guárico westward to Falcón and nw Lara, and in the Andes from c Lara to Táchira.
*T. a. sclateri*: COLOMBIA on the w slope of the e Andes in Santander, on the e slope of the e Andes in Boyacá, and in the Macarena mountains in Meta. *T. a. aurulenta*, *T. a. palmitae* and *T. a. occidentalis*: the Perijá mountains and all 3 Andean ranges in COLOMBIA except where *T. a. sclateri* occurs. *T. a. goodsoni*, *T. a. aequatorials* and *T. a. pulchra*: ECUADOR on both slopes and the e slope of the Andes in PERU south to Ayacucho. *T. a. sophiae*: e slope of the Andes in PERU, to Cochabamba, BOLIVIA (Isler and Isler, 1987).

Elevation Range

700-2500 m; most numerous 1000-1500 m (Isler and Isler, 1987).

Habitat

Inhabits interior of mossy forest and shrubby forest edge; also occurs in second growth and occasionally wanders to isolated trees in clearings near forest (Isler and Isler, 1987).

Population

No information.

Conservation Status

Not globally threatened (BirdLife International, 2002).
Not listed in CITES appendices.

## 8.6 Diet and feeding behaviour

Food Preference

Golden tanagers observed in the wild ate fruit about half the time (57% of 307 obs.); over 22 species were taken. Favoured melastome fruits (59% of all fruit eaten), especially *Miconia* berries (89% of all melastomes). Also ate fruits of *Ilex* (13%), *Cecropia* (12%), and *Ficus* (8%). Observations have been made of Golden tanagers eating flowers or parts of flowers from the melastome, *Topobea brachyura* (2% of all feeding records). Stomach contents: vegetable matter (8); animal and vegetable matter (1). Contents included fruits, seeds and insects (Isler and Isler, 1987).

Feeding

Forages in the crowns of trees of various heights. Median foraging height was about 10 m off the ground; rarely descended below 3 m. Perched on twigs or branches to pick berries and reached down from petioles to eat *Cecropia* catkins. Occasionally clung to or hung from petioles and fruit clusters to peck pieces out of larger fruits. Typically hunted for insects on mossy branches within tree crowns. Moved quickly from branch to branch but hopped slowly along a branch. Used the diagonal-lean or head-down method to deliberately

examine the undersides of branches and limbs; 76 of 102 observations were on branches 1.3-5 cm in dia. Searched bare branches only 16% of the time. Occasionally hung from vines, branches or moss to inspect moss-covered tree trunks or hanging moss clumps. Foraged at times in foliage but only examined twigs and moss and ignored leaves (Isler and Isler, 1987).

## 8.7 Reproduction

Sexual Maturity/Age at First Breeding

No information.

Seasonality

Recorded breeding dates: Colombia July, September and October. Venezuela March (Isler and Isler, 1987).

Nests

Only the female builds the nest, but both sexes carry nesting material (Isler and Isler, 1987).

Eggs/Laying/Clutch size

Eggs (1-2) laid on consecutive days, are white, slightly tinged pink with reddish brown spots that coalesce at the large end (Isler and Isler, 1987).

Incubation Period

The incubation period is 14-15 days and is carried out by the female only (Isler and Isler, 1987).

Hatching

No information.

Development and Rearing

No information.

## 8.8 Behaviour

Activity

Occurs in pairs or as single binds, sometimes small groups of up to 5 or 6 individuals typically accompany mixed-species flocks, especially flocks of other *Tangara* species. In Venezuela, observed in larger groups of up to 30 individuals. In captivity: Displays were performed by the male before nest building and by the female when feeding the young. In display, head is thrown back, wings drooped, and tail slightly raised, accompanied by shriller and shriller cries ending with a trailing note. The male offered nesting material during the nuptial display (Isler and Isler, 1987).

# Specific species captive management

## 8.9 Compatibility

Golden tanagers bred successfully in the company of several species of smaller tanagers and other passerines, and were not aggressive to them (Mei, 1983).

Kleefisch (1971, in Ingels 1972a) reported that Golden tanagers nested successfully in the company of numerous passerines, including 17 other tanager species, in a 15m x 50 m aviary, with many other species breeding as well. G. Schleussner (pers. comm.) reported that Golden tanagers are compatible with other tanagers that are entirely different in coloration, and that size did not matter, but doubted that they would be compatible with other yellowish species with a cheek patch.

Small groups of un-paired Golden tanagers can be held together until a pair is formed, then pairs need to be separated from others. Young from a previous nest need to be removed when a pair begins renesting (G. Schleussner, pers. comm.).

## 8.10 Feeding

### Basic Diets

A Golden tanager diet recommended by Vince (1996) is: "50% fruit, 33% proprietary softbill pellets, 10% chopped, hard-boiled egg, 5% vegetables and greens, 2% live food. The fruits and vegetables should be diced into cubes of between 0.5 cm and 1.2 cm. If offered chunks or slices most softbills will still be able to eat them. The finished diet should be loose and moist to the touch. Avoid large amounts of fruit juice, or the mixture will become an inedible sludge."

## 8.11 Breeding

### Nests

Probably an important factor in breeding success is to have a diversity of nests, nest sites and nest materials. A pair should be given an aviary with plenty of bushes and vegetation. If the vegetation is heavy nesting Golden tanagers often prefer to build their own nests (G. Schleussner, pers. comm.). Artificial nest sites are also often accepted : half or fully open-fronted boxes, planted hanging baskets, planters, and cup-shaped wicker baskets should all be provided in secluded locations, and preferably in foliage

(Vince, 1996). Covered baskets and wire baskets have been used as nest structures. Sphagnum moss, leaves, grass, twigs and plant fibres, including cocoanut, have been used as nesting materials (Ingels, 1972a; Oiler, 1996). Thin, not too long cocoanut fibres were found by G. Schleussner (pers. comm.) to be preferred.

### Number of Nest Sites

When providing artificial nests sites, it is best to have more than one nest site available for one pair, allowing the birds to choose which nest to use.

### Nest Location

Artificial nests should be placed in dense vegetation, with seclusion from visitors and other birds. When a pair makes its own nest, but fails to finish it properly, artificial nests should be placed in close proximity of the birds' own nest. Nests of golden tanagers have been built in the side of a hanging plant root ball, in an artificial ficus plant, and high in rockwork. Nests have been found in the upper third of enclosures, from ca. 1.5 m-5 m (Oiler, 1996). Nests have also been built 0.5 m from the ground (Kleefisch, 1971 in Ingels, 1972b).

Nest Density

If there are multiple tanager species in the exhibit, it is advised to have a distance of at least 6 to 7 m between the nests, to prevent accidents due to territorial and/or aggressive behaviour.

Egg Laying and Incubation

(See 8.7).

Hatching

No information.

Development and Rearing

No information.

## 8.12 Management Notes

Sexing

This species is monomorphic. Sex determination techniques are discussed in section 1.6.

Ring Size

2.9 mm. Chicks can be ringed at five days of age if a closed ring is used.

## 8.13 EAZA Passerine TAG Population Management

Population Status

Breeding of Golden tanagers in Europe has not been very successful or consistent so far, and the European population still depends on wild caught birds. Only 17 specimens in 5 zoos were reported in the EAZA TAG Survey 2002 (Brouwer *et al.*, 2002). of which 3 zoos have bred Golden tanagers between 1 January 1997 – 31 December 2001. This means that each zoo held on average 3.4 birds and that 60 % had some breeding results in the previous five years. A total of 44 Golden tanagers in 8 zoos were reported in the 1996 EAZA TAG Survey (Brouwer *et al.*, 1997), thus a 61.4% decrease occurred within five years.

- Arnhem*
- Berlin-Tierpark
- London
- Stuttgart*
- Walsrode*

* Zoos that bred *T. arthus* between 1 January 1997 and 31 December 2001.

Species Management Programmes

The Golden tanager is being monitored by Dieter Rinke (Vogelpark Walsrode).

# 9. Blue-necked tanager

## Natural history data

### 9.1 Taxonomy

Class: Aves
Order: Passeriiformes
Family: Emberizidae
Subfamily: Thraupinae
Genus: *Tangara*
Species: *Tangara cyanicollis*
Common name: Blue-necked tanager
Sub-species: *Tangara cyanicollis granadensis*
*Tangara cyanicollis caeruleocephala*
*Tangara cyanicollis cyanicollis*
*Tangara cyanicollis cyanopygia*
*Tangara cyanicollis hannahiae*
*Tangara cyanicollis melanogaster*
*Tangara cyanicollis albotibialis*
(Peters, 1970)

### 9.2 Morphology

Weight

17 g (14.0-18.8 g).

Length

12 cm.

Coloration

Adult: Hood blue, throat sometimes violet; wing-coverts, wing-edgings, and rump turquoise to greenish straw; posterior underparts black, violet or blue.
Subadult: Brownish grey; hint of adult colours especially on ear-coverts and wing-edgings (Isler and Isler, 1987).

Vocalizations

Blue-necked tanagers are often noisy while foraging. Utters a complaining moderate-pitched *che* and a high-pitches *seet*. Gives notes singly or repeats the *che* in rapid series that may end with a louder *chep* or *seep*. Also *zibít zibít* (rendered in Portuguese), reminiscent of a siskin, i.e. C*arduelis* spp (Sick, 1985).

### 9.3 Physiology

No information.

### 9.4 Longevity

No information.

## 9.5 Zoogeography/Ecology

Distribution

*T. c. hannahiae*: COLOMBIA on the e slope of the e Andes in Norte de Santander, the Perijá mountains, and VENEZUELA in the Andes of Zulia, Táchira, Mérida, and w Barinas and mountains from w Lara eastward through Yaracuy and Carabobo to n Guárico (Meyer de Schauensee and Phelps, 1978). *T. c. granadensis:* COLOMBIA on both slopes of the C and W Andes from Antioquia (USNM) south to Cauco and Huila; both this subspecies and *caeruleocephala* and intermediates occur on the w slope of the E Andes. *T. c. caeruleocephala*: COLOMBIA on the e slope of the E Andes from e Cundinamarca southward through e ECUADOR to La Libertad and San Martín, PERU. *T. c. cyanopygia*: the entire Pacific slope of ECUADOR. *T. c. cyanicollis*: e Andean slope from Huánuco, PERU south to Cochabamba, BOLIVIA. *T. c. melanogaster*: BRAZIL in the n half of Mato Grosso (Sick 1955, Fry 1970 in Isler and Isler, 1987) and s Pará. *T. c. albotibialis*: known only from Veadeiros, Goiás, BRAZIL (Isler and Isler, 1987).

Elevation range

300-2400 m; usually above 1000 m in the Andes (Isler and Isler, 1987).

Habitat

Blue-necked tanagers inhabit semi-open areas; often found in isolated trees and bushes. In the Andes, occurs at forest edge and in clearings with scattered trees, secondary growth, plantations, and inhabited areas; occasionally found inside forest and open woodland. In Brazil (*T. c. melanogaster* and *T. c. albotibialis*), lives in palm groves in gallery forest, in dry forest, and in scrub (cerrado) (Isler and Isler, 1987).

Population

No information.

Conservation Status

Not globally threatened (BirdLife International, 2002).
Not listed in CITES appendices.

## 9.6 Diet and feeding behaviour

Food Preference

In the wild Blue-necked tanagers ate fruit (86% of all obs.), insects (13%), and flower buds (1%). Took more than 24 species of fruit, favouring *Miconia* berries (51% of all fruit eaten) and *Cecropia* catkins (19%). Stomach contents: vegetable matter (9); vegetable and animal matter (1). Contents included fruit, berries, seeds, and insects (Isler and Isler, 1987).

Feeding

Blue-necked tanagers in Valle, Colombia, forage mostly in crowns of bushes and small trees; median foraging height is about 8 m off the ground; rarely goes above 15 m. Perches upright on twigs or branches to pick berries which it swallows whole; rarely pecks pieces out of larger fruit. Hangs from leaves, petioles, or catkins to eat *Cecropia* fruits. Insects are mostly captured by sallies to air and leaves; also searches flower heads and a fruiting stalk of a palm

(Hilty data, in Isler and Isler, 1987). In Peru, forages in canopy foliage and on bare limbs, twice on lichen covered branches but not seen in mossy situations (Parker data in Isler and Isler, 1987 ). In Bolivia, sallies to the underside of a leaf (Remsen data in Isler and Isler, 1987).

## 9.7 Reproduction

Sexual Maturity/Age at First Breeding

No information.

Seasonality

Breeding dates: Colombia February and July (Isler and Isler, 1987).

Nests

A mossy cup nest was found at moderate height in a tree in a clearing in Colombia, (Isler and Isler, 1987).

Eggs/Laying/Clutch Size

One clutch contains two eggs that are white with brown spots (Isler and Isler, 1987).

Incubation Period

Incubation is about 15 days (Isler and Isler, 1987).

Hatching

No information.

Development and Rearing

The nestling period is approximately 20 days, and fledglings become independent after 3 weeks (Isler and Isler, 1987).

## 9.8 Behaviour

Activity

Blue-necked tanagers are encountered mostly in pairs, also alone and in family groups. Usually travels in single-species flocks that may join feeding aggregations at fruiting trees and shrubs or follow mixed-species flocks at forest edge. Rests in trees between feeding sessions (Isler and Isler, 1987).

# Species Specific Captive Management

## 9.9 Compatibility

It is best to hold this tanager in pairs, rather than larger conspecific groups (Ingels 1972b).

Successfully bred when held with Red-legged honeycreepers at Zürich Zoo (R. Zingg, pers. comm). Also bred in an aviary with seven other species (Baars, 1986), and in an aviary with many other passerine, including 17 species of tanagers (Kleefisch, 1971 in Ingels 1972b).

The young need to be removed if the parents begin breeding again, or the parents will chase them (Baars, 1986).

## 9.10 Feeding

### 2.1 Basic Diets

A Blue-necked tanager diet recommended by Vince (1996) is: “50% fruit, 33% proprietary softbill pellets, 10% chopped, hard-boiled egg, 5% vegetables and greens, with 2% live food. The fruits and vegetables should be diced into cubes of between 0.5 cm and 1.2 cm. If offered chunks or slices most softbills will still be able to eat them. The finished diet should be loose and moist to the touch. Avoid large amounts of fruit juice, or the mixture will become an inedible sludge”.

## 9.11 Breeding

### Nests

Probably an important clue to breeding success is to have a diversity of nests, nest sites and nest materials. A pair should be given an aviary with plenty of bushes and other vegetation. Blue-necked tanagers are reported to have used a wicker basket as a nest structure and filter floss and hay as nest materials (Oiler, 1996). A pair at Zurich Zoo used a small basket (R. Zingg, pers. comm.). This species has also built an oval, cup-formed nest of dry leaves and broad grasses, lined with coconut fibres (Ingels, 1972b).

### Number of Nest Sites

When providing artificial nests sites, it is best to have more than one nest site available for one pair, allowing the birds to choose which nest to use.

### Nest Location

In captivity nests are usually located in the top of the exhibit, if nesting possibilities are available there. Most nests in captivity are found in dense vegetation with seclusion from visitors and cage mates. Dense vegetation and possibilities to nest high in the exhibit may provide appropriate conditions for Blue-necked tanagers to breed.

### Nest Density

If there multiple species in the exhibit, it is advised to have a distance of at least 6 – 7 m between the nests, to prevent any accidents to happen due to territorial and/or aggressive behaviour.

### Egg Laying and Incubation

Incubation reported by Kleefisch (1971 in Ingels, 1972b) was 12 days, thus shorter than the 15 days reported by Isler and Isler (1987).

### Hatching

No information

### Development and Rearing

While Isler and Isler (1987) reported that the nestling period is approximately 20 days, a chick fledged after 11 days at Zürich Zoo (R. Zingg, pers. comm.) and Kleefisch (1971, in Ingels, 1972b) noted that fledging occurred after 14-16 days.

## 9.12 Management Notes

Sexing

This species is monomorphic. Sex determination techniques are discussed in section 1.6.

Ring Size

~2.8-2.9 mm. Chicks can be ringed at five days of age if a closed ring is used.

## 9.13 EAZA Passerine TAG Population Management

Breeding of Blue-necked tanagers in Europe has not been very successful or consistent so far, and the European population still depends on wild caught birds. A total of 18 specimens are located in 7 zoos in the EAZA TAG Survey 2002 (Brouwer *et al.*, 2002), of which 2 zoos have bred the Blue-necked tanager between 1 January 1997 – 31 December 2001. This means that each zoo held on average 2.6 birds and that 28.6% had some breeding results in the previous five years.

- Berlin-Tierpark
- Krefeld
- Munster
- Straubing
- Stuttgart
- Walsrode*
- Zurich*

* zoos that bred *T. cyanicollis* between 1 January 1997 and 31 December 2001

Species Management Programmes

Blue-necked tanagers are attractive and relatively numerous in European zoos, and are included in the EAZA Passerine Collection Plan.

# 10. Red-legged honeycreeper

## Natural history data

### 10.1 Taxonomy

Class: Aves
Order: Passeriiformes
Family: Emberizidae
Subfamily: Thraupinae
Genus: *Cyanerpes*
Species: *Cyanerpes cyaneus*
Common name: Red-legged honeycreeper
Sub-species: *Cyanerpes cyaneus carneipes*
*Cyanerpes cyaneus gemmeus*
*Cyanerpes cyaneus eximius*
*Cyanerpes cyaneus tobagensis*
*Cyanerpes cyaneus cyaneus*
*Cyanerpes cyaneus brevipes*
*Cyanerpes cyaneus dispar*
*Cyanerpes cyaneus violaceus*
*Cyanerpes cyaneus pacificus*
*Cyanerpes cyaneus gigas*
*Cyanerpes cyaneus holti*
(Peters, 1970)

### 10.2 Morphology

Weight

14 g (11.0-18.3g).

Length

12 cm.

Coloration

Under-wing coverts yellow; legs bright red (male); bill length highly variable. Male in alternate plumage: blue violet; back black; crown turquoise; no throat patch. Male in basic (eclipse) plumage: upper parts olive-green; eyebrow white; under parts dull yellowish white streaked olive-green; wings and tail black.
Female: similar to male in basic plumage but with greyish olive wings and tail; legs dark, reddish brown (Isler and Isler, 1987).
A partial albino with a light bill, white head and shoulders male was described in Costa Rica (Kratter and Nice, 2001).

Vocalizations

Calls: utters two types of notes, a short weak high-pitched tsip, *tsst* or *zzee* and a nasal mewing moderate-pitched *dzey* or *chaa* given randomly.
Dawn song: monotonously repeats, sometimes for 20 minutes or more, one of

the two types of call notes with pauses of 1-4 sec. Possible courtship song: a barely audible melodic warble sung by the male in the presence of a female; heard by Skutch, (1962) in the wild and described by Gibson (in Isler and Isler, 1987) in the aviary as a short note whistled twice, a longer ascending note, and a rapid double note whistled 5 times.

## 10.3 Physiology

No information.

## 10.4 Longevity

Two males known to have lived for 12 years and 16 years respectively in captivity (F. Nielsen, pers. comm).

## 10.5 Zoogeography/Ecology

Distribution

*C. c. carneipes*: Oriente, CUBA (Probably introduced); one record on JAMAICA (an escape?); s MEXICO from se San Luis Potosi, Vera Cruz, Puebla and Oaxaca (incl. Cozumel I.) through both slopes of CENTRAL AMERICA (incl. Coiba and the Pearl is., PANAMA) to extreme e PANAMA and Cordoba (Rio Sinu), COLOMBIA. *C. .c. pacificus*: west of the Andes from c Choco, COLOMBIA to Manabi, ECUADOR. *C. c. gigas*: Gorgona I. Off Cauca, COLOMBIA. *C. c. gemmeus* and *C. c. eximius*: along the w base of the e Andes from Santander, COLOMBIA, north to the Santa Marta region and the Perija Mountains; VENEZUELA along the bases of the Perija Mountains and the Andes, coastal ranges (except driest areas) from Falcon eastward to Sucre, and on Margarita I. *C. c. tobagensis*: TOBAGO. *C. c. cyaneus, C. c. brevipes, C. c. dispar*, and *C. c. violaceus*: TRINIDAD; the e base of the Andes and the Macarena Mountains in Meta, COLOMBIA; from e Vaupes and e Guiania, COLOMBIA, Bolivar and e Monagas, VENEZUELA, and THE GUIANAS southward through BRAZIL to Maranhao, Goias, and c Mato Grosso, and westward to PERU south of the Rio Maranon and east of the Andes and n BOLIVIA (south to La Paz, Cochabamba, and Santa Cruz). *C. c. holti*: coastal BRAZIl from Pernambuco southward to s Rio de Janeiro (Sick 1985).
(Isler and Isler, 1987)

Elevation Range

From sea level to 2000 m; mostly below 1200 m (Isler and Isler, 1987).

Habitat

Typically encountered in flowering trees at forest edge and in tall secondary growth, open woodland, and semi-open situations where trees are not too low or too far apart; especially favours flowering shade trees of coffee plantations and areas of human habitation. Also inhabits savannah forest, gallery woodland, and occasionally occurs in the canopy of terra firma and low-lying forest. Migrates seasonally in conjunction with the flowering and fruiting of favoured trees (Isler and Isler, 1987).

Population

No information.

Conservation Status

Not globally threatened (BirdLife International 2002).
Not listed in CITES appendices.

## 10.6 Diet and feeding behaviour

Food Preference

Typically forages from mid-heights to treetops, occasionally descends lower. In Trinidad: Searches at higher levels for insects than for fruits; of 125 observations, 44% involved insect-searching, 44% fruit-eating, and 12% were at flowers (proportions of insects, fruits and flowers varied seasonally). Favoured *Miconia* berries (33% of all fruits eaten) and fruit with fleshy arils. Arillate fruits from a vine three trees, constituted 35% of fruit-eating observations ( Snow and Snow 1971).
Stomach contents: vegetable matter (8); animal matter (2); both (2). Contents included berries, fruit, seeds (incl. seeds of *Miconia*), flies, beetles (incl. Snout beetles), caterpillars, hymenopterans (incl. chalcid hymenoptera, ants and ichneumons), spiders and nectar (Isler and Isler 1987).
Skutch (1962) especially mentions three species of *Clusia* as food plants for honeycreepers; the small seeds are surrounded with a soft aril that they take for most of the year.

Feeding

*Cyanerpes* species (including Red-legged honeycreepers) consume fruits, insects and nectar in special ways. Narrow curved bills enable them to extract nutritious arils through cracks in slowly opening seedpods before heavier billed birds can reach into the tough husks. In addition, *Cyanerpes* use their curved bills to reach tiny insects hiding beneath thin branches, twigs and vines. These honeycreepers, especially the Red-legged honeycreepers, also take insects on the wing often by waiting around fragrant flowers.
Hangs upside down or hovers to extract arils from newly opening pods and clings to, or hangs from foliage to obtain small fruits. Feeds on oranges or other large pulpy fruits through holes made by larger birds. Comes to feeding tables for bananas; slices off pieces of banana with a sideways scissor like action of the bill. When insect-searching, creeps along limbs using the "diagonal-lean" method to glean the undersides of slender branches and twigs less than 1.3 cm in diameter or stretches neck up to pick prey off leaves (in Trinidad, usually searched leaf tops). Flutters at the tips of slender branches and hovers to glean leaves or to snap up insects coming to flowers; also aerial sallies (in Trinidad, 40% of insect prey were taken in flight by hovers, sallies, etc.). Inspects curled dead leaves and clings to rough tree bark to examine crevices. When feeding at flowers, clings beside blossoms and inserts its bill inside to obtain nectar and/or to capture small insects. In captivity, drank artificial nectar with a rapid pumping action without lifting its head (Isler and Isler, 1987).
The tip of the tongue has a few small hair-like papillae (F. Nielsen, pers. comm).

## 10.7 Reproduction

Sexual Maturity/Age at First Breeding

Red-legged honeycreepers reach sexual maturity within one year (Vince, 1996).

Seasonality

Due to the distribution of the wild population of the Red-legged honeycreeper, there is not much seasonality in the breeding cycle. Breeding has been recorded throughout almost all year; from March in Trinidad to December in Brazil (Isler and Isler, 1987).

Nests

Red-legged honeycreeper nests in the wild have been found from about eyelevel to 14 m above the ground, but usually less than 5m high in isolated bushes or trees in pastures or gardens or at the edge of a thicket. The nest is a shallow, small, thin-walled semi-hemispherical cup made of wiry fibrous rootlets and slender stems. The nest is attached with spider web to a branch crotch in dense outer foliage. Materials are sometimes stolen from other birds. (Isler and Isler, 1987).

Eggs/Laying/Clutch Size

Eggs (2-3, mostly 2) are laid on consecutive days, and are white or bluish, speckled with brown, especially in a wreath at the large end (Isler and Isler 1987).

Incubation

Females in Costa Rica incubate for 12-13 days (Isler and Isler, 1987).

Hatching

No information.

Development and Rearing

The nestling period is 14 days. Both parents feed chicks although female takes most of the responsibility (Isler and Isler 1987).

## 10.8 Behaviour

Activity

*Cyanerpes cyaneus* and other *Cyanerpes* species actively dart and flutter high in trees, pausing only periodically to rest. They travel in pairs or single-species groups that at times join mixed-species flocks.

The degree to which flowers are tapped for nectar varies greatly among species as well as seasonally. The three long-billed species appear to travel great distances seasonally in search of favourite fruiting and flowering trees.

Typically seen in groups of 5-15 individuals, sometimes in larger aggregation of up to 100; pairs split off during the breeding season. Travels apart from or with mixed-species flock; may contribute to mixed-species flock formation (Moynihan 1962c in Isler and Isler). Quarrelsome but normally limits hostilities to posturing, calls, and an occasional pursuit. Disputes are often between females. Contestants face each other, bow up and down, turn from side to side, flit wings outward and upward, and repeat a nasal *chaa*. They may

stare motionless except for flitting wings, with bills pointed skyward (Skutch 1954, 1962b in Isler and Isler, 1987).

Intensely active; criss-crosses and flutters about through foliage. Flight between trees is rapid and direct. Occasionally stops and perches for long periods on bare branches high in trees. Bathes in foliage after a rain by flapping around in wet leaves or splashing in water-filled bracts of bromeliads (Isler and Isler, 1987).

# Species-specific captive management

## 10.9 Compatibility

Honeycreepers are usually compatible with similarly sized birds (Vince, 1996), but are highly territorial towards conspecifics (especially males), even in a large aviary (F. Nielsen, pers. comm.).

Based on experiences at Copenhagen Zoo, F. Nielsen (pers. comm.) has found that if the enclosure is large enough, young males can usually remain in the parental aviary until they begin acquiring adult plumage., while females can often remain for longer, even through the next breeding attempt.

## 10.10 Feeding

### Basic Diets

A Red-legged honeycreeper diet recommended by Vince (1996) is: One dish with 50% nectar, 25% fruit, 25% sponge cake, bread or primate pellet. In a separate dish, fine grade insectivorous diet (50% powdered proprietary softbill pellets, 15% finely chopped, hard-boiled egg, 10% powdered trout chow, 10% live food, 9% pureed apple, 6% tofu) with small mealworms, small waxworms and 56 mm. crickets. Supply fruit flies and fly maggots.

## 10.11 Breeding

### Nests

Probably an important factor in breeding success is to have a diversity of nests, nest sites and nest materials. A pair should be given an aviary with plenty of bushes and other vegetation. *Cyanerpes* nests are often so frail and thin-walled, that the eggs can be seen through them thus use of half-open-fronted nest boxes might be encouraged (Vince, 1996). Red-legged honeycreepers have nested in an open basket, and use fine materials, e.g. goat hair, filter floss, sisal fibres, cambia shreds, paper, jute string and coconut fibres to build their nests (Oiler, 1996). G. Schleussner (pers. comm..). found that they readily use closed baskets for waxbills They like to seal the nest with spider webbing in captivity as well as in the wild (F. Nielsen, pers. comm.).

### Number of Nest Sites

When providing artificial nests sites, it is best to have more than one nest site available for one pair, allowing the birds to choose which nest to use.

### Nest Location

Nests at Copenhagen Zoo and private breeders have sometimes been located in hanging ferns and nests generally built at heights between 2 - 4 m (F. Nielsen,

pers. comm). Nests reported in Oiler (1996) were in the upper canopy of a ficus tree at the top of the exhibit.

Most nests in captivity are found in dense vegetation providing seclusion from visitors and cage mates. Dense vegetation at the top of exhibit may be stimulating for Red-legged honeycreepers to breed.

Nest Density

A distance of at least 6 – 7 m between nests to prevent any accidents due to territorial and/or aggressive behaviour is advised if there are multiple tanager species in the exhibit.

Development and Rearing

In the wild nestlings are brought fruit primarily, but insects are also given and seem a necessity in captivity (Isler and Isler, 1987).
Plenty of live food is essential, including wax worms, fruit flies, mealworms and fly maggots. Nectar and soft fruits are important in rearing and should always be available (Vince, 1996).

## 10.12 Management Notes

Sexing

Sex-determination of Red-legged honeycreepers is relatively easy since they are dimorphic (see 10.2). Males in basic plumage resemble females but can always be distinguished by their bright red legs.
Males in the wild and at Copenhagen Zoo are in eclipse plumage from December to February (F. Nielsen, pers. comm.).

Nest Inspections

F. Nielsen (pers. comm) warned against inspecting the nest during incubation, as he has found that the honeycreepers are very shy at this point, and will desert the nest.

Ring Size

2.3 mm. Chicks can be ringed at five days of age if a closed ring is used.

## 10.11 EAZA Passerine TAG Population Management

Breeding of Red-legged honeycreepers in Europe has not been very successful or consistent to date, and the European population still depends on wild caught birds. According to Brouwer *et al.* (2002) 47 specimens were located in 16 zoos in 2002, of which 4 zoos bred the Red-legged honeycreeper between 1 January 1997 – 31 December 2001. This means that each zoo held on average 2.9 birds and that 25 % had some breeding results in the previous five years.

- Alphen
- Arnhem*
- Basel
- Berlin-Zoo
- Chester
- Emmen
- Köln
- Krefeld
- Leipzig
- Randers
- Rotterdam
- Stuttgart*

- Frankfurt*
- Copenhagen
- Walsrode
- Zurich*

* zoos that bred *C. cyaneus* between 1 January 1997 and 31 December 2001.

Species Management Programmes

The Red-legged Honeycreeper is an attractive, typical honeycreeper. It is included in the European Passerine Collection Plan, and is currently being monitored by Flemming Nielsen (Copenhagen Zoo).

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## **Appendix I:** Some Nectar Producing Plants

The following nectar producing plants have been used with tanagers and/or hummingbirds. Many are North American, but may be useful for thinking of comparable, more easily acquired plants (information submitted by Joep Wensing, Burger's Zoo).

| | | |
|---|---|---|
| *Lantana camara* | Shrub Verbena | Verbenac. |
| *Costus* spp | Spiral ginger, Spiral Flag | Zinigerbac. |
| *Hedychium* spp. | Ginger lily, Garland lily | Zinigiberac. |
| *Alpinia* spp. | Ginger lily | Ziniberac. |
| *Heliconia* spp. | False Bird of Paradise | Heliconiac. |
| *Malvaviscus arboreum* | Wax mallow | Malavac. |
| *Hamelia patens* | Scarlet bush, Firebush | Rubiac. |
| *Pentas lanceolata* | Star cluster | Rubiac. |
| *Whitfeldia elongata* | | Acanthac. |
| *Passiflora* spp. | Passion flower | Passiflorac. |
| e.g *P. menispermifolia, P. biflora* | | |

Nectar-producing North American desert and semi-desert plants:

*Fouquiera splendens* (Ocotillo)
Easy to cultivate, difficult to obtain, blooms sparingly but spectacular.

*Epilobium canum* (also called *Zauschneria californica*)
Is the best known *Epilobium* species. All *Epilobium* spp. very useful, easy to cultivate and obtain. Flowers from August onwards in native habitat.

*Calliandra californica*
Small tree, difficult to obtain, flowers sparingly all seasons, easy to cultivate.

*Calliandra tweedi*
Small tree, common, flowers sparingly all seasons, easy to cultivate.

*Justica californica*

*Castilleja chromosa, C. coccinea* (annual*), C. integra, C. minima*
All red *Castilleja* species are very good, but are difficult to cultivate. Semi-parasitic and need extremely well-drained soil. Often grows on pure gravel. Nearly impossible to get information on host plants.

*Salvia* (all red species)
Easy to cultivate but difficult to control.

*Ribes sanguineum*
Easy and particularly useful as it flowers in February-March.

*Ribes speciosum*.
Similar, but richer in nectar. Grows slowly.

*Cordia boissieri*
Slow grower, difficult to obtain, but magnificent small tree of Texas.

*Erythrina flabelliformis*
Easy to cultivate, difficult to obtain, seeds very poisonous.

*Galvezia speciosa*
Easy and useful.

*Heuchera sanguinea*
Over-rated.

*Lonicera sempervirens*

Not strictly a desert plant but very easy and useful. Some flowers all year round, but mostly in spring.

*Penestemon*, all red spp. and cultivars.

Fairly easy and useful, but needs to be sustained as flowers tend to be prone.

*Russelia eqisetiformis*

Very easy and useful, a must. Flowers all year.

North American temperate plants

*Aesculus pavia*

A must, as flowers in early spring, beautiful.

*Agastache cana*

Useful perennial, flowers late.

*Monarda didyma*

Èasy, useful.

*Asclepias tuberosa, A. curassavica* (tropical)

Easy, useful

*Lobelia cardinalis*

Needs plenty of water. Easy, useful, magnificent, needs a stick. Not to be confused with *L. splendens*, a more tender Mexican species.

*Lobelia siphilitica*

Easy, useful.

*Bignonia capreolata*

Easy, useful.

*Campsis radicans*

Easy, useful.

*Bouvardia glaberrima*

Easy, useful.

*Delphinum cardinale*

Easy, useful.

*Dicentra eximia* and *D. spectabilis*

Easy, useful.

*Erythrina herbacea*

Fairly easy, but difficult to get to flower, Very useful.

*Hamelia patens*

Easy, useful, flowers from early July to October.

*Impatiens capensis*

Easy but annual, very useful.

*Ipomea coccinea, I. quamoclit*

Both very easy, useful.

*Cuphea micropetala*

Easy, useful , flowers from spring to early winter.

*Justicia* spp.

All easy, very useful.

*Nicotiana glauca*

Easy but not tried.

## **Appendix II:** Examples of Commercial Food and Camera Products Available

## Nectar Substitutes

Avian Bird Products www.avian.nl
Avian nectar

Aves Product BV www.avesproduct.com
Avesnectar

Nekton Products www.nekton.de
Nektar-Plus
Nectar concentrate for hummingbirds and other nectar-feeding birds

Avicon www.cuttleboneplus.com/avico.htm
SunBird Pre-mix Nectar Diet

Roudybush www.Roudybush.
Lory Nectar

## Fruit substitutes

Mazuri www.mazuri.com
Mazuri® ZuLiFe™ Bird Gel is a nutritionally complete, low iron diet designed specifically for adult birds which are predisposed to iron-storage disease. resembles ripe fruit in texture.

## Invertebrate substrates/supplements

Avian Birdfood Products www.avian.nl
Avian Mealworm substrate
For feeding to mealworms, buffalo worms, morio worms, and crickets
Fruit fly substrate
Drosophila

Aves Product BV www.avesproduct.com
Aves Mealwormfood
For feeding to mealworms, buffalo worms and morio worms
Aves Insect dusting powder
For feeding to crickets and meal worms

Nekton Products www.nekton.de
Nekton Drosophila Concentrate
For breeding fruit flies
Nekton Cricket Concentrate
For feeding to crickets and grasshoppers
Nekton Waxworm Concentrate
For breeding wax worms (bee moth larvae)

## SoftBill Food Products

Avian Birdfood Products www.avian.nl
- Tovu Universal Food Low Iron (under 65ppm)

Aves Product BV www.avesproduct.com
- Fruit Mix Start Low iron (40 ppm)
- Aves-Insectile fine

Mazuri www.mazuri.com
- Mazuri® ZuLiFe™ Soft-Bill Diet

Pretty Bird www.prettybird.com
- Softbill Select

http://www.kaytee.com/home/
**exact Original Softbill**

Avicon www.cuttleboneplus.com/avico.htm

**Bug -N- Berries**
**Universal Insectivore Diet**

## Colour-Feeding

Nekton Products www.nekton.de

Vitamin supplements to brighten colours, enhance plumage and prevent colours fading
- Nekton-R
- Nekton –R –Beta
- Nekton Gelb

Avian Birdfood Products www.avian.nl
- Avian Spirulina
- Avian Triovit

## Cameras

"Spy Supply" products
www.spysupplystore.com

## **Appendix III:** European Laboratories Offering DNA Feather Sexing

**Austria**
Pluma Österreich
Lochauestrasse 2
6912 Höbranz
Tel: + 43 (0) 5573 8 54 03
Fax: + 43 (0) 5573 8 54 03
Email:

**Czech Republic**
GENSERVICE, s.r.o.
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Email: genservice@volny.cz

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Palackeho 174
612 38 Brno
Tel: + 420 5 41321229
Fax: + 420 5 41211509
+ 420 5 41212383
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Pluma GbR-Molekularbiologische Analytik
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Fax: + 44 (0) 1872 262 737
Email: abiuk@globalnet.co.uk

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# Appendix IV: Reference Ranges for Physiological Data Values

**I**nternational **S**pecies **I**nformation **S**ystem
Standard International Units

**SILVER-BEAKED TANAGER *Ramphocelus carbo***

**Physiological reference ranges calculated for:**

- **Both sexes combined**
- **All ages combined**

**Sample results submitted by 8 member institutions.**


Back to Index of Species

## Reference Ranges for Physiological Data Values

| Test | Units | Mean | St. Dev. | Minimum Value | Maximum Value | Sample Size[a] | Animals[b] |
|---|---|---|---|---|---|---|---|
| WHITE BLOOD CELL COUNT | *10^9/L | 9.970 | 5.202 | 3.700 | 22.10 | 46 | 30 |
| RED BLOOD CELL COUNT | *10^12/L | 4.01 | 1.16 | 2.23 | 7.70 | 26 | 19 |
| HEMOGLOBIN | g/L | 148 | 11 | 140 | 156 | 2 | 2 |
| HEMATOCRIT | L/L | 0.503 | 0.059 | 0.370 | 0.720 | 41 | 28 |
| MCV | fL | 129.9 | 37.3 | 61.0 | 217.4 | 20 | 15 |
| MCH | pg/cell | 48.5 | 17.5 | 36.1 | 60.9 | 2 | 2 |
| MCHC | g/L | 299 | 27 | 280 | 318 | 2 | 2 |
| NUCLEATED RED BLOOD CELLS | /100 WBC | 0 | 0 | 0 | 0 | 1 | 1 |
| HETEROPHILS | *10^9/L | 2.115 | 1.879 | 0.276 | 9.720 | 43 | 28 |
| LYMPHOCYTES | *10^9/L | 6.004 | 4.354 | 0.663 | 17.80 | 43 | 28 |
| MONOCYTES | *10^9/L | 0.613 | 0.614 | 0.111 | 2.873 | 27 | 17 |
| EOSINOPHILS | *10^9/L | 0.289 | 0.326 | 0.048 | 1.225 | 20 | 15 |
| BASOPHILS | *10^9/L | 1.460 | 1.265 | 0.056 | 5.304 | 32 | 21 |
| CALCIUM | mMol/L | 2.13 | 0.35 | 1.50 | 2.63 | 12 | 7 |
| PHOSPHORUS | mMol/L | 2.10 | 0.29 | 1.81 | 2.52 | 5 | 4 |
| SODIUM | mMol/L | 157 | 1 | 156 | 158 | 2 | 1 |
| IRON | µMol/L | 12.71 | .0000 | 12.71 | 12.71 | 1 | 1 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| URIC ACID | mMol/L | 0.678 | 0.292 | 0.137 | 1.178 | 17 | 10 |
| TOTAL BILIRUBIN | µMol/L | 14 | 22 | 2 | 46 | 4 | 3 |
| GLUCOSE | mMol/L | 16.15 | 3.441 | 10.82 | 21.98 | 14 | 8 |
| CHOLESTEROL | mMol/L | 8.366 | 1.891 | 6.630 | 11.50 | 5 | 1 |
| CREATINE PHOSPHOKINASE | U/L | 1501 | 879 | 635 | 2928 | 6 | 2 |
| LACTATE DEHYDROGENASE | U/L | 950 | 433 | 537 | 1737 | 8 | 3 |
| ALKALINE PHOSPHATASE | U/L | 260 | 106 | 168 | 410 | 4 | 3 |
| ALANINE AMINOTRANSFERASE | U/L | 162 | 108 | 85 | 238 | 2 | 2 |
| ASPARTATE AMINOTRANSFERASE | U/L | 285 | 165 | 116 | 681 | 15 | 8 |
| GAMMA GLUTAMYLTRANSFERASE | U/L | 13 | 0 | 13 | 13 | 1 | 1 |
| TOTAL PROTEIN (COLORIMETRY) | g/L | 36 | 13 | 15 | 59 | 12 | 7 |
| GLOBULIN (COLORIMETRY) | g/L | 21 | 10 | 10 | 29 | 3 | 3 |
| ALBUMIN (COLORIMETRY) | g/L | 8 | 2 | 7 | 10 | 3 | 3 |
| FIBRINOGEN | g/L | 2.000 | 1.410 | 1.000 | 3.000 | 2 | 1 |

[a] Number of samples used to calculate the reference range.
[b] Number of different individuals contributing to the reference values.

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**SILVER-BEAKED TANAGER *Ramphocelus carbo***

**Average weights calculated for:**

- **Both sexes combined**

**Weights submitted by ISIS member institutions.**



Back to Index of Species

## Reference Ranges for Physiological Data Values

| Age Grouping | Units | Mean | St. Dev. | Minimum Value | Maximum Value | Sample Size[a] | Animals[b] |
|---|---|---|---|---|---|---|---|
| 0.9-1.1 months | Kg | .0242 | .0012 | .0217 | .0266 | 21 | 6 |
| 1.8-2.2 months | Kg | .0239 | .0029 | .0199 | .0293 | 11 | 9 |
| 0.9-1.1 years | Kg | .0324 | .0114 | .0180 | .0480 | 12 | 9 |
| 1.8-2.2 years | Kg | .0257 | .0042 | .0200 | .0324 | 10 | 8 |
| 2.7-3.3 years | Kg | .0274 | .0021 | .0239 | .0320 | 12 | 8 |
| 4.5-5.5 years | Kg | .0274 | .0036 | .0198 | .0338 | 10 | 7 |

[a] Number of samples used to calculate the reference range.
[b] Number of different individuals contributing to the reference values.

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## **Appendix V:** MEDARKS-Based Post Mortem Form

*Tanager Pathology Report Form*

Date of examination: ..... Date of death: .....
Case number (local): .....

Owner: .....

Examiner:.....

Species: ..... Identification: .....

Sex: .....Age:..... ..... Weight (at death): ... .....(g)

Clinical signs prior to death:
.....

.....

.....

Treatment:
.....

.....

.....

| | |
|---|---|
| 1. General condition | |
| 2. Striking lesions/<br>3. abnormalities | |
| 4. Skin | |
| 5. Nails | |
| 6. Feathers | |
| 7. Oral cavity/Bill | |
| 8. Eyes | |
| 9. Nares | |
| 10. Infraorbital sinus | |
| 11. Subcutis, fat | |
| 12. Muscles | |
| 13. Air sacs | |
| 14. Peripheral lymphnodes | |
| 15. Thymus | |
| 16. Pleura | |

| | |
|---|---|
| 17. Trachea | |
| 18. Lungs | |
| 19. Pericardium | |
| 20. Heart | |
| 21. Blood vessels | |
| 22. Lymphnodes | |
| 23. Ribs | |
| 24. Diaphragm | |
| 25. Peritonem | |
| 26. Mesenterium | |
| 27. Liver | |
| 28. Spleen | |
| 29. Pancreas | |
| 30. Kindey | |
| 31. Adrenal glands | |
| 32. Urinary bladder | |
| 33. Uretha | |
| 34. Ovaria | |
| 35. Genital tract | |
| 36. Esophagus | |
| 37. Stomach | |
| 38. Small intestines | |
| 39. Brains | |
| 40. Meningi | |
| 41. Nerves | |
| 42. Bones | |
| 43. Bone marrow | |
| 44. Joints | |
| 45. Miscellaneous | |

| **ANCILLARY DIAGNOSTICS - RESULTS** | |
|---|---|
| Histopathology | |
| Toxicology | |
| Cytology | |
| -chlamydia staining | |
| Parasitology | |
| -intestinal | |
| -external | |
| -blood | |
| Microbiology | |
| Virology | |
| Level of iron in the liver | |