PROCEEDINGS

OF THE

FOURTH SYMPOSIUM

ON THE

NATURAL HISTORY OF THE BAHAMAS

Edited by
W. Hardy Eshbaugh

Conference Organizer
Donald T. Gerace

Bahamian Field Station, Ltd.
San Salvador, Bahamas
1992

Printed in USA by Don Heuer

ISBN 0-935909-41-9

NATURAL HISTORY OF THE BAHAMA PARROT *AMAZONA LEUCOCEPHALA BAHAMENSIS* ON ABACO ISLAND

Rosemarie S. Gnam *
Department of Ornithology
Amer. Mus. Nat. Hist.
New York, N. Y. 10024 USA.

ABSTRACT

Although the Bahama Parrot (Amazona leucocephala bahamensis) was once abundant and ranged throughout the Bahamas archipelago, it is now endangered and survives on only two islands - Abaco and Great Inagua. Bahama Parrots on Abaco nest in limestone-solution cavities beneath the ground, a habit unique among New World Parrots. Between 1985-1988, I located 76 nests in two nesting areas on southern Abaco. I collected data on their reproductive behavior, nesting success and feeding ecology. In addition, three population counts were made during the nonbreeding season to estimate the size of the parrot population on Abaco. The Abaco population of the Bahama Parrot is under stress. Present threats to this population include: nest predation by feral cats, poaching of parrots, and unprotected habitat.

INTRODUCTION

The parrot genus Amazona is confined to the neotropical region, from Mexico to Argentina (Forshaw 1989). Of the 27 extant species, nine are endemic to the West Indies and five of these species and two subspecies are considered to be endangered or threatened (King 1977). The Cuban Parrot (Amazona leucocephala) is a polytypic species with five recognized subspecies: leucocephala (Cuba), palmarum (western Cuba and Isla de la Juventud), caymanensis (Grand Cayman), hesterna (Cayman Brac), and bahamensis (Bahamas) (Bond 1956).

Although the Bahama Parrot (A. l. bahamensis) probably was present on all major islands in the Bahama archipelago, historically, it was recorded from Abaco, New Providence, San Salvador, Long Island, Crooked Island, Acklins, and Great Inagua (Fig. 1). Today, this subspecies is regarded as endangered and persists only on the islands of Abaco and Great Inagua, at the northern and southern ends of its former range (Fig. 1). In recent years this population has declined as a result of habitat destruction, logging activities, development, Hurricane Betsy in 1965, capture for pets, and hunting pressures (Attrill 1981; Snyder et al. 1982).

Bahama Parrots were studied by Snyder et al. (1982) in 1977, who estimated the then Abaco population to number less than 1000 birds. Unlike the population on Inagua and other Caribbean Amazona species, all of which nest in tree cavities, Bahama Parrots on Abaco nest exclusively in underground limestone-solution cavities (Fig. 2). The subterranean nesting habit of the Abaco population on relatively flat terrain is unique among New World Parrots.

Since 1985, I have been studying the breeding biology of this subspecies and its current status in the wild. In view of its endangered status, the overall objective of this project has been to develop a sound biological understanding of this parrot upon which an effective conservation program can be based. To achieve this objective my research efforts on Abaco focused upon: (1) population size estimates, (2) nesting success, (3) nesting behavior and (4) feeding ecology.

STUDY AREA AND METHODS

I studied Bahama Parrots on Great Abaco, 64 km south of Marsh Harbour (26 ° N, 78 ° W) from 1985 to 1988. Parrots were restricted to the Caribbean pine (Pinus caribaea) and mixed broadleaf coppice (native, evergreen hardwood) areas of southern Abaco. Henry (1974) described the vegetation of the pine forests of Abaco.

Since 1986, I conducted three Bahama Parrot population counts during the non-breeding season (January) to estimate the size of the Abaco population. My methodology followed that of Snyder et al. (1982) in which they derived population estimates from roost counts. Since parrots on Abaco roosted communally at night and moved to and from roosts in flocks, survey counts were made at roosts and along flight paths to roosts. Observers counted a minimum (subtracted any birds possibly

* Present Address: 23 Mount Vernon Ave., Alexandia VA 22301 USA.

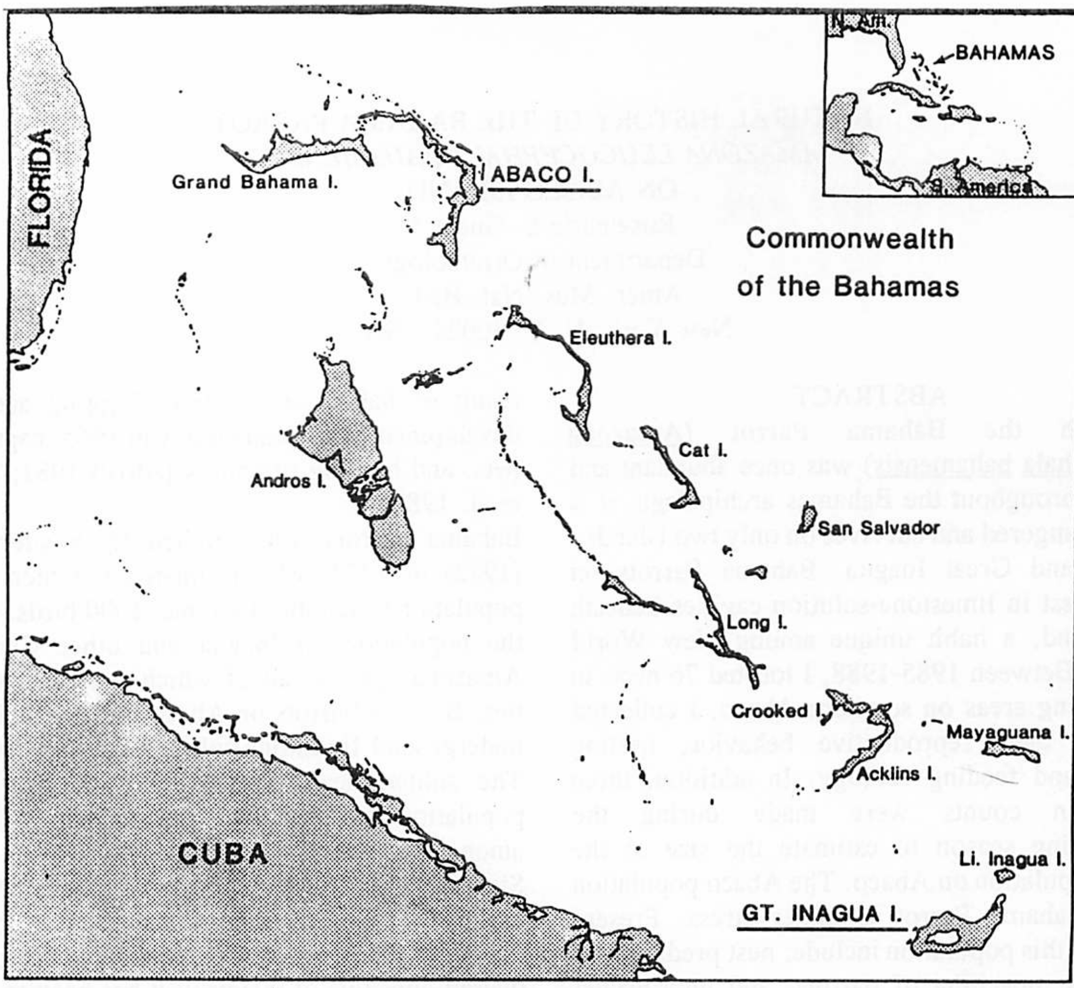


Figure 1. The Bahama Parrot (Amazona leucocephala bahamensis) survives on only the islands of Abaco and Great Inagua. The map shown is a courtesy of Stephen Nash and Wildlife Preservation Trust International.

Figure 2. The Bahama Parrot (Amazona leucocephala bahamensis) at its nest site, Abaco Island, Bahamas.

seen more than once) to a maximum (all birds counted) number of parrots in a flock or a roost. On successive days, observers progressively surveyed the pine/coppice areas of southern Abaco.

I collected nesting and feeding data from early May through September. Nests were found by daily searches into two study areas, designated as Nest Areas 'A' and 'B' (Gnam and Burchsted 1991). I found nests by following individuals or pairs in these areas during the pre-egglaying period and incubation; and by searching around known parrot nests for nests of neighboring pairs. From 1985 to 1988, I located 76 nests but not all of these nests were active in a given year. Clutch size was recorded in all active nests and nests were checked at least once a week until chicks fledged or the nest failed.

I examined components of nesting success that spanned the nesting cycle from nest initiation through fledging. This allowed me to evaluate loss at successive stages of the cycle as well as to estimate the overall reduction in nesting success (Rockwell, et al. 1987). I observed total clutch laid (TCL), clutch size at hatch (CSH), nestlings at hatch (PHN) and brood size at fledging (BSF). This indicated extant nesting output at the major stages of the nesting cycle. Following Rockwell et al. (1987), I dichotomized the evaluation of losses between those stages. For those nests that did not fail totally between stages, I calculated per capita success rates, specifically: egg survival (P1=CSH/TCL), hatching success (P2=PHN/CSH) and fledging success (P3=BSF/PHN). The probability of total failure was used to evaluate complete loss at the stages. These were: total laying failure (TLF), total nesting failure (TNF), total hatching failure (THF) and total brood failure (TBF).

We recorded the nesting and feeding behavior in Nest Areas 'A' and 'B'. Observation blinds were placed 10-15 m from the nests of five pairs every nesting season and the behavior was recorded from sunrise to sunset (a 14-15 hour period). Nesting pairs were observed at least once a week from egglaying until chicks fledged or the nest failed.

Feeding behavior was observed from blinds and by walking through the nest areas during daily nest visits. We followed the methodology of Snyder et al. (1987) to record our feeding observations. Each feeding encounter was scored as one observation, irrespective of the number of parrots involved or the length of time that they fed. Thus, we assumed that the observed frequency of feeding on a particular food item was equivalent to the proportion of an individual's time spent feeding on that item. Since I suspected that the single observation of a large flock feeding on a given food item overrated the dependence of parrots upon that item, feeding observations were not weighted by the number of parrots feeding.

RESULTS

Population Size

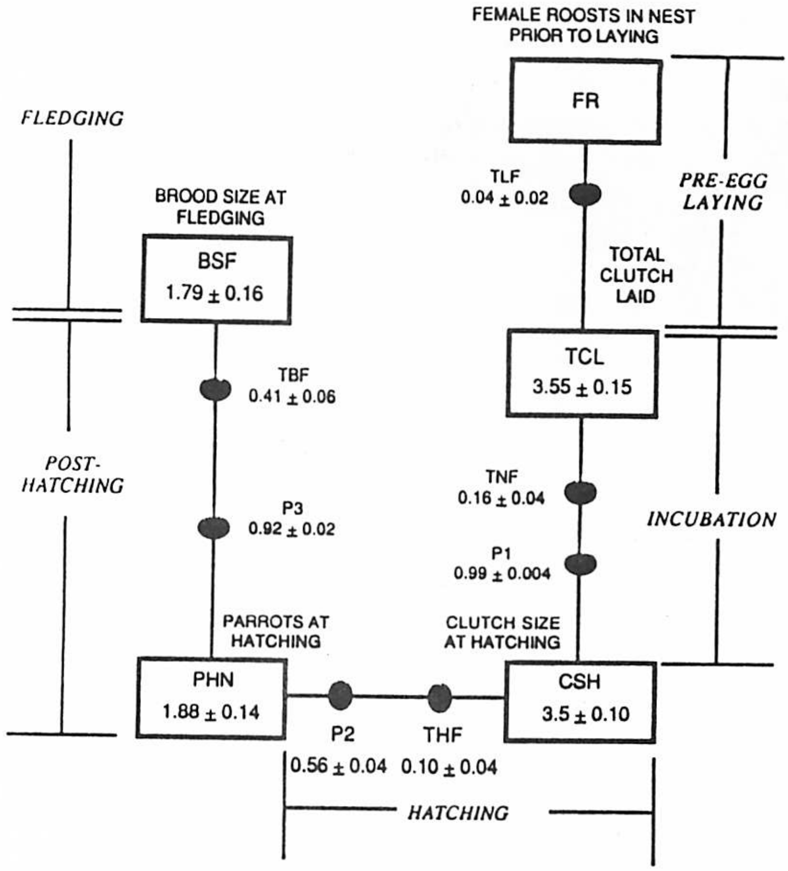
An extensive analyses of population estimates was presented in Gnam and Burchsted (1991) but I'd like to present a brief review here. Current (1989) population estimates range from a well-defined minimum of 860-1142 parrots (actual birds counted) to a less well-defined maximum of 1300 parrots.

Nesting Success

Estimates of the components of nesting success are summarized in Figure 3. The reproductive output of individuals flows through the nesting cycle from pre-egglaying through egglaying and hatching to fledging (Fig. 3). From a mean, initial clutch (TCL) of 3.55 eggs, a successful nesting pair of Bahama Parrots hatched a mean of 1.88 chicks (PHN) but fledged only a mean of 1.79 chicks (BSF) (Fig.3). While losses accrued throughout the cycle, they were highest during the hatching and post-hatching stages. Partial hatching failure (1 - P2) and total brood failure (TBF), respectively, were the primary sources of loss at these stages. (Fig. 3). Forty-four percent of the eggs that were present in a clutch at hatching (CSH) failed to hatch.

In contrast to other subspecies of leucocephala and other Caribbean Amazona, Bahama Parrots on Abaco exhibited low reproductive success with less than 42% of all egglaying pairs fledging young annually (Gnam and Rockwell 1991).

Causes of nest failure in the Bahama Parrot were (in ascending order of importance) : human disturbance (poaching of chicks); flooding of nest cavities during heavy rains; abandoned eggs; chick



The standard errors of TFL, TNF, THF, TBF are estimated with equations for binomial distributions. Standard errors of the remaining components are estimated fron one-way analyses of variance of the effects of years on the fecundity variable. The estimate is formed as:

$$SE = \{MS_B/(df_T + 1)\}^{1/2}$$

where MS_B is the Mean Square between years and df_T is the total degrees of freedom.

Figure 3. Fecundity components and their relation to the nesting cycle of the Bahama Parrot (Amazona leucocephala bahamensis) on Abaco Island, Bahamas, 1985-1988. Mean values for each component are shown with their standard errors. Definitions for each of the components are given in the text.

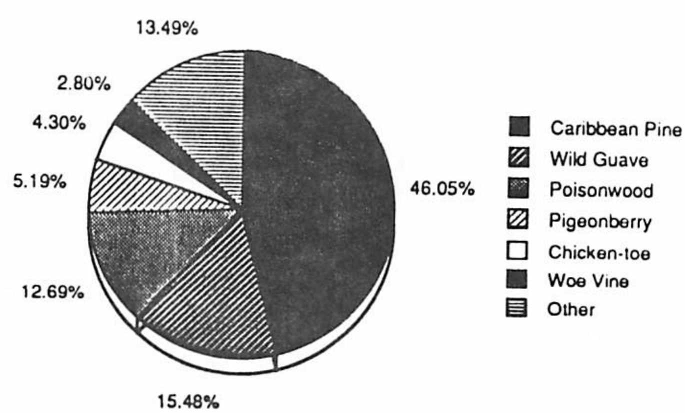


Figure 4. Feeding records for Bahama Parrots (Amazona leucocephala bahamensis) on Abaco Island, Bahamas, 1985-1988.

deaths from unknown causes; and predation by snakes, land crabs (Cardisoma guanhumi), rats (Rattus rattus) and feral cats (Felis catus).

Because of their ground-nesting habit, Bahama Parrots are extremely vulnerable to predation by feral cats. In 1988, Bahama Parrots on Abaco exhibited the lowest reproductive rate that I have observed in four years of study, with only 29% of nests fledging young. The cause of this poor reproductive performance was increased nest predation by feral cats. Feral cat predation was responsible for failure at 14 nests (45%) and the nesting female was injured in two (14%) and killed in seven (50%) of the 14 known attacks. Prior to 1988, I had observed only four definite instances of nest predation by feral cats. The high level of cat predation continued in 1989, when 39% of the nests in one nesting area failed because of feral cat predation and only 42% of all nests fledged young. The reasons for this high level of cat predation remain unclear; but I believe learning of this predatory behavior by cats is involved and also, cats may be dispersing into parrot nest areas in search of food in response to forest fire patterns.

Nesting Behavior

Bahama Parrots were monogamous, seasonally defended their nest site and mates remained together throughout the nesting cycle to produce a single brood. Clutches of 2-5 eggs were laid during late May and early June in limestone-solution cavities. Nest cavities ranged in depth from 39.5 to 323 cm. The mean nest depth was 125.1 $\pm$ 6.6 (s.e.) cm.

While the female incubated the eggs, the male visited the nest on average four times per day to feed her. Females spent an average of only 62 minutes per day off the nest and were dependent upon the male to provide food. Most feedings occurred in the morning and late evening. During egglaying, copulation often followed feeding bouts.

Eggs hatched asynchronously in late June and early July, approximately 26-28 days after the female began incubation. After the first week post-hatching, the female left the nest to forage with the male. Parents returned to their nests four to six times per day to feed the nestlings.

By the fourth week post-hatching, most females no longer roosted in the nest; at this stage, the chick's body feathers had erupted from their sheaths, particularly on the back, wing and thighs.

Chicks fledged asynchronously in late August and early September, 56-58 days after hatching. Several days before fledging, chicks began to appear at the nest lip when their parents were in the nest area. Upon fledging, chicks flew considerable distances (>300 m) accompanied by their parents. Radio-tracking of fledglings in 1989 showed that both parents and their fledglings remained in the pine forest immediately after fledging; but then gradually moved over a two week period from the pine forest to the coppice.

Feeding Ecology

From 1985 to 1988, I recorded 686 feeding observations of Bahama Parrots. During the breeding season, parrots fed upon the seeds, fruits and flowers of 18 plant species in the nest area. These plant species were (in descending order of frequency): Caribbean pine, wild guava (Tetrazygia bicolor), poisonwood (Metopium toxiferum), pigeonberry (Duranta repans), beef-bush (Tabebuia bahamensis), woe-vine (Cassytha filiformis), bastard stopper (Petitia domingensis), prickly green-brier (Smilax havanensis), bay-rush (Zamia pumila), pond top palm (Sabal palmetto), butler bough (Exothea paniculata), Krug's holly (Ilex krugiana), myrsine (Myrsine floridana), short-leaved wild fig (Ficus citrifolia), cinnecord (Acacia choriophylla), gum elemi (Bursera simaruba), Bahamian holly (Xylosma buxifolium) and common Ernodea (Ernodea littoralis). Caribbean pine, wild guava and poisonwood accounted for 76% of all our feeding records (Fig. 4). I regularly observed parrots feeding on these three food sources before they entered their nests to feed chicks.

Nutrient composition of Bahama Parrot food items was determined (Gnam 1991). Seeds provided major dietary protein and lipid sources in the diet, where as flowers and fruits contributed primarily carbohydrates. Seeds from unripe Caribbean pine cones were the major staple in their diet. They provided the parrots with 91% of the protein and lipids in their total diet.

DISCUSSION

Conservation Implications

Bahama Parrots demonstrated the K-oriented (Pianka 1970) reproductive strategies of parrots; e.g. small clutches, high parental investment and the fledging of few offspring. Reproductive success is low and nest predation by introduced predators, ie. feral cats, imposes a severe drain on an already 'stressed' reproductive system (Gnam and Rockwell 1991). A feral cat control program for southern Abaco would reduce the loss of breeding females from the population and increase recruitment as a result of higher nesting success.

A major threat to the continued survival of Bahama Parrots on Abaco is its remaining habitat remains unprotected and subject to increasing developmental pressures from agriculture and tourism. The reliance of the Abaco population of Bahama Parrots on Caribbean pine seed for dietary protein during its nesting season makes the preservation of this pine forest habitat critical. Parrot conservation on Abaco depends upon preserving large tracts of Caribbean pine and implementing appropriate fire management and lumbering regimes to minimize the loss of cone-producing stands and allow for their regeneration.

Since the extant Bahama Parrot population on Abaco is small and localized, it is highly vulnerable to extinction from catastrophes (Ewens et al. 1987). When the population was larger and more widespread on Abaco, parrot populations could survive the stress of hurricanes because devastated areas could be repopulated from surviving refugia.

Previous workers recommended re-establishing the Bahama Parrot on other Bahamian islands to increase its probability of surviving catastrophes (Attrill 1981; Snyder et al. 1982). Although captive-raised individuals are commonly used in reintroduction and restocking programs, a better alternative exists with the Bahama Parrot - the translocation of wild-caught individuals (Wiley et al. 1992). There are compelling reasons for favoring this approach. Captive breeding programs are very expensive, time consuming and labor intensive (Derrickson and Snyder 1992). Judging from other such programs, such as the Puerto Rican Parrot (Snyder et al. 1987), it may take years to establish a self-sustaining population which is capable of supplying significant numbers of birds for release. Also, they often distract resources and funding from the real problems which face the species in the wild and may not easily be solvable (Imboden 1987). The Bahamas National Trust initiated a captive breeding program for the Inagua population in 1977, but the program has had very limited success (Fitzgerald and Larson 1989).

In addition, captive-raised parrots are at best much less likely than wild-caught parrots to survive in release efforts because of behavioral problems (Wiley et al. 1992). Finally, the existing wild populations of Bahama Parrots are clearly large enough to safely donate the few dozen parrots that should be required in relocation efforts, and such efforts can be made at comparatively small expense.

In conclusion, the present Abaco population of the Bahama Parrot is under stress. It numbers less than 1300 birds and its nesting success is currently being depressed by increased feral cat nest predation. Conservation measures (Gnam 1990) to protect its habitat in a reserve and manage the population need to be implemented now while numbers are sufficiently large to maintain biological viability.

ACKNOWLEDGMENTS

I'd like to dedicate this paper to Owante Gottlieb who passed away in 1992. She was an ardent supporter of parrot conservation efforts on Abaco. We will miss her greatly.

I thank Susan Berman, Carol Boyles, Al Burchsted, Claire Carrier, Grace Chambers, Linda De Lay, Ian Lothian, the 1989 Operation Raleigh crew, Erin Shanahan, Kirsten Silvius, Pat Smith, Bill Strausberger Jr., Martha Walsh, Jill Weech, and Lori Willimont for their assistance in the field. The Bahamian government, through the Ministry of Agriculture, Trade and Industry, gave me permission to study the Bahama Parrot. Maurice Isaacs, Michelle Knowles, Simon Pinder (Ministry of Agriculture), Shireen Chambers, John Hook (Forestry) and Friends of the Abaco Parrot offered logistical support.

Financial assistance is gratefully acknowledged from AAZK Chapter - Audubon Zoo; the American Federation of Aviculture; the Frank M. Chapman Memorial Fund, American Museum of Natural History; Friends of the Abaco Parrot;

ICBP-Pan American Section; ICBP-U.S. Section; the James Bond Research Fund-Amazona Society; J.McOmie and the Utah Avicultural Society; Mr. Fables Wildlife Conservation Fund; the Roger Tory Peterson Institute; the United States Fish and Wildlife Service, Office of International Affairs; Wildlife Conservation International, New York Zoological Society; Wildlife Preservation Trust International; the Women's Research and Development Fund, the City University of New York; the World Nature Association, and the Zoologische Gesellschaft fur Arten und Populationsschutz. During the course of this study, I was supported by an award from the Leopold Schepp Foundation, the Mina Rees Dissertation Fellowship (City University of New York) and by a National Institute of Mental Health Animal Behavior Training Grant (MH15341-07A1) to Hunter College's Biopsychology Program.

A special note of thanks to Owanta Gottlieb and Friends of the Abaco Parrot who provided me with funds to attend this symposium in San Salvador and present this paper.

LITERATURE CITED

ATTRILL, R. 1981. The status and conservation of the Bahama Parrot. Pp.81-87 in R. F. Pasquier (Ed.). Conservation of New World Parrots. ICBP Technical Publication Number 1. Smithsonian Institution Press, Washington, D. C.

BOND, J. 1956. Check-list of birds of the West Indies. 4th edition. Wickersham Printing Company, Lancaster, PA.

DERRICKSON, S. R. and N. F. R. SNYDER. 1992. Potentials and limits of captive breeding in parrot conservation. Pp. 133-163 in S. R. Beissinger and N. F. R. Snyder (eds.) New World Parrots in Crisis. Smithsonian Institution Press, Washington, D.C.

EWENS, W. J., P.J.BROCKWELL,J.M.GANI, and S.I. RESNICK. 1987. Minimum viable population size in the presence of catastrophes. Pp. 59-68 in M. Soule (Ed.) Viable populations for conservation. Cambridge University Press, Cambridge.

FITZGERALD, L. AND S. LARSON. 1989. Captive breeding of the Bahama Parrot. Proceedings AAZPA Southern Regional Conference. Pp. 474-479.

FORSHAW, J. M. 1989. Parrots of the World. 3rd edition. Lansdowne Editions, Melbourne.

GNAM, R. S. 1990. Conservation of the Bahama Parrot. American Birds, 44:32-36.

1991. Breeding biology of the Bahama Parrot. PhD. dissertation. The City University of New York, New York.

GNAM, R. S. and A. BURCHSTED. 1991. Population estimates for the Bahama Parrot (Amazona leucocephala bahamensis) on Abaco Island, Bahamas. J. Field Ornithol., 62:139-146.

GNAM, R. and R. F. ROCKWELL. 1991. Reproductive potential and output of the Bahama Parrot. Ibis, 133 : 400-405.

HENRY, P. W. T. 1974. The pine forests of the Bahamas. British Foreign and Commonwealth Office Land Resource Study 16.

IMBODEN, C. 1987. The captive breeding controversy. ICBP World Birdwatch, 9:6-7.

KING, W. B. 1977. Endangered Birds of the World: the ICBP bird red data book. Smithsonian Institution Press, Washington, D. C.

PIANKA, E. R. 1970. On r and K selection. American Naturalist, 104:592-597.

ROCKWELL, R. F., C. S.FINDLAY,and F.COOKE. 1987. Is there an optimal clutch size in lesser Snow Geese? American Naturalist, 130:839-863.

SNYDER, N. F. R., W. B. KING, AND C. B. KEPLER. 1982. Biology and conservation of the Bahama Parrot. Living Bird, 19:91-114.

SNYDER, N. F. R., J. W. WILEY, AND C. B. KEPLER. 1987. The parrots of Luquillo: natural history and conservation of the Puerto Rican Parrot. Western Foundation of Vertebrate Zoology, Los Angeles, California.

WILEY, J. W., N. F. R.SNYDER, R. S. GNAM. 1992. Reintroduction as a conservation strategy for parrots. Pp.165-200 in S. R. Beissinger and N. F. R. Snyder (eds.) New World Parrots in Crisis. Smithsonian Institution Press, Washington D. C.