Determining the Size of American Alligators Using Hind-foot Track Length

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Abstract: Size distribution information is useful for crocodilian management, but can be hard to obtain. Indirect and less costly demographic inferences made from track measurements may be valuable for management decisions. We related hind-foot lengths (HF) with total length (TL) to determine if we could indirectly assess alligator size using track length. Regression showed that HF was an excellent predictor ($F_{1,246}=15722.9$, $R^2=0.98$, $P<0.01$) of TL and track length was an exceptional predictor of HF ($F_{1,14}=7520.3$, $R^2=1.00$, $P<0.01$). The correlation between track length and HF length also was significant ($N=15$, $r=0.99$, $P<0.01$). Thus, alligator size can be accurately estimated from measures of track length at sites where capture and direct measurement is impractical.

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 54:337 – 340

Most techniques used to estimate size of crocodilians require that the animals be directly observed. For example, size of crocodilians can be estimated based on the relationship between total length and snout length and assessed during night light counts (Chabreck 1966, Murphy 1977, Woodward and Marion 1978, Messel et al. 1981, Webb et al. 1983, Taylor and Neal 1984, Brandt 1989). Size class estimates also have been made from direct observations of basking alligators (*Alligator mississippiensis,* Thompson and Gidden 1972) and photographs (Choquenot and Webb 1987, Stewart 1988).

Platt et al. (1990) determined the relationship between hind-foot length and snout-vent length of 39 female alligators harvested in southeastern Louisiana and the relationship between hind-foot length and track length from five captive juvenile alligators. Platt et al. (1990) found that hind-foot track length did not differ from actual hind-foot length for alligators in southeastern Louisiana and that hind-foot length

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was a good predictor (r^2=0.77) of female alligator snout-vent length. However, this research involved small alligators (TL range=48.9–57.5 cm); accuracy may differ for larger individuals. We identified the relationship of hind-foot length with body length measurements of alligators in coastal South Carolina.

Funding was provided by the Yawkey Foundation and the South Carolina Department of Natural Resources. S. E. Daves, J. H. Dozier, A. G. Dupree, B. K. Harmon, C. L. Rhodes, W. E. Rhodes, M. D. Spinks, C. C. Wilkinson, and M. M. Wilkinson provided field assistance in capturing alligators. S. L. Dodd, P. E. Moler, and A. R. Woodward commented on the manuscript.

Methods

During May–September 1993 and May 1994, we captured and released alligators as part of several studies (Rhodes and Wilkinson 1994, Wilkinson and Rhodes 1997) on the Santee River Delta of coastal South Carolina. Dorsal total length (TL) was measured to the nearest 0.1 cm. Sex also was recorded (Chabreck 1966). Hind-foot length (HF) was measured to the nearest 0.1 cm from the first single extended scute posterior to the heel to the anterior end of the longest toe (3rd digit), not including the nail. Hind-foot track lengths were measured to the nearest 0.1 cm at capture sites when clear tracks were present and associated with HF lengths of captured animals. Animals were grouped by sex and size [≥121 cm TL (harvestable), <121 cm TL (juveniles)] based on the minimum size at harvest throughout the southeastern United States. Linear regression was used to explore the relationships between body length measurements, hind-foot length, and track length (SAS Inst. 1988). Data for both sexes and size classes were combined after initial model fitting and comparisons yielded no difference in relationships of body length and HF between sexes ($F_{1,243}$=0.22, P=0.64) and size classes ($F_{1,243}$=0.86, P=0.36).

Results and Discussion

Captured alligators (N=248) comprised 132 males and 116 females, 162 of which were ≥121 cm (Table 1). Total length ranged from 31.3–382.8 cm. Due to

Table 1. Means (cm) and standard errors for morphological measures of South Carolina alligators.

			Total length		Hind-foot length	
Group	Sex	N	$\bar{x}$	SE	$\bar{x}$	SE
Harvestable	Both	162	231.1	7.8	20.0	2.2
Harvestable	F	80	222.7	4.8	19.4	0.4
Harvestable	M	82	239.2	8.2	20.6	0.7
Juvenile	Both	86	67.6	4.9	6.3	1.5
Juvenile	F	52	69.2	3.6	6.4	0.3
Juvenile	M	34	65.0	3.7	6.1	0.4
Both	Both	248	174.4	9.7	15.3	2.8

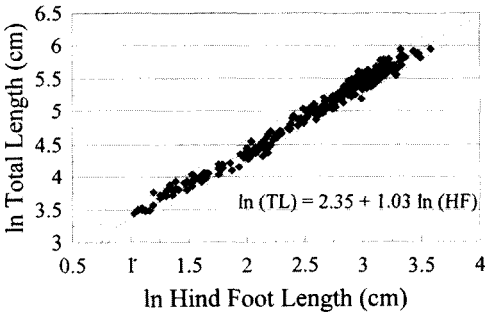

Figure 1. Loglinear regression of total length (ln) on hind-foot length (ln) and 95% confidence limits (dashed lines) for 248 alligators captured in coastal South Carolina during 1993–1994.

heterogeneity of variances in measurements among alligators <121 cm and ≥121 cm, a loglinear model ($F_{1,246}=15722.9$, $R^2=0.98$, $P<0.01$, Fig. 1) for TL provided the best fit to our field measurements:

$$\ln (TL)=2.35+1.03 \ln (HF)$$

Track length was an excellent predictor of HF length ($F_{1,14}=7520.3$, $R^2=1.00$, $P<0.01$) for harvestable animals (TL range=137.2–350.5 cm). Therefore, HF and track length could be used interchangeably in the above equation.

Alligator tracks differ very little from actual foot size in experimental situations (Platt et al. 1990) and in our field observations. This method can be valuable in estimating size of alligators that cannot be observed directly. Female alligators routinely leave tracks around their nest sites (P. M. Wilkinson, pers. observ.) but require much effort to capture and measure directly. The relationship between HF length and body length can be used to accurately estimate length of alligators at most sites where capture and direct measurement is impractical. Additionally, capture operations that target alligators of particular size using passive traps such as the walk through snare design (Wilkinson 1994) would be enhanced where HF track length can direct efforts toward individuals of specific size.

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