

THE PURPLE-BELLIED PARROT *Triclaria malachitacea*: ITS BIOLOGY AND HUSBANDRY

by Juan Cornejo

The Purple-bellied Parrot *Triclaria malachitacea* is endemic to south-east Brazil, where the wild population is in decline. It is not very well known in captivity, in which it has a high mortality and a low reproductive rate. At the beginning of 1998, the Loro Parque Foundation, Tenerife, Canary Islands, Spain, possessed the largest collection with 21 (9.10.2) of the approximately 60 individuals in captivity outside of Brazil.

My study of this species began in October 1996 and its objectives were:

To compile the existing information on its biology and general situation in the wild.

To compile the information on its husbandry in captivity, both from the existing literature and from experience gained through keeping this species at the Loro Parque Foundation.

Name and Systematics

Scientific: *Triclaria* (Wagler, 1832), *Triclaria malachitacea* (Spix, 1824), before denominated *Triclaria cyanogaster*. *Triclaria*: Epithet from Greek mythology for the goddess Diana. *Malachitacea*: from the Latin *malachiteus* = green and *-aceus* = resemblance (Jobling, 1991).

English: Purple-bellied Parrot.

Spanish: Loro de Ventre Púrpura.

Yupi (Brazilian aborigine): Cica, Sabiá-cica (Mother of the thrush or robin).

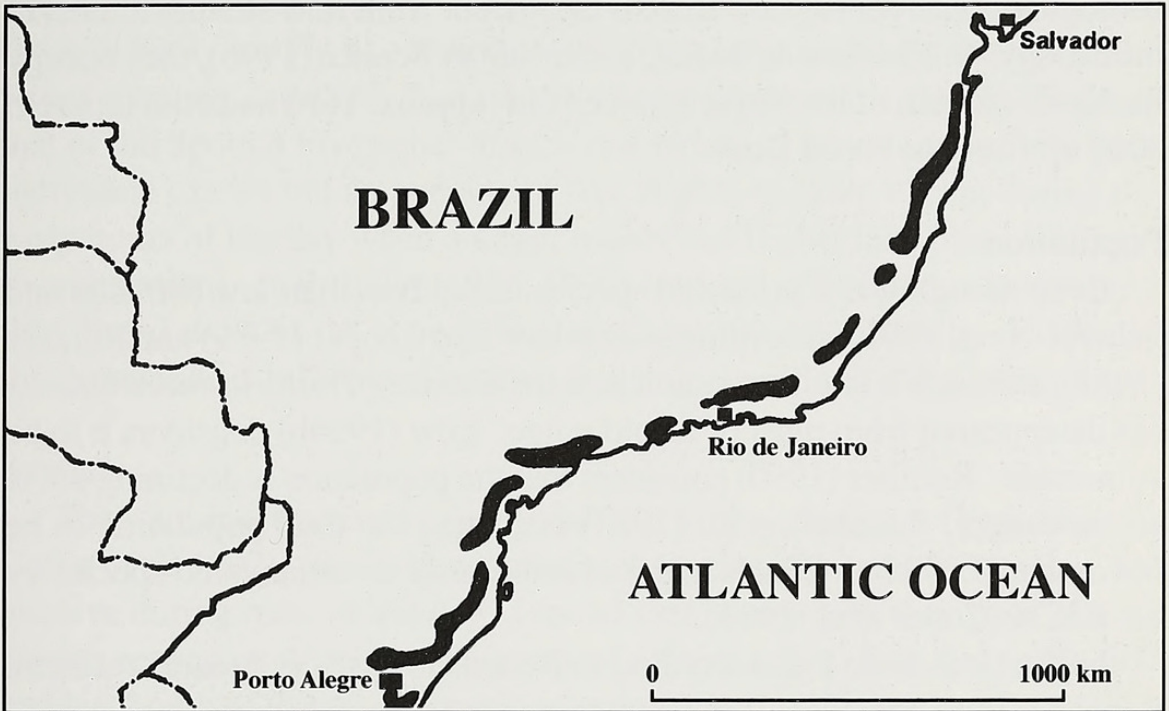
Class Aves, Order Psittaciformes, Family Psittacidae, Subfamily Psittacinae, Tribe Arini, Genus *Triclaria* (monotypic), Species *Triclaria malachitacea*.

Ecology and Habitat

Distribution

Brazil: This species is endemic to the Atlantic forest of south-east Brazil, from south-east Bahia State south to northern Rio Grande do Sul (Arndt, 1996; Bertagnolio, 1981; Collar et al. 1992; Forshaw and Cooper, 1989; de Grahl, 1986; Low, 1994a; Ridgely, 1981; Robiller, 1990 and Sick, 1993). It has been found in the states of Rio de Janeiro, São Paulo, Paraná and Rio Grande do Sul (Collar et al. 1992). One record for Campo Grande (Sick, 1985) has been discarded by Straube and Scherer-Neto (1995) and by Collar et al. (1992).

Argentina: Two records exist: Canevari et al. (1991) identified this species in November 1986 in Provincial Urugua-i Park and Rumboll (1990) identified it in April 1983 in the National Park of Iguazú. This author justifies these movements outside the usual area of distribution, as being a search for new habitat, due to the progressive destruction of its original habitat.



Distribution in Brazil according to Robiller (1990)

Habitat

It occurs on the escarpment and in humid forest as well as in the altiplanos within its range of distribution (Arndt, 1996; Belton, 1984; Forshaw and Cooper, 1989; Ridgely, 1981; Robiller, 1990), while Sick (1993) stated that it occurs in xerophytic woodland.

In the breeding season it is found at altitudes of 300m-1,000m (approx. 980ft-3,280ft) (Arndt, 1996; Collar et al. 1992; Forshaw and Cooper, 1989; Robiller, 1988, 1990). Outside the breeding season they group to carry out displacements towards the lowlands of the coast (Collar et al. 1992; Forshaw and Cooper, 1989; Sick, 1968, 1993), as do Pileated Parrakeets *Pionopsitta pileata* (Bertagnolio, 1975, 1981; Straube and Scherer-Neto, 1995). Sick (1993) confirmed that they visit the town of Parati, Rio de Janeiro.

According to Yamashita in Collar et al. (1992) it occurs in habitat rich in bromeliace forests along watercourses in valleys. In the states of Paraná and São Paulo, according to Straube and Scherer-Neto (1995), it is restricted to dense Ambrophils forests. According to Bencke (1996) in Rio Grande do Sul it inhabits patches of broadleaf forest and pine groves of mainly *Araucaria angustifolia*.

There is evidence that during the course of the year they carry out short displacements to forests and gardens around cities (Bertagnolio, 1981; Forshaw and Cooper, 1989; Ridgely, 1981; Sick, 1968; Straube and Scherer-Neto, 1995) and to corn fields (Bencke, 1996).

Yamashita (in Collar et al. 1992) and Sick (1968) stated that they are found in the canopy of high trees. Collar et al. (1992) stated that in the Biological Reserve Augusto Ruschi they occur from mid-stratum almost to the canopy. In Rio Grande do Sul, according to Bencke (1996), they occupy the lower stratum of the forest between 5m (approx. 16ft) and 10m (approx. 32ft) up from the forest floor.

Population

Even though it is a protected species under Brazilian law (Straube and Scherer-Neto, 1995), according to Forshaw and Cooper (1989) and Ridgely (1981), although it is still common in some districts, *Triclaria malachitacea* has disappeared from most of its old range. Low (1994b) considers it to be vulnerable. Robiller (1990) considers that the population is declining but is not in danger. Lambert et al. (1993) estimated the total population to be fewer than 5,000 individuals and it is considered an endangered species by the IUCN (Collar et al. 1994).

In Rio Grande do Sul, according to Belton (1984), it is a scarce resident. Bencke (1996) considers it to be quite common in wide regions of mature forest and in a 45sq km (approx. 17sq miles) area that embraces the east-central part of the state, estimated a maximum of 10,000 individuals. Aleixo and Galetti (1997) consider it to be fairly common in the Estadual Intervalles Park (São Paulo State). Straube and Scherer-Neto (1995) regard it as an unusual species in the states of São Paulo and Paraná.

Collar et al. (1992) say that its density has been underestimated due to its shyness, but according to Bencke (1996) and Straube and Scherer-Neto (1995) its habit of forming into small groups and its peculiar song make it a conspicuous species. Because of the resemblance of the female to that of *Pionopsitta pileata* and the overlapping of the two species' ranges (Bertagnolio, 1975, 1981; Forshaw and Cooper, 1989; Low, 1994a), confusion has probably arisen in some cases. All this seems to indicate that it is not a very abundant species.

Vocalisation

Its very characteristic voice, melodious and difficult to describe, is unlike that of any other parrot. It vocalizes both in flight and at rest (Belton, 1984; Straube and Scherer-Neto, 1995). Males sing more frequently and more strongly. Females can also sing. Rossi dalla Riva captured an individual with a different song. It was described as 'tone deaf' (Bertagnolio, 1981). My study of eight captive pairs found no very significant differences between

the number of vocalizations uttered by the males and females during the day. The profile showed an increase in the number of vocalizations during the first and last hours of the day (Cornejo in preparation).

Flight

Several authors describe its flight as quick, slight and precise (Belton, 1984; Forshaw and Cooper, 1989). Murray (1969) described having seen those in his aviary fly like a shrike with long glides with only the tips of the wings moving, and catch flies on the wing with the same circular flight as that of the Spotted Flycatcher *Muscicapa striata*. I found in captivity each individual carries out an average of five flights an hour, except during the early hours of the day when a larger number of flights take place (Cornejo in preparation). In Robiller (1988, 1990) Burkard affirmed that in captivity they spend most of the time flying, settling only occasionally. Evidently this behaviour is influenced by their housing conditions and surroundings.

Activity

They are most active at dawn and late in the afternoon (Yamashita in Collar et al. 1992). As is characteristic of species of humid forests they are inactive during most of the day. I found that in captivity they pass 75% of the day resting or sleeping. The greatest activity takes place during the first and last hours of the day (Cornejo in preparation).

Food and Feeding

According to Bertagnolio (1981), Collar et al. (1992), Forshaw and Cooper (1989) and Sick (1968) their natural diet is based on seeds and the pulp of different forest trees, as well as nectar and invertebrates. In Rio Grande do Sul, according to Bencke (1996), the last two foods are eaten less frequently, instead they eat mostly vegetable matter, mainly the seeds of *Pachystroma longifolium*, *Actinostemon concolor*, various fruits of the family *Myrtaceae* and sometimes Corn *Zea mays* growing in fields adjacent to patches of forest. Pizo et al. (1995) agree as to the importance of *Myrtaceae* fruits but not the importance in the area of *Euterpes adulis* (Palmito), which was considered by Bertagnolio (1981) and Collar et al. (1992) to be their principal source of food. Belton (1984) stated that they eat the pine kernels of *Araucaria angustifolia*. Citric fruits also form part of their diet and Allmenroeder in Keller (1990), Carvalho in Collar et al. (1992), Forshaw and Cooper (1989) and Sick (1968) agree that they like Lemons *Citrus medica*, of which they eat only the seeds. Pizo et al. (1995), state that they eat oranges. Bencke (1996), Bertagnolio (1981), Collar et al. (1992), Low (1972) and Murray (1969) state that they like to eat tree bark. Murray (1972) was of the opinion that their natural diet also includes leaves and Low (1972) reported that in captivity they have been seen eating leaves.

Movements and Sociability

Yamashita in Collar et al. (1992) stated that they move at the level of the tree canopy or even above it. Bencke (1996) said they will cross small clear areas *contra* Collar et al. (1992). Bertagnolio (1981) and Yamashita in Collar et al. (1992) affirm that they usually go about in small groups and according to Robiller (1988, 1990) these are especially frequent outside of the breeding season. However, almost 50 of the 106 records registered by Bencke (1996) were of pairs. According to Pizo et al. (1995) they live in pairs or small groups of up to four individuals.

Territory

Collar et al. (1992) and Straube and Scherer Neto (1995) confirmed their strong territorial instinct by getting aggressive reactions from playing recordings. Arndt (1996), Fricker (1990), Murray (1969) and Robiller (1988, 1990) found that the same strong territorial instinct exists in captive paired birds.

Reproduction

In the wild they nest from September to January (Bencke, 1996; Bertagnolio, 1981; de Grahl, 1986), or earlier (Arndt, 1996; Camargo, 1976; Forshaw and Cooper, 1989). They use natural holes in trees in which to nest (Arndt, 1996; Bencke, 1996; Bertagnolio, 1981; Camargo, 1976; de Grahl, 1986) including, according to Bertagnolio (1981) and de Grahl (1986), holes in palm trees.

Table 1. Nest and nest location.

hA	hN	E	D	Source
-	4.5m	30x5cm	90cm	Camargo (1976)
-	1.5m	35x5cm	220cm	Camargo (1976)
-	~2m	20x16cm	-	Straube/Scherer-Neto (1995)
~20m	5.13m	16x8cm	>100cm	Bencke (1996)
-	3.43m	20.5x3.5cm	35-40cm	Bencke (1996)
-	4.3m	10.5x7cm	-	Bencke (1996)
-	~12m	-	-	Bencke (1996)
-	~4m	-	-	Bencke (1996)
-	-	31.6x24.9cm	-	Arndt (1996)

hA = Nest tree height

hN = Height from the ground to the lower lip of the entrance to the nest

E = Nest entrance measurement

D = Depth of nest

Aviculture

General

According to de Grahl (1986), the first news of this bird dates back to 1820, when Príncipe Max described it, soon after an explorer named Nattere bought one in a market on the 'River of Janeiro'. The Austrian Emperor had two between 1822 and 1825 and, in 1878, a merchant named Hamburgo Lintz offered a couple to Dr. Ruá. In 1879, Messrs. Hagenbeck had one in Berlin, when the famous collection at London Zoo still did not have one. There seems not to have been any further news of any captive individuals until 1905, when one appeared in England. The first one arrived at Berlin Zoo in 1910 (Robiller, 1988, 1990). Nothing further seems to have been written about this species until two arrived in England in 1960. In 1964, the late Herbert Murray imported two pairs from Brazil and in 1968 almost achieved what would have been the first recorded successful breeding of this species in captivity, had not the youngster died in the nest. Then in 1971 Rossi dalla Riva hatched one youngster (the other egg contained a dead embryo).

At the end of 1997 the captive population outside of Brazil was restricted to pairs belonging to private collections in Italy, Germany, Switzerland, Spain, Portugal and the USA, plus those at Vogelpark Walsrode, Germany, Palmitos Park and the Loro Parque Foundation, Canary Islands, Spain, totalling altogether approximately 60 individuals.

The one that has lived the longest in captivity could be a male that arrived in January 1986 at Loro Parque, and at the beginning of 1998 was at least 13 years old.

Housing

Experience demonstrates that this is a delicate and difficult species to establish in captivity (Arndt, 1996; Bertagnolio, 1981; Fricker and Fricker, 1992; Gismondi, 1990; Krenek, 1994; Low, 1988, 1994a; Murray, 1969; Patzwahl, 1993; Robiller, 1988, 1990). Imported birds require time to become acclimatized, but once this has been overcome, become stupendous aviary birds.

In large aviaries they are able to demonstrate the beauty of their flight. The smallest aviary in which reproductive successes have been documented was 3m x 1m x 1m (approx. 9ft 9in x 3ft 3in x 3ft 3in), suspended 1.5m (approx. 5ft) above the ground, at the Loro Parque breeding facility. Bigger aviaries are, of course, preferable. They are said to like green-walled shelters (Bertagnolio, 1981; Low, 1994a). According to Arndt (1996) they should be housed in pairs in separate but continuous aviaries. Krenek (1994) housed two females with each male but only the dominant female of each trio bred, thereby demonstrating the monogamous tendencies of *Triclaria*.

Silva (1991) stated that they do not tolerate well temperatures higher than 37.5°C (99.5°F). Arndt (1996) and Collar et al. (1992) consider the minimum temperature for them is 20°C (68°F). However, Fricker and Fricker (1992) and Low (1994a) affirm that they are not delicate in low temperatures. If they have a nest-box which they like, they will roost in it at night (Arndt, 1996; Bertagnolio, 1981; Fricker, 1990; Fricker and Fricker 1992), although this behaviour is not always observed (Silva, 1991).

According to Wasilewski (per. comm.) they have a propensity to suffer from infestations of roundworms, so preventative measures must be taken in the design of their housing, the provision of prophylactics and other veterinary measures.

Diet

The basic diet provided for them at Loro Parque is the same as that provided for most of the other parrots in the collection. The food is prepared daily in the approximate proportions listed in the Appendix (p. 37). They are fed twice daily: the first feed is given at 8.30am and includes a dish (D1) containing fruits and vegetables (Group 1) mixed with small seeds (Group 2). A second dish (D2) contains two types of pellets (Group 3). At the second feed, at 2.30pm, the first dish (D1) is replaced by another dish (D3) containing legumes and large seeds (Group 5), together with small seeds (Group 4). Calcium and vitamin/mineral supplements are added to Group 4. This routine is designed to induce the birds to eat more vegetables and fruits than they would eat if these were served together with the seeds and legumes. The birds are hungrier in the morning and more eager to eat whatever is served up for them. Twice daily feeding also mimics the foraging habits of the birds in the wild because since not all their food is served up at once, they are able to choose new food items throughout the day (Lafeber, 1991; Harrison, 1986; Reese, 1991). In the breeding season, the basic diet is enriched with a homemade cake, the ingredients and preparation of which are detailed in the Appendix.

At Loro Parque each pair receives 155g of food each day, of which each individual, consumes about 12g fruit and vegetables, 14g seeds and pulses, 1.2g pellets, with everything accompanied by 6ml water. Of the various items in the diet, they have a preference for pear, apple, guava and pepper, as well as the corn and sunflower seed (Cornejo and Wolf in preparation).

Each pair has its water changed twice daily. A calcium block made at Loro Parque (See Appendix) is available at all times. As well as providing the birds with calcium, it is abrasive and helps them keep their beaks in good condition.

The calcium supplement used is Calcic Carbonate Carmisur, S.L., the vitamin/mineral supplement is Pet Chef Professional Breeder Supplement,

the pellet is the Pretty Bird Hi-Energy Special and the commercial mixture of small seeds is marketed by Wilde Zaden of Dufky.

In 1993 the diet also included boiled chicken once a week and, occasionally, mealworms *Tenebrio molitor* (Patzwahl, 1993). During the time that this diet was used the breeding results were remarkably good, with three pairs raising a total of nine young.

Reproduction

The following authors have documented the breeding of this species in captivity: Bertagnolio (1981), Fricker (1990), Fricker and Fricker (1992), Krenek (1954), Low (1988 and 1994a), Murray (1969), Patzwahl (1993), Robiller (1988 and 1990) and Silva (1991).

Display and mating

The breeding season at Loro Parque starts at the beginning of the winter. The first signs of reproductive behaviour are usually the increased activity and aggressiveness of the males.

Males can begin to display from the age of one year old. At Loro Parque the youngest breeding pair were a two year eleven month male and a two year nine month old female.

During the display the male walks along the perch with his body inclined or held erect, raising the feathers of his head and mantle and spreading the tail. He shakes his head rapidly and vocalizes and at the same time dilates the pupils of the eyes, producing a very attractive effect. According to Low (1994a) and Robiller (1988, 1990) the females also sing and shake their heads. The dilation of the pupils is common in other Neotropical parrots, such as those of the genus *Amazona* and also in species of the mainly Asian genus *Psittacula*.

Consistent with a chick requesting food, the male also leans forward until touching the perch and sings strongly while shaking the wings lightly, in response to which the female regurgitates food and gives it to him. In other species of Neotropical parrots, such as the Amazons, it is exclusively the male that regurgitates food and only the female that solicits it. With *Triclaria* I found that both sexes indulge in this behaviour with the same frequency (Cornejo in preparation).

Bertagnolio (1981) and Silva (1991) observed the male mating with one foot on the perch and the other on the female's back.

Nest

The few documented breeding successes in captivity have taken place in vertical wooden nest-boxes. These have varied in size from 20cm-30cm x 20cm-30cm x 40cm-60cm high (approx. 8in-1ft x 8in-1ft x 1ft 4in-2ft high).

At Loro Parque breeding successes have been achieved using vertical wooden boxes and boxes fixed at an angle of 45 degrees, both with an entrance hole between 7.5cm and 10cm (approx. 3in-4in) in diameter and with 15cm (approx. 6in) of sawdust in the bottom of the box. Krenek (1994) obtained good results using wooden lined metal boxes.

Chicks and Eggs

In captivity in the Canary Islands and England they nest during January to May. The female spends some time in the nest-box before laying (Bertagnolio, 1981 and Silva, 1991). She lays on alternative days and the normal clutch consists of four eggs, although smaller clutches are not unusual. The biggest documented clutches are of seven and eight eggs and were obtained by Krenek (1994), who removed the eggs as the female laid them. They lay one clutch a year, but according to Silva (1991), if the first clutch is lost or removed, they lay again one month later but if the same thing happens again, will not lay for a third time.

The eggs normally measure 31.5mm x 24.5mm (Bertagnolio, 1981; Krenek, 1994; Nichols in Forshaw and Cooper, 1989; Robiller, 1988, 1990). The smallest eggs do not usually hatch (Low, 1988, 1994a). According to Robiller (1988, 1990) a fertile egg weighs 10.2g on the day it is laid.

Incubation

The females are usually tight sitters (Murray, 1969; Silva, 1991). According to Bencke (1996), Low (1994a), Patzwahl (1993), Robiller (1998, 1990), Silva (1991), Sweeney (per. comm.) and Vriends (per. comm.) the average incubation period is 28 days. Incubation begins with the laying of the first egg (Silva, 1991).

The males feed the females during incubation (Bencke, 1996; Bertagnolio, 1981; Murray, 1969; Patzwahl, 1993) and occasionally continue doing so until the chicks are one month old (Silva, 1991). Krenek (1994) artificially incubated 10 eggs at 37.3°C (99°F) and 50% humidity, and seven hatched successfully.

Chicks

Newly hatched chicks weigh 7 ± 1 g (Low, 1994a) and have long, white down on the wings, back and underparts (Bertagnolio, 1981 and Silva, 1991). The ears and eyes are closed (Low per. comm. and Silva, 1991) *contra* Bertagnolio (1981). The claws are grey (Silva, 1991). According to Low (per. comm.) and Krenek (1994) the eyes begin to open about the 19th or 20th day and the ears a few days before this. The second down is light grey and appears about the 14th day. The pin feathers appear during the fourth week (Krenek, 1994).

The chicks remain in the nest for between seven and eight weeks (Arndt,

1996; Fricker, 1990; Fricker and Fricker, 1992; Low, 1992; Patzwahl, 1993; Silva, 1991; Sweeney per. comm. and Vriends per. comm.). Rossi dalla Riva in Bertagnolio (1981) affirmed that during the last few days the chicks are in the nest, it is the male that is in charge of their feeding. According to Silva (1991) and Patzwahl (1993) the chicks continue to be fed by their parents for four or five weeks. Bertagnolio (1981) and Low (1994a) agree that the chicks closely resemble those of the Pileated Parrot *Pionopsitta pileata*, while to Silva (1991) they are reminiscent of those of the genus *Pionus*.

Triclaria chicks have been hand-reared in several collections. Low (1988) used Nestlé cereals for babies, germinated wheat, de-husked sunflower seeds, papaya or apple, and carrot, to which were added calcium and vitamins. A female raised at Loro Parque was tame enough after six years to respond to whistles, eat from the hand and allow its head to be caressed, *contra* Murray (1969) who stated that this species is independent in character and indifferent to humans, and Low (1988, 1994a) who affirmed that hand-reared individuals show indifference to the person who takes care of them.

Population Management

Genetics

The captive breeding of *Triclaria malachitacea* must be planned so as to avoid endogamia (inbreeding), otherwise there will be a reduction in fertility and in the survival rate of the offspring, and an increase in susceptibility to illness. It is important that pairs are formed using individuals selected from widest possible gene pool. A centralised studbook must be created and exchanges between collections controlled by a studbook coordinator. The genetic lines of each individual should be determined using DNA analysis.

Demography

To increase the size of the captive population is fundamental to assure the continuity of the population without the necessity to capture further birds from the wild. It is also an important security measure should possible mutations, epidemics or other disasters put the captive population in danger.

Conservation

In Situ

According to Bertagnolio (1981) and Collar et al. (1992) the decline of this species has been brought about by hunting, land clearance for farming and the intensive collection of *Euterpe edulis* (Palmito), which some consider to be its main food plant. (According to Bertagnolio (1981) the Purple-bellied Parrot is particularly fond of the small fruits of the 'Palmito', a type

of palm growing in dense forest. The fibrous pith of this palm yields a starchy substance used mainly as a thickening agent in soups and puddings, and is extensively collected by cutting down the mature trees.) Bencke (1996) considers that in Rio Grande do Sul the cutting of wood for the curing of tobacco is the main threat and not the gathering of Palmito. According to Rumboll (1990), on São Paulo's south coast 85% of its habitat has been cut down. Straube and Scherer-Neto (1995) also cite this as the main cause of its decline in this area.

Studies indicate that the population is also decreasing because of increasing human activity and survives only in the most inaccessible areas and those for which humans have no use. This supposes their exclusion to isolated areas of forest where the opportunities for survival are not so great. According to Bencke (1996) one of the measures required is to create protected forest corridors linking these 'islands'.

According to Bencke (1996), the capture of individuals for the bird market is not significant in the state of Rio Grande do Sul, but according to Straube and Scherer-Neto (1995) it is significant on São Paulo's south coast. The commercial exploitation of wild individuals must be avoided because of the risk this poses to the wild population. A complete census of the wild population is recommended, along with a more complete study of its biology. This will determine with greater precision the population's status and the appropriate measures necessary for the protection of this species.

Ex Situ

To assure the survival of this species in captivity by achieving self-sustaining populations, collections in possession of this species must undertake responsible planning for its breeding. It will also be necessary to take into account the possibility of the need for captive bred birds to be released into the wild, therefore hand-rearing should be undertaken only when absolutely necessary. The results of investigations in to the biology of this species must be made widely available so that the best use can be made of the information.

Conclusion

As is shown in this work, there is still much to be learnt about the biology of this species. Larger and more complete studies need to be carried out to accurately determine the situation regarding *Triclaria malachitacea* in its natural habitat and to determine what conservation measures are required.

In aviculture, although it has been known for many years, it continues to be a difficult species to maintain and persuade to breed. A combined effort by the collections that possess this species, which includes an international breeding programme, would be an important step forward in obtaining better breeding results and thereby increasing the captive population.

APPENDIX

Loro Parque base formula for daily preparation of fresh diet, and cake and calcium block.

Mix 1			
Foodstuff	Amount	Foodstuff	Amount
Apple	40kg	Orange	15kg
Pumpkin	Seasonal	Carrot	20kg
Guava	Seasonal	Pear	12kg
Sea Beet [†] /Lettuce	5kg	Watercress	5kg
Spinach	5kg	Beetroot (boiled 1hr)	8kg
Prickly Pear	20kg	Banana	Seasonal
Pepper	18kg	Date	Seasonal
Millet	2kg	Bird Seed	2kg
Oats	2kg	Seed Mix [‡]	2kg
[†] Sea Beet <i>Beta vulgaris</i> var. <i>cycla</i> L.			

Mix 2			
Foodstuff	Amount	Foodstuff	Amount
Beans (boiled 1hr)	18kg	Sunflower (de-husked)	5kg
Corn (boiled 3-4 min)	20kg	Lentils (boiled 15 min)	18kg
Millet	2kg	Bird Seed	2kg
Oats	2kg	Seed Mix [‡]	2kg
[‡] Commercial mix that includes 11 different seeds			

Cake [¤]			
Foodstuff	Amount	Foodstuff	Amount
Wheat Flour	8kg	Soya Flour	2 kg
Grated Carrot	4kg	Cooked Beef	3 kg
Eggs	48	Calcium	30g
Baking Powder	300g	Water	8-10 litres
[¤] Baked 150°C (334°F) for 1hr 45min			

Calcium Block			
Substance	Amount	Substance	Amount
Milled Oyster Shell	1kg	Calcium Carbonate	2kg
Charcoal	0.5g	Rock Salt	250g
Red Clay	1kg	Milled Limestone	3kg
Milled Cuttlefish Bone	250g	White Cement	1kg

Products mentioned in the text

Carbonate Calcic: calcic supplement manufactured by Carmisur, S.L., Ctra. de Estepa s/n, Gilena, Seville, Spain.

Nutribird Pellets P19 and G18: formulated pellets manufactured by Versele-Laga n.v., Kapellestraat 70, B-9800 Deinze, Belgium.

Pet Chef Professional Breeder Supplement: Vitamin-mineral supplement manufactured by Pet Chef Ltd., Blean Park, 12 Honey Hill, Blean, Canterbury, Kent CT2 9JP, England.

Wilde Zaden: mixture of seeds marketed by N.V. Dufky S.A., Aziestraat 1, 900 Gent, Belgium.

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