

GAPING BEHAVIOR IN BASKING EASTERN PAINTED TURTLES¹

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ABSTRACT

Basking eastern painted turtles (*Chrysemys picta picta*) in northern Virginia were occasionally observed to gape, a behavior characterized by opening the mouth briefly and then reclosing it without directing the gesture toward another turtle in an aggressive manner. Previous investigators have suggested that this behavior has a thermoregulatory or social function. Spearman rank correlation coefficients between number of gapes per hour and water temperature (-0.008), air temperature (-0.288), mean emergences per hour (-0.305), and mean number of turtles basking per hour (-0.171) were not significantly greater than zero as predicted. Based on these data I tentatively reject earlier hypotheses relating gaping behavior to thermoregulatory and social functions. Surprisingly, the data suggest a possible negative relationship between gaping behavior and crowding at the basking site. The similarity between gaping behavior and certain other aggressive behaviors under crowded basking conditions may be responsible for this putative relationship. [J PA Acad Sci 64(2):78-80, 1990]

INTRODUCTION

Basking turtles are occasionally observed to gape (Fig. 1). This behavior, also referred to in the herpetological literature as gasping, panting, or yawning, is characterized by opening the mouth briefly and then reclosing it without directing the gesture toward another turtle (Bury, et al. 1979). This behavior differs from the open mouth gesture discussed by Bury and Wolfheim (1973), Bury, et al. (1979), and Lovich (1988) since the latter is always directed at another turtle in an aggressive manner.

Although basking behavior has been the subject of numerous investigations (Boyer 1965; Auth 1975; Crawford, et al. 1983; and Spotila, et al. 1984), the function of gaping remains unclear. Since most observations of gaping that have been published occurred when turtles

were involuntarily exposed to high temperatures, it was assumed to be primarily thermoregulatory and an attempt by the animal to lower body temperature (Legler 1960; Boyer 1965; Hutchison, et al. 1966; Pritchard and Greenwood 1968; Moll and Legler 1971). Moll and Legler (1971) stated that gaping in turtles probably serves the same thermoregulatory function as panting does in mammals. In spite of their conjecture, gaping is generally considered to be an inefficient cooling mechanism for turtles (Bury and Wolfheim 1973; Moll and Legler 1971; and Bartholomew 1982). Gaping has also been described as a social behavior (Bury and Wolfheim 1973). In their study, Bury and Wolfheim reported that gaping (including open mouth gestures) occurred frequently during behavioral interactions among basking Pacific pond turtles (*Clemmys marmorata*).

The primary objective of this study was to determine if the frequency of gaping events observed in a group of basking *Chrysemys picta picta* increased at higher environmental temperatures. Since gaping has also been described as a social behavior (Bury and Wolfheim 1973), another objective was to determine if the number of turtles occupying a basking site influenced the rate of gaping. The following null hypotheses were tested:

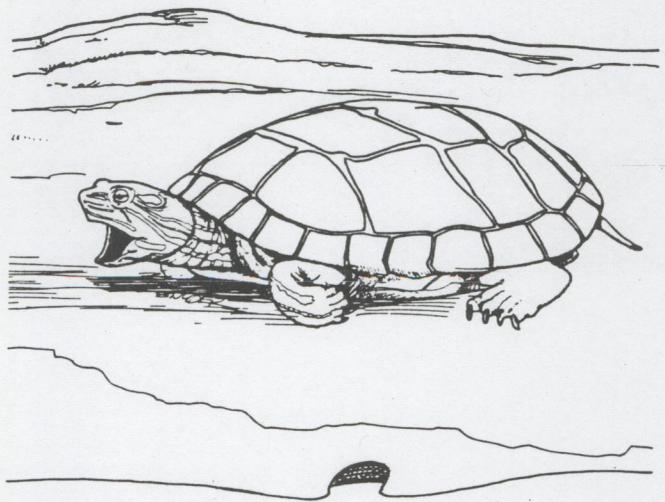


FIGURE 1. Gaping behavior in the eastern painted turtle (*Chrysemys picta picta*). Duration of a gape usually lasts two seconds or less.

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H_{O1}—there is no significant correlation between gaping behavior and environmental temperatures.

H_{O2}—there is no significant correlation between gaping behavior and the density of basking turtles.

My predictions were, 1) if gaping serves a thermoregulatory function, then the rate of gaping should increase with increasing air and water temperatures, and 2) if gaping occurs in a social context, then the rate of gaping should increase with increased crowding at the basking site. The second prediction is based on the assumption that social behavior in basking turtles is density dependent (Lovich 1988).

MATERIALS AND METHODS

The study was conducted at Mason Neck National Wildlife Refuge in Fairfax County, Virginia from May through September of 1982 and 1983 as part of a larger study of basking behavior (Lovich 1988). Observations were made of basking turtles in a large marsh adjacent to the Potomac River with a Bausch and Lomb 60 × spotting telescope. Gaping behavior was measured as the number of gapes per hour. The number of turtles basking and emerging per hour at a single basking site (22 × 600 cm log) was calculated as the average of four consecutive 15 minute counts to compensate for frequent submergences and re-emergences of individual turtles. Air and water temperatures near my observation point were measured hourly with a hand held thermometer. Relationships between gaping frequency and other variables were tested using Spearman rank correlation coefficients (Zar 1984). The level of statistical significance was set at $\alpha \leq 0.01$ to maintain an experimentwise error rate of $\alpha = 0.05$ (Sokal and Rohlf 1981).

RESULTS

During 98.5 hours of observation, 107 instances of gaping were observed (Table 1). Duration of each gaping episode was usually two seconds or less. Gaping was observed at all times of the day and at any stage of basking (see Auth, 1975), but appeared to be most frequent after turtles had basked for relatively long periods of time. Gaping was observed at air temperatures and water

temperatures ranging from 21-31°C and 22-31°C respectively. Some turtles gaped immediately after emerging. Spearman rank correlation coefficients between the number of gapes observed per hour and other variables are as follows: water temperature, -0.008; air temperature, -0.288; mean emergences per hour, -0.305; and mean number of turtles basking per hour, -0.171. None of these correlations are significantly greater than zero ($P > 0.01$).

DISCUSSION

A previous study has indicated that eastern painted turtles gape when air temperatures exceed 40°C (Ernst 1972). The results of my analysis indicate a statistically insignificant correlation between gaping and environmental temperatures less than 40°C. Groups of basking *Chrysemys p. picta* do not increase the rate of gaping at higher air and water temperatures, within the range observed in this study. Additionally, the direction of correlation is opposite to that predicted. While my data do not necessarily imply that individual painted turtles gape at a constant rate as their body temperature increases, it does cast some doubt on the proposed thermoregulatory function of gaping in this species. In support of this contention, studies with crocodylians indicate that gaping has little or no effect in lowering body temperatures (Diefenbach 1975; Spotila et al. 1977). The small surface-to-volume ratio of turtles compared with the amount of evaporative area offered by the buccal mucosa would render cooling by gaping as inefficient at best (Moll and Legler 1971). It seems logical to assume that a basking turtle stressed by high temperature would simply dive into the water to lower its body temperature (Moll and Legler 1971). Evidence in support of this was observed during the present study. Painted turtles that had basked for long periods of time frequently submerged momentarily and then immediately re-emerged.

I found insufficient evidence to conclude that the correlations between gaping behavior and variables related to crowding at the basking site are significantly different from zero. Thus, gaping does not appear to have a social function either as Bury and Wolfheim (1973) have suggested. Whereas open mouth gestures are stimulated by greater densities of basking turtles, or high rates of emergence (Bury and Wolfheim 1973; Bury et al. 1979; Lovich 1988), gaping is not. As with environmental temperatures, the direction of correlation is opposite to that predicted. The high negative correlation between gapes per hour and mean emergences per hour (-0.305 ; $0.025 > P > 0.01$) is worth noting. Lovich (1988) reported that the number of open mouth gestures (OMG's) exhibited by basking *C. picta* was positively correlated with the frequency of emergences. In addition, basking turtles avoided potentially aggressive interactions. The similarity between OMG's and gaping under crowded conditions may lead to signal misinterpretation among basking

TABLE 1. Comparison of gaping activity with other variables for *Chrysemys picta picta* (this study) and *Chrysemys picta bellii* (Bury et al., 1979).

Variable	Reference	
	This study	Bury et al. (1979)
Gapes observed	107	44
Gapes/hour	1.08	1.63
Gapes/emerging turtle	0.10	0.04
Gapes/basking turtle	0.21	0.09

turtles. Because of this possibility, the frequency of gaping may decrease with crowding at a basking site. Preliminary support for this hypothesis is suggested by data summarized in Table 1. Bury et al. (1979) observed that the number of gapes per emerging and basking turtle was approximately one-half of what I observed. Basking sites were limited at his study area (R.B. Bury, pers. comm.) and thus more crowded relative to those at Mason Neck in Virginia.

The primary function of gaping is not clearly established. I found no support for the thermoregulatory or social functions previously suggested for this behavior. However, experiments conducted under controlled conditions may reveal that the rate of gaping does in fact increase at temperatures higher than those recorded during my study. It is also possible that turtles respond to gaping signals from conspecifics with subtle behaviors that I did not detect. Additional detailed observations will be required to confirm this possibility. Other explanations, not tested in this study, have been offered. Moll and Legler (1971) suggested that perhaps it was important in drying the horny sheaths of the jaws and the cornified epithelium at the tip and sides of the tongue to promote ecdysis of these parts. Drying may also be important in the control of oral parasites (Diefenbach 1975). These potential explanations should be tested in future studies.

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