See also:

Draaiboek voor de Lora tellingen (pdf 190 KB)
Afdeling Milieu en Natuurbeheer (DROB), januari 2005

Plan van aanpak Loraregistratie (pdf 214 KB)
Dienst Ruimtelijke Ontwikkeling en Beheer, Bonaire
Afd. Milieu- en Natuurbeheer
Nov. 2000

Voorlichtingsplan Loraregistratie (pdf 227 Kb)
Dienst Ruimtelijke Ontwikkeling en Beheer, Bonaire
Afd. Milieu- en Natuurbeheer
Dec. 2000

THE YELLOW-SHOULDERED AMAZON PARROT (*Amazona barbadensis*)

2003 Field Study on Bonaire

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Bonaire Department for Planning and Resource Management (DROB), World Parrot Trust, Amazona Society USA, Parrot Society UK, and Amazona Society UK

1. Introduction

During the spring of 2003 I was awarded funds to visit the Dutch Antillien Island of Bonaire in the Caribbean. This island is home to a population of Yellow-shouldered Amazon Parrots (*Amazona barbadensis*) and it was my intention to contribute towards the parrots' conservation, gain some understanding of their situation and to determine what research would be necessary to benefit their future conservation management. I used my bicycle as transport, which saved the expense of hiring a car, and allowed me to stay on Bonaire for four months from mid May to mid September.

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2. Background

The Yellow-shouldered Amazon Parrot is a medium sized parrot with a short tail. As is typical of the Amazona genus *A. barbadensis* is mostly green with colourful head, wing, thigh, and tail feathers. The extent of this colouration varies between individuals. The subspecies *A. barbadensis rothschildi* is described as having less yellow on the head and bend of wing. The validity of this classification however, is much disputed. After examination of skins from all parts of the geographical range Low (1981) concluded the subspecies classification was not valid. More recently genetic analysis of a limited number of birds has been conducted concluding that there is no significant genetic variation between sub populations (Sanz & Grajal 1998).

Habitat loss and alteration have had a negative affect on this species, but the most significant pressure they have faced, and continue to face, is poaching. Trade in parrots for the local market has a long history and keeping a pet parrot is very traditional in this region. On Bonaire in particular poaching has been so intense that there are actually more *A. barbadensis* in captivity than in the wild. This species is classified as vulnerable on the IUCN Red list and listed as an Appendix 1 species by CITES (Snyder et al. 2000).

Amazona barbadensis generally inhabit a dry xerophytic thorny scrub. Mangroves may be used during the nesting periods, particularly on Margarita. In this harsh environment, seasonal drought and the subsequent low food availability can have a significant effect on population numbers. On Bonaire there have been drought periods when large numbers of *A. barbadensis* have starved despite the efforts of islanders to provide food for these birds (Voous 1983). Less intense dry periods may have a negative effect on reproductive output as well as other natural factors such as predation and parasitism.

3. Current Status

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Chick development
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The total wild population size for this species is not known, however, it is probably no more than 5000 (Sanz & Grajal 1998) and possibly less than 4000. One difficulty in estimating the number of *A. barbadensis* is that they occur in several isolated populations, these includes two separate mainland populations in northern coastal areas of Venezuela, the Venezuelan islands of Margarita and Blanquilla and the Dutch Antilles islands of Bonaire and Curaçao. The Yellow-shouldered Amazon also formerly occurred on Aruba. Unfortunately this population was exterminated due to being considered a crop pest and consequently they were considered extinct from the island by the 1950s (Voous 1983). Interestingly, despite its location between Aruba and Bonaire there are no historic records of this species on Curaçao. The population that is currently found on Curaçao is introduced and the birds are believed to have originated from mainland Venezuela and Bonaire (E. Newton verbally).

Little has been reported on the status of the mainland Venezuelan populations. The western state of Falcón is estimated to hold between 400-700 individuals (Snyder et al. 2000). The number of *A. barbadensis* found in the western state of Lara is unknown. There are two eastern states of mainland Venezuela where *A. barbadensis* are found. These are Anzoátegui and Sucre. There does not appear to have been an estimate of the number of *A. barbadensis* in this region. The Island Resource Foundation reports that even within the eastern and western mainland populations, groups of *A. barbadensis* are “local and disjunct”.

Since 1989 the Venezuelan islands of Margarita and Blanquilla have received conservation attention from the Venezuelan NGO, Provita. The number of *A. barbadensis* on Margarita is reported to have increased dramatically as a result of this work. In 1989 the population estimate was of 800 individuals. Only 7 years later in 1996, the estimate was 1900 individuals (Snyder et al. 2000). The population on the small island of Blanquilla is believed to between 80 to 100 birds.

Several population size estimates have been made on Bonaire for *A. barbadensis* during the last 20 years (Reijns and Van der Salm 1981, Mellink and Molina 1984, Joordens 1987, Van Helmond and Wijsman 1992, and Scholtens 2001). These suggest that the population has fluctuated between 100 and 500 individuals. The current estimate is between 350 and 500 birds. There has not been a formal count of the number of introduced Yellow-shouldered Amazon parrots on Curaçao.

4. Previous work and current situation specific to Bonaire

On Bonaire the local name for the Yellow-shouldered Amazon Parrot is Lora. For convenience I will use this name for the remainder of the report.

Since 1980 several scientists have visited Bonaire to estimate the Lora’s population size. Unfortunately, there has been little continuity or development of methodology by these researchers. In recent years regular annual counts have been developed and coordinated by members of STINAPA (the non-governmental National Parks Agency) and DROB (the governmental department for Planning and Resource Management). The situation has therefore improved, as there is now some continuity between the counts. Each year volunteer observers participate and their involvement serves to raise awareness within the community. I learnt of only one earlier study (Mellink and Molina 1985) that had investigated the reproductive biology of the Lora on Bonaire. I will refer to this study in greater detail below.

The Lora of Bonaire are one of the many species that have been the focus of a pride campaign. Working with STINAPA, Enit Schulzen and then later Janneke van Gerwen, promoted the Lora through T-shirts, posters, stickers and many activities including puppet shows and costumes. This has worked well and there is certainly a level of awareness within the community. Efforts should be made to continue and develop this work in order to educate the island’s children about their wildlife.

On Bonaire the Lora have been protected by law since 1952. Unfortunately, this protection has not been enforced and approximately 1 in 6 homes keep a pet Lora. Additionally, there are many homes that have pet parrots such as macaws and other amazon parrots originating from Venezuela. In 2002 efforts were made to begin the enforcement of the Lora’s protected status. An island wide amnesty was held whereby owners of captive Lora could register their birds and have them legalised. All registered birds were banded with a unique numbered steel ring (Montanus 2003). If a person is now found with an unbanded Lora they face a relatively large fine and the confiscation of their pet. The possibility of having confiscated birds necessitated the construction of a place to house them. An aviary (approximately 3x8x3metres) has been built at the island’s Ministry of Agriculture field site where daily care will be easy to provide.

The World Parrot Trust (WPT) was involved with the registration campaign. Ruud Vonk of the Benelux WPT group coordinated a shipment of “Happy Healthy Parrot” information leaflets in Dutch which were given to each owner during the banding work. WPT also negotiated for the rings to be purchased at a discounted price.

5. Feeding notes and Distribution

The north of Bonaire forms the majority of the Lora’s natural habitat which includes the vegetation categories mixed evergreen-deciduous thorn woodland, succulent evergreen shrubland and sclerophyllous evergreen shrubland (Web site of the Netherlands Antilles Government). In contrast, the parrots do not visit the salt flats that cover the southern third of the island. In the central area of the island the natural habitat has been significantly reduced in favour of mixed planted/cultivated crops and presently this appears to offer relatively poor foraging for the Lora.

The Lora population has to respond to seasonal variations in food availability. Sustained dry seasons are common and it appears that during these periods the wild Lora have difficulty obtaining adequate food from the remaining natural habitat. At these times it is now normal to find many parrots foraging in and around the residential areas of Kralendijk and Rincon (Map 1). The Lora have shown that they can adapt and exploit the available exotic fruit from cultivated trees.

Public Opinions

Generally, it would appear that visiting Lora are welcomed and people are sympathetic to their cause. Boi Anton, island historian and editor of the Papiemento newspaper Extra highlighted the conflict that can occur in some cases between poorer fruit growing members of the community and foraging Lora. Despite this important issue I observed only one garden (in the village of Sobi Rincon) where the fruit of a cultivated Papaya tree (Carica papaya) were protected, a measure presumably taken to keep inquisitive Lora away. Crop raiding parrots and their potential persecution are difficult yet potentially important topics for Lora conservation. On two separate occasions, both in residential areas, I observed an individual Lora that had clearly sustained an injury. The first was during a morning roost watch (30.5.03); the bird was very lethargic, had difficulty moving around and appeared to have a bloodied wing. The second occasion (8.8.03) was in Rincon where I saw another bird with a bloodied wing. Both of these birds may have had lucky escapes from the few Crested Caracara (Polyborus plancus) that are present on the island. They may equally however, have been targeted by an unhappy landowner. Clearly, protecting the Lora from persecution of this kind would be extremely difficult which highlights the importance of continuing and developing education efforts.

There have been several significant droughts on Bonaire where large numbers of Lora have starved. In the prolonged drought of February to June 1978, an estimated 200 Lora were reported to have died, despite the efforts of STINAPA board members who organised the provision of imported mangos for the wild birds (Voous 1983). In anticipation of future droughts the group Save de Loras was formed. This NGO holds funds for the sole purpose of importing food for wild Lora in the event of a future drought. Thankfully they have not been called upon frequently.

Introduced donkeys and goats are present throughout the island and on several occasions I noticed wild pigs around Dos Pos and Keteldal. As the donkeys are considered a quirky tourist attraction but are also the primary danger to road users and raid waste bins there is mixed public opinion regarding them. The goats are eaten by local people and as a result are considered by some to be important for the human population. These species represent a pending ecological disaster for Bonaire. Thankfully efforts are being made to exclude them from the national park and a “Donkey Safari Park” is being created. The introduced Troupial (Icterus icterus) is a common bird found throughout the vegetated areas of Bonaire. This species feeds on a variety of foods including fruits preferred by the Lora. The abundance of Troupials may represent a major food resource limitation for the Lora.

Feeding on Cactus

Voous (1983) lists nearly 30 different food items (mostly fruits and seeds) that wild Lora have been observed eating. Throughout Bonaire there is an abundance of tall candle cacti of which there are three species. Voous does not mention the cactus fruit, which the Lora certainly eat. He does however, suggest that the wild Lora eat the juicy upper shoots of only one species of the candle cacti, the Kadushi (Subpilocereus repandus). During this year’s visit no attempt was made to create a complete list of all feeding observations. Where Lora were feeding on candle cacti however, notes were recorded and observations of Lora feeding directly from both Kadushi and Datu cacti

(Ritterocereus griseus) were made.

Rainfall

The total precipitation recorded for 2003 up to and including September at the Hato weather station, (Bonaire Web Cams) was 105mm. The Netherlands Antilles Meteorological Service provides climatic data summarised from the last 30 years. Their data is collected from the Flamingo airport, 5km south of the Hato station. Both of these stations are on the West Coast. Comparing the monthly precipitation data for the same period indicates that in 2003 (up to and including September) there was 56% less precipitation than average. This is despite the relatively heavy rain in July 2003 (55mm) that was 51% more than average for the month. All other months in 2003 from January to September received less than average precipitation.

During May, June and the first weeks of July it was possible to observe groups of Lora in most areas of Kralendijk. It would appear that these birds were able to achieve greater foraging success from various town gardens than in their natural habitat in the north of the island. The apparent low availability of natural food would almost certainly be related to dry spring months. On July 10th 8mm of rain fell and a further 40mm fell on July 12th. The other 7mm of rain fell on 4 other days during the month. These rains had a dramatic effect on the habitat. It is logical to believe that this in turn brought about the considerable reduction of Lora presence in Kralendijk.

Map 1. Bonaire

Birds in Town

I arrived on Bonaire in mid May and at that time it was possible to observe many Lora in various areas around the main town Kralendijk. During the first weeks in June the southern end of the town and in particular one garden within this area was busy with many feeding Lora. I observed over 15

Lora feeding on the large Kenepa or Genip tree (Melicoccus bijugatus) in the garden at one time. The owner Larry Gerherts believed his kenepa tree is the first to provide ripe fruit in Kralendijk and he reported having had as many as 30 Lora visiting his garden to feed on the delicious fruit. These birds were incredibly tolerant of human presence and it was possible to approach the birds within 10 meters. Some of these visiting Lora even flew to the ground to feed on fallen fruit despite Mr Gerherts' three dogs.

Around Kralendijk there are several localised areas where wild Lora could generally be found. Mr Gerherts' home is within the southern area of town that also includes the two exclusive tourist resorts of Plaza and Divi Flamingo. Both of these resorts have groomed lush gardens that are watered and appear attractive to Lora. Equally, the well kept gardens of Republik at the north end of Kralendijk were another location where Lora could frequently be seen.

I was interested to see how quickly the wild Lora would respond to a new food source. Fortunately the room I rented was within the area visited by the Divi Flamingo group of Lora, and these birds often passed over. I halved two mangos and put them on the 1.5 meter high back wall of my "garden" where they would be clearly visible by passing birds. A Cossie tree (Acacia tortuosa) from the neighbour's garden provided close perching and cover. Less than 24 hours later a group of four Lora had visited the tree and eaten the mangoes. This clearly shows that the wild birds are very adept at quickly exploiting new food sources.

Birds Outside of Town

Wild Lora were seen in many locations beyond the urban areas of Kralendijk and Rincon. Before the rains in early July, Lora appeared to be widely distributed in low densities. During this period I observed Lora in locations where they are not typically found. This included Belnem and Sorobon to the south, and in the vicinity of Lagoen to the east. Most of these sightings were single observations of very few birds. Before the July rains Lora were only seen in high densities at a limited number of locations outside of the towns. By far the most important of these locations are Fontein and Dos Pos. Each of these areas have a source of fresh water; Fontein has Bonaire's only natural spring, and at Dos Pos water is raised from a well by a wind powered pump. More importantly from the parrot's perspective there are a few large fruit trees remaining at each location from former fruit plantations.

The intense burst of rain in July brought about a remarkable change to the habitat and consequently to the distribution of Lora. The numbers of birds in the town declined rapidly and fewer observations of Lora in unusual locations were made. In the hilly areas to the north where the habitat is less degraded (Web site of the Netherlands Antilles Government) Lora densities increased. There was a marked increase in the number of birds present at Fontein and particularly at Dos Pos.

6. Roosting

Distribution

Before the July rains when many Lora were foraging in urban areas, I was aware of three large roosting sites near Kralendijk. These were at Hato, Seru Largu and Seru Grande. See Appendix 1 and 2 for roost observation summaries. At the same time the resident group of Lora were roosting at Fontein, and there appeared to be another large roost location at the north end of Gotomere Lake. Outside of these large groups I observed pairs and small groups (<10) roosting separately. Due to the amount of ground that needed to be covered it was not possible to attempt to search or quantify all of these.

Attempts were made to learn which specific roosts foraging birds were using (Appendix 3). The Hato roost included birds that foraged in Republik and toward Santa Barbara. Those roosting at Seru Grande certainly included individuals that visited the Divi Flamingo area in the south of Kralendijk, 5km distant. In the north, at least some of the birds foraging in Rincon passed through the valley of Dos Pos on their way to and from the roost north of Gotomere.

A major change in the distribution of roosting Lora took place following the July rains. A combination of reports from people living near the roost sites and my own observations suggest that less than two weeks after the rains the three large Kralendijk roosts were either unused or visited by far fewer birds. Roost locations in the north that I had been informed of and had found inactive in June were now being used again by the Lora. The most notable of these were the Keteldal and Montana north roosts (near Dos Pos). The roosts at Seru Wekua and Buraco de Gris were also active at this time and there were possibly birds roosting in an area referred to by Jerry Ligon as "Peaceful Canyon" (Map 1). The

number of Lora visiting other roost sites, particularly those in the Washington Slagbaai National Park probably also increased, however the size of the park and the time required, prevented me from monitoring all the potential locations.

Roosting Behaviour

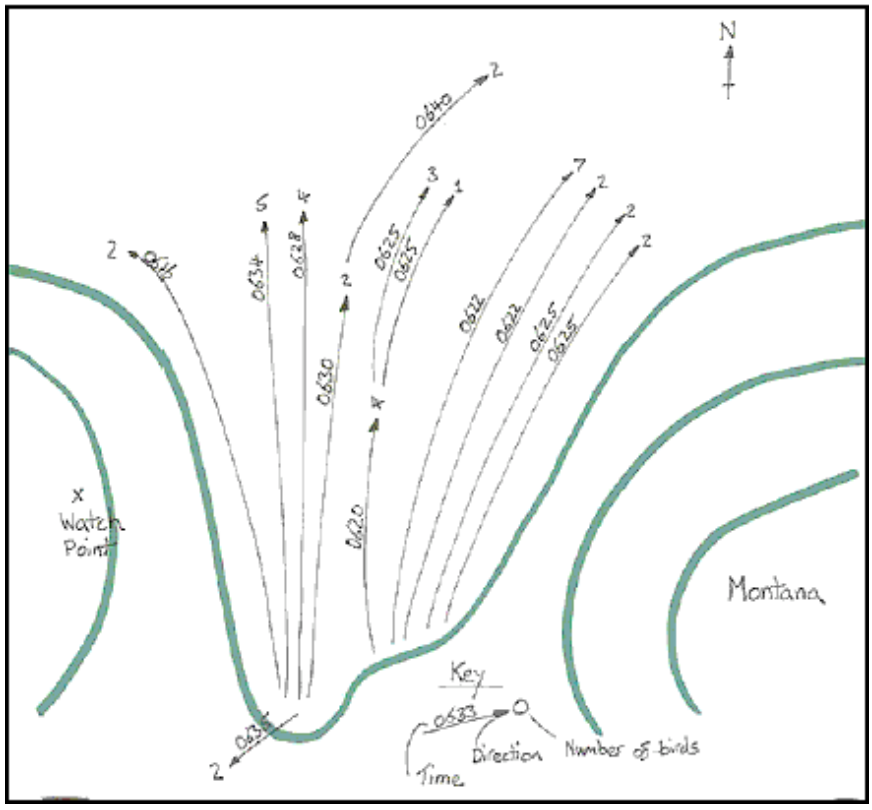
The number of Lora visiting specific roosts can vary over a period of days as well as seasonally. This variation can be noted from the roost summaries (Appendix 1,2 and 3). Roosting birds do not tend to form a tight group in a single tree. The larger roosts in particular can be spread out over several trees on a hill side or valley bottom. Ketaldal and Montana north for example, are both large scattered roosts in adjacent valleys and at their closest they are less than 200meters apart. In the evening the Lora generally arrived at the roost from 1800hrs. Birds that had been foraging in the immediate vicinity of the roost beforehand made earlier arrivals. By 1900hrs movements had in almost all cases stopped.

Two late observations were made of a single bird on the West Coast. The second of these observations was at the Tolo nest site after an evening feeding visit and this bird called from directly over the nest while flying north at 1915. The Tolo area is not particularly busy with parrots and consequently I suspect this bird was the pair male. Another late observation (1912) made six days earlier further north along the coast may have been the same bird. Interestingly the pair male at Dos Pos was also observed late one evening, in this case, leaving the nest cliff at 1907.

Vocalisations continue after dark and were noted up to 1920. After this time the observer would have generally left the area. On one occasion as I was leaving a roost watch in the dark 4 birds flew overhead between the Montana north and Keteldal roosts (26.8.03). These roosts are very close together. No other observations were made of Lora changing roosts during the night. The Seru Grande roost was disturbed during the night causing birds to fly in the dark, however in this case the birds remained at the same roost site. The cause of the disturbance was not seen but the Lora's behaviour was similar to that of other observations when they are disturbed by Caracara. There were approximately 300 pigeons roosting at this site that were also disturbed.

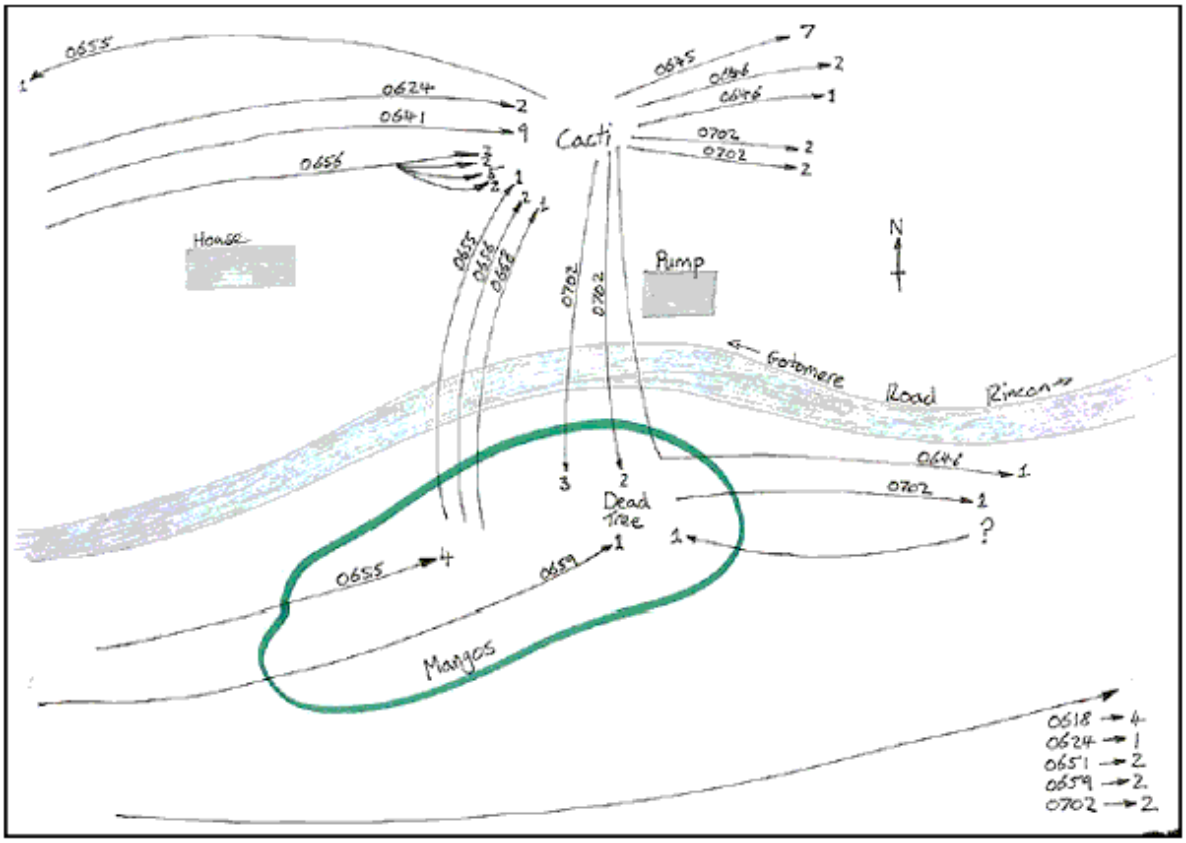
Morning observations of roost departures often gave a more accurate estimation of the number of birds frequenting the roost. First vocalisations were heard by 0615 and in all but one case some individuals had moved by 0620. Morning roost departure behaviour did not follow a strict pattern and on several occasions many birds remained in the vicinity for over an hour. Figures 1,2 and 3 illustrate the variation of Lora movement that was observed at two different roosts and at Dos Pos. This information was gathered primarily to aid the evaluation of the annual roost count observations discussed below.
The morning departure of birds from Montana north valley (Fig.1) was very straightforward with the majority of Lora flying directly from the roost and not returning. A simultaneous watch at Dos Pos (Fig. 2) illustrated that birds were first noted later than is typical at a roost and that the birds generally moved from the west to the east and out of sight. At Keteldal (Fig. 3) the departure of birds was more complicated with many birds moving several times when leaving the roost valley.

Figure 1. Departure movements from the Montana north roost (3.9.03)



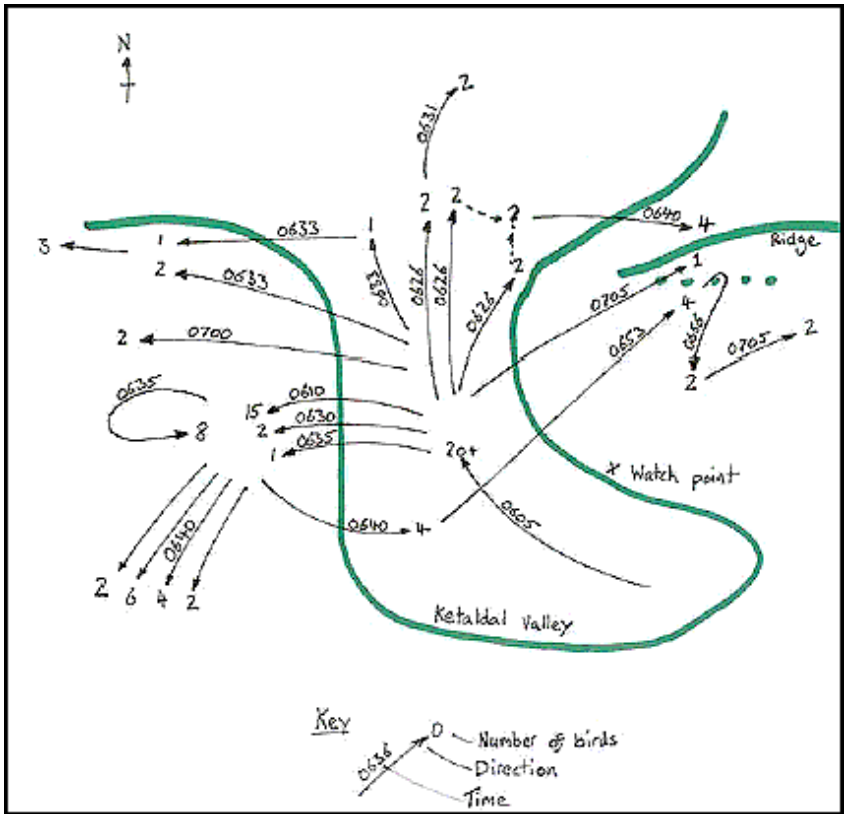
The tallies of all moving birds shown in the roost data (Appendix 1,2) indicate that more movements were observed during morning watches than in evening watches. The Keteldal example (Fig. 3) illustrates this typical morning departure behaviour where groups move several times before leaving the roost area. The relative frequency of smaller sized groups does not vary dramatically between morning and evening movements. Large groups (6+) were more common during morning watches. The majority of roosting birds were observed within approximately half an hour of the first movement. In all morning observations all Lora were observed by 0711hrs. This is especially relevant to the annual count methodology discussed below.

Figure 2. Movements through Dos Pos (3.9.03)



During morning watches large groups were often observed temporarily leaving the roost site and returning shortly after. In some cases the individuals that formed a large group would return in a number of smaller groups. Two birds moving together as a pair was by far the most common unit, however, paired individuals also moved within groups. This was also the case during foraging. While associated with a group, these pairs appeared to remain in close proximity of each other.

Figure 3. Departure movements from the Keteldal roost (27.8.03)



7. Nesting

Early in my visit to Bonaire I spoke to Jerry Ligon and George Thode the two foremost naturalists on the island. Neither of these gentlemen knew of any Lora breeding activity at that time. Similarly they believed there was little or no breeding activity for the other psittacine species on the island, the Brown-throated Conure (Aratinga pertinax xanthogenius). During my own field observations I also found very little sign of breeding activity. In particular I was looking for preening or feeding between Lora. Over several weeks I visited different areas and conducted watches where I believed breeding birds would potentially be found.

Only two breeding pairs of Lora were located. These were at Dos Pos and near Tolo. Further observations of these pairs allowed a limited study into the birds nest site requirements, their breeding behaviour, chick development, the response of adult birds to repeated nest inspections, and the pressures breeding Lora on Bonaire face.

Nests

On Bonaire the Lora is known to use both tree and rock cavities. The availability of suitable sized trees appears to be very limited. A formal search for tree nests was not conducted however, several notably large trees were visited and searched for cavities. Only 3 trees with cavities large enough for Lora were found on the western side of Bonaire. Each of these trees had been previously poached and the cavities were no longer of any use to the parrots, as unblocked access holes had been cut into them with chainsaws. Measurements were taken of these cavities to gain an understanding of the nest characteristics Lora prefer (Appendix 4). The repair of these cavities was considered, however, as it is clear poachers know of these sites it was decided that it would be best not to. If future research indicates a significant reduction in poaching then it would take little work to repair these nest sites.

Within the many rock cliffs in the north of the island there appear to be numerous cavities. Determining the number of these cavities that suit the requirements of Lora, however, would be very hard to quantify primarily because it would involve a considerable amount of climbing. Despite this difficulty it may be prudent to at least conduct a small study in a future season to assess the availability of suitable cavities within a sample of potential cliffs. Limited availability of nest locations would obviously be a serious problem for the Lora. The two known active nests during 2003 were both in rock cavities. Measurements of these cavities were also taken (Appendix 4.).

Behaviours of parents

From observations of the known breeding pairs it appears the Lora are generally conspicuous around the nest site. Alternatively it may be that I just did not spot the inconspicuous pairs! I have summarised below some general observations from the two pairs.

At Tolo the male arrived to feed the female between 0600 and 0704hrs (6 observations). On two of those occasions a second feeding visit was recorded and on one of these particular days a further (third) visit was observed. The sequences of visits on these days were as follows: 0704 and 1046hrs, and 0654, 0817 and, 0956hrs. Aggressive interactions between the nesting pair and additional parrots were observed during the morning when the male made three visits. These interactions involved the nesting pair calling while tail fanning and stretching their wings above their bodies. The pair also chased and displaced the other birds several times. The presence of other parrots may therefore have been the cause for his repeated visits. Only one evening feeding visit was observed at the Tolo nest. This visit took place at 1758hrs, approximately one hour before sunset.

It was possible to conduct nest inspections at the Dos Pos nest. The location of the nest on the cliff and the topography of the area restricted the view of the pair immediately before or after a nest inspection and consequently fewer feeding visit observations were made at this site. In general the male was present in the early morning and late evening as at Tolo (Appendix 5). No second feeding visit was seen in the morning at Dos Pos and neither of the males were observed providing an afternoon feeding visit before the regular evening visit at around 1800hrs. Parrots are typically less active during the midday to early afternoon period however, as few watches were conducted during this part of the day the lack of recorded activity may be due to observer bias.

Following the arrival and calls from the male, the females generally left the cavity in less than one minute (8 of 10 observations). Neither female was fed directly at the nest site, generally the female was fed in a tree near to the nest site. The Dos Pos pair would fly up to approximately 200 meters

from the nest, whereas the Tolo pair were never observed more than 75 meters from the nest during a feeding visit. On average the male provided 8 transfers of regurgitated food (14 Observations). The lowest amount observed was 2 transfers and the highest was as incredible 21 transfers. At Tolo the female was on average only out of the cavity for 8.5 minutes. The longest duration she was observed out of the cavity was 21 minutes. There was an aggressive interaction between the nest pair and other parrots on this particular occasion.

As a consequence of my presence during nest inspections the Dos Pos female was occasionally off her nest for periods of greater than one hour. The female did return to the nest following each inspection. Nest inspections were conducted as swiftly as possible, however efforts will have to be made in future to reduce the duration the female is off the nest.

The male of the Dos Pos pair was observed entering the nest cavity on two occasions. The first observation was the day the first chick is believed to have hatched. On this occasion the male entered the cavity with the female after an evening feeding visit at 1826hrs. He was in the cavity for 8 minutes before leaving and flying away alone. Whether or not he assisted in the feeding of the chick is unknown. The second observation of the male entering nest followed a nest inspection. It was also in the evening, 1806hrs. The first chick was then 3 days old and the second is believed to have hatched that day. The Tolo Male was never observed entering the nest.

Chick Development

The dimensions of the nest entrance at Tolo made it impossible to inspect the nest contents. With the aid of climbing equipment it was possible to conduct a nest inspection at the Dos Pos nest. Relatively little detailed information was collected, however some very important observations were made from the seven nest inspections. The three chicks hatched on days 0, 3 and 7 (age of first chick). The nest failed on day 11 (age of first chick). There are too few data to attempt to note any patterns in development (Appendix 6). A single ecto-parasite was noted on the first chick on day 8, and many more were seen on day 9. The species of the parasite was not confirmed.

Over the course of 4 days the three chicks were killed youngest to eldest. Each of the chicks suffered two puncture wounds, one on the right side of the rump, the other between the base of the eye and the top of the neck. The severity varied but the location of the wounds was consistent. None of the chicks' eyes had opened at this time. The tip of one of the second chicks' wings had also been removed. There appeared to be no attempt on the part of the killer to eat the chicks. These observations closely matched those documented by Synder et al. (1987) where Pearly-eyed Thrashers (Margarops fuscatus) attempted to take over nests of the endangered Puerto Rican Amazon (*Amazona vittata*). Furthermore, fine twigs were present in the cavity which is also consistent with Pearly eyed Thrasher nest building behaviour and observations were made of Pearly-eyed Thrashers in the vicinity of the nest.

8. The blue parrot

Volunteers during the 2003 annual count confirmed the presence of a blue parrot that had been previously observed by George Thode. It appears that this individual was a natural mutation of *Amazona barbadensis*. Many residents later spotted this individual in gardens or while exercising and I was often informed of sightings during the first month of my stay. I was not fortunate enough to see the bird myself and as reports of sightings ceased I suspected the individual had been caught or killed. A blue Lora would be very obvious and therefore relatively easy prey for one of the island's Caracara. During my last days on Bonaire I heard that a bird keeper had indeed caught the blue parrot and following dubious descriptions I attempted to visit this person. Unfortunately I did not see the bird or gather any further information.

9. Campaign

Keeping a pet parrot is very traditional on Bonaire and there are over 600 captive Lora. During the registration campaign in 2001 many owners were asked the age of their bird. The survey was not conducted in a scientific manner but nevertheless the 246 responses give a significant indication of the captive Lora's population age structure. The ages given by this sample of Lora owners suggest that approximately 50% of the captive Lora are less than 5 years old. A further 25% are between 5 and 10 years and the remaining 25% are over 10 years old. Very simply, these figures indicate that a shocking 300 chicks have been removed from the wild in the last 5 years. They also indicate that only a relatively small number of the captive birds are living a long life. This highlights the poor level of

husbandry the majority of these captive birds receive, which ultimately results in their early death.

I believe that if owners of pet Lora improved their care it would benefit the lives of their pet birds. The conservation of the wild birds would also benefit assuming that if the captive birds live longer then the demand for chicks from wild nests would be reduced. In view of this I felt it was necessary to launch a pet parrot care campaign. The Parrot Society UK had donated £500 specifically for direct conservation measures such as posters and T-shirts. Both of these approaches had been used during earlier awareness campaigns, so a new angle was required. As this campaign would benefit both wild and captive birds I believed it was appropriate to use this money and that of the other organisations supporting the project.

The campaign was discussed with several people involved with the media on Bonaire. It was clear that a campaign of this nature fronted by a local person would be far more effective than one lead by a visiting European such as myself. Fortunately, I had been introduced to Anna Pauletta, a Bonairean lady who had been on the ringing team. She seemed to know everybody on the island and as a parrot keeper herself she made an excellent candidate to front the campaign. Naturally she could speak Papiamentu the local language, but more importantly the local people respected her and were interested to learn from her.

The objective of the campaign was to promote good parrot care. We did not wish to encourage the keeping of pet parrots. We would highlight the Lora's protected status and relate topics to the wild birds where possible. It was decided the campaign would run for eight weeks and each week there would be a "Lora owner of the week". Anna and I discussed eight components of good pet care such as having a large cage, giving the bird attention, providing fresh wood, and most importantly what a parrot should be fed. Many of the captive Lora are overweight and their owners simply do not know how best to feed their birds. Arrangements were made for us to visit the Lora owners and on these days I hired a car to transport us and usually Anna's daughter and grandchild. In all cases we were warmly received and often we were invited to suggest any improvements for their parrot's care.

Pictures of the Lora owners, their bird(s) and Anna appeared in the local newspapers along with an article discussing why they had been chosen and why that aspect was important for good care. George and Laura De Salvo who produce The Bonaire Reporter generously provided a digital camera and they reproduced the pictures in full colour (Appendix 7). Anna translated the articles, which then appeared in Papiamentu along with the photos in the Extra newspaper. These articles were also broadcasted on the island's radio.

One of the eight campaign components was providing toys for pet Lora and the local Cub-Scout group became involved by agreeing to make and distribute parrot toys. I purchased various hardware materials such as rope and chain and collected some wood from common trees. At the Cub-Scout meeting we used the materials to build toys and the children were encouraged to give their toys to someone they knew with a Lora. George and Laura DeSalvo reported on the event and also brought Oscar their wonderful parrot along to add to the excitement. A group picture of the children and Cub-Scout leaders proudly showing their toys made the front cover of the Reporter. Anna Pauletta spoke to the children about the wild Lora and the work we were doing.

The campaign also included a slide show that I presented. The show illustrated pressures endangered parrots face, focusing on the Lora in particular and the efforts that are being made to help them. The talk received a good deal of attention and in future I hope to be able to coordinate a similar presentation aimed more specifically at the local people. A short parrot movie was also shown. Filmmaker Hendrik Wutts of Scubavision had joined me in the field on two occasions and from the footage he recorded he produced a short video that included a nest inspection. This allowed me to illustrate the work I had been doing on Bonaire and emphasise how such work could benefit the Lora's conservation.

10. Discussion

Feeding

The regularity with which the wild Lora visit the town to feed and their rapidity in returning to their natural habitat after rain strongly suggest that food availability is a limiting factor for the wild Lora. Habitat loss and degradation are obvious causes. To prevent further ecological problems control of introduced mammals must be encouraged. In addition the significance of the exotic Troupial as a competitor for food resources ought to be investigated. Future research should also aim to monitor food availability and its relation to reproductive success.

Roosting

The importance of studying the Lora's roosting behaviour was to benefit the methodology of the annual counts. A reliable population estimate is vital for assessing the parrot's status. The current estimate is made through a large-scale simultaneous roost count involving volunteers at various known active roosts. The counts also serve to raise awareness of the Lora's situation. The involvement inexperienced volunteers creates a large potential for over estimating the Lora population. I was fortunate enough to be able to work with Gijs van Hoorn (DROB) the current count coordinator and suggest possible methods to limit the chance of over counting. My suggestions included:

- Pre count training in descriptive note taking and identification (to avoid counting the sympatric Brown-throated Conure)
- Synchronising observers watches to aid later analysis of observations and reduce potential for recounting by different observers
- Ensuring that at least one group member has binoculars
- Stationing experienced and trusted observers at large roosts where there is the largest potential for recounting, but also stationing young volunteers at active sites to inspire and encourage their further involvement.

During the latter period of my visit on Bonaire the fieldwork focused on specific roosts to establish patterns in the birds behaviour. This allowed me to offer some insight into the bird's behaviour that would assist future evaluation of the volunteers' notes. In particular I was interested in trying to establish when all the birds at a roost in the morning had been counted and the potential for recounting. Using the departure movements from Keteldal (Fig.3) as an example, a count of the total number of moving bird observed (including recounting) would have resulted in an estimation of 94 birds. Compared to my estimate of 30 individuals that figure would be an overestimate of 64 birds or 213%. It is therefore very important to have an appreciation for this potential error at both the observation and evaluation stage of the count.

Nesting biology

Reproductive output of the wild Lora population on Bonaire has clearly been limited for some considerable time by poaching. The number of chicks being taken into captivity for pets is considerable and the wild population will certainly be aging. What presently appears to be a stable population may suddenly crash as the older birds that form the majority of the population die off.

Molink and Molina (1984) believed there was sufficient supply of tree nests and at the time of their study poachers marked nest trees with paint or stones to aid finding them in future years. The current poaching method of opening a nest using a chainsaw may have destroyed the majority of the large tree cavities. The National Park probably has a greater proportion of suitable sized tree cavities than most other areas on the island. A simple assessment of nest availability in this and other areas ought to be included in future work. A lack of nest sites would be serious limitation on trying to restore the Lora population.

Collecting base-line information on the breeding behaviour of wild Lora will prove valuable when assessing their response to future management practices. As with several other island parrots of the *Amazona* genus, the breeding male Lora provides more than two feeding visits a day to his partner (Snyder et al. 1987, Koenig 2001). This contrasts with observations of mainland species (Enkerlin-Hoefflich 1995) and the island species yellow-billed Amazon *A. collaria* (Koenig 2001). A comparison of the breeding behaviour of island and mainland *A. barbadensis* would be interesting. Aggressive interactions between the nesting pair and other parrots were observed in the vicinity of the Tolo nest. Parrot offspring are known to remain with their parents for some time and Koenig (2001) specifically, observed yearlings accompanying pair males to the nest. In this case yearlings were no longer tolerated once the brooding of chicks had begun. There is therefore a good case to suggest that the additional birds observed at the Tolo nest were offspring from the previous year.

Voous (1983) described the Pearly-eyed Thrasher's distribution as restricted during the dry periods "but otherwise widely, though sporadically distributed throughout the whole of the hilly region". Molink and Molina (1984) also reported that the Pearly-eyed Thrasher was not evenly distributed over Bonaire. They also believed that competition with Lora for nest sites was low. From my own observations I would suggest that the Thrasher is now more common than these descriptions and further study is necessary to accurately assess the current level of competition with Lora for nest sites.

Another bird species that may also pose a threat to Lora nests is the exotic Troupial (Molink and Molina 1984, George Thode verbally). From the small sample of nests this year I did not observe any interactions between Lora and Troupial. I believe that determining the seriousness of chick predation and poaching is the most important research goal for next season.

Bonaire's management of the Lora

The efforts the island government have made to protect the wild Lora in recent years are to be applauded. The ringing campaign in 2002 was a great step toward actual protection for this species. This must be followed by strict enforcement to maintain the attention of the public and allow the wild population the opportunity to recover. There appears to be some uncertainty as to the ultimate destination of confiscated birds. The two obvious options are to either attempt to release confiscated birds back into the wild, or develop captive breeding.

I believe there are many reasons not to release confiscated birds at this time. My primary concern is the importation of birds from mainland Venezuela. This is relevant because the validity of the possible subspecies *A. b. rothschildi* remains dubious. If the sub species classification is indeed valid, then the potential for hybridisation resulting from the release of Venezuelan birds would be a serious conservation concern. In addition the financial cost of releasing birds on a small scale can be very high (Sanz & Grajal 1998). The active management of the wild population on Bonaire would almost certainly be a more optimal use of such funds.

Developing captive breeding and using the confiscated birds for education purposes would provisionally be a better role for these birds, at least until the clarification of their species status. School children could be educated about the reasons the parrots are vulnerable to extinction and Lora owners could learn husbandry techniques and how to breed from their own captive birds. Encouraging the owners of the 600 captive Lora to develop their own captive breeding has the potential to be of great benefit to the wild birds. This may indeed be the next step for campaign work (P. Montanus verbally). If there was no demand for chicks the wild bird's reproductive output could presumably be much greater.

Transport

On the small island of Bonaire using a bicycle as transport is not entirely unfeasible. The duration of my 2003 visit was doubled by doing so. This allowed me to develop sound working relationships with the many important people involved with Lora conservation. Conducting fieldwork from a bicycle however, has its limitations. From my field notes I estimate I cycled well over 2000 miles however, I would have liked to have covered far more. Future research on the Lora will benefit considerably from the use of a car.

Summary

The current status of *Amazona barbadensis* is not as favourable as the estimate of its population numbers suggests. Each of the isolated areas where these birds are found have suffered intense poaching. Low recruitment of young birds will have resulted in aging sub-populations. It is fortunate that conservation work has already begun in some areas. Efforts to assess the mainland populations and restore/increase reproductive output in all areas are a priority. On Bonaire this will involve assessing limitations to reproductive success and food availability. Developing captive breeding by Lora owners could potentially benefit wild bird conservation. The long-term conservation of this parrot requires clarification of the species status as this has major implications for the management of all the sub-populations.

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