

PROPOSAL FOR A PHOTOGRAPHIC METHOD FOR SIZE ESTIMATES OF CROCODYLIANS

Recently, Magnusson (1983) summarized the advantages and disadvantages of visual estimates of size of crocodilians. His experiments showed that inexperienced observers could not accurately estimate the lengths of pieces of cord whose sizes were comparable to those of crocodilian heads under field conditions. However, he did conclude that experienced observers are able to use a series of clues that enable fairly accurate size estimates to be made with some species.

If an observer can get close enough to a crocodilian to make a visual estimate of the length of a crocodilian's head, then they are close enough to take a photograph. An electronic flash at night does not appear to disturb wild crocodilians and a photograph of the head often gives definitive taxonomic data and features that may be measured accurately.

In four species examined for this report, increasing size is associated with a progressive lengthening of the snout in relation to the total head length (Fig. 1). *Crocodylus intermedius* measured were captive specimens, whereas the others were wild caught.

Given that the ratio of the snout length divided by the total head length of any one species is related directly to the total size of the individual, then a photograph of a crocodilian head (when taken at right angles to the head) can be used to calculate this ratio, and thus the size of an individual. Since it is a ratio, it is a figure that is somewhat independent of the distance at which the photograph was taken.

Preliminary results show that providing the photograph is taken at right angles to the head of the animal, then the ratio calculated from a 35mm colour slide projected onto a screen is the same as the ratio obtained by direct measurement. Deviations from 90° will distort the ratio measured on a photograph, but since an observer is invariably higher than the crocodilian head to be photographed,

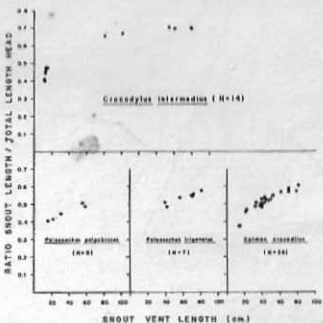


Figure 1. The Snout Length:Total Head Length Ratio as a function of the snout-vent length in four species of crocodilians.

and can thus usually see both of the eyes, the eye orbits may be used in the manner of rifle sights to orientate the observer to the required angle. When both eye orbits of the crocodilian are in line with the eye of the observer the head of the crocodilian is at a 90° angle, and therefore at the correct angle to be photographed. Adult crocodilians will often facilitate this by swimming broadside on to the observer. Failing this many individuals stay on the surface long enough for an observer, either on foot or in a boat, to move their position.

I have not attempted to fit curves to Fig. 1 because the data are incomplete, and ratios derived from photographs need to be compared with those derived from direct measurements. It can be seen from Fig. 1 that the ratio levels out when a snout-vent length of about 80 cm is reached. Thus, this technique has limited use for the adults of large species. These few data did not show any obvious differences between sexes of any one species. Webb and Messel (1978) have shown sexual dimorphism in *Crocodylus porosus* with regard to interocular width and the width of the head at the midpoint of the cranial platform, and Ayarzagüena (1980) has demonstrated that the eyes of female *Caiman crocodilus* are proportionally larger and more rounded than in the male. It may well be possible to detect such differences with photographs. I am initiating such a study, and am most interested in pooling my data with other crocodilian workers to see if calibration curves for the aforementioned species can be derived.

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STEFAN GORZULA

Fundación para la Defensa de la Naturaleza Apartado 70376 Caracas 107, Venezuela and Departamento de Ecología C.V.G. Electrificación del Caroni C.A., Apartado 62413, Caracas, Venezuela

EGG EXTRUSION AFTER BELLY PRESSING: A SIMPLE MEANS FOR THE DETERMINATION OF OVULATION IN THE SMOOTH NEWT

In a number of urodele amphibian species, females do not ovulate unless they have been inseminated (Humphrey, 1977; Tsutsui, 1931). In the roughskin newt *Taricha granulosa*, ovulation appears to be induced via a neuroendocrine reflex involving male courtship behavior, insemination and the hormone progesterone (Moore, McCormack and Swanson, 1979). This mechanism of induced ovulation can be seen as an adaptation that prevents the wastage of female parental effort resulting from oogenesis and premature ovulation in the absence of active spermatozoa.

During the course of an investigation of the breeding ecology of the smooth newt, *Triturus vulgaris*, a simple method was discovered which enables one to determine whether females have started to ovulate and, thus, have probably mated.

METHODS AND RESULTS

If a female smooth newt is held belly upwards and gentle pressure is exerted by rolling a finger along the belly in a snout-vent direction, up to 3 eggs, encapsulated in jelly coats, may be extruded from the cloaca. These eggs appear to be identical to those which females normally lay, wrapped individually in the leaves of aquatic plants.

Three experiments were conducted to determine if extruded eggs are indeed ovulated and fertilized eggs.

1. Fifty extruded eggs were collected from females in the field. These eggs were brought back to the laboratory and maintained in plastic troughs containing aged tap water. Within 3 to 4 days, developing embryos were clearly visible in 37 (74%) eggs. None of these developed as far as hatching, due to a fungal infection.

2. Five females which extruded eggs in the field were maintained in the laboratory individual troughs containing aged tap water and pieces of aquatic vegetation. Within days, all of the females had laid eggs, at inspection of the clutches revealed them to contain developing embryos.

3. Female newts captured on land as they migrated to the water (N = 5) and captured there (N = 14) had their bellies pressed and were then preserved in formalin. Upon dissection, a check was made for the presence of eggs in the oviducts. None of the females captured on land extruded eggs when pressed and none contained oviducal eggs. This result is not surprising, as smooth newt court and oviposit in water. Seven of the aquatic females extruded eggs when pressed; all of them also contained oviducal eggs. Of the 7 aquatic females which did not extrude eggs, only 2 had eggs in their oviducts.

DISCUSSION

The data presented above strongly suggest that extruded eggs are fertilized and that egg extrusion after belly pressing is a reliable indicator of ovulation in the smooth newt. Failure to elicit egg extrusion usually, but not always, indicates the absence of ovulation. Such failure may result if a female has either not been inseminated, or if she has already laid her complement of yolkeggs.

The technique of belly pressing has obvious application for the field biologist requiring simple, quick and reliable means for assessing the reproductive status of a female. It is currently being used to determine the proportion of a population of female smooth newts which are available for mating at any given time in the breeding season. Knowing this proportion, it is then possible to calculate theoretical sex ratio of the population (see Emlen and Oring, 1977), for inseminated females tend to be unresponsive to further

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