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Conservation and Management Strategies for Commonly Exploited Amazonian Turtles

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ABSTRACT

In the Amazon, turtle hunting is more than simply a method of obtaining meat, it is a way of life and part of local culture. To reduce the illegal catch of Amazonian freshwater turtles knowledge about the ecology of the species is needed to establish conservation and management strategies. The exploited species have a high reproductive potential but a large percentage of the hatchlings are consumed by predators (mainly fishes) if left without proper management. It is suggested that a proportion of the hatchlings should be collected on the nesting beaches and subsequently raised in semi-natural conditions for later releases into lakes. This should be done at regular intervals to produce a commercial harvest after 8 years. Such a strategy would provide an economic incentive to protect and maintain wild populations as sources of hatchlings.

INTRODUCTION

In the past, the general consumption of turtle meat and the industrial utilization of eggs was an important aspect of life in Amazonian Brazil. Recently, due to over exploitation, there has been a significant shift in the use of turtle products. Industrial use has been reduced to minor local cottage industries for the production of folk remedies and cosmetics. Human consumption has changed from that where turtle meat formed a

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staple part and source of protein in the Amazonian diet, to one where it is now an expensive delicacy. In Manaus, for example, important occasions are celebrated with a 'tartarugada', that is a banquet of turtle meat prepared in many different ways. Thus, the exploitation, illegal commerce and consumption of turtles are socially important for the upper classes and economically important for the lower classes, who obtain the turtles to supply the demand by the former.

Two genera of turtles, *Podocnemis* and *Kinosternon*, are the most heavily exploited in Amazonian Brazil. Others are occasionally collected for particular remedies, but generally are not used for human consumption. The five Brazilian species of *Podocnemis* (Pelomedusiade), *P. expansa*, 'tartaruga', *P. unifilis*, 'tracajá', *P. sextuberculata*, 'pitiú', *P. dumeriliana*, 'carbeçudo', and *P. erythrocephala*, 'irapuca' are all exploited to various degrees. *Kinosternon scorpioides*, 'muçuã' (Kinosternidae) is collected, principally near Belém and the island of Marajó, in the delta of the Amazon River. 'Tartaruga' and 'tracajá' are the most sought-after species for meat and eggs. In Manaus, a large-sized adult of 'tartaruga' is worth as much as US$ 15.00 in the illegal market, approximately 25% of an average worker's monthly income.

The biology of Amazonian turtles, particularly *P. expansa* and *P. unifilis*, has been intensively studied (Alho & Pádua, 1982*a*, *b*, *c*; Alho *et al.*, 1979, 1981, in press; Foote, 1978; Medem, 1958, 1960, 1964, 1969, 1971; Mosqueira-Manso, 1945; Neill, 1965; Ojasti, 1967, 1971; Pádua & Alho, 1982; Ramirez, 1956; Roze, 1964; Smith, 1974, 1979; Valle *et al.* 1972; Vanzolini, 1967). A combination of the knowledge on Amazonian turtle ecology and the constraints related to their biology are needed for wise conservation and management.

PROTECTION AND HEADSTART PROGRAMME

As populations of Amazonian turtles continue to decline, a headstart programme combining protection of nesting beaches and feeding habitats, particularly for *P. expansa* and *P. unifilis*, must be put into action to maintain and restore present population levels while satisfying the demand for meat and eggs.

Brazilian law (Lei no. 5.197, of 3 January 1967) protects the turtles in the wild, forbidding their capture and use. The Brazilian agency in charge of wildlife conservation (Instituto Brasileiro de Desenvolvimento

Florestal, IBDF-DN) protects nesting beaches in the Amazonian area. The nesting population has increased in recent years due to this programme (Alfinito, 1980; Alho & Pádua, 1982*a*; Alho *et al.*, 1979; IBDF, 1967-present). As a result, there is an abundant annual production of hatchlings on the protected nesting beaches (Table 1).

The rationale behind the recent upsurge of interest in utilization of Amazonian turtles is based on their biological cycle. The mean clutch size

TABLE 1

The Brazilian Rivers with the most Important Protected Nesting Beaches for *Podocnemis expansa* and Evaluation of the Mean Number of Nesting Females per Year Based on the Number of Nests and the Mean Hatchling Production per Year of the Protected Beaches (Source IBDF-DN) from 1978–1982

State or territory of Brazil	*River*	*Number of nesting females per year*	*Number of hatchlings per year*
Amazonas	Purus	1 117	104 300
Amazonas	Juruá	291	21 400
Rondônia	Guaporé	226	11 470
Roraima	Branco	1 935	180 756
Pará	Tapajós	353	18 566
Pará	Xingu	1 859	98 450
Pará	Trombetas	5 184	393 345

for *P. expansa* is 91·5 eggs, ranging from 63 to 134, with a mean of 85·98 hatchlings per nest, ranging from 53 to 128 (Alho & Pádua, 1982*a*). However, less than 20 % of the hatchlings return to the nesting beaches as adults (IBDF, 1967-present). In my opinion, the majority of this loss is due to predation by birds, lizards and particularly fishes. This great loss of ecological and economical resources constitutes a challenge for conservation and rational utilization practices.

Proposals for the management of hatchlings on the nesting beach

On hatching, small turtles dig to a level close to the surface sand. This movement creates a kind of funnel in the sand that is particularly easy to recognize. At this time nesting areas can be fenced easily using chicken wire to trap the hatchlings when they emerge from the nests. All the

hatchlings should be taken to protected tanks. Then, 20% of the year's crop of hatchlings should be immediately released to the lakes and rivers, or they may also be protected for a few weeks before they are set free, as is now usually done by IBDF-DN. When these hatchlings reach a size which makes them less vulnerable to predation they should be released into the lakes. The remaining 80% of the hatchlings can then be distributed to various headstarting facilities, for example, for captive-rearing in tanks and semi-artificial lakes where a supplementary diet is provided and where they are protected from predators and disease.

Rearing and releasing programme

In the flooded forest a large number of small lakes are available to receive the hatchlings for the headstart programme. Semi-artificial lakes should be prepared for each cohort of hatchlings received from different yearly crops. To red ice mortality and to speed growth, it is best first to receive the hatchlings in small tanks and transfer them to larger containers as they grow year by year until they reach semi-artificial lakes when adult. It is important, however, for full control, that each year's cohort of hatchlings be raised separately until age 8 when the programme ends (Table 2). This benefits conservation by releasing into the natural

TABLE 2

Headstart Programme for Amazonian Turtles based on 5000 Hatchlings Cohort Captive-reared Turtles from Age 0 to 8 where 10% of those are Released to the Natural Environment at Annual Intervals

Duration (in years) of the headstart programme	*Balance of turtles in the programme*	*Estimated number lost by mortality (5%) during current year*	*Number of turtles being released to the feeding grounds for conservation means (10%)*
0 (Starts)	5000	250	—
1	4750	237	475
2	4038	201	403
3	3434	171	343
4	2920	146	292
5	2482	124	248
6	2110	105	211
7	1794	89	179
8 (Ends)	1526[a]	76	152

[a] Harvest.

environment 10% of the remaining young captive-raised turtles at annual intervals. Thus, 20% of each year's crop of hatchlings could be immediately released and 80% could be maintained in captivity, well protected from predators and diseases. By reducing drastically the high, early-age natural mortality through semi-captive rearing, the wild populations may be increased by headstarting. Amazon turtles are easy to pen-rear, with low mortality and present a good increment in early growth (Alho & Pádaa, 1982*c*: R. Best, pers. comm.). It has been shown that, when pen-reared, *P. expansa* has a potential for individual first-year growth of 400 g, with a mortality of less than 3% (R. Best, pers. comm.). They can reach maturity in seven or eight years, considerably sooner than wild animals, if a rich supplementary diet of chopped fishes, fruits and plants is provided. In the Museu Goeldi, Belém, Brazil, *P. expansa* and *P. unifilis* have been successfully reared to maturity in about eight years and individuals reaching maturity have reproduced each year. The care of turtles in captivity is relatively easy if the planning and husbandry programme deals with the specific life requirements of the young turtles (Campbell & Busack, 1979; Klima & McVey, 1982; Reichart, 1982).

Harvesting programme

At the end of each eight-year cycle, if the cycle was begun with 5000 hatchlings, the selected turtle farmers should have more than 1500 mature turtles for marketing (Table 2). At current market prices, this should produce a gross income of more than US$ 22 500 per cycle so that the producer could expect a net profit of up to US$ 10 000 per cycle.

DISCUSSION AND RECOMMENDATIONS

To reduce the intentional catch of the Amazonian turtles, which is illegal in Brazil, it is necessary to apply our knowledge of the species' ecology. Anyone interested in obtaining (or buying) a turtle or its eggs in the Amazon can do so. Legal prohibition, or other legislation, will be merely an exercise in frustration. Commerce cannot be efficiently limited by punitive resolutions in an area as vast and uninhabited as the Amazon and populations cannot be maintained at sustained levels by law enforcement officers.

Exploited *Podocnemis* species have a high reproductive potential. If

natural predation and other natural losses of eggs and juveniles are controlled, a high survivorship is obtained. If they are reared in semi-artificial ponds they will have a greater chance to survive in the wild after release. By releasing the captive-raised turtles in their feeding habitats (lakes) they might be able to follow the species-specific migration routes to nest sites on the river beaches. Thus, subsequent recruitment by wild populations can be assumed since aggression is not an important behaviour pattern in these species. By releasing annually 10% of the remaining captive-reared turtles into the lakes at a time when they can safely grow to reach reproductive condition, it should accelerate recruitment to the natural population and thus improve natality on the protected nesting beaches. Natality may be improved because more turtles close to reproductive size or age are released into the environment and added to the natural populations.

There should be a significant harvest of adult turtles at the end of each cycle for the commercial market and to stimulate the local population to support the conservation programme. Every year a new programme on an eight-year cycle is needed. Thus, a headstart programme with an annual cohort of hatchlings will provide the economic incentive to protect the wild populations which are the sources of hatchlings. These programmes need to be fully controlled by the conservation agency (IBDF-DN) to avoid abuse. Gradually private farming and ranching will be able to participate in the headstart programme, provided that there are enterprises interested in investing in turtle culture in the Amazon. Part of the profits from the sales of adults should be used to finance conservation work.

Although there has been a drastic decline in the populations of Amazonian turtles, particularly *Podocnemis*, because of uncontrolled exploitation for centuries, the turtles are still fairly abundant in protected areas (Table 1). In many localities, however, populations may be small or totally absent. Thus, the natural adult populations require complete protection and prevention of interference with reproductive activities on the nesting beaches as well as elimination of exploitation in the feeding grounds. Equally important, the migration routes from the lakes to the rivers should be protected.

Since there is a synchronization between low water and nesting (Alho & Pádua 1982*a*, *b*), the construction of hydroelectric plants that affect the ebbing regime of rivers in protected areas, such as biological reserves and nesting sanctuaries, must be avoided.

Before the full benefits and risks of a headstart programme can be evaluated, the following measures are needed: (a) the determination of the minimum and the maximum size of captive-rearing operations that are commercially feasible; (b) the continuation of research to provide detailed information on population ecology and behaviour; and (c) to improve conservation education by organizing political action and education.

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