overt aggression by a male tree squirrel towards juveniles has not been reported before. However, similar incidents have been reported for Arctic ground squirrels, *Spermophilus parryii*, in which immigrant males sometimes killed young while establishing residence in a new area (McLean 1983). Infanticide in the Columbian ground squirrel (*Spermophilus columbianus*) was reported by Balfour (1983) and Waterman (1984).

Unless it is concluded that the male tree squirrel was showing aberrant behaviour it must be presumed that he was gaining an advantage by killing the juveniles. Since the start of observations this male accompanied the family group and did share the same nest at night although the juveniles were then hidden in a tree 30 m away by the female. The assumption is made that the previous male in the group had been replaced by the present male. As a new member of the family group, a male can raise the inclusive fitness (Hamilton 1964) by killing unrelated juveniles. Although infanticide probably occurs at low frequencies, the validity of this hypothesis needs to be tested by further study.

References

BERTRAM, B.C.R. 1975. Social factors influencing reproduction in wild lions. *J. Zool., Lond.* 177: 463 – 482.

BALFOUR, D. 1983. Infanticide in the Columbian ground squirrel, *Spermophilus columbianus*. *Anim. Behav.* 31: 949 – 950.

HAMILTON, W.D. 1964. The genetical evolution of social behaviour. *J. Theor. Biol.* 7: 1 – 52.

McLEAN, I.G. 1983. Parental behaviour and killing of young in Arctic ground squirrels. *Anim. Behav.* 31: 32 – 44.

VILJOEN, S. 1975. Aspects of the ecology, reproductive physiology and ethology of the bush squirrel, *Paraxerus cepapi cepapi* (A. Smith, 1836). MSc. thesis, University of Pretoria.

VILJOEN, S. 1976. Age determination in the bush squirrel (*Paraxerus cepapi cepapi*). *Zool. Afr.* 12: 89 – 99.

VILJOEN, S. 1977. Behaviour of the bush squirrel *Paraxerus cepapi cepapi* (A. Smith, 1936). *Mammalia* 41: 119 – 166.

WATERMAN, J.M. 1984. Infanticide in the Columbian ground squirrel, *Spermophilus columbianus*. *J. Mammal.* 65: 137 – 138.

Recent records of megalopae of the crab *Varuna litterata* (Fabr.) entering Natal estuaries

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An unusual occurrence involving the stranding of many thousands of megalopae of the crab *Varuna litterata* on an outgoing tide is recorded. The locality was sandflats adjacent to the mouth of the Mgobezeleni estuary at Sodwana Bay, Natal, in mid-May 1985. Other records of recent local sightings are included.

'n Buitengewone gebeurtenis, waarby die stranding van duisende megalopae van die krap *Varuna litterata* deur die uitgaande gety betrokke was, word aangeteken. Die lokaliteit was die sandvlaktes aangrensend aan die mondingvan die Mgobezeleni getyrivier by Sodwanabaai in Natal, in die middel van Mei 1985. Ander optekenings van ontlangse plaaslike waarnemings word ook gemeld.

During a recent visit to Sodwana Bay on the Maputaland coast, from 15 – 18 May 1985, a number of small crab megalopae were noted, swimming up into the Mgobezeleni estuary on the incoming afternoon tide. The following morning (*ca.* 08h00) a vast accumulation of these megalopae was found stranded by the outgoing tide on the sandflats about 20 m north of the shallow channel of the outflowing river. The megalopae were two and three layers deep on the drying sand in an area of about 100 m^2 (see Figures 1 and 2). That afternoon large numbers of megalopae were again noted entering the estuary on the incoming tide.

The river was flowing strongly at the time of the visit, and at low tide the bay was noticeably tinted with clear brown humic stain emanating from the river.

Specimens of the megalopae were collected and identified as the young of the crab *Varuna litterata* (Sandiford, 1984).

Figure 1 Thousands of *Varuna* megalopae stranded by the receding tide.

Figure 2 Several layers of megalopae on the dry sand.

Table 1 Other sightings of *Varuna* megalopae

Estuary and locality	Date	Observer
Msikaba estuary, Transkei	Late May 1985	D Elliot (pers. comm.)
Mpambanyoni, Scottburgh	June 1984	R van der Elst (pers. comm.)
Umgeni, Durban	29 June 1984	ORI staff
Richards Bay, Lake Mzingazi	16 July 1984	J W D Turner (pers. comm.)
Umkomaas River, Umkomaas	24 July 1984	Natal Parks Board staff

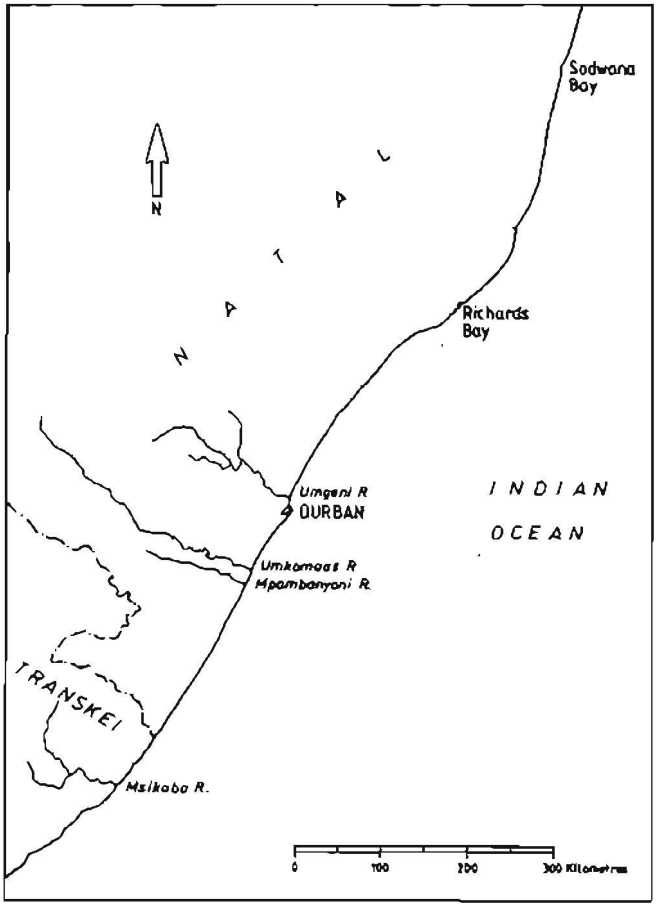

Figure 3 The Natal coast showing localities of sightings mentioned in the text.

A number of other sightings have been reported and recorded as shown in Table 1. In addition, Bruton (1980) recorded several thousand crab megalopae on the downstream wall of the old bridge over the Mgobezeleni estuary at Sodwana on 9 May 1976. They were not positively identified but the date suggests that they were the result of a similar occurrence to that recorded here.

Another sighting on 17 June 1972 at Sodwana Bay by van der Elst (pers. comm.) was accompanied by the observation that a number of bonefish, *Albula neoquinacea* captured by anglers, were found to be feeding on the *Varuna* megalopae. All nine *Albula* sampled, ranging in length from 376–735 mm (mean 580 mm) had distended stomachs, crammed with megalopae.

Varuna litterata is a widely distributed species described as Indo-Pacific by Barnard (1950). Kemp (1915) mentioned the tendency for megalopae of this species to migrate into fresh water, although Barnard considered the species to be estuarine and intertidal. Kemp described the crab as abundant in the Ganges delta, and noted that the megalopae were carried in thousands into areas of quite fresh water, and even into pipes of the Calcutta water supply. The species has, however, not yet succeeded in colonizing fresh water (Gurney 1942), since it is apparently compelled to return to the sea to breed. In March 1980 a number of male and female *Varuna* were seen crossing the sandbar to the sea at the Siaya lagoon near Mtunzini (Bickerton & Sapsford 1981). None of the females were carrying eggs, suggesting that mating and egg production occurs in the sea. Adults were commonly encountered in the upper reaches of both streams feeding the Siaya lagoon (Bickerton & Sapsford 1981). *Varuna* is also encountered in other freshwater systems with links to the sea in KwaZulu, such as Lakes Mzingazi, Nsezi and Cubhu. The fact that *Varuna* is not recorded from Lake Sibaya is further evidence of the essential marine link in the life history of this crab.

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References

BARNARD, K.H. 1950. Descriptive catalogue of South African Decapod Crustacea. *Ann. S. Afr. Mus.* 38: 1–837.

BICKERTON, T. & SAPSFORD, C. 1981. Notes on the reproductive behaviour of the estuarine crab *Varuna litterata*. Siaya Project Newsletter No. 3: 2–4.

BRUTON, M.N. 1980. An outline of the ecology of the Mgobezeleni Lake system at Sodwana, with emphasis on the mangrove community. In: Studies on the Ecology of Maputoland. (Eds) Bruton, M.N. and Cooper, K.H. pp. 408–426.

GURNEY, R. 1942. Larvae of Decapod Crustacea. Ray Society, London.

KEMP, S.W. 1915. Fauna of Chilka Lake. Crustacea Decapoda. *Mem. Ind. Mus.* 5: 199–325.

SANDIFORD, L. 1984. Characterisation and aspects of the biology of the megalopae of *Scylla serrata* (Forskal) and *Varuna litterata* (Fabr.) in the Lake St Lucia system. Environmental Biology 3 Project, U.N. Durban. Unpublished.