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LIMITATIONS TO REPRODUCTIVE SUCCESS IN WILD AMAZON PARROTS

Principal Investigator: Dr. Ann Brice

Grantee Institution: University of California, Davis

Collaborators: Dr. Kim Joyner

Sra. Nini de Berger

Institution: Asociación Audubon de Guatemala

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A.I.D. Grant Project Officer: Joyce Turk

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EXECUTIVE SUMMARY

We have now completed the third of a three USAID-funded project entitled "Limitations to Reproductive Success in Wild Amazon Parrots"(Aug. 1992-Aug. 1995). Our objective was to identify factors that limit the reproductive success of the Yellow-naped Amazon in southern Guatemala. It is a parrot of great popularity in captivity because of its beauty and uncanny ability to mimic human speech, but before our research very little was known of its natural habits in the wild. We chose to work in an area of disturbed habitat because it is, unfortunately, the condition that much of the wildlife in the tropics is increasingly facing. We wanted to document the ecology of the Yellow-nape and focus on what its problems for survival might be, so that in the future Guatemalans might be able to consider management options to preserve this popular wildlife species.

Each year we focused on a different potential limiting factor for population growth. These included predation, parasites and nest sites availability. During the first year we placed flashing around the base of half the nest trees to deter ground dwelling predators. For the second and third years we placed artificial nest boxes at various sites to provide more nesting opportunities. During the third year we dusted half the nest cavities with carbaryl powder to control the ectoparasite load. The results from two of the three experimental manipulations were equivocal due primarily to the fact that the majority of chicks were stolen from the nests at a few weeks of age each year, leaving us with extremely small sample sizes. The nest boxes were rarely used by the parrots.

In spite of the frustration with chick theft for the illegal pet trade, the project should be considered very significant and successful on many terms. We have been able to document that poaching does indeed occur on a large scale in southern Guatemala and present this data to Guatemalan officials as well as aviculturists in North America and Europe, who often deny that significant smuggling still exists. We have gathered a great deal of data on the ecology and chick health of the Yellow-nape including: population surveys, nest site selection, habitat preferences, nest site competitioon, nest cavity measurements, parental attentiveness at the nests, annual fruiting phenology of parrot feeding trees, radio telemetry of selected fledglings during the first year, weekly chick health assessments, documentation of chick growth parameters, and parasite identification. We have developed field measurement and assessment techniques which are being adapted by biologists at other sites. We implemented an extensive conservation education program in Guatemala and hope that it will be continued by Guatemalans. And finally, we have trained a number of Guatemalan biologists, veterinarians and community people. They represent the best of Guatemala, and they must now take the lead in working to preserve their country's rapidly-dwindling biodiversity.

RESEARCH OBJECTIVES

This project was undertaken because so little is known about parrots in their natural habitats, yet it is generally accepted that up to one-third of the 350 species worldwide are in some state of decline (Collar and Juniper 1992). They are extremely popular as pets and have been exported legally and illegally from countries of origin for years (Knights and Curry 1990, Mulliken and Thomsen 1990), but virtually no research has been conducted to determine their population size and structure. We chose to study the Yellow-naped Amazon (*Amazona auropalliata*) because it is one of the most popular large parrots in captivity due to its uncanny ability to mimic human speech. Its natural range extends south from Oaxaca, Mexico through the Pacific Slope of Guatemala and as far south as northwest Costa Rica (Forshaw 1989). We chose to study the Yellow-nape in the severely disturbed habitat of southern Guatemala because these were habitat conditions (cattle ranches and sugar cane operations) the parrots would be increasingly likely to encounter throughout their range.

The question we asked was what might be limiting the population size of the Yellow-nape. If we could answer that, it would serve as a basis for further investigations into long-term conservation and management strategies in Guatemala for maintaining biodiversity in general and for conserving the Yellow-nape in particular. The Yellow-nape is a species whose decline could be easily missed by the casual observer or even in a short-term population survey. It is an extremely long-lived species, estimates range from 50-75 years (Stoodley and Stoodley 1990). Adults are still readily found in their range, but we wanted to know if enough young were being recruited into the existing population and at what rate. And if not, why not?

Although parrots are only one small facet of the diversity of life that is being diminished by human encroachment, they serve as powerful symbols of exotic beauty and wildness and draw our attention to the problem in a way that few other species can. Beissinger and Snyder (1992) sounded the alarm in "New World Parrots in Crisis". In their introduction they commented, "There have been so few detailed studies of psittacines in the wild that parrot biology could be considered one of the present "frontiers" of ornithology." Simply completing a three year study of the ecology of the Yellow-nape is innovative in itself. Without such studies nothing can be said about the management and conservation of the species. The research results we will publish and present in the next few years on the Yellow-nape will have importance that extends beyond Guatemala.

Because there have been few ongoing studies of parrots in the wild our project has gained some attention in the world of parrot biology. Other current neotropical parrot research includes a multi-year conservation program to save the still extremely endangered Puerto Rican Parrot (*Amazona vittata*) and which resulted in the most thorough documentation of a parrot species (Snyder et al. 1987), a study of three species of Amazons in northwestern Mexico (Enkerlin and Packard 1993); an ongoing study of the macaws of Manu, Peru (Munn 1992) and ongoing, as yet unpublished studies of the Green-rumped Parrotlet (*Forpus passerinus)* by Beissinger in Venezuela. In addition there is now more research being undertaken by local biologists in countries of origin than there were when we began in the early 1990s.

We received initial support for our research from various avicultural organizations in the U.S. This funding helped us conduct pilot studies before the USAID funding began. During the

period of USAID funding we also received additional funding to allow us to expand the scope of data collection regarding chick health from the Association of Avian Veterinarians, American Federation of Aviculture and the Wildlife Health Education Program at the UC Davis School of Veterinary Medicine. In Guatemala we were given logistical support and guidance from several organizations including Asociación Audubon de Guatemala, Defensores de la Naturaleza, Universidad del Valle, and the government conservation agency CONAP.

METHODS AND RESULTS

Population Censusing

Methods

Each January at the beginning of the Yellow-nape breeding season we utilized a fixed-point method to survey the Yellow-nape population of Caobanal, the ranch which we used asour primary study site. We broke the ranch into five areas and on each of five days counted Yellow-napes in the appropriate area from 1600 hr. until dark. We placed observers in the same positions each year.

We also conducted monthly counts at Las Ilusiones, a second ranch that had an amazon roost site. Several times a year we surveyed the site four times during the month.

Results:

Table 1 presents results of the annual survey at Caobanal and Table 2 presents the results of the roost count survey. The annual survey is remarkably consistent over the three year period. In any given year we found no more than 10 breeding pairs of Yellow-napes on the ranch, yet we counted over 100 birds in the survey each year. Many of these had to represent nonbreeding birds and birds passing through the property, perhaps en route to the roost site. The monthly roost survey show a trend toward fewer birds early in the nesting season, but there was considerable variation throughout the year. The final count of only 26 birds in November 1995 is reflective of the fact that all trees, except for the primary roosting trees ,were removed to plant sugar cane.

Nest Location, Monitoring and Fate of Chicks

Methods

To locate nests we put as many people as available in the field in the early morning and evening to observe amazon behavior early in the nesting season. We always began with known sites from former years and branched out from those points. After observing birds entering cavities, we waited 7-14 days to climb to the nest to confirm occupancy. Our reasoning was that the female should be at the end of incubation or have young chicks by our first climb, and by that point we were confident that the parents would not desert due to our disturbance.

Our method of climbing trees utilized basic rock climbing techniques. We shot a monofilament line over a branch near the nesting cavity with a bow and arrow or a slingshot and then pulled a larger rope over by attaching it to the monofilament. The climber wore a climbing harness and used ascenders to climb (see Appendix-Photos). Once the climber reached the nest and put on a safety strap, s/he took any chicks out of the cavity, put them in a bag and lowered it to the veterinarian on the ground. While the chicks were gone, the climber took nest measurements, collected litter samples and during the third year dusted half the cavities with carbaryl powder (see section entitled "Effect of Parasites").

Table 1. Annual Yellow-Naped Amazon Survey at Caobanal

Area	*1993*	*1994*	*1995*
Chahuite	18	17	15-18
Reforma	13	22-23	24
Campo Santo	11-13	13	16
Muro	32-42	20	22
Corozo	32-33	36	43
TOTALS	**106-119**	**108-109**	**120-123**

Table 2. Las Ilusiones Yellow-Naped Amazon Roost Count

Month	1993	1994	1995
Jan	148	71	75
Feb	93	139-40	95
Feb	91	---	---
Mar	165	122-6	138
Mar	124	163-5	182-192
Mar	147	198	198
Mar	132	186-7	173
Apr	211	205-9	164
May	243	181	133
Jun	199	181	
Jun	---	234	
Jun	---	196	
Jun	---	219	
Jul	218	254	146
Jul	178	---	
Aug	238	189	
Sep	182	97	
Sep	196	166	
Sep	240	175	
Sep	186	150	
Oct	103	123	
Oct	103	---	
Nov	115	87	26
Dec	131	105	
Dec	108	102	
Dec	156	122	
Dec	94	102	

Once a nest was identified as active, we continued to climb to it once a week until the chicks fledged or the nest failed. See Appendix-Forms for the data collected during each climb. See section below on chick health for veterinary handling methods and results. Our observers, hidden in blinds, collected time budget data on nest site attentiveness using binoculars and/or spotting scopes during all three years of the study.

Once the nest was no longer active, we climbed to it and took extensive measurements to use for comparative purposes. See Appendix-Forms for listings of the data collected,and Figure 1 for a presentation of the physical measurements taken.

Results

Each year we located more nests and were able to gather more data. The following were the total nests found each year (in 1994 we expanded to a third ranch): 1993 = 21, 1994 = 27 and 1995 = 31. Table 3 presents a summary of the reproductive success each of the three years. We were very discouraged at the level of poaching which continued in spite of our educational efforts. As high as the poaching appears in the table, we believe it would have been worse without our constant presence at the nest sites during the daylight hours. Our observers stopped numerous poaching attempts. Having at least two-thirds of the nests poached by humans or fail for natural reasons, reduced any experimental results to non-significant levels.

We are still analyzing the nest site attentiveness data. Table 4 presents a partial summary of the data gathered the first year.

Assessment of Chick Development and Health

Methods

Each year the veterinary team collected extensive chick data which included direct physical measurements and over 40 subjective observations taken weekly on each chick. See Appendix-Forms for a sample of the chick health form and an egg examination form. The team collected blood, fecal and cloacal and choanal swab samples for laboratory analysis at weeks 4 and 7-8. Parasite samples were also collected.

Results

Biometric measurements have not been analyzed beyond the first year and a few select chicks of 1994 (see Annual Report 1994). Preliminary use of this data suggests that weight curves alone may not be an adequate assessment of growth as some chicks had stunted bone growth but still had normal weight curves. To broaden the scope of these biometric studies 25 captive Yellow-napes (confiscated as very young chicks by authorities in Guatemala) were measured at almost 2 years of age. These results indicate that either captively-raised amazons may have greater growth or that fledging wild amazons are still growing at the time of fledging.

Preliminary analysis of clinical pathology data shows several trends. Amazon chicks at 4

Table 3. Reproductive success of Yellow-nape Amazon nests in southern Guatemala.

	1993	1994	1995
	n = 19	n = 27	n = 31
% nests fledging young	21	33	10
% nests that failed	26	33	22
% nests that were poached	32	33	52
% nests that failed or were poached*	21	--	13
% nests of unknown fate+	--	--	3

* Eggs or chicks disappeared, but the exact reason could not be documented.
+ Chick(s) had been present, but outcome was not documented

Table 4. Sample of Yellow-nape Nest Site Attentiveness Totals in 1993 in Minutes for Time of Day and Sex at or Near the Nest

Time (hrs)		Activity Type[a] 1	2	3	4	5
Period 1 (0600-0900)	Males	0.090	0.535	31.908	21.547	209.025
	Females	60.476	3.720	24.419	14.067	160.432
Period 2 (0900-1200)	Males	0.134	0.717	5.365	3.733	202.240
	Females	62.010	2.947	6.364	6.451	134.417
Period 3 (1200-1500)	Males	0.000	0.000	0.000	1.434	198.087
	Females	56.989	5.100	2.583	0.551	134.298
Period 4 (1500-dark)	Males	0.617	2.183	30.588	12.830	219.441
	Females	49.240	10.808	24.203	9.600	171.808
All Periods	Males	0.850	3.435	67.861	39.544	828.793
	Females	228.715	22.575	57.569	30.669	600.955

[a] 1= in the nest
2= on the lip of nest
3= within 5 meters
4= 5-25 meters
5= > 25 meters

weeks of age have similar packed cell volumes and total plasma solids as do captive adults. White blood cell counts may be slightly higher and tend to be more heterophilic at 4 weeks of age as compared to 7 weeks of age. Total protein and albumen levels are lower in 4 week chicks than in 8 week chicks, which are still lower than captive juvenile birds. This clinical pathology data will serve in helping to identify incidences of disease and malnutrition in both wild and captive amazons.

Effect of Parasites on Reproductive Success

Methods

The experimental protocol for 1995 was based on the previous 2 years of field data and the original experimental design. External parasites had been identified in the past, although substantial negative effects of the parasites were only rarely documented. Most nests had chicks showing some form of skin lesion (flakiness, dryness, scrapes, scabs, irritations, microabscesses). These skin lesions may have been caused by some form of insect, and we were able to document that they were caused by parasites in several instances. Examples include the whitish subcutaneous discoloration, edema, and indurating welts seen with the skin mites (Dermanyssidae) and the fly larvae holes, crusting, and skin edema seen with the fly strike (Calliphorid). The remaining skin lesions could possibly be attributed to the insects seen in the nest litter, such as the abundant Soldier Fly larvae (Stratimyiidae).

To study the effect of these parasites and insects, an experiment was set up in which half of the nests (randomly selected) would be treated with 10% carbaryl. This was delivered in a powder form and was diluted from its original 80% concentration (Sevin® to 10% by adding baby powder). The powder had a slight scent but did not seem to affect parent attentiveness to the chicks. Nest litter was not dusted with this powder until at least one chick had hatched, and it was thought that movement of the unhatched eggs during application of the powder to the litter would not cause problems. Chicks were less than one week of age during the first nest litter treatment. Volume delivered to each nest (1-6 tablespoons) depended on the amount and depth of litter present and on the previous week's success in dusting. It usually required 1 to 2 treatments to rid the litter of most insects and several weeks longer in some instances to rid the litter of the Soldier Fly larvae. We speculate that is almost impossible to get rid of litter Soldier Fly larvae as the adults can continually lay eggs in the newly excreted untreated fecal material, which is quite abundant in most nests. Rotting larvae, killed by the application of Sevin, caused a foul odor in a few nests, although no negative effects were seen with the chicks.

Additionally chicks were treated with oral Ivermectin (220ug/kg bodyweight, 0.1% diluted with sterile water) at 4 and 7 weeks of age and dusted directly with the carbaryl powder once the chicks had erupting feathers (at approximately 3 weeks). Chicks were dusted thereafter at weekly intervals until fledging. As in previous years chicks were bled and tested for intestinal parasites at 4 and 7 weeks of age. Blood testing included evaluation for a complete blood count, serum biochemistries, and a screen for blood parasites.

Twenty-two nests were included in the study. The possible effects of using the carbaryl

powder and oral Ivermectin were to be evaluated by comparing chick health, presence of parasites, blood results, chick weight gain and fledging success.

Results

Due to the heavy failure rate of the nests, is was difficult to compare treated and non-treated birds with any precision. Nineteen of the 22 nests were poached or failed for other reasons leaving only 3 to fledge young. Fortunately most nests that were either poached or failed did so when the chicks were already several weeks old, making some observations and early weight gain analysis possible. Only 4 of the 11 treatment nests survived long enough for at least one direct carbaryl dusting of at least one chick in the nest. The two groups had comparable numbers of nests surviving more than 4 weeks of age, although the non-treated group had significantly more nests fail at one week of age or less. The non-treated group also had significantly fewer chicks, which was probably due to chance.

The treated group of 11 nests included 26 chicks. Three nests had mites, 4 had Soldier Fly larvae, and 7 nests had skin lesions of various types. The non-treated group of 11 nests included 19 chicks, 1 with mites, 4 with fly strike and 5 nests with skin lesions. No chicks died or were missing before the entire nest failed or was poached in either group. However, 2 chicks from 2 different nests in the treatment group were found dead on the ground under the nest. These most likely died from falling from the nests, the reasons for which were undocumented. The data suggests that the carbaryl treatment was successful in preventing fly strike lesions. The only nests with Soldier Fly larvae were in the treatment group. This could have been due to chance, due to more older nests in the treatment groups or due to some unknown effect of the carbaryl dusting. Equal numbers of nests with thin chicks existed in both groups.

Sexing of Yellow-nape Chicks

Methods

All chicks still in nests at 4 weeks of age were bled and samples were analyzed by Zoogen, Inc., Davis, CA using a PCR/DNA method. Zoogen provided the service at no charge.

Results

Seventeen chicks were sexed in 1994 and 21 in 1995. Of the 38 chicks 19 were males and 19 females. A total of 20 nests were represented averaging about 2 chicks per nests. In these 20 nests the sexes and numbers were distributed as follows:

Nests with all males and multiple chicks:	2
Nests with all females and multiple chicks:	2
Nests with more males than females	1

Nests with more females than males	4
Nests with the same numbers of each	3
Nests with a single male chick:	5
Nests with a single female chick:	3
Nests with one chick:	8
Nests with 2 chicks:	6
Nests with 3 chicks	6

Artificial Nest Box Placement

Methods

In 1992 15 wooden nest boxes of various sizes were built and placed in trees around Caobanal for the 1993 season. Nest boxes were constructed of pine wood, varnished and had a bottom door as well as a top roof which could be lifted up. The entrance hold was placed near the roof. Wood shavings were put in the nest box and were pre-treated with 10% carbaryl.

Due to our experience with bee occupancy of the 1992 boxes, for the 1994 breeding season we put up 10 boxes, all of which contained a small piece (1/8 inch) of a Shell No-Pest Strip® in a screen box on the underside of the top.

For the 1995 nesting season 7 boxes were available for parrots (others from earliers years still had bees or had fallen apart).

Results

Within two weeks of placement in 1992 13 of the 15 wooden nest boxes were inhabited by Africanized bees. In 1994 none of the boxes attracted bees during the parrot nesting season, presumable due to the pesticide strip, but 5 had bees before the start of the following season. One of the boxes was occupied by Yellow-napes, and they produced chicks. However, the chicks were stolen before fledging. In 1995 nest inspection was documented at 2 boxes, and one produced 3 chicks, which, oddly, were abandoned by the parents right at fledging.

The low occupancy of artificial nest boxes by the birds has been reported in other amazon species, even with a documented lack of suitable nesting sites. With a longer term project we might have been able to determine if it was due to our construction and/or placement, low numbers of breeding adults, or adequate natural nesting sites. As deforestation continues in southern Guatemala, it would be worthwhile to study the question of nest box further as a possible managment tool to maintain the species. Even with such a small sample size we feel confident that the application of the pesticide strip was successful in deterring the bees for a period sufficient to rear chicks, and the chicks appeared to suffer no ill effects.

Radio-collaring of Selected Fledglings

Methods

We used radio collars (Wildlife Materials, Inc. SOM-2380-MVS) and a single receiver (Wildlife Materials, Inc. TRX-1000S) to track fledglings for at least one year after they left the nest. The brass collars were placed on the young birds an estimated 3-4 days before fledging. This allowed us to climb to the nest to check the chick and collar at least once before the birds left the nest. In addition to field notes, the trackers filled out a form during each observation session.

Results

In 1993 we collared two chicks, but one flew out of range almost immediately. The second was tracked regularly for a year and a half until the battery died. In 1994 we collared five chicks and were able to follow three for one year. At least two of the five batteries malfunctioned in 1994. In 1995, due to particularly heavy poaching, only two chicks were collared. The battery malfunctioned on one after a few months, but the second was still being tracked by a local field observer until the time of this report. This data is now being analysed. We do kow that fledglings remain with their parents until the following breeding season and are fed by them for months after leaving the nests.

Selection of Tree Species and Nest Sites by Amazons

Methods

Each year we took extensive measurements of the nest cavity, its position on the tree and its overall condition. See Figure 1 for a listing and illustration of what which measurements were taken. We also measured the size and distance of the 20 trees closest to the nest tree (five per compass quadrant).

In 1994 we identified and marked all trees on Finca Caobanal with a dhb (diamater breast height) greater than 50 cm. This was done on a fenced pasture by pasture basis to get an understanding of the various habitats within the study area. Each tree received a number and was recorded on a pasture map. We then selected five each of the 17 most abundant tree species which accounted for 95% of the trees and took the measurements described in the paragraph above, and we also assessed presence of cavities from the ground. Next we randomly chose one each of the 17 to climb and take cavity measurements to determine which ones were available but unoccupied by parrots. We took cavity measurements listed in Figure 1. Finally we climbed five each of the three most popular parrot nest trees (*Enterlobium cyclocarpum*, the conacaste, *Terminalia oblonga*, the volador and *Ficus sp.* the amate) to see how our cavity analysis from the ground compared with direct measurements.

Figure 1. Medidas Tomadas en Cada Cavidad (from Centeno 1995)

a = altura de la cavidad

b = ancho de entrada x alto de entrada

c = profundo de entrada

d = profundo del hueco

e = ancho x largo del fondo del hueco

f = circunferencia de rama del hueco

g = dirección

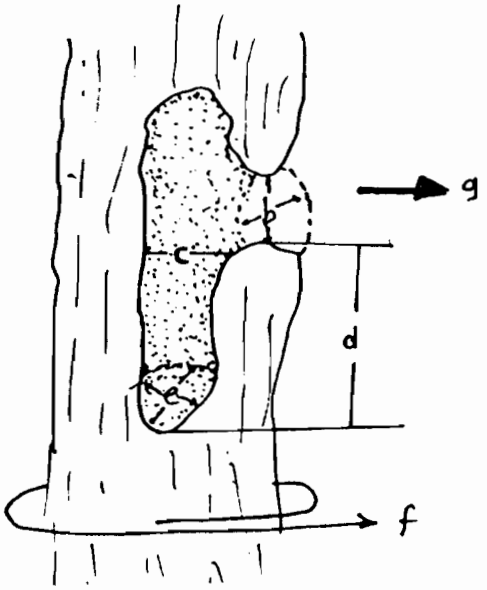
h = origen de la cavidad

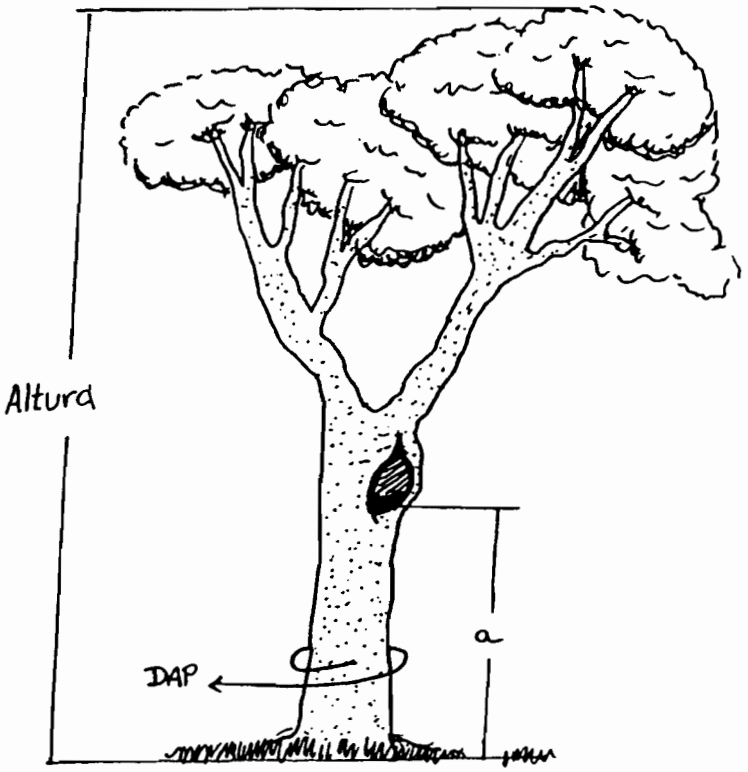
i = si tiene otros animales

j = si está húmedo o no

altura del arbol

dap = diámetro al pecho





Results

Table 5 presents a summary of three measurements (cavity entrance width, cavity depth and internal diameter) taken on *A. auropalliata* nests and compared with nest cavities of two other species of amazons. In addition the table compares our nests with a sampling of available but unused cavities in the primary study site area. We found that the Yellow-nape prefers a cavity much deeper and with a larger interior than the average available cavity offers, but this size was signficantly smaller than the Puerto Rican and Hispaniolan Amazons used.

We identified and marked 2,638 trees. This allowed us to identify the most abundant trees in the study area and compare them with the most frequently chosen parrot nest trees. Table 6 presents a summary of the number of cavities per hectare and per tree species for the three most abundant nest tree species.

The habitat data is now being analyzed. By actually climbing a sampling of non-nest trees with cavities we were able to determine how inaccurate we were in trying to judge presence and size of cavities from the ground.

Nest Reuse

Methods

Each year we climbed nests from the previous year that weren't being used in the current year to see if we could determine why. We took standard nest measurements and looked for changes, e.g. signs of alteration of the cavity or limb, presence of Africanized bees, etc.

Results

In 1995 12 of our 31 trees were nest trees occupied before, but two nests were in different cavities and two had been used in years previous to 1994 but not in 1994. In 1994 8 of 20 nests we had monitored in earlier years were used again. Frequently we found nests in the general area where pairs had nested in previous years, and our impression is that birds are fairly faithful to the area where they nested before but often change nest cavities.

Fruiting Phenology

Methods

From March 1995 to July 1995 we conducted a monthly study of the fruiting phenology of 15 species of trees, with five of each surveyed. These were all trees thought to be fed upon by the Yellow-napes. We rated each tree as to the abundance and maturation of the fruit, abundance of leaves and flowers.

Table 5. Medias de Tres Medidas Tomadas de Cavidades Disponibles Pero no Usados, Cavidades de Amazona auropalliata, de A. vittata (Snyder et al. 1987) y de A. ventralis (Snyder et al. 1987) (from Centeno 1995)

	Ancho de Entrada (cm)	**Profundo de Cavidad (cm)**	**Diámetro Interno de Cavidad (cm)**
Disponibles n = 115	13.49 [12.08-14.97]*	22.02 [19.06-26.91]	11.69 [10.21-13.7]
A. auropalliata n = 31	13.50 [11.55-15.78]	43.48 [36.30-51.32][a]	20.66 [17.98-23.52][a]
A. vittata n = 12	21.52 [17.73-25.67[a,b]	95.17 [78.28-113.70][a,b]	32.79 [30.02-35.69][a,b]
A. ventralis n = 47	12.44 [12.69-18.46]	98.16 [86.60-110.45][a,b]	33.94 [30.88-37.16][a,b]

* los valores son medias y dentro de los corchetes son los errores esándar

[a] hay diferencia significativa con las disponibilidad al nivel de P = 0.05

[b] hay diferencia significativa con los nidos de *A. auropalliata* al nivel de P = .05

Table 6. Número de cavidades por hectárea de los tres árboles usados con más frequencia por *A. Auropalliata* y número de cavidades por árbol (from Centeno 1995)

Tipo de Cavidad	Especie de Arbol					
	Amate (9)*		Conacaste (40)		Volador (19)	
	por hectárea	por árbol	por hectárea	por árbol	por hectárea	por árbol
Ideal	0.053 ∓ 0.020	0.25 ∓ 0.09	0.039 ∓ 0.043	0.21 ∓ 0.20	0.003 ∓ 0.001	0.49 ∓ 0.28
Utilizable	0.116 ∓ 0.052	0.55 ∓ 0.25	0.046 ∓ 0.022	0.24 ∓ 0.12	0.008 ∓ 0.003	0.46 ∓ 0.14
Minima	0.210 ∓ 0.084	0.97 ∓ 0.40	0.075 ∓ 0.067	0.38 ∓ 0.34	0.009 ∓ 0.005	0.49 ∓ 0.28

***Las cantidades dentro de paréntesis son las cantidades de árboles muestreados antes de encontrar cinco con cavidades**

Results

See Table 7 for a sample of the fruiting phenology of one tree species eaten by Yellow-napes. The peak of the parrot nesting season coincides with the peak of fruit production in many tree species. During the breeding season in a normal year our observations indicate that there is ample food for the parrots to feed on.

Conservation Education

Methods

We could see from two seasons in Guatemala before USAID funding began that conservation education was vital to deterring the poaching of nestling amazons, and USAID supported our concerns in this area. In 1993 FUNDAVES a Guatemalan-run education center was initiated with the support of USAID money budgeted for conservation education as well as other funding from Guatemala and the US. The owners of Caobanal donated space for the center which houses parrots confiscated by the Guatemalan government and operates several demonstration ecological projects, such as recycling, composting and reforestation. FUNDAVES's main purpose is education, and it became the hub of our education efforts.

For three years we designed and ran extensive programs in the schools on the ranches where we worked and in the surrounding communities. Our education team saw some 700 school children each year. The program included several visits to the classroom and in 1994 also a trip to FUNDAVES. Among the education materials that we developed were a four color poster with parrots and a short message about protecting natural resources and a coloring book entitled "Los Animales de Guatemala". In addition to the schools the poster was put in every bar and store in the region. We also gave out t-shirts with the same design as the poster and the message "¡Vivan los Loros!".

We tried to reach adults as well as children. A women's soccer team was started on Caobanal with our t-shirts and donated soccer shoes from the US as uniforms. We attended community meetings and church programs with our message of protecting the parrots and the habitat in general. The veterinarians began a program of providing vaccines and deworming for backyard fowl, which was another opportunity to talk with people about our project and how protecting natural resources would affect them.

We also held a symposium in 1995 at the Asociación Audubon headquarters in Guatemala City to which all interested conservationists were invited. There we had the opportunity to present our findings and to encourage more Guatemalans to become involved in our efforts.

Results

The success of our education efforts is very hard to measure. We are confident that we increased the community's awareness of the Yellow-naped Amazon but whether this resulted in

Table 7. Fruiting Phenology of Five Conacastes (*Enterolobium cyclocarpum*) on Finca Caobanal.

Fruiting Phenology of Five Conacastes on Caobanal													
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1993												
#1				m-1	m-1	0	0	0	0	0	0	0	0
#2				m-2	m-1	0	0	0	0	0	0	0	0
#3				m-1	m-2	0	0	0	0	0	0	0	0
#4				m-3	m-1	0	0	0	0	0	0	0	0
#5				m-1	m-1	0	0	0	0	0	0	0	0
	1994												
#1		g-2	g-2	m-2	m-1	p-1	0	0	0	0	0	0	g-2
#2		g-2	g-3	m-3	m-2	p-1	0	0	0	0	0	0	0
#3		0	g-1	g-2	m-2	p-1	0	0	0	0	0	0	0
#4		g-2	g-2	m-3	m-1	p-1	0	0	0	0	0		g-3
#5		g-1	g-1	p-1	m-1	p-1	0	0	0	0	0		g-3
	1995												
#1		g-3	g-3		m-1	0	0	0					
#2		g-3	g-3		m-1	0	0	0					
#3		0	g-3		m-1	0	0	0					
#4		g-3	g-3		m-1	0	0	0					
#5		g-3	g-3		0	0	0	0					

g = green 1 = <25% fruit
m = mature 2 = 25-50% fruit
p = past 3 = >50% fruit

less poaching by community people is impossible to verify. The level of poaching did not decrease during the three years, but the consensus was that the poachers were coming from outside the community.

The success of the women's soccer team in building community spirit and providing a healthy outlet for the women was easier to measure. In 1995 the "Proyecto de Loros" team traveled as far as Guatemala City to compete and returned with a first place trophy.

Approximately 1,000 domestic fowl belonging to families living on three ranches and surrounding communities were vaccinated for Newcastle's and Pox virus, and all birds were dewormed with Ivermectin. Numerous dogs and cats were also vaccinated and dewormed. The feeling of the field biologists was that community support appeared to increase after the vaccination program, but again there was no objective method of assessment.

The symposium generated great interest among members of such groups as Asociación Audubon and Defensores de la Naturaleza since very little data has been gathered on Guatemalan wildlife. How this translates into continued support remains to be seen.

Adopt-a-Nest Program

Methods

In the 1994 and 1995 breeding seasons we offered incentives to ranch workers and their families to protect parrot nests. We held meetings for all the ranch workers on two of the ranches. At those two meetings we explained our program to study the Yellow-nape, showed how some of our equipment worked and asked for their support (see Appendix-Photos). We then let anyone sign up to guard a nest. When young fledged, the guard would be paid the going poaching rate plus a bonus for each fledgling.

Results

This program convinced us that most poaching was done by people outside the immediate ranching communities. Those who had signed up to guard a nest took their jobs seriously, as time permitted, and usually came to help us when we climbed to their nests each week. Nevertheless, many of the assigned nests were still poached, and the guards did feel an element of danger in trying to stop an active poaching attempt. In effect we put the local people at a disadvantage because we convinced them not to poach in hopes of a bigger reward, and then others came in, took the birds, and left our guards empty-handed since our agreement was no money would be paid until the birds fledged.

Captively-raised Parrots Pilot Program

Methods

In 1994 under the supervision of FUNDAVES, six pairs of confiscated and donated Orange-fronted Conures (*Aratinga canicularis*) were placed in homes of families living on Caobanal. The birds were surgically sexed and found to be healthy, and then they were placed with cages, nest boxes, bowls and daily food. The families picked up the food (rices, beans and corn) from FUNDAVES daily. Our veterinarian visited to homes to check on the birds weekly. The idea was to see if producing captively-reared parrots might become an alternative to stealing them from the wild. We chose the Orange-fronts because they are poached for the local pet trade, and they breed after the first year unlike the Yellow-napes that don't breed for until they are 4 or 5.

Results

By 1995 one pair had produced young. One pair was killed by predators; another pair died; and one member of a third pair escaped. The remaining two were doing fine, but had produced no eggs. To make a program like this succeed would take a great deal of management--from placing birds with families to legally marketing the offspring, but any possibly viable alternatives are worth exploring in the hope of relieving the collection pressure on wild parrots.

IMPACT, RELEVANCE AND TECHNOLOGY TRANSFER

Before the initiation of our study of the factors limiting the reproductive success of the Yellow-naped Amazon nobody had any idea how such a population was coping with the very disturbed habitat of southern Guatemala. We were able to document the Yellow-nape's life cycle over a three year period. We now know what they like to eat, what type of nest cavity and nesting tree they prefer, what predators they are likely to encounter, what role of the parents play, particularly after fledging, how they spend the non-breeding season, how their communal roosts function, etc. All this basic knowledge about the Yellow-nape is new and will be very useful for management purposes in Guatemala in years to come.

Without a doubt the most striking aspect of our study was the documentation of the overwhelming rate of poaching of the young each year, which was presented in Table 3. The land owners were aware that young birds were occasionally taken, but they were shocked to find out the extent of the poaching. The owners of Caobanal informed their employees that anyone caught stealing birds would be fired, and in 1994 two people were let go. Despite this support the poaching has not decreased.

Poaching coupled with the increasing habitat destruction make the Yellow-napes' continued survival very perilous. Of the 19 nests located off of Finca Caobanal in 1995 all but 5 were located in areas to be planted in sugar cane. Sugar cane farming calls for the removal of most trees except for those near waterways, whereas cattle ranching leaves large shade trees intact in the pastures and along the numerous fence rows. Increasingly the cattle ranchers are converting to sugar cane to maximize profits. We were able to obtain permission from the land owners and the sugar cane conglomerate to mark the biggest nest trees slated for cutting and thus have them spared this year. Six nest trees were felled immediately, and in all likelihood the other 8 will be cut now that we are gone. These results have been made available to the Guatemala conservation organizations and the government conservation agency.

In the short term the project had the greatest impact on those Guatemalans working directly with us. Each year we trained field workers and conservation educators. We were also lucky to have several university students finish their training with us. One conducted research for his undergraduate thesis on the Yellow-nape nesting trees as part of his employment with us, and several of his tables have been presented in this report. He is now a very committed conservationist and will be one of the leaders of the conservation movement in Guatemala. Another finished his veterinary training with us and completed his thesis using the confiscated birds from FUNDAVES as his subjects. He has been hired by the landowners at Caobanal to provide veterinary care to their collection of captive birds, and he is the executive director of FUNDAVES. He too has developed a sense of mission concerning the conservation of wildlife in Guatemala. A third student worked with us while finishing her undergraduate work and was then motivated to pursue a Ph.D. in ecology in Chile. An additional student from Mexico worked for us for over a year and is now completing his undergraduate thesis on nest site attentiveness and chick growth.

We also believe our project exerted a profound effect on the local people who worked for us. The majority of them had only a few years of education, several had never used a watch before, but they developed a tremendous commitment to the wildlife and habitat of their region. Three of

them went back to school to finish their high school degrees, which will give them much greater job opportunities.

During our three year project, we often had biologists from other countries visit our site to see what they could learn from us that would apply to their own work. We were always willing to share information and most of our field forms were translated into Spanish so that they could readily be used by biologists in Spanish-speaking countries (see Appendix-Forms).

PROJECT ACTIVITIES/OUTPUTS

Publications

Brice, A.T. 1992. The Role of the Psittacine Research Project. Proceedings of the Parrot Biology Symposium UC Davis, pp. 1-3.

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Toft, C.A. and A.T. Brice. 1993. The status of the Yellow-naped Amazon in Guatemala, Exotic Bird Report, 5(2):1-5.

Presentations at Meetings

Brice, A.T. "The Yellow-naped Amazon in Guatemala", 5° Simposium Internacional de Fauna Silvestre, Tamaulipas, Mexico, October 1993.

Brice, A.T. "Parrot Reintroduction: Problems and Solutions", Society for Conservation Biology Annual Meeting, Parrot Symposium, Guadalajara, Mexico, June 8, 1994.

Duarte, J.P. "Conservation Education in Guatemala", Society for Conservation Biology Annual Meeting, Parrot Symposium, Guadalajara, Mexico, June 8, 1994.

Joyner, K.L. "Aviculture, Stewardship and Medicine on the Wild Side", Midwest Avian Research Exposition Annual Conference, 1993.

Joyner, K.L. "Avian Wildlife Veterinary Medicine and Conservation", College of Veterinary Medince, North Carolina State University, Raleigh, N.C. 1994.

Joyner, K.L. and Hernández, E. "Conservation Practices in Captive Breeding and Field Projects" and "Management, Reproduction and Pediatrics of Non-domestic Avian Species", workshops

presented at the Guadalajara Zoo, Guadalajara, Mexico, 1993 and 1994.

Joyner, K. L. "The Role of Veterinary Medicine in Conservation Biology", Society for Conservation Biology Annual Meeting, Parrot Symposium, Guadalajara, Mexico, June 8, 1994.

Joyner, K.L. "Aviculture in Developing Countries" and "Psittacine Ecological Techniques" Workshop on the Management of Scarlet Macaws, Carara, Costa Rica, April 1995.

Joyner, K.L. "Aviculture on the Wild Side", Annual Meeting of the American Federation of Aviculture, August 1995.

In Addition

Dr. Brice and Dr. Joyner and Dr. Wiley were invited participants in a workshop on the Puerto Rican Parrot, Rio Piedras, Puerto Rico, December 5-8, 1995.

Dr. Brice spoke regularly about the project in Guatemala at avicultural meetings throughout the western states before and during the three years of USAID funding.

Dr. Wiley and Dr. Brice were founding members of the Association for Parrot Conservation in 1993. This organization was formed by parrot field biologists to promote the sharing of information among biologists and the public regarding the status of parrots in the wild.

PROJECT PRODUCTIVITY

The stated purpose of the project was to determine what factors might be limiting the population size of Yellow-nape Amazons in southern Guatemala. We chose to emphasize the effects of predation and parasites. We failed to maintain adequate sample sizes for the experiments listed in the protocol each season due to the heavy levels of poaching. On the other hand, quite a large amount of data was gathered that wasn't listed in the protocol. Our data on nest sites, habitat use, fruiting phenology, roost site activity, and parental attentiveness all added substantially to the project. Our documentation of habitat destruction and poaching has painted a grim but realistic picture of the state of the Yellow-nape. Our efforts in the area of conservation education went well beyond what we originally stated, and our hope is that we have left some structure in place in the form of FUNDAVES so that the Guatemalans may continue this important work.

FUTURE WORK

Dr. Brice, Dr. Joyner and Dr. Toft plan to spend the next year analyzing and writing up the data gathered for future publication. It is not clear whether we will continue long term studies of the Yellow-nape in Guatemala. There are several negative aspects, not the least of which is the social instability of the country. We were very fortunate that no one connected with the project was ever harmed, but there is an undercurrent of potential violence that is unsettling. On the other hand, the ranch owners and the local people we regularly interacted with had great enthusiasm and a tremendous desire to see the the project succeed. It was their continual support that made the project a succeess.

Several of the Guatemalans we trained continue to be active in conservation biology at Caobanal. Veterinarian Juan Pablo Duarte is still running FUNDAVES and is trying to raise funds to continue its conservation education programs. Biologist Marco Centeno is currently working with the owner of Caobanal to devise projects that will benefit the wildlife, the local people and the owner. In conjunction with government officials he is also developing a program for sustainable use of Guatemala's resources. The solutions are not simple, but the people now have additional tools to go forward on their own.

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APPENDIX 1-FORMS IN SPANISH

EXAMEN FISICO

ESPECIE: _____ # ANILLO: _____ # JAULA: _____
FECHA: _____ CONDICION CORPORAL (1-4): _____ PESO: _____

GENERAL:

Actitud: _____
Postura: _____
Plumaje: _____
Musculatura: _____
Apetito: _____
Heces: _____
Hidratación: _____

CABEZA:

Ojos: _____
Orejas: _____
Nariz: _____
Pico: _____
Cavidad oral: _____
Plumas - cresta: _____

CUERPO:

Cuello: _____
Buche: _____
Columna: _____
Condición pectoral: _____
Palpación abdomen: _____
Ombligo: _____
Organos visibles: _____
Plumón flanco: _____
Cloaca: _____
Glandula uropigial: _____
Plumas cola: _____

MIEMBROS:

Palpación ala: _____
Función ala: _____
Plumaje ala: _____
Vena ulnar: _____
Palpación pierna: _____
Función pierna: _____
Plumaje pierna: _____
Dedos/uñas: _____
Función dedos: _____

OTRAS OBSERVACIONES: _____
_____
_____

FORMULARIO DE ÁRBOL/CAVIDAD DEL NIDO 1995

Fecha:_____ Localización/# del árbol:_____

Especie del árbol:_____ Árbol vivo: S N

Rama del nido viva/muerta:___ Origen de la cavidad:_____

Condición de la entrada/cavidad:_____

Cavidad se inclina más paralelo o perpendicular a la tierra:_____

Cavidad se inclina más paralelo o perpendicular a la rama:_____

Descripción de la cavidad (dibujo en revés):_____

_____

Descripción de otras entradas (dibujo en revés):_____

_____

Altura de la entrada (cm.):_____ Ancho de la entrada:_____

Diámetro interno de la entrada:_____

Largo interno de la cavidad (base del borde del nido hasta el fondo donde están los pichones/huevos; incluso la profundidad de la viruta):_____

Altura interna de la cavidad (base del borde del nido hasta el techo):_____

Profundidad de la viruta:_____

Diámetro interno del suelo donde están los pichones/huevos:_____

Orientación de entrada:_____ Orientación de segunda entrada:_____

Altura de segunda entrada:_____ Ancho de segunda entrada:_____

Circunferencia del árbol a entrada:_____

Altura de la cavidad:_____ Altura del árbol:_____

Diámetro del árbol a 5 pies:_____

Observaciones:_____

_____

EXAMIN DE LA VIRUTA 1995

Fecha:_____ Localización/# árbol:_____

Especie del árbol:_____ Rama del nido muerta/viva:_____

Se examinó la viruta en el campo o el laboratorio:_____

Agua estancada en la cavidad: S N Viruta moja el palo: S N

Viruta pequeñamente húmeda: S N Viruta completamente seca: S N

Niveles variados de humèdad de la viruta: S N _____

Profundidad de la viruta:_____ Olor de la viruta:_____

Descripción de la viruta:_____

_____

Tipos de larva en la viruta:_____

Estimación (en #) de cada clase de larva en la viruta:_____

_____

Clases de escarabajos en la viruta:_____

Estimación (en #) de cada clase de escarabajo en la viruta:_____

Otras clases de insectos en la cavidad/viruta:_____

Estimación (en #) de cada clase de insecto en la viruta:_____

Porcentaje heces:_____ Volumen de la prueba de la viruta:_____

Fragmentos de huevo/pluma presentes: S N _____

Fragmentos de insecto presentes: S N _____

Insectos muertos presentes: S N _____

Se polvoreó la cavidad con Sevin: S N Volumen de Sevin:_____

Cultivo de larvas:_____

Pruebas:_____

_____

Observaciones:_____

_____

FORMULARIO DE LA SUBIDA 1995

Fecha de la subida:_____ Localización árbol/# nido:_____

Especie del árbol:_____ Tiempo:_____

Motivo para subir:_____

Método de subir:_____

Hora equipo llegó al árbol:_____ Hora equipo dejó árbol:_____

Subidor:_____ Escritor:_____ Observador:_____

Se observó árbol mismo día de subida: S N Cuándo:_____

La pareja estaba en el área cuando el árbol fue subido: S N

Dónde:_____

Equipo espantó a la hembra de la cavidad: S N Del árbol: S N

Conducta de la pareja:_____

_____

Rastros de abejas/insectos/iguanas/mamíferos/humanos en el, o

cerca del árbol/cavidad: S N Dónde:_____

Condición de la cavidad:_____

Condición de la viruta: _____

Número de huevos en el nido:___ Número de pichones en el nido:___

Se manipularon los huevos: S N Se bajaron huevos al suelo: S N

Se removieron los huevos: S N

Condición/sitio de los huevos:_____

Condición/edad de los pichones:_____

Se bajaron pichones para examinar: S N Se examinó la viruta: S N

Manipulaciones de los pichones:_____

Alteraciones del árbol/nido:_____

Observaciones:_____

_____

FORMULARIO DEL HUEVO 1995

Fecha:_____ Localización/# árbol:_____

Nido activo: S N Cuántos días inactivo:_____

Posición del huevo en el nido:_____

Se manipuló huevo en árbol: S N Se manipuló huevo en suelo: S N

Se llevó huevo al laboratorio: S N Dibujo huevo en revés: S N

Se examinó el huevo en el suelo:_____

Se examinó el huevo en el laboratorio:_____

_____

Ancho huevo:_____ Largo huevo:_____ Olor del huevo:_____

Forma completa del huevo:_____

Cáscara está sucia: S N _____

Sangre en cáscara presente: S N _____

Hendiduras/agujeros presentes:_____

Otras observaciones de la cáscara:_____

Condición de la yema:_____

Condición del albumen:_____

Huevo fecundo: S N Descripción del blasto:_____

_____

Embrión vivo: S N Edad del embrión:_____

Cuánto tiempo muerto:_____

Descripción del embrión:_____

_____

Causa de la muerte:_____

_____

Observaciones:_____

_____

FORMULARIO DE LOS PICHONES 1995

del nido:_____ Fecha:_____
del pichón (orden):_____ Edad estimada:_____
Se puso anillo: **S N** Abierto/cerrado:_____ # del anillo:_____

Manipuladores:_____
Examinador:_____ Escritor:_____

Hora pichón afuera nido:_____ Hora pichón adentro nido:_____
Hora pichón afuera bolsa:_____ Hora pichón adentro bolsa:_____

Actitud: Soñoliento, Alèrta, Agresivo (atacando, picando), Agachando, Moviendose, Dando vueltas, Temblando, Débil, Otro:_____

Postura: Cabeza principalmente arriba, Cabeza principalmente abajo, Cabeza extendida, Inclinado, Agachado, Posado sobre sus tarsos, Posado sobre sus patas, Alas extendidas, Piernas desplegadas, Otras:_____

Vocalizaciones: Quieto, Poco frequente, Cuando manipulando, Frecuente, Constante; Gorjeando, Gañiendo, Gruñiendo, Chillando, Siseando, Pujando, Otro:_____

Frequencia cardiaca: antes manipulación:_____ después:_____
Frequencia respiratoria: antes manipulación:_____ después:_____

Respuesta alimentaria: Ninguna, Débil, Poco frecuente, Moderada, Frecuente; Vigorosa

Peso:_____ Tipo báscula:_____ Condición corporal:_____

Tarso:_____ Radio:_____ Largo del ala:_____

Ancho pico:_____ Profundidad pico:_____ Largo pico:_____

Largo rectrices centrales en cálamo:_____ en pluma:_____

Largo decima primaria en cálamo:_____ en pluma:_____

Largo primera secundaria en cálamo:_____ en pluma:_____

% de plumas del cuerpo en cálamo: (P=presente, A=ausente)

Cabeza:	A	P	% cálamo =	100%	75%	50%	25%	0%
Buche:	A	P	% cálamo =	100%	75%	50%	25%	0%
Pecho:	A	P	% cálamo =	100%	75%	50%	25%	0%
Abdomen:	A	P	% cálamo =	100%	75%	50%	25%	0%
Escapularias:	A	P	% cálamo =	100%	75%	50%	25%	0%
Covertoras(ala):	A	P	% cálamo =	100%	75%	50%	25%	0%
Espalda:	A	P	% cálamo =	100%	75%	50%	25%	0%
Piernas:	A	P	% cálamo =	100%	75%	50%	25%	0%
Cola:	A	P	% cálamo =	100%	75%	50%	25%	0%

Localización de plumón natal:
Ausente, Puntas;
Cabeza, Cuello, Espalda, Abdomen, Alas, Piernas, Todas partes

Localización de plumón juvenil:
Ausente, Subcutáneo;
Cabeza, Cuello, Espalda, Abdomen, Alas, Piernas, Todas partes

Plumón juvenil expuesto por plumas del cuerpo:
Cabeza, Cuello, Espalda, Abdomen, Alas, Piernas, Todas partes

Líneas de estres: **P A** *Donde*(**P**rimaria/**S**econdararia/**C**overtora/Cola)
Cuantos *Severidad*(**L**eve/**M**oderado/**E**xtremo) (ej IP2M, DC5L-E)

_____

Plumas sucias/rotas/de colores raros: _____

_____

Corona amarilla presente: **S N** Tamaño de corona: _____

Deshidratación: Ausente, Insignificante, Moderado, Extremo,
Demasiado hidratado

Piel sucia: _____
Color de la piel: _____

Piel escamosa: _____
Otras observaciones de piel: _____

Localizaciones de lesiones/dimensiones/causas/descripciones:

_____

_____

_____

Parásitos externos: _____

_____

Cabeza: _____

Color pico superior: Lados _____ Central _____
Color pico inferior: Lados _____ Central _____

Comisura pico superior: Blando Poco duro Duro
Comisura pico inferior: Blando Poco duro Duro

Otras observaciones de pico: _____

Diente de huevo: Presente Ausente Desapareciendo

Párpados: Sellados, Abriendose, Poco abiertos, Todos abiertos

Color del iris: Difícil decir, Negro, Gris, Pardo, Puntos de rojo

Otras observaciones de ojos: _____

Aberturas de oídos: Cerradas, Abriendose, Abiertas;
Pequeñas, Normales, Grandes, Anormales

Otras observaciones de oídos: _____

Aberturas de las narices: Cerradas, Abriendose, Abiertas;
Pequeñas, Normales, Grandes, Abnormales

Otras observaciones de narices: _____

Color de la coana: _____

Otras observaciones de boca: _____

Tamaño buche: Vacio, Escaso, 1, 2, 3, 4 Motilidad buche: **P A** ___
Material en buche: Pedazos comida, Flúido, Como masa, Otro _____

Otras observaciones del buche: _____

Alas: _____

Ombligo: Abierto, Cerrado;
Costra, Tapón, Cordón de tejido

Otras observaciones del ombligo: _____

Yema: Visible subcutáneo, No visible, Otro: _____

Abdomen: Cóncavo, Plano, Convexo, Saliente del ventriculo
Hígado visible, Intestinos con comida, Opaco

Otras observaciones del abdomen: _____

Cloaca: _____

Heces: **A P** Descripción: _____
Orina: **A P** Descripción: _____

Piernas: _____
Color de los dedos/uñas: _____

Otras observaciones de los pies: _____

Pruebas: _____

Fotografía: _____ Heces del pichón: **S N** _____
Venipuntura (cantidad/sitio): _____
Parásitos externos: _____
Cultivos: _____
Sevin en la viruta: **S N** Sevin en el pichón: **S N** Sexado: **S N**

APPENDIX 2-PHOTOGRAPHS

Tree climber nears nest cavity with two biologists belaying him from the ground as community people look on.

Veterinarians Dr. Kim Joyner and Dr. Juan Pablo Duarte place a radio collar on a Yellow-nape chick.

Biologist Marco Centeno signs up ranch-hands to participate in the adopt-a-nest program.

Our educational poster is put up in a local bar by expert tree climber and conservation educator Efraín Hernandez.

School children enjoy the coloring books "Los Animales de Guatemala" and also the crayons donated by school children in Davis, California.

The soul of the project--the Guatemalans:
Dr. Juan Pablo Duarte, veterinarian
Marco Centeno, wildlife biologist
Efraín Hernandez, climber,
telemetry expert, scout, etc.
Mirna Morales, conservation educator