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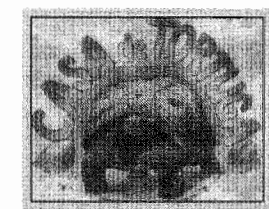
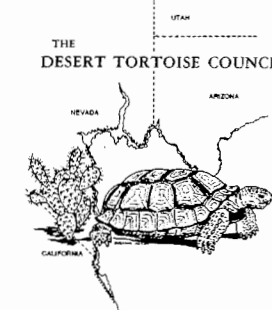
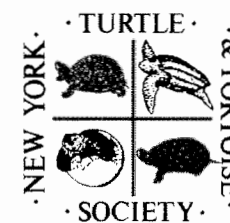
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CONTRIBUTORS



Walter Allen

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163 Amsterdam Avenue, Suite 365
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Effects of Exploitation on *Dermatemys mawii* Populations in Northern Belize and Conservation Strategies for Rural Riverside Villages

JOHN POLISAR

Florida Museum of Natural History, University of Florida, Gainesville, FL 32611, USA

ABSTRACT: *Dermatemys mawii* is a large, highly aquatic, herbivorous freshwater turtle of the Gulf of Mexico and Caribbean drainages of southern Mexico, Belize, and Guatemala. Because *Dermatemys* lays its eggs in scattered locations during the high water periods of the late rainy season, exploitation of nesting females and their eggs is inconsequential. Exploitation is primarily for meat and is most intense during the latter part of the dry season. All three methods of capture in northern Belize are selective for large juveniles and adults. The effects of relentless hunting have been decreased densities and population structures skewed towards juveniles, with a marked reduction in the proportion of mature females.

Dermatemys nesting behavior makes headstarting programs impractical. Management recommendations have focused on increasing adult survivorship through reduction of large-scale commercial exploitation. In the absence of strong enforcement capabilities, and in an area of low human population density, legal restriction of commercial hunters' activities has proven a feasible initial strategy. By allowing continued small-scale removal by subsistence hunters, the support of that numerically larger constituency may be maintained.

The Central American river turtle, *Dermatemys mawii*, is a large, highly aquatic, herbivorous freshwater turtle of the Gulf of Mexico and Caribbean drainages of southern Mexico, Belize, and Guatemala (Alvarez del Toro et al., 1979; Iverson and Mittermeier, 1980; Iverson, 1986). It is the sole living representative of the formerly widespread and diverse family Dermatemydidae, which dates from the Jurassic of Europe and the Cretaceous of North America, Europe, and East Asia (Romer, 1956; Iverson and Mittermeier, 1980; Hutchison and Bramble, 1981). Throughout its restricted range *Dermatemys* is heavily exploited for its meat (Holman, 1964; Lee, 1969; Mittermeier, 1970, 1971; Alvarez del Toro et al., 1979; Moll, 1986), which is consumed by rural people and sold in urban markets. Years of unrestrained exploitation have raised concern over the status of *Dermatemys*. It is listed on Appendix II of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) (USFWS, 1992), as "Endangered" under the provisions of the U.S. Endangered Species Act (USFWS, 1994), and as the highest priority species (i.e., Action Plan Rating = 1) in the IUCN Species Survival Commission action plan for the conservation of tortoises and freshwater turtles (IUCN/SSC/TFTSG, 1991).

Hunting has virtually eliminated *Dermatemys* from much of its former range in southern Mexico (R. Vogt, pers. comm.), and the status of the species in Guatemala is unclear. As late as 1984 *Dermatemys* was common to abundant in sparsely populated areas of Belize, but declining where accessible to a harvesting public (Moll, 1986).

In 1986 Moll proposed that the remaining, relatively in-

tact populations in Belize offered an opportunity to obtain the biological data needed to manage this species. That opportunity was seized when the leaders of seven villages of the Community Baboon Sanctuary, a grassroots wildlands management project that maintains riparian forest habitat for black howler monkeys, *Alouatta pigra* (Horwich, 1986, 1990; Horwich and Lyon, 1988), invited me to study *Dermatemys* in the 32 km section of the Belize River that bisects their sanctuary. The invitation stemmed from concern that local levels of harvest had become unsustainable. Field research began in late 1989 and expanded rapidly, eventually including an additional 54 km of the Belize River, 39 km of tributary systems, and an additional five villages. It also included urban market counts and fieldwork in the Río Bravo Conservation and Management Area and the Crooked Tree Wildlife Sanctuary, with focus on reproductive biology and exploitation patterns. Data on reproductive cycles, minimum sizes at maturity, nesting and mating seasons, incubation periods, methods of exploitation and marketing, and seasonality, scale, and effects of exploitation were collected. The high level of local cooperation contributed greatly to this research effort, and living in the villages during this study provided an understanding of local perspectives, needs, and customs.

In northern Belize, *Dermatemys* lays its eggs in scattered locations during the high water periods of the late rainy season (late September–December). As a result, exploitation of the difficult-to-locate nests has been inconsequential (Polisar, 1992). Exploitation for meat occurs year-round, but peaks during the last two months of the dry season (April

and May), when low water levels facilitate capture. In northern Belize there has been a strong tradition of serving *Dermatemys* (locally known as "hickatee") for dinner at Easter.

The data showed that intensive hunting within an area resulted in decreased densities and lower proportions of adults, particularly adult females. All three methods of hunting—harpoons, nets, and freediving—were selective for larger size classes. When the small juveniles that had previously eluded capture matured, they too were collected, creating an illusion of continued abundance in populations that were probably already non-reproductive and in decline. These dynamics appeared less severe in lightly or intermittently exploited populations. The status of the central Belize River population in the vicinity of the Baboon Sanctuary, and that of other heavily exploited populations, indicated that the level of harvest was not sustainable.

The ultimate objective of the project was to develop pragmatic management recommendations that could be applied in a rural, undeveloped setting with minimal wildlife law enforcement. The formulation of these recommendations required gathering data over a wide range of topic areas—reproductive biology, exploitation and marketing patterns, cultural traditions, and legal and community conservation opportunities.

Headstarting was not a practical initial step in the conservation of *Dermatemys* because (1) nests were difficult to locate, (2) the flood season nesting pattern resulted in highly dispersed gravid females, making capture rates low, and (3) funding and infrastructure for captive breeding and care were lacking.

Because the cause of decline was the excessive removal of older turtles for human consumption, management needed to focus on increasing adult survivorship. A reduction in the overall scale of exploitation provided a practical way to begin that process, and restricting the activities of commercial hunters who removed large numbers for profit seemed feasible. Local subsistence hunters, though greater in number than the commercial hunters, removed fewer turtles. While a complete ban on turtle harvest would be ineffective in most locations due to opposition from the public and subsequent noncompliance, a harvest strategy that emphasized the reduction of large-scale removal for profit offered some

opportunity for attracting public support. By allowing continued small-scale removals by subsistence hunters, the support of that numerically large constituency might be maintained. With strong public support, concerned villagers could initiate a legal means to curb market hunting.

It was also essential to recommend some completely closed zones which could provide insurance if harvest management should prove difficult to implement. Closed zones also had the potential to serve as natural restocking areas.

Some villages were interested in *Dermatemys* conservation, while others were not. One of the better-organized villages, Freetown Sibun, was interested in establishing legal restrictions for its section of the Sibun River. Residents

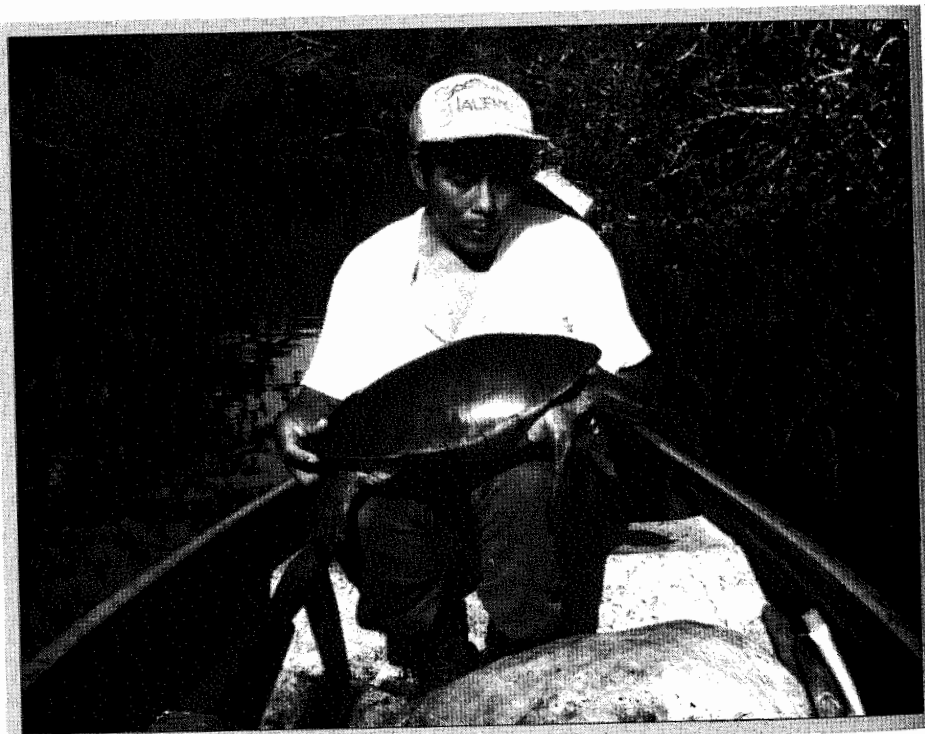


Figure 1. Atanacio "Taniko" Soler with typical adult female *Dermatemys*, lower Río Bravo, Belize.

were concerned about the decline of turtles in their area and were resentful that non-resident market hunters were removing turtles to sell elsewhere. Other villages expressed the same concerns, but were less well organized. Freetown Sibun subsequently submitted a request for local regulations to the Ministry of Natural Resources. That document was taken into consideration, as were my detailed recommendations for the remainder of northern Belize, when the Belize Fisheries Department drafted nationwide comprehensive legislation protecting and managing *Dermatemys mawii* in April 1993 (Statutory Instrument No. 55, 1993).

This new legislation includes year-round possession limits (which should eliminate large-scale removals without reducing small-scale use), a short closed season (1–31 May), a complete prohibition on the sale and purchase of *Derma-*

temys, and a series of protected zones in the major waterways of northern Belize, including the entire Río Bravo system, a section of the Belize River, a section of the New River Lagoon, Cox and Mucklehany lagoons, and the lower Sibun River. This includes large and small whitewater rivers, a large clearwater lagoon, darkwater lagoons, brackish lagoons, and an estuary.

Although the above describes the progress made, much remains to be accomplished. Management is a dynamic process that requires long-term commitment. Continued work with rural communities is required to increase appreciation of the uniqueness and vulnerability of *Dermatemys*, to assess compliance, and to identify need for further refinement of the regulations. Although it is essential to ensure compliance in urban meat markets, a substantial trade taking place outside those formal markets will also require monitoring. In some cases stricter regulations may be necessary. Freetown Sibun has recently expressed a desire for a complete ban on hunting of turtles in its area.

Field research on large, spatially dispersed, herbivorous turtles occupying large, deep aquatic habitats can be labor intensive and expensive, and is severely limited by funding constraints. A long-term study, comparing the population densities and structures of exploited and unexploited sections of rivers would provide a means of assessment of the efficacy of management measures, as well as information useful for the management of other turtles in other regions.

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