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Conserving the terecay (*Podocnemis unifilis*, Testudines: Pelomedusidae) through a community-based sustainable harvest of its eggs

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Abstract

The exploitation of South American river turtles as a food source has long been considered the main factor contributing to the decline of populations. Along a stretch of the Aguarico River (Ecuador), we investigated the spatial and temporal distribution of terecay (*Podocnemis unifilis*) nests, factors affecting nest outcome, and the effect of offering a reward for each hatchling captured on the pattern of egg consumption by the local human community. Flooding influence on egg mortality appears to be particularly important in this Amazonian region, destroying 63.1% of all nests. This amount of nests resulted more than sufficient to satisfy the local community's consumption needs (28.2%). The proposed reward for each hatchling ensured the voluntary participation of the Cofan people in the terecay conservation project, leading to: (i) nests being harvested only from sites where there were likely no hatching possibilities, (ii) efficient management and protection of nesting beaches with abolition of poaching of nests and adult females, and (iii) transplantation of nests from sites that would be flooded (and whose yield exceeds human consumption). Therefore, we argue that in this area of Aguarico River there are both biologically and socially favourable conditions for the establishment of a sustainable harvest of terecay eggs. Possible factors determining high nest mortality due to flooding in this area, as well as opportunities to make the project evolve toward economic self-sustainability, will also be discussed.

Keywords: *Podocnemis unifilis*; River turtles; Community-based conservation; Sustainable use; Eggs harvest; Flooding

1. Introduction

Human use of turtles (adults and eggs) as a food source is the main factor contributing to the decline of chelonian populations in 46% of taxa, in addition to being a cofactor in other 20% (Klemens and Thorbjarnarson, 1995). High ratio of eggs and hatchlings to adults, high rate of survivorship of large juveniles and adults, delayed sexual maturity and long reproductive life span are all features of turtle demography that make their populations especially sensitive to the exploitation of juveniles and adults; the harvesting of eggs and hatchlings, which naturally sustain high mortality rates, is of lesser impact (Crouse et al., 1987; Brooks et al., 1991; Congdon et al., 1993, 1994; Garber and Burger, 1995; Gibbs and Amato, 2000; Thorbjarnarson et al., 2000; but see also Hailey, 2000). For example, in the case of *Podocnemis expansa*, a change of the exploitation system from mainly eggs (i.e., the traditional mode of exploitation) to mainly adult females led to the devastation of many populations (for a review, see Thorbjarnarson et al., 2000). These considerations have an

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important consequence for the management of turtle populations: increasing survival rate of the early life stages is not effective for population recovery when mortality rates of the large juveniles and adults are increasing (Heppell et al., 1996; Gibbs and Amato, 2000). However, management of early life stages might be a viable option when a program of sustainable exploitation of the population is the target. Nesting site protection or controlled harvest programs of eggs, for example, could help to increase the survival rate of adults, especially when they are collected mainly during the nesting period (as for *Podocnemis* spp.).

Conservation strategies involving sustainable use have to take into account both biological and socio-economic factors (Westing, 1996). Several studies have shown that socio-economic sustainability can be achieved through community-based management plans. For instance, in the case of the olive ridley sea turtles at Ostional, Costa Rica [reviewed by Campbell (1998) and Thorbjarnarson et al. (2000)], a successful conservation program was carried out through a controlled nest-predation project based on the exploitation of nests that would otherwise be lost for natural causes.

Podocnemis unifilis (terecay) is a highly aquatic river turtle which inhabits the Amazon and Orinoco basins (Pritchard and Trebbau, 1984; Iverson, 1992). It is classified as vulnerable (VU A1acd) on the 2004 IUCN Red List (IUCN, 2004), as endangered by the US Fish and Wildlife Service, and it is on Appendix II of the Convention on International Trade of Endangered Species (CITES). While still abundant locally, many populations of terecay are experiencing a drastic decline, due to human consumption of eggs and adult females (Thorbjarnarson et al., 2000). Adults females are easily captured during the dry season when the water level falls exposing the open sandy beaches where they nest. The exploitation of terecay populations is currently increasing, mainly due to a dramatic decline of *P. expansa* populations (Mittermeier, 1978; Alho, 1985; Thorbjarnarson et al., 1997; Thorbjarnarson et al., 2000), historically preferred by local people because of its greater size and egg production, as well as for the facility of collection when females congregate for nesting (Bates, 1863; Vanzolini, 1977; Foote, 1978; Smith, 1979).

Terecay is considered a good model for the study of sustainable use programs (Soini, 1998; Vogt and Soini, in press) and, being widely exploited throughout its range (Pritchard and Trebbau, 1984), it is also a good model for the study of community-managed programs.

We studied a population of terecay along a stretch of the Aguarico River in the Ecuadorian Amazon. This area is inhabited by three human communities whose main means of subsistence are hunting and fishing, and who heavily exploit the resident terecay population. Old inhabitants of that area report the disappearance in recent years of the local *P. expansa* population (only two nests found by Velasco during 1995) and an annual decrease in the number of terecay nests. In this paper, we present: (1) results of a survey of the nesting beaches in the area; (2) an analysis of the spatial and temporal distribution of terecay nests; (3) an analysis of the nests' outcome inside the territory of the local Cofan community; and (4) an assessment of the Cofans' reliability in managing terecay's nests. We also suggest a conservation plan to guarantee the long-term survival of *P. unifilis* in Cuyabeno through the involvement and effective use of the "local people" resource. For this aim:

(a) We test the hypothesis that nests that would otherwise be lost due to environmental factors such as flooding and beach erosion are sufficient to satisfy the local human demand.
(b) We evaluate if, by giving people a fair remuneration for each naturally hatched egg, they would guarantee: (1) location of all nests in that area; (2) consumption of eggs only from nests which would be lost for environmental reasons; (3) protection of nesting sites during the period of nesting and egg incubation, with consequent abolition of poaching of adult females and eggs; (4) long-term monitoring of the population; and (5) transplantation of potentially flooded nests whose yield would eventually exceed human consumption.

2. Materials and methods

2.1. Study area

Our study was conducted between May 1998 and May 1999 along 140 km of the Aguarico River, a white-water secondary tributary of the Amazon River, in a flat area of primary forest of the Ecuadorian Amazon close to the Andes, in the "Reserva de produccion faunistica de Cuyabeno" (RPFC). Rainfall is abundant throughout the year (annual average: 3000 mm) yet relative dry (average monthly rainfall (AMR): 200 m) and wet (AMR: 380 mm) seasons exist (F.A.O., 2001). River levels are markedly seasonal. During the wet season (April–August) extensive areas of low-lying forest are inundated. In the dry season (November–February), river levels drop and banks of sediment deposits emerge as sandy beaches along the Aguarico shore. During the dry season, the area of occupancy of the river turtles is reduced, and females emerge to lay eggs.

The Aguarico River's banks inside RPFC are inhabited by three native human communities: the Quichoua Communities living in the villages of Playas and Zancudo, and the Cofan community of Zabalo. Their existence and culture is linked to hunting and fishing, although there is well-developed tourism in the