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A RECENT SURVEY OF THE AMERICAN CROCODILE IN TURNEFFE ATOLL, BELIZE. A countrywide survey of the American crocodile (*Crocodylus acutus*) in Belize was conducted from July 1996 to October 1997 (Platt and Thorbjarnarson, 1997, 2000a and b). Fewer than 1500 non-hatchling *C. acutus* are currently believed to occur in Belize. Turneffe Atoll harbors the largest population and highest concentration of nesting activity anywhere in Belize (Platt and Thorbjarnarson 2000a). An estimated 200-300 non-hatchling *C. acutus* inhabit the atoll, including 15-25 breeding females, and this population is thought to play a vital role in regional metapopulation dynamics. However, the conservation status of the Turneffe Atoll population is considered tenuous because reproduction is dependent on beach ridge habitats that are increasingly threatened by development (Platt and Thorbjarnarson 1997, 2000a,b). During June-July 2002, I worked with Oceanic Society volunteers to assess the current status of *C. acutus* in the Turneffe Atoll and make recommendations for a long-term conservation and monitoring program. Significantly, this is the first such investigation conducted in the atoll since the survey of 1996-97.

Crocodile nesting: We searched known crocodile nesting areas on Northern, Blackbird, and Deadmans Cays for recently hatched nests. The site on Northern Cay (17° 29.76' N; 87° 47.02' W) is the most important nesting beach in the entire coastal zone of Belize. It consists of a high sand ridge adjacent to a shallow lagoon that provides excellent nursery habitat for hatchlings and undoubtedly enhances neonate survival (Platt and Thorbjarnarson 2000b). Seven to 10 clutches were deposited annually on this beach from 1994 to 1997 (Table 1). In July 2002 we found six recently hatched nests on Northern Cay that had been excavated by female crocodiles. The nesting area was greatly modified by Hurricane Keith in 2000; considerable beach erosion was evident and much of the tree canopy was damaged, resulting in a profusion of understory vegetation that may limit sites available for crocodile nesting. However, tidal

discourages crocodile nesting. Although some suitable nest sites remain, we found only a single nest at the extreme northern end of the ridge (17° 20.602'N; 87° 47.917'W).

In addition to known nesting sites, we also searched beaches along the eastern shore of southern Calabash Cay. These beaches are excellent habitat, but no evidence of nesting was found here in previous surveys. During the current survey we encountered a pod of 12 to 15 neonates while conducting a spotlight survey of Bull Bay, and found a freshly excavated nest and an old nest, probably from 2001, the following day (17°15.703' N; 87° 50.185' W).

In summary, we found eight recent (2002) nests during the current survey, considerably fewer than noted in our previous investigation (Table 1). The reason for this apparent decline in nesting activity is unclear. It is doubtful that nests were overlooked in 2002 as the location of nesting beaches are well known, these sites were thoroughly searched, and nests are conspicuous after being excavated by the female. The decline in nesting activity may indicate a population decline, but

Table 1. Number of American crocodile nests found at nesting beaches in the Turneffe Atoll. Data from 1994-1997 in Platt & Thorbjarnarson (1997). Note that 1995 data are incomplete (NS = not searched).

Location	1994	1995	1996	1997	2002
Blackbird Cay (east)	0	NS	5	3	1
Blackbird Cay (west)	2	1	1	2	0
Deadmans Cay	1	1	0	0	0
Northern Cay	8	NS	7	10	6
Calabash Cay	0	NS	0	0	1
Total	11	2	13	15	8

given the lack of data from 1998-2001, speculating on population trends is somewhat premature, although the need for additional monitoring is clearly obvious. The fate of *C. acutus* in the Turneffe Atoll is closely linked to the fate of the few remaining nesting beaches and these sites should be stringently protected from any form of development.

overwash also deposited a large amount of sand at the eastern end of the lagoon, which is now being used for nesting.

Two nesting sites were previously identified on the eastern shore of Blackbird Cay (Platt and Thorbjarnarson 1997). The first site is a partially cleared beach ridge approximately 100 m north of Blackbird Resort. We found a well-used crocodile trail traversing the beach and an old nest (2001?) containing several eggshells, but no evidence of recent nesting activity, although the site remains suitable nesting habitat. A second and more significant nesting area is located approximately 3 km north of Blackbird Resort. This site consists of an elevated beach ridge extending about 1.5 km along the shoreline. Much of the vegetation on the beach ridge was cleared in 1995, creating excellent nesting habitat. We found most of the ridge is now overgrown with dense vegetation that probably

Spotlight surveys: We conducted spotlight surveys along the eastern and western shores of Blackbird Cay, the western shore of northern Calabash Cay, and the eastern and western shores of southern Calabash Cay. Survey routes are described in Platt and Thorbjarnarson (1997) and Platt (2002). A total of 49 crocodiles were encountered along 40.1 km of survey route (encounter rate = 1.2/km) (Table 2). This encounter rate is somewhat higher than the previously reported rate of 0.9/km (Platt and Thorbjarnarson, 1997), but results of the 2002 survey were undoubtedly skewed by conducting spotlight counts in areas known to harbor crocodiles. Encounter rates along individual routes were similar to previous surveys. Because of the variability inherent in spotlight counts, long-term monitoring will be required to detect population changes.

Table 2. Results of spotlight surveys conducted in the Turneffe Atoll (June-July 2002). Data from Calabash Cay/Bull Bay does not include pod of hatchlings encountered during the survey.

Location	Date	Crocodiles observed	Kilometers surveyed	Encounter rate (crocodiles/km)
Blackbird Cay (Soldier Bight)	30 June	4	4.7	0.8
Blackbird Cay (eastern)	1 July	11	4.1	2.6
Calabash Cay (northern)	2 July	2	2.1	0.9
Blackbird Cay (western)	3 July	7	11.5	0.6
Blackbird Cay (eastern)	5 July	15	4.1	3.6
Blackbird Cay (Soldier Bight)	8 July	2	4.7	0.4
Calabash Cay/Bull Bay	12 July	8	8.9	0.8
Total		49	40.1	

Crocodiles observed during spotlight surveys were classified as juveniles (total length [TL] = 30-90 cm), subadults (TL = 90-180 cm), adults (TL > 180 cm), or "eyeshine only" (EO). Of the 49 crocodiles observed (excluding hatchlings), 1 (2.0%) was classified as a juvenile, 17 (34.6 %) as subadults, 15 (30.6%) as adults, and 16 (32.6%) as EO. The high percentage of subadults and adults encountered is probably due in part to sampling bias; juveniles remain concealed in mangroves and therefore escape detection during spotlight surveys (Platt and Thorbjarnarson 2000a).

We captured and tagged 12 crocodiles ranging in size from 50.1 to 212.0 cm TL during the 2002 survey. A subadult crocodile captured on 1 July 2002 along the eastern shore of Blackbird Cay was originally captured in the same area on 26 November 1996. This individual measured 97.5 cm when first captured and 130.0 cm when recaptured, having grown only 32.5 cm in approximately 5.5 years. While conclusions based on the growth rate of a single animal are tentative, low growth rates could have important demographic consequences for *C. acutus* in the Turneffe Atoll. Because juvenile crocodiles are most vulnerable to predation and osmotic stress, rapid growth early in life is vital to minimize the time spent in the smaller size classes. If growth rates are excessively slow, juveniles will remain vulnerable for much longer periods and a concomitant decrease in survival can be expected.

Recommendations:

1. Establish permanent transects for spotlight surveys. These should preferably follow previous survey routes to allow direct

comparison of encounter rates and detect population changes.

2. Monitor nesting beaches to determine annual nesting effort in the Turneffe Atoll. Annual nesting effort is an extremely sensitive indicator of population trends. Additionally, suitable nesting habitat on other cays should be searched each year. Searches are best conducted shortly after hatchling emergence in early July when freshly excavated nests are most obvious.

3. Clear vegetation from nesting beaches on Blackbird and Northern Cays to provide open microsites for nest construction. This work should be conducted outside of the reproductive period (mid-February through early July) to avoid possible disturbance of nesting females.

4. Continue capture and tagging of crocodiles. The crocodiles marked in June-July 2002 complement the ninety crocodiles tagged during our earlier survey (Platt and Thorbjarnarson 1997). Recaptures will generate important data on long-term growth, survival, and population size.

5. Monitor *C. acutus* nesting on Northern Cay, Lighthouse Atoll. A small reproducing population of American crocodiles occurs on the cay (Platt et al. 1999), and nest sites are readily accessible and warrant monitoring.

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