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USE OF ARTIFICIAL NESTS BY THE YELLOW-SHOULDERED PARROT (*AMAZONA BARBADENSIS*)

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Resumen. – Uso de nidos artificiales por la Cotorra Cabeciamarilla (*Amazona barbadensis*). – El uso de cajas nido o nidos artificiales es una técnica de manejo usada para aumentar el tamaño de la población reproductiva de psitácidos amenazados. Como parte de un programa para la conservación de la Cotorra Cabeciamarilla (*Amazona barbadensis*) en la Isla de Margarita, Venezuela, colocamos, en 1993, 16 nidos de madera en una de las áreas de reproducción de la especie. Las dimensiones de las cajas nido se basaron en las medidas promedio de las cavidades naturales usadas como nidos por la Cotorra Cabeciamarilla. Los nidos artificiales fueron colocados en especies de árboles usadas por la Cotorra Cabeciamarilla para anidar, así como también en otras especies. Los nidos artificiales fueron usados por primera vez por la Cotorra Cabeciamarilla en 1997, y durante nuestro estudio un total de cuatro diferentes cajas nido fueron usadas de 1997 a 1999. El éxito, en general, de los nidos artificiales para la Cotorra Cabeciamarilla fue bajo (5.6%). Esto pudo deberse a problemas de diseño de los nidos artificiales o a que las cavidades naturales no eran un recurso limitante en esta área. Los nidos artificiales sufrieron altas tasas de saqueo debido a que eran muy conspicuos y a que los pichones podían ser obtenidos fácilmente a través de la puerta de observación. Un programa de reparación y mejoramiento de cavidades naturales resultó más exitoso como técnica de manejo para la Cotorra Cabeciamarilla. Las 15 cavidades reparadas fueron usadas repetidamente desde que estuvieron disponibles.

Abstract. – The use of artificial nests is a management technique used to increase the breeding population of endangered parrots. As part of a program devoted to the conservation of the Yellow-shouldered Parrot (*Amazona barbadensis*) on Margarita Island, Venezuela, we placed 16 wooden nests in one of the species' breeding areas in 1993. The dimensions of nest boxes were based on the average measurements of natural cavities used as nests by Yellow-shouldered Parrots. Artificial nests were placed on tree species used by nesting Yellow-shouldered Parrots, and on other tree species as well. Artificial nests were used by Yellow-shouldered Parrots for the first time in 1997, and during our study a total of four different boxes were used from 1997 to 1999. The overall success of Yellow-shouldered Parrots with artificial nests was poor (5.6%). This could be due to design problems of artificial nests or to the possibility that cavities were not a limiting resource in this area. Artificial nests suffered higher poaching rates because they were more conspicuous and the chicks were readily accessible through an observation door. A program to recover and improve natural cavities resulted more successful as a management technique for Yellow-shouldered Parrots. All 15 repaired cavities were used repeatedly shortly after being available. *Accepted 21 November 2002.*

Key words: Yellow-shouldered Parrot, *Amazona barbadensis*, Psittacidae, artificial nests, management, Margarita Island, Venezuela.

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INTRODUCTION

Population increase among hole nesting birds may be limited by the availability of nest sites (Brawn & Balda 1988, Newton 1994). Nest-site limitations result from a scarcity of adequate nest sites *per se*, behavioral limitations in the abilities of the species to locate what nest sites may exist, and vulnerability of nest sites to competitors and predators (Snyder 1978). One *in situ* management technique used to increase the breeding population of cavity nesting birds is to increment the number of breeding places by providing nest boxes or artificial nests. The success of this technique has been very variable and depends on each species' characteristics (Snyder 1978, Brawn & Balda 1988). Most species of parrots nest in cavities of trees and palms, either those occurring naturally or those that have been excavated by other species (Juniper & Parr 1998). Due to the fact that many parrot species are threatened (Snyder *et al.* 2000), artificial nests have been used as a strategy to increase their populations (Snyder 1978, Snyder *et al.* 1987, Nycander *et al.* 1995).

The Yellow-shouldered Parrot (*Amazona barbadensis*) inhabits the arid zones of Venezuela and the Caribbean islands of Margarita, La Blanquilla (Venezuela) and Bonaire (Netherland Antilles) (Rodríguez & Rojas-Suárez 1995). Globally, it is considered "vulnerable" (BirdLife International 2000) and, in Venezuela, it is one of the most endangered parrots because of habitat loss and the illegal pet trade (Desenne & Strahl 1991, Collar *et al.* 1992, Rodríguez & Rojas-Suárez 1995). As part of a program devoted to the conservation of the Yellow-shouldered Parrot on Margarita Island, we placed artificial nests in one of the species' breeding areas. Here, we report on the limited success of artificial nests as a management technique for the Yellow-shouldered Parrot.

METHODS

We carried out this study during a 7-year period (1993–1999) in the Macanao Peninsula (300 km^2), western Margarita Island (10°51'–11°1'N, 63°46'–64°24'W), Venezuela. The climate is semiarid tropical with a mean annual precipitation of 500 mm and a mean annual temperature of 27°C. The vegetation is an open cactus-chaparral plant community with abundant columnar cacti and leguminosae (Hoyos 1985).

We placed 16 wooden artificial nests, following the design for standard next boxes used in Puerto Rico to control the Pearly-eyed Thrashers *(Margarops fuscatus*) (Snyder *et al.* 1987). The dimensions were based on the average measurements of natural cavities known to be used as nests by Yellow-shouldered Parrots (Table 1). The artificial nests were 160 x 30 x 30 cm, with an oval entrance 20 x 15 cm on the side (Fig. 1). At the bottom, a 10 x 10 cm door allowed chick observation and monitoring. The inside of the nests was covered with chicken-wire to allow adults and fledglings to climb up and down. About 10 cm of the nest bottom was filled with bark chips of *Bulnesia arborea*, the same filling used by wild Yellow-shouldered Parrots in natural cavities (pers. observ.). Nests were attached to the host trees (Fig. 2) with aluminum bands fixed with screws, and the tree trunks were protected with wide bands of rubber.

Nest boxes were installed in late March 1993, at the beginning of the breeding season. That year the first active nest began on 2 April and the last one initiated between 15–20 May. Based on the record of natural nests in previous years, we chose to install nests at six sites in our main study area (La Chica creek). Each site was located 200 to 600 m apart from adjacent sites and two to four nests were hung in each. Within each site, nest boxes were placed about 50 to 100 m from

TABLE 1. Characteristics of natural cavities used by nesting Yellow-shouldered Parrots on Margarita Island in 1990 (N = 21) and used for the design of the artificial nests. All measurements in cm.

	Internal diameter	Depth	Entrance		
			Width	Height	Height from the ground
Mean	22.4	105.8	13.7	27.7	370.6
SD.	8.0	71.3	5.9	18.5	182.1
Minimum	12.0	7.0	7.0	7.0	125.0
Maximun	40.0	268.0	31.0	88.0	778.0

each other. Artificial nests were placed on tree species (*Bulnesia arborea,* and *Caesalpinia granadillo*) used by nesting Yellow-shouldered Parrots, and on other tree species as well (*Capparis odoratissima, C. hastata* and *Casearia tremula*). The height of the nests entrance ranged from 2 to 4 m above the ground (Table 2), as it reflects a compromise between the height range observed in natural nests, the supporting tree architecture, and the possibility of checking the nests frequently. The degree of vegetation coverage in trees used by Yellow-shouldered Parrots to nest is variable. Thus, we chose supporting trees with enough coverage to protect the nest from excessive sunshine, but keeping them visible to parrots from several meters away.

We checked the nests for signs of usage by parrots or any other animals. During the first year, we did so once a week during the breeding season (April to August) and once a month until the end of the year. In following

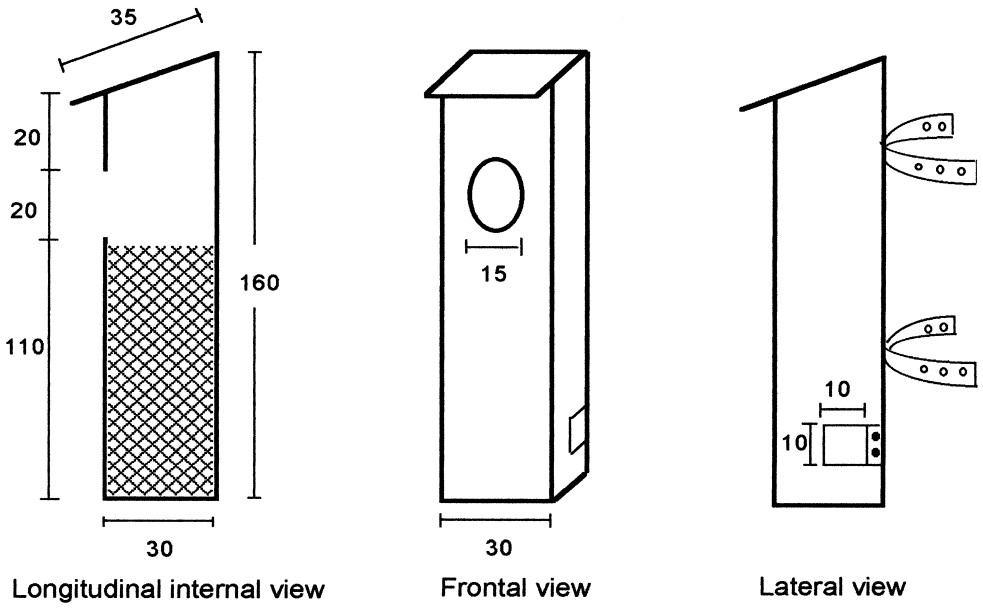

FIG. 1. Diagrams of artificial nests installed for Yellow-shouldered Parrots on Margarita Island in 1993. All measurements in cm.

FIG. 2. Artificial nest installed on a *Bulnesia arborea* tree.

years, boxes were checked every two weeks only during the breeding season.

RESULTS

Artificial nests were used by Yellow-shouldered Parrots for the first time in 1997, when one nest was used. Again in 1998 only one nest was used, and in 1999, three nests were used at different sites, for a total of four different nest boxes in four different sites used from 1997 to 1999 (Table 2). Although all eggs in nest boxes hatched, fledglings were produced in only one of them. In all other nests, chicks were poached by humans (Table 3). Two artificial nests stolen in 1995 were not replaced, so only 14 nests were available during the following years. If we define a success measurement of the artificial nests for the Yellow-shouldered Parrot as the proportion

TABLE 2. Entrance height (cm), supporting trees, annual use and success of artificial nests installed for the Yellow-shouldered Parrot on Margarita Island from 1993 to 1999. N = not used, Y = used, - = no data.

Nests	Supporting trees	Entrance height	Use by the parrots in year						
			93	94	95	96	97	98	99
1	*Bulnesia arborea*	255	N	N	N	N	N	N	N
2	*Capparis odoratissima*	176	N	N	Stolen	-	-	-	-
3	*B. arborea*	245	N	N	N	N	N	N	N
4	*Caesalpinia granadillo*	203	N	N	N	N	N	N	N
5	*Casearia tremula*	196	N	N	Stolen	-	-	-	-
6	*B. arborea*	285*	N	N	N	N	N	Y	Y
7	*C. granadillo*	243	N	N	N	N	N	N	N
8	*B. arborea*	281	N	N	N	N	N	N	N
9	*C. odoratissima*	264	N	N	N	N	N	N	N
10	*B. arborea*	315	N	N	N	N	N	N	N
11	*B. arborea*	271	N	N	N	N	N	N	N
12	*B. arborea*	415*	N	N	N	N	Y	N	N
13	*C. hastata*	268	N	N	N	N	N	N	N
14	*B. arborea*	233	N	N	N	N	N	N	N
15	*B. arborea*	208*	N	N	N	N	N	N	Y
16	*B. arborea*	229*	N	N	N	N	N	N	Y
Total			16	16	14	14	14	14	14

* Used nest boxes.

of nests used (5) divided by the total nests available during the monitoring time (88), we obtain a success of only 5.6%. This number excludes the year 1993, because the nests were set very close to the beginning of the breeding season and probably the pairs had already selected the cavities.

Interestingly, one natural nest used repeatedly since 1993 was not used in 1998 and 1999 when a nearby artificial nest was active. As parrots were not individually identified, we were not able to determine whether one or two pairs switched from nesting in the natural nest to the artificial one between 1997 and 1999. The natural cavity had inner irregular walls with exfoliations and one nestling died in 1994 when its wing was caught by one of these exfoliations.

A design problem became evident during our observations of the behavior of the first pair that used an artificial nest. The artificial nests lacked a perch near the entrance where the parrots could land before entering it. This was solved the same year, at the end of the breeding season, by adding a small branch close to the nest entrance of all the artificial nests.

Since the first year, the artificial nests were used by other animals for roosting or breeding, including the Robinson's mouse opossum (*Marmosa robinsoni*), which usually modified the interior of the nest filling it with leaves, and the dark tree rat (*Echimys semivillosus*). Nests were also used frequently by geckos (e.g., *Thecadactylus rapicaudus*), and once by the tropical rat snake (*Spilotes pullatus*). Additionally, two nests were invaded by honey bees (*Apis mellifera),* but one of the colonies died shortly after it took over the box.

DISCUSSION

The overall success of Yellow-shouldered Parrots with artificial nests was poor. This could

TABLE 3. Breeding success of the artificial nests used by Yellow-shouldered Parrots on Margarita Island between 1993 and 1999.

Nest identification	Year	Clutch size	Brood size	Number of nestlings	
				poached	fledged
12	1997	3	3	0	3
6	1998	3	3	3	0
6	1999	4	4	4	0
15	1999	2	2	2	0
16	1999	4	4	4	0

be due to design problems or to the possibility that cavities are not a limiting factor in this area. The artificial nests were first used in 1997 when the breeding population in the study area had increased by about 30% above that of 1993. This increase supports the idea that cavities were not a factor limiting population growth, at least until 1999. Since then, it appears that the breeding population increased enough that parrots began to need more cavities than the naturally available ones, and hence used artificial nests. The number of breeding pairs in the study area in 1999 reached a maximum of 49 in 10 years of monitoring. The maximum in previous years was 43 en 1997 and the average for the period 1990–1996 was 25.

The artificial nests had the associated disadvantage of increasing poaching because they are more conspicuous and the chicks are readily accessible through the observation door. Therefore this technique would only be efficient in areas where illegal trade is not a problem, or where it is counteracted through effective surveillance programs.

Since 1992 we developed a program to recover natural cavities that seemed appropriate to be used by nesting Yellow-shouldered Parrots. Usually, these cavities were in trees that years before had been cut open at the nest bottom to extract the nestlings from the nests. The recovery and improvement of natural cavities was extremely successful. Indeed, 100% of the 15 cavities repaired were used in the same or next year, and repeatedly since. The same behavior was also shown by the Puerto Rican Parrot (*Amazona vittata),* which prefers improved natural cavities to nest boxes (Wiley 1985, Snyder *et al.* 1987).

Although next boxes have been successful with other psittacid species such as the Green-rumped Parrotlet (*Forpus passerinus*) (Beissinger & Bucher 1992) and *Ara* macaws (Munn 1992, Nycander *et al.* 1995, A. J. González-Fernández pers. com., D. Brightsmith pers. com.), results have been rather poor for *Amazon*a parrots (Snyder *et al.* 1987, Beissinger & Bucher 1992, D. Brightsmith pers. com.). In the Venezuelan llanos, four pairs of the Yellow-crowned Amazon (*Amazona ochrocephala*) used wooden nest boxes, similar to ours, every year from 18 available (A. J. González Fernández pers. com.). The nests had a very short life and were rotten after three years.

Because of the general low success of artificial nests used by *Amazona* parrots, the costs of making and maintaining them, and the increased risk of poaching, a systematic recovery of natural cavities seems a more advisable strategy for the management of endangered *Amazona* species prior to embarking on a program that uses artificial nests.

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