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No place to nest or bask: Effects of human disturbance on the nesting and basking habits of yellow-blotched map turtles (*Graptemys flavimaculata*)

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ABSTRACT

Considerable recent attention has focused on how human disturbance alters the behaviour of imperiled taxa. Data on such impacts are common for waterfowl, marine mammals, and some large game animals. However, little is known about how human disturbances affect reptiles, perhaps because most reptiles are secretive and are not commonly seen by the public. We studied the impact of human disturbances on the nesting and basking behaviour of the yellow-blotched map turtle (*Graptemys flavimaculata*) on the Pascagoula River in southeastern Mississippi, USA. We found that both nesting and basking behaviour of map turtles were altered by human recreational activities. Turtles attempting to nest commonly abandoned their attempts upon the approach of a boat and, prior to nesting, numerous individuals waited several hours near the beach without emerging. Basking turtles frequently dove into the water upon the approach of a boat and some did not return to bask. Anglers in small boats that remained in the vicinity of basking sites caused the most disturbances, whereas personal water crafts (jet skis) caused fewer disturbances. Our data suggest that interruption of nesting activities may have an especially severe impact on the viability of this population through changes in numbers of clutches females are able to lay and altering the microhabitat females select for their nests.

1. Introduction

Although habitat destruction or modification and the introduction of invasive species are generally considered to be among the most important threats to biodiversity (Foin et al., 1998), considerable attention recently has focused on the ways in which human disturbance alters the behaviour of imperiled taxa (see review in Frid and Dill, 2002) and whether such alteration leads to reduced population sizes (Gill et al., 1996; Beale and Monaghan, 2004). Studies on organisms as diverse as waterfowl (Gill et al., 1996; Rodgers and Schwikert, 2002), marine mammals (Constantine et al., 2004; King and Heinen, 2004), and large terrestrial game species (Stockwell et al., 1991) indicated that human disturbance can significantly alter feeding schedules, habitat use, and time spent nursing young. Even though the population consequences of such disturbances often are not known, changes in behaviour and habitat use concern conservation biologists and wildlife managers.

Despite the wealth of information available for birds and mammals, comparatively little is known about how human disturbances affect reptiles, perhaps because most reptiles

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are secretive and are not commonly seen by the public (but see Johnson et al., 1996; Hecnar and M.'Closkey, 1988; Parent and Weatherhead, 2000). However, in many aquatic habitats, freshwater turtles are frequently seen basking and nesting, especially in river systems where human recreational activities are common. Direct harassment of basking turtles by recreational shooters ("plinking turtles") is a well-known activity in much of North America (Ernst et al., 1994) and has obvious negative impacts. The ways by which less overt disturbances affect aquatic turtles is poorly known, but given the rapid decline seen in many turtle species throughout the world (Gibbons et al., 2000), data on such impacts clearly are needed.

From 1993 to 1997, we studied the behavioural and reproductive ecology of the yellow-blotched map turtle (*Graptemys flavimaculata*) on the Pascagoula River in southeastern Mississippi, USA. This turtle underwent a severe decline in the 1980s and is currently listed as Threatened under the US Endangered Species Act of 1973, as amended. One of the major factors contributing to this decline is human disturbance, especially on sandbars where this species nests (U.S. Fish and Wildlife Service, 1991). Here, we report information on nesting and basking behaviour in this species, specifically on the impacts resulting from human disturbance. Further, we make recommendations to area managers as to how these impacts could be minimized.

2. Methods

Our research was conducted within the Ward Bayou Wildlife Management Area in a small portion of the Pascagoula River near Vancleave, Jackson County, Mississippi (Fig. 1). Two boat landings, located 5.0 km upstream and 10.6 km downstream of the study site, function as a source for human activity. We studied a 300 m section of the river, which included both a nesting beach (Beach #7) on the west bank and a basking area along the east bank (Fig. 1). The nesting beach was a sandbar approximately 50 m long by 10 m wide and about 1 m high, with low herbaceous vegetation. Across the river from the nesting beach was a steep cut bank with numerous fallen trees and branches used as basking substrates by *G. flavimaculata*. Most basking structures were separated by 1 or 2 m from the shore. A detailed description of river dimensions, annual mean discharge rates, and substrate composition can be found in Brauman (1995) and Jones (1996).

2.1. *Effects of human disturbance on nesting*

Disturbance of nesting was determined via observation from a blind (1.2 m × 1.2 m × 1.7 m) set up in one of two locations, either directly across the river from Beach #7 or on the south end of Beach #7 (Fig. 1). We conducted observations for a minimum of 4 h at a time at irregular intervals between 05:00 and 19:00 h using a 60 × 114 spotting scope with tripod, and we did not conclude until at least one hour past the last nesting event. Hourly air temperature and daily water temperature measurements were recorded to the nearest 0.1 °C using a Miller and Weber quick reading thermometer.

The numbers of nest attempts were standardized per hour of observation (unit of effort) by dividing the number of observed attempts per hour by the number of times observations were conducted during each hour. Because of the difficulty in maintaining positive identification of unmarked submerged turtles, it was often not possible to determine if a female was making her first nesting attempt, or had previously attempted nesting but abandoned her effort(s). As a result, if positive identification could not be made, it was assumed that the observation was of a new individual making her first attempt. Therefore, the number of reported females attempting to nest is likely too high, but the number of nesting attempts observed is accurate. Nesting activities were separated into six categories: pre-nest activity, locate nest site, excavate nest, lay eggs, bury nest, and return to water. Times for each activity were recorded to the nearest whole minute. During the 1998 field season, all observed disturbances from humans and the reaction of the turtles to those disturbances were documented. Date, time, type of watercraft, and purpose in the area (e.g. fishing, playing, passing through, picnic or camping) were recorded.

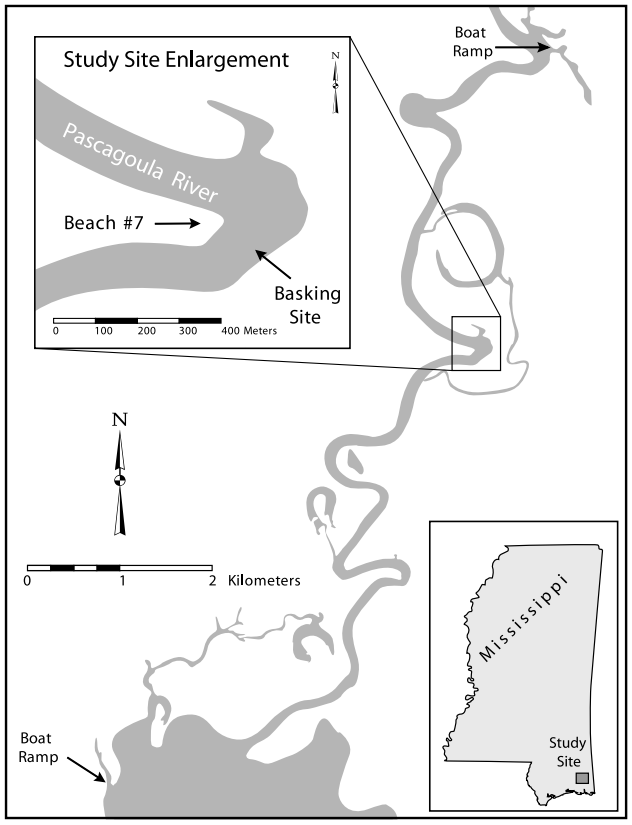

Fig. 1 – Study site on the Pascagoula River located within the Ward Bayou Wildlife management area in Jackson Co., MS.

2.2. *Effects of human disturbance on basking*

We conducted observations from 28 May 1997 to 13 July 1998, with a minimum of one day of observation per week, except for January and February 1998 when high water precluded such observations. A blind (1.2 m × 1.2 m × 1.7 m) was set up immediately before observations began, and was placed across the river from the basking logs at the edge of the woods (Fig. 1). Because of the proximity of the basking site to the nesting sandbar, disturbances to basking were the