Detection of American alligators in isolated, seasonal wetlands

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Abstract
Although the American alligator has been well-studied in coastal marshes and large reservoirs, very few studies have taken place in the isolated, seasonal wetlands that occur within the inland portion of the alligator’s range. Understanding alligator populations in these systems is important because, although they are subject to the same management strategies and regulations as their more well-studied counterparts, they may have markedly different population dynamics and densities. Additionally, understanding patterns of alligator presence in isolated, seasonal wetlands is important to understanding how alligators may affect these critical habitats as ecosystem engineers. However, survey methods designed for large, open water systems may not work in these small, vegetated wetlands, and their efficacy in this habitat has yet to be documented. We conducted eyeshine surveys for alligators along walking transects through isolated, seasonal wetlands in southwest Georgia. We used a double-observer method with a Huggins closed capture analysis to determine the detection probability of this method, to model the effects of observer and wetland type on that parameter and to estimate abundance. We found that detection probability for eyeshine surveys under the best-supported model was 57%, between 2 and 5 times higher than documented in other habitats. We then compared eyeshine surveys with systematic trapping to ascertain which components of the population were more likely to be detected by each method. Both methods were effective in detecting a range of size classes in the wetlands; however, the two methods were most effective when used in concert. Wildlife biologists studying population trends and establishing harvest quotas can use this information to design surveys in the inland portion of the alligator’s range.

Key words
Alligator mississippiensis, crocodilian populations, detection probability, double-observer eyeshine survey, Huggins closed capture design, seasonal wetland.
Introduction

The American alligator (*Alligator mississippiensis*) is among the most frequently studied vertebrates in North America. However, these studies have been conducted almost exclusively in coastal marshes (McNease and Joanen, 1974; Mazzotti and Brandt, 1994; Wilkinson and Rhodes, 1997) and large reservoirs (Ruckel and Steele, 1984; Brandt, 1991). Although these habitats contain relatively dense populations of alligators, they constitute a small fraction of the total native range, which extends from central Texas to coastal North Carolina, and as far inland as Oklahoma (Conant and Collins, 1998). Despite evidence that inland populations differ from coastal populations in their ecology and population dynamics (Hayesodum et al., 1993; Ryberg et al., 2002; Lutterschmidt and Wasko, 2006), these populations have yet to be well-studied.

Understanding alligator populations in the isolated, seasonal wetlands that occur within the inland portion of their range is critical for two main reasons. First, statewide management plans are based on monitoring and research conducted primarily in coastal marshes and large reservoirs, where survey logistics are easier and alligator densities are highest. In Georgia, management plans are then applied equally across all habitats within a harvestable region (G. Waters, pers. comm.). If alligator populations in isolated, seasonal wetlands have lower abundance levels and distinctly different population dynamics than those in large reservoirs or marshes, then applying such broad-scale management strategies may lead to an over-harvesting of these populations (Ryberg et al., 2002). Second, the seasonal wetlands of the coastal plain constitute unique communities that provide critical habitat for a variety of threatened and endangered plants and animals (Gibbons, 2003; Semlitsch and Bodie, 2003; Sharitz, 2003). Because these wetlands dry nearly every year, they provide a low-predator environment for aquatic invertebrates and larval amphibians and are often important amphibian breeding sites. They are also used by a number of reptiles, as well as a suite of birds and some mammals, for foraging and habitat (Burke and Gibbons, 1995; Naugle et al., 2001; Roe et al., 2004). As alligators are large, aquatic predators known to heavily manipulate their environment through the construction of nest mounds and burrows (McIlhenny, 1935; Jones et al., 1994; Palmer and Mazzotti, 2004), their presence may play an important role in the dynamics of these small communities.

To obtain data on the presence and abundance of alligators in these systems, appropriate survey methods are required. However, the methods traditionally used for surveying and sampling populations are specifically designed for the large, open-water systems in which most historic studies have been conducted. Aerial nest counts, which are commonly used in coastal marshes, are inadequate in inland sites with heavy vegetative cover (Hayesodum et al., 1993). Eyeshine surveys, the most common method used for surveying alligator populations, are generally conducted in open water from a boat, which gives the observer the advantage of height, for increased visibility, and speed, to cover more ground. However isolated, seasonal wetlands are typically too shallow and vegetated to allow the use of wa-