Nesting ecology of west african dwarf crocodile

Environment, Animals

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Osteolaemus tetraspis experiences rapid population declines throughout its range due to anthropogenic related disturbances. Conservation of this species is complicated by high paucity of data especially on its nesting ecology. The current study investigated the temperature dynamics of O. tetraspis natural nest incubation and a dummy nest (artificial nest constructed by the researcher), fecundity and nest attendance and hatchling care. Temperature dynamics were investigated using Hobo tidbits® data loggers. Fecundity was assessed based on clutch size, nesting and hatching success. Nest attendance and hatchling care were investigated through direct field observations and the use of camera traps. The study did not detect any relationship between nest incubation temperature and ambient temperature. Further, range of temperature in the dummy nest was significantly lower than the natural nest. The nesting success rate, mean clutch size and mean hatching rate were 75%, 7. 8 ± 2. 5 and 79. 64 ± 39. 45% respectively. Mothers did not respond to distress calls of hatchlings when hand captured. The result suggests that dwarf crocodile incubation temperatures are independent of ambient temperature.

Although the dummy nest experiment was hindered by a lack of replicates, the preliminary result indicates it may not be a suitable surrogate for monitoring O. tetraspis natural incubation temperature. The small mean clutch size recorded is congruent with reports that O. tetraspis has the smallest clutch reported for any crocodile clutch size. With regards to maternal response, it could be that O. tetraspis simply do not respond to distress calls of hatchlings or mothers calculate the risk involve before responding. This study has provided the first in-situ quantitative data on breeding ecology for this species, which should lay a foundation for conservation breeding efforts and related management decisions. Future studies should employ bioacoustics and camera traps which eliminate the bias of human presence to assess maternal response to hatchling distress call. It will also be interesting for future studies to build upon the dummy nest experiment by conducting studies with replicates.

Crocodilians, which comprises crocodiles, alligators, caimans and gharials are unique aquatic animals that can be found throughout the tropical and subtropical regions (Grigg and Kirschner, 2015). Compared to other taxa (like birds and butterflies to mention a few), crocodilians are less diverse with a total of 24 extant species worldwide (Martin, 2008), though new additional species are being described from recent molecular studies. Crocodiles play important roles in the aquatic ecosystem through selective feeding of fish, nutrient recycling as well as creation and maintenance of burrows that harbour many species including fish, frogs and snakes during drought (Mazzotti et al., 2008; Ross 1998). From the conservation point of view, crocodiles have been used as flagship species to secure the protection of various aquatic ecosystems around the world including Cuba and the Philippines (Shirley, 2007). Despite this, some species of crocodiles have been subject to heavy commercial exploitation, habitat loss and persecution (Shirley, 2007).

West Africa is home to three species of crocodiles, the West African slender-snouted crocodile (Mecistops cataphractus), West African crocodile (Crocodylus suchus) and West African dwarf crocodile, currently assigned to Osteoleamus tetraspis, all of which are native to Ghana (Shirley et al., 2009). Unfortunately, crocodile research and conservation has not received much attention in West Africa (Shirley et al., 2009). Consequently, the West African species are regarded as the least known crocodilians in the world with inadequate knowledge about their basic ecology and population status (Shirley, 2007). Crocodiles of West Africa, and Ghana in particular, are faced with threats ranging from hunting pressure and direct persecution to habitat destruction and modification (Shirley et al., 2009).

Among the three species, O. tetraspis is believed to be the most common and widely distributed in Ghana. However, an abundant population of the species is yet to be discovered in the country (Shirley and Oduro, 2007). O. tetraspis is also the most heavily hunted crocodile in Ghana because locals perceived to be less dangerous and easier to capture than the larger crocodiles. Recent studies and information gathered from local hunters indicate that O. tetraspis is experiencing rapid population decline and it is becoming increasingly rare throughout its range in Ghana (E. Amoah, unpubl data; pers. coms). The current status of O. tetraspis in Ghana requires detailed ecological information to adequately respond to its threats. However, the observed low abundance of the species across its ranges make such ecological studies challenging. Chirehin is a village in the Brong Ahafo Region of Ghana where the species is wholly protected by traditional belief and treated as a river god (Nana Owusu Gyan II pers. coms). Consequently, there is an abundant population of O. tetraspis in the area and is probably the most significant population discovered in the whole of West Africa so far. This study investigated the nesting ecology of O. tetraspis in the Chirehin Community Land in order to enhance conservation initiatives on the species in Ghana and West Africa as a whole.

The taxonomy of dwarf crocodiles in West Africa is under revision in the light of recent genetic and morphological studies (Eaton et al. 2009; Shirley et al., 2014). Specimens from Upper Guinea biogeographic zone of West Africa, including Ghana, previously considered to be of the nominate species Osteoleamus tetraspis are now thought to represent a distinct evolutionary lineage of specific status (still unnamed). Additionally, recent studies validate a distinct species of the Congo basin, Osteoleamus osbornii. In this thesis the name Osteoleamus tetraspis/O. tetraspis is used throughout, pending taxonomic change. The African Dwarf crocodile (O. tetraspis sensu latu) is classified as Vulnerable by the IUCN Red List but the pending separation of the species into three clades with differing status is likely and the West African species may warrant Endangered status due to extensive hunting and habitat loss-related population declines (M. Shirley, pers. comm.). Despite its threatened status, the ecology of O. tetraspis is poorly known and it is considered one of the least studied crocodilians in the world

(Eaton, 2010). Specifically, there is a notable paucity of information on the nesting ecology of O. tetraspis with work limited to observations in Côte-d’Ivoire (Waitkuwait, 1982, 1989). Although these studies helped in providing basic information about nesting period, clutch size, and nest site selection, there is yet no data on temperature dynamics of egg incubation, fecundity, female defence and parental care. Inadequate data coupled with increasing threats from anthropogenic activities pose great challenges to long-term management of this species. Reproductive parameters such as hatching rate, clutch size and nest success greatly affect the population dynamics of wildlife species (Fuller and Sievert 2001), including crocodiles.

Additionally, in crocodiles, temperature dynamics during incubation is very important as this influences hatchling sex ratio, embryo and hatchling abnormalities, growth, and survival (Deeming, 2004; Pinal et al., 2003; Thorbjarnarson, 1997; Lang and Andrews, 1994; Ferguson and Joanen 1982). The results from this study will be the first in-situ quantitative data on breeding ecology for this species, which will not only lay the foundation for conservation breeding efforts, but will also establish baseline data from which real sustainable use decisions can be made – including harvest programmes. 1. 3 Aim This study aims to investigate nesting ecology of West African dwarf crocodile (Osteolaemus tetraspis) in the Chirehin Community Land, Ghana.

To achieve the overall aim of the study, three major objectives were set for the project:

1. Assess the temperature dynamics of Osteoleamus tetraspis natural nests incubation and dummy nest
2. Assess Osteoleamus tetraspis fecundity
3. Investigate nest attendance and hatchling care in Osteoleamus tetraspis

I hypothesized that:

- There will be no correlation between O. tetraspis nest temperature and ambient temperature
- There will be no significant variation in temperature regimes among O. tetraspis nests
- There will be significant variations in temperature regimes between O. tetraspis nest and a dummy nest
- Hatching success of O. tetraspis will exceed an average of 50%
- There will be no trade-off between clutch size and parameters (mass, width, length)
- The mean clutch size of O. tetraspis will be within the reported range of 6-13. 6
- Females will respond to distress call of hatchlings
- Frequency of visits will not vary significantly among nesting females.

Data for this study were collected from Nimprun Stream located in a village called Chirehin which is about 27 km drive from Kintampo in the Brong Ahafo region of Ghana (7˚51’30″N-7°53’0″N; 1°41’30″W-1°43’0″W) (figure 2. 1). This study area was selected over other known habitats of the O. tetraspis in Ghana because it harbours the most abundant known population in Ghana and probably the whole of West Africa (pers. obs, E. Amoah; M. Shirley, pers.

comm.). This makes it a viable location for conducting detailed studies on the breeding ecology of this rare species. Nimprun Stream is located about 1. 2 km from the Chirehin village which has a human population of over one thousand (1000). The stream is deeply embedded in local culture and all its aquatic creatures including O. tetraspis have benefitted from traditional belief that strictly prohibit their consumption. The stream has an average width of about 1. 5m.

The catchment of Nimprun Stream consists of mosaic vegetation mainly raffia palm, guinea grass and sage weed which are sparsely interspersed with forest patches. Most portions of the stream catchment are water saturated and very challenging to walk through especially during the wet seasons. Although no formal faunal assessment has been done, incidental encounters made during this study indicate that the area has rich biodiversity. So far over 30 species of birds, eight species of mammals, three species of snakes and species of monitor lizard have been recorded (Appendix A). 1. 6. 1 Land Use The main land use activity identified around the catchment of Nimprun Stream is farming. The major crops grown in the area include cashew, maize, yam, pepper and okra/okro. People have encroached on most parts of the stream bank and there is virtually no buffer left around this stream. Empty agrochemical containers are common along the banks of the stream. The area has also been subject to perennial bushfires mostly resulting from uncontrolled burning activities of farmers especially during the dry seasons.

General Description of Crocodiles

The extant 24 species of crocodilians belong to the order Crocodylia (Martin, 2008). This order comprises three families including Crocodylidae (crocodiles), Alligatoridae (alligators and caimans) and Gavialidae (gharial) (Brochu, 2003). Crocodiles mostly inhabit fresh water ecosystems like streams, rivers, wetlands, lake, ponds and many others (Martin, 2008; Shirley, 2007; Ross, 1998; Grigg and Gans, 1993; Waitkuwait, 1989), and some have adapted to occasionally staying in saline ecosystems like mangroves and estuaries (Webb et al., 2010; Martin, 2008; Mazzotti and Dunson, 1984) Crocodiles are lizard-like creatures with three major distinctive parts namely: head, body and tail. Crocodiles experience great change in size from hatchling to adult. Their body is covered by heavy leathery skin of various sizes and shapes of scales (Grigg and Gans, 1993). On the dorsal part, rectangular scales, called scutes, run in parallel rows from shoulder to tail. Layers of small bones called osteoderm lie beneath the scutes and protect the body from injury (Hoser, 2012; Grigg and Gans, 1993).

In addition to protection, osteoderms also function as solar panels during basking transferring heat from the surface to the core body (Grigg and Gans, 1993). There is substantial morphological difference in the skull and jaw of all the extant 24 species and this has an influence on the feeding habit of the species (Martin, 2008). Crocodile sensory organs such as the eyes, ears and nostril openings are well positioned high up the skull which permit them to hide their whole body under water and concurrently, breath, see and hear (Martin, 2008). This feature ease their navigation, communication and hunting activities. Crocodilians have a palatal valve which is an extension of the tongue that completely separates the oesophagus from the trachea. A feature that permits them to breathe easily even if their mouth is full of water (Hoser, 2012; Grigg and Gans, 1993).

Importance of Crocodiles

From the theoretical perspective, several reasons have been proposed for biodiversity conservation and these have been broadly grouped into instrumental and intrinsic values (van der Ploeg et al., 2011). From the instrumental value standpoint, biodiversity must reap direct benefit to human society which may take the form of fish caught from the wild, clean water, preventing erosion, providing leather among many others (Millennium Ecosystem Assessment, 2005; Balmford et al., 2002). On the other hand, intrinsic values places emphasis on the species itself irrespective of its benefit to mankind. Although crocodiles have been persecuted throughout history due to fear and misconception (Shirley, 2007; Grigg and Kirshner, 2015), their importance can never be overemphasized. The importance of crocodiles can be categorised into ecological, cultural and economic values (van der Ploeg et al., 2011).

Ecological Importance

Crocodiles are regarded as very important species in the freshwater ecosystem (Shirley, 2007; Ross, 1998). Research has revealed that crocodiles significantly contribute to fish yield when present in a river (Aust, 2009). Crocodiles create and maintain ponds or burrows which serve as refuge for fish, snakes, frogs and other aquatic animals during drought

(Mazzotti et al., 2008). Crocodiles promote the common health of fish stock by selectively consuming higher proportion of ailing fish than healthy fish. They also help check balances in the population in aquatic ecosystem by preying on the most common fish. Crocodile droppings are known to be important source of nutrition for fish (van der Ploeg, 2011; Glen et al., 2007; Leslie and Spotila, 2001).