Thermal Regulation of the American alligator (*Alligator mississippiensis*) in the Everglades

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In an attempt to rectify a century of hydrologic alterations to the everglades, a massive restoration effort is underway. Restoration managers are using a spatially explicit, individually-based model, the Across Trophic Level System Simulation (ATLSS), to predict the response of native flora and fauna, including the American alligator (*Alligator mississippiensis*), to alternative water management scenarios. Despite the prominence of the alligator within the ecosystem and elsewhere within its range, many important biological and ecological questions about the species remain unanswered. It is not only a top consumer and a keystone species in the Everglades, but also physically influences the system through construction and maintenance of gator holes and trails. The Everglades is believed to be a harsh environment for alligators and Everglades alligators' weight, maximum length, and sexual maturity are less than elsewhere. A combination of low food availability and high temperatures are currently suspected as the reason for this poor condition.

We initiated a study on thermoregulation, and body temperature patterns of alligators both in Shark Slough in Everglades National Park and in Water Conservation Area 3A North. A total of 66 alligators were captured and surgically implanted with radio-transmitters. A subset of 29 of these also were implanted with disk shaped temperature data loggers (diameter = 3.0 cm and thickness = 1.5 cm). Each device was capable of recording 7944 temperature readings from a range of -5 to 37° C with an accuracy of +/- 0.2° C. Data loggers were programmed to record core body temperature (T_b) every 72 minutes, allowing 396 days of continuous data collection. . Environmental temperatures were recorded in the marsh near the home ranges of implanted alligators. A total of 15 functioning data loggers were retrieved from animals recaptured after one year.

Alligators exhibited distinct patterns of T_b within the annual temperature cycle. T_b was more variable in spring than in any other season. Importantly, the normally limited prey base in the Everglades becomes concentrated in pools during the dry season, which peaks in spring. The increased activity of spring reflects the importance of this season in the ecology of alligators in the Everglades. The high temperatures of summer increase the metabolic cost to alligators in the Everglades. When combined with low food availability resulting from the high water levels of the renewed wet season, summer appears to be a time of negative energy balance. Fall T_bs declined with the declining ambient temperatures. Alligators were apparently avoiding metabolically active temperatures in fall since prey is dispersed. Although low T_bs were maintained during the winter

months, they were occasionally raised to activity levels. These heating events were not synchronized as would be expected if environmental factors alone were inducing basking behavior. We speculate higher T_bs in winter may be necessary for excretion of metabolic wastes. Everglades' alligators are adapted to fluctuating hydropatterns. While low water levels decrease their ability to thermoregulate, they also concentrate prey in an otherwise nutrient poor system. Without a food base to support the resulting high metabolic rate, a high stable T_b would be detrimental.

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