

Short Communications

Predation on tent tortoise and leopard tortoise hatchlings by the pale chanting goshawk in the Little Karoo

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Received 26 June 1991; accepted 9 September 1991

Predation by the pale chanting goshawk *Melierax canorus* on *Psammobates tentorius* and *Geochelone pardalis* hatchlings correlates with the habitat preference of these tortoise species as well as with the breeding pattern of *P. tentorius*. It is not known why the particularly abundant *Chersina angulata* was not preyed upon.

Predasie op pasuitgebroeide *Psammobates tentorius* en *Geochelone pardalis* skilpadjies deur die bleek-singvalk *Melierax canorus*, het sterk ooreengekom met die skilpaaie se habitatvoorkeure asook met *P. tentorius* se seisoenale broeipatroon. Dit is onduidelik waarom die besonder volop *Chersina angulata* nie geroof word nie.

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Aspects of the ecology of the widespread and common, but poorly known, pale chanting goshawk (*Melierax canorus*) (Steyn 1982), were investigated by means of a quantitative study of the species's diet. The study area is situated in the Little Karoo, just east of Calitzdorp (33°32'S / 21°42'E). Three veld types occur, namely Spekboomveld (SBV), Karroid Broken Veld (KBV) and Succulent Karoo (SK). These veld types lie in parallel bands, from the SBV in the north to the SK in the south (Acocks 1975). There is a reduction in the rainfall of approximately 40 mm from the wetter north to the drier south (landowners pers. comm.; annual mean = 241 mm). The study area is primarily used for ostrich farming. Although part of a much wider study of the spatial, temporal and social variation in the diet of the pale chanting goshawk, in this note we report on predation on tortoise hatchlings.

The relative abundance of tortoise species in the study area was determined by counting all observed tortoises while driving (on a motor-cycle) or walking on a circular route (73 km) through the study area. The angulate tortoise (*Chersina angulata*) occurs in highest densities in the SBV (0,36 tortoise/km), with densities then dropping off towards the KBV (0,24 tortoise/km) and SK (0,14 tortoise/km). The tent tortoise (*Psammobates tentorius*) in this census was only observed in the border regions between the KBV and SK (0,06 tortoise/km), and in casual observations in the SK, with no individuals seen in the SBV. The angulate tortoise :

tent tortoise census ratio for the total study area was 18 : 1. Leopard tortoises (*Geochelone pardalis*) were rare in the study area, and only three individuals were seen over a period of 17 months (January 1988–March 1989, September–December 1989), two in dense SBV and one in KBV.

The diet of *M. canorus* was studied by collecting pellets on a monthly basis from April 1988 to February 1989 beneath pre-selected perches. Pellets found beneath perches before the monthly collections started were labelled pre-April, and no predation date could be associated with these prey remains. The pellets were dissolved in water and the macroscopic remains visually identified. A total of 742 pellets was collected, of which 48 contained tortoise remains. Only the scutes and occasionally the limbs of tortoises were identifiable, as diurnal raptors are known to be able to digest bone (Newton 1986). Tortoise remains comprised 45% (by number) of the reptile diet of the goshawk.

Results indicate that, of the three tortoise species occurring in the study area, *P. tentorius* was preferred as prey by the goshawks. The remains of 36 tent tortoises were recovered from the pellets. This was determined by: (a) the presence of 19 first vertebral (VI) scutes (characterized by the anterior constriction in the scute where it makes contact with the small nuchal scute) in the pellets; (b) the presence in some pellets of more scutes than could be present on a single tortoise (i.e., more than five large vertebrals, more than two large abdominals, etc.). No pellet was positively determined to contain the remains of more than two tortoises.

The scutes ranged in length from 5–8 mm. There are no hatchling tent tortoises in the Port Elizabeth Museum herpetological collection, but a regression of plastron length to VI scute length was prepared from preserved material (see Appendix 1). A significant positive correlation exists ($R^2 = 0,72404$; $p < 0,001$; $df = 22$; t test) between the measurements and there is no evidence of allometric change related to differential growth. Extrapolation of the regression into the region covered by the VI scute length of prey items (5–8 mm) indicates that they originated from tortoises with plastron lengths of 16–30 mm. This corresponds to tortoises of 20–35 mm total length, which is similar to that of hatchlings (25–30 mm; Branch 1988).

Half of all *P. tentorius* hatchlings were caught by two pairs of birds occupying territories incorporating KBV and SK. The border between the KBV and SK is clearly defined (Acocks 1975) and this dividing line ran through the territories of both pairs, and therefore the source of the prey could not be attributed to a specific veld type. Out of a total of 38 reptilian prey items obtained from pellets of these pairs, 18 were tent tortoises. In the whole study area, in cases where capture month is known, tent tortoises were caught as follows: four in April, three in May, seven in June and a single record in September. Tent tortoise eggs are laid from September to January and the 'incubation' period is given as 220 days (7–8 months; Branch 1988). Therefore the eggs are expected to hatch from April to August. Although no hatchling weights have been recorded for this species, hatchlings of the closely related geometric tortoise (*Psammobates geometricus*) weigh approximately 6–8 g, and measure 35–40 mm (*P. tentorius* hatchlings measure 25–30 mm; Branch 1988). It is thus probable that tent tortoise

hatchlings will weigh approximately 5 g and that predation occurs soon after hatching. Excluding the hatchling predation of the above-mentioned pairs, five tent tortoises were caught in the Spekboomveld, six in the Karroid Broken Veld and seven in the Succulent Karoo.

Scutes of 12 leopard tortoises were found in the pellets. Seven were from pre-April pellets and the others were found in the following months: one each in February and May, two in June and one in October. Leopard tortoises may lay from 3–6 clutches comprising 6–15 eggs per season, with an incubation period of 10–15 months (Branch 1988). Hatchlings measure 40–50 mm and weigh 23–50 g (Branch 1988), and may emerge over a longer period than tent tortoises. Most leopard tortoise prey items were hatchlings with no evidence of growth on the scutes. However, at least two sets of tortoise scutes had growth rings, indicating that they came from juveniles up to 12 months of age. Under natural conditions tortoise growth is slow during the first year and juvenile weight may have only increased to 50–80 g after 12 months (Patterson, Boycott & Morgan 1989). This is possibly reaching the upper limit of prey size taken by goshawks, as ossification of the hatchling shell will have increased its protection. Seven leopard tortoise hatchlings (58%) were preyed upon in the SBV, one in the KBV, three by the two pairs on the border of the KBV and SK, and one in the SK.

The numbers of hatchling tortoises caught in the study area correlates with the abundance of the different species, except that there was no predation on the super-abundant angulate tortoise. Elsewhere, adults and juveniles of this species are readily preyed on by a variety of avian predators (see below). As the angulate tortoise prefers wetter habitats (Branch 1988), it may be that they did not breed in 1987 and 1988, both years of below average rainfall in the region (1987: 181 mm; 1988: 183 mm; mean = 241 mm) (N.B. Palmer pers. comm.).

Very little comparative quantitative data is available on predation of tortoises, and more specifically hatchlings, by birds. The black eagle (*Aquila verreauxi*) is known to take the angulate tortoise (Steyn 1984; Fraser 1985; Branch & Els 1990). Shells of five juvenile *G. pardalis*, two adult *P. tentorius*, and 53 (17 juveniles) greater padlopers (*Homopus femoralis*) were found below nests of an average of 18 pairs of black eagles between 1986–89, all in the Karoo National Park (R.A.G. Davies *in litt.*). The martial eagle (*Polemaetus bellicosus*), is also known to take *P. tentorius* (Boshoff, Palmer & Avery 1990). On Dassen Island kelp gulls (*Larus dominicanus*) preyed mainly on juvenile angulate tortoises and the absence of hatchling shells was attributed to their soft shells which can be torn apart and eaten at the capture site (Branch & Els 1990). Branch (1991) noted a record of predation on the angulate tortoise by the black-headed heron (*Ardea melanocephala*). Elsewhere there are few records of avian predation on hatchling or juvenile tortoises. In certain areas in California the common raven (*Corvus corax*), may prey heavily on juvenile desert tortoises (*Gopherus agassizi* [Anon 1989]). The common raven, like the pale chanting goshawk, is a generalist feeder (Anon 1989; G.M. unpublished records). As the above mentioned are all records of adult or juvenile predation, it is unclear how the variation in size and weight of the shell, and the habits of the various

tortoise species render them more vulnerable to different avian predators.

Given the habitat preference, calculated densities and seasonal breeding pattern of the tent tortoises, they do appear to form an important food source for the opportunistic pale chanting goshawk. However, as only three adult leopard tortoises were seen in the study area, it would appear that leopard tortoise hatchlings may suffer higher predation pressures. Compared with the hatchling tent tortoise, the larger hatchling leopard tortoise will possibly be easier to detect and will certainly provide a higher energy return.

Acknowledgements

This research was supported in part by grants (for G.M.) from the Foundation for Research Development, the Frank M. Chapman Memorial Fund (American Museum of Natural History), the Bob Blundell Memorial Scholarship, the Leslie Brown Memorial Grant, and the FitzPatrick Institute. We thank Tim Crowe, Gay Palmer, André Boshoff, Rob Davis and Ernst Beard for their constructive comments on this note.

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Appendix 1

Material examined: (PEM = Port Elizabeth Museum) *Psammobates tentorius*: PEM × 574, Abbotsbury, Graaff Reinet; PEM × 162, Farm Request, Somerset East District; PEM × 590, between Steytlerville and Willowmore; PEM × 576, Valk River, near Lake Mentz, Eastern Cape; PEM × 54, × 161, × 186, × 193 Adendorp, Graaff Reinet; PEM × 208, Farm Mayfair, Albany District; PEM × 588, Droegkloof near Klaastroom, Prince Albert District; PEM × 136, Nelspoort, Beaufort West District; PEM × 207, Fish River Valley near Fort Brown, Eastern Cape; PEM × 211, × 29, Farm Moedersonskraal, Jansenville District; PEM × 248, Carlisle Bridge, Grahamstown; PEM × 338, × 573, × 591 Graaff Reinet; PEM × 60, Farm Hopewell, Louisvale, Kenhardt District; PEM × 575 and × 572, no locality; three uncatalogued specimens without locality data.

Morphological variation in the girdled lizard *Cordylus mclachlani* Mouton 1986

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Received 18 October 1990; accepted 3 October 1991

The girdled lizard *Cordylus mclachlani*, previously known only from the type locality in the south-western Cape, South Africa, was found at several new localities as far north as Nieuwoudtville. The external morphology of the 32 additional specimens thus obtained was investigated to establish the nature of geographical variation. Specimens from the type locality, which lies on the southern periphery of the known distribution range, differ from the rest in the number of suboculars, the shape of the interparietal scale and in the presence of a post-interparietal scale. Because of some overlap in these characters, separate taxonomic status for the specimens outside the type locality is not considered. The diagnostic character set for the species is updated and additional ecological information is supplied.

Die gordelakkedis *Cordylus mclachlani*, voorheen slegs bekend vanaf die tipelokaliteit in die suidwes-Kaap, Suid-Afrika, is by verskeie nuwe lokaliteite, so ver noord as Nieuwoudtville, gevind. Die uitwendige morfologie van die 32 bykomende eksemplare wat so verkry is, is ondersoek om die omvang van geografiese variasie te bepaal. Eksemplare vanaf die tipelokaliteit, wat die suidelike grens van die bekende verspreidingsgebied uitmaak, verskil van die ander eksemplare in die aantal subokulêre skubbe, die vorm van die interpariëtale skub en in die teenwoordigheid van 'n postinterpariëtale skub. A.g.v. oorvleueling in hierdie eienskappe word aparte taksonomiese status vir eksemplare buite die tipelokaliteit nie oorweeg nie. Die stel diagnostiese eienskappe vir die spesie word op datum gebring en aanvullende ekologiese inligting word verskaf.

Mouton (1986) described a new girdled lizard, *Cordylus mclachlani*, from the Koue Bokkeveld in the Cape Province. It was believed to have a very limited range and accordingly

was listed under the restricted category in the updated SA RDB (Branch 1988). After the description of the new species, private collection material of a similar cordylid collected during 1975 in the Nieuwoudtville and Clanwilliam districts, 200 km to the north of the type locality of *C. mclachlani*, came to light. A preliminary analysis of this additional material showed that these specimens display most of the diagnostic characters of *C. mclachlani*, but that there are also some distinct differences. The limited material, however, did not allow any firm conclusions regarding the taxonomic status of the northern population to be reached. This prompted a more intensive survey of the area between the two localities which resulted in additional material from several new localities.

A detailed analysis of geographical variation was now possible. The purpose of this study was to determine whether the geographical variation in *C. mclachlani* is categorical or clinal in nature. This is seen as a prerequisite for any taxonomic decision. Furthermore, the additional material allowed elaboration of the descriptive character set supplied for the species by Mouton (1986).

Forty-two specimens from ten localities (Figure 1) were investigated for 15 meristic, 11 two-state and seven morphometric characters. These are the external morphological characters which discriminate either among populations of *C. mclachlani* or between *C. mclachlani* and other *Cordylus* species Mouton (1986). The considerations followed in taking measurements and scale counts were the same as those followed by Mouton & Van Wyk (1989).

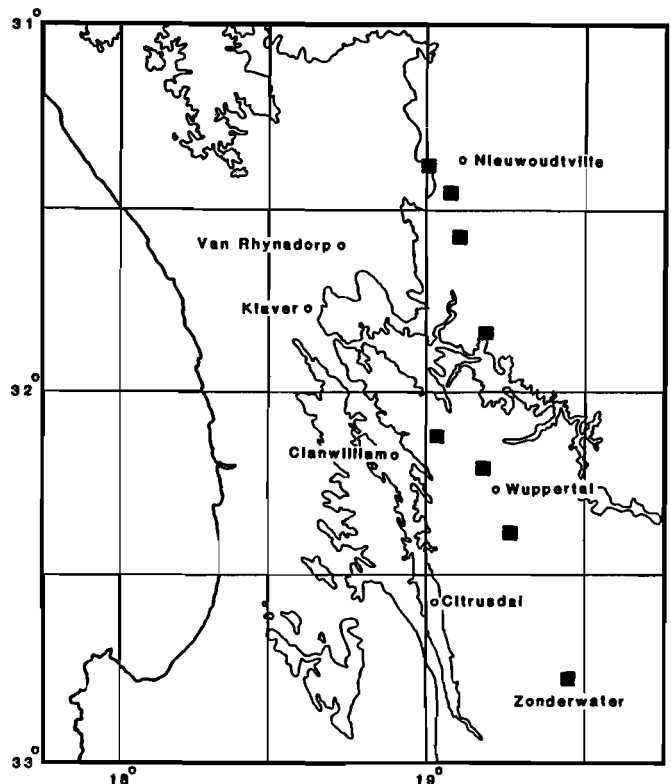


Figure 1 Localities in the south-western Cape where *Cordylus mclachlani* has been collected to date (the 300 m contour line is indicated).