Green grass was present in 46 scats, and dry grass in 19 scats. The high incidence of grass in the scats indicates that it is deliberately taken by this mongoose. The presence of *A. cyclops* seed in some scats (4,5%) is possibly incidental, but in view of the relatively high occurrence the deliberate taking of these seeds cannot be ruled out.

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Diet of *Gerres* fry in the Kosi system

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The biology of juvenile and adult *Gerres* occurring in the estuaries of southern Africa has been studied in detail (Cyrus 1980; Cyrus & Blaber 1983 and in press). This short note gives details of the diet of *Gerres* fry (<40 mm S.L.) in the Kosi system (mouth at 26°54′S/32°53′E), Natal, South Africa.

Five sites in the system (Estuary, Water Level Recorder, Makhawulani, Mpungwini and Nhlange) were sampled quarterly from July 1978 to July 1980. For location of these sites in the system see Cyrus & Blaber 1983. The fry were collected using a 10 m × 1,5 m × 4 mm bar mesh seine-net. All specimens were preserved immediately in 10% formalin for analysis in the laboratory. Stomach contents of individual fish were analysed using the three methods given below.

(i) Numerical occurrence. The number of each food type in all stomachs was expressed as a percentage of the total number recorded.

(ii) The points method of Ricker (1968). The percentage fullness of a stomach was assessed, food items were sorted into species groups and points were then allocated to each group according to the proportion they represented in relation to the other groups present, and the fullness of the stomach. This method gives an approximate volumetric analysis of diet.

(iii) Percentage calorific contribution of each food item. Energy values of individual food items were used to establish the percentage energy contribution of each food type. The calorific values used for the different groups were obtained from a number of sources and are listed in Cyrus & Blaber (1983).

Diet of different species

During the study fry of four species were collected. Table 1 shows the percentage energy contribution of the most important food items to the diet of each species at each of the five seining sites.

(i) Gerres filamentosus

Fry of this species were collected only at the Estuary and, although polychaetes and marine calanoid copepods were important in terms of percentage 'points' and numerical analysis, polychaetes formed 86% of the energy value of the diet (Table 1).

(ii) Gerres acinaces

Polychaetes and terebellid tentacles were the dominant food items of *G. acinaces* at the Estuary, although an energy value was not available for the latter thus biasing the results shown in Table 1. At the W.L.R., 'points' and numerical analysis were dominated by polychaetes, copepods and chironomid larvae, but in terms of energy only chironomid larvae and polychaetes were important. In Makhawulani copepods and Cumacea were consumed in large numbers but energy analyses indicated the overwhelming importance of the siphon tips of *Hiatula lunulata* (Table 1).

(iii) Gerres rappi

Fry of *G. rappi* were collected from the W.L.R., Makhawulani, Mpungwini and Nhlange sites. At the first, polychaetes, amphipods and ostracods were important ('points'), but in terms of energy, polychaetes and the copepod, *Pseudodiaptomus stuhlmanni*, were the most valuable (Table 1). In Makhawulani, polychaetes and *P. stuhlmanni* were important ('points') but *H. lunulata* siphon tips made up 48% and polychaetes 36% of the total energy consumed. Large numbers of copepods, amphipods and *Hymenosoma orbiculare* were eaten in Mpungwini ('points'), but again the energy analysis showed that *Hiatula lunulata* siphon tips were more important (Table 1). In Nhlange *P. stuhlmanni* were the dominant food by all three methods of analysis.

(iv) Gerres oyena

Only four specimens were collected (two each from the W.L.R. and Makhawulani, in winter), energy analyses showed that *H. lunulata* siphon tips and polychaetes were the important prey while *P. stuhlmanni* and amphipods were also present.

Seasonal analysis

In the seasonal analysis of food taken by *Gerres* fry many items contributed similar percentages using 'points', numerical and energy analyses. Table 2 summarizes the dominant food items (in terms of energy) consumed by each species during the dif-

Table 1 Diet of *Gerres* species (<40 mm S.L.) at five localities in the Kosi system during 1979 analysed according to percentage contribution of each food item in terms of energy (Joules). (*n* = number; underlined figures = important items in diet; *G. acin* = *G. acinaces*; *G. fil* = *G. filamentosus*)

	Estuary		Water Level Recorder		Makhawulani		Mpungwini	Nhlange
Species	*G. acin* *n* = 95	*G. fil* *n* = 46	*G. acin* *n* = 16	*G. rappi* *n* = 63	*G. acin* *n* = 99	*G. rappi* *n* = 51	*G. rappi* *n* = 89	*G. rappi* *n* = 13
Hiatula lunulata (siphons)	4	–	–	–	63	48	71	–
Polychaeta	93	86	36	51	4	36	< 1	–
Ostracoda	–	–	–	7	< 1	< 1	< 1	–
Copepoda — calanoid (marine)	2	13	–	–	–	–	–	–
Copepoda — calanoid	–	–	7	28	9	–	6	88
Copepoda — harpacticoids	< 1	–	< 1	< 1	< 1	3	–	–
Isopoda	–	–	–	–	7	8	8	–
Amphipoda	< 1	–	6	9	2	< 1	10	< 1
Cumacea	–	–	< 1	–	2	–	< 1	–
Mysidacea	< 1	< 1	–	–	2	–	–	–
Hymenosoma orbiculare	–	–	–	–	2	–	3	–
Chironomidae (larvae)	–	< 1	49	4	8	4	< 1	11

Table 2 Dominant food items, according to their energy value, in the diet of three species of *Gerres* fry during different seasons. (G.a. = *G. acinaces*, G.f. = *G. filamentosus* and G.r. = *G. rappi*)

	Summer	Autumn	Winter	Spring
H. lunulata	G.a, G.r	–	G.r	–
Polychaetes	G.a, G.f	G.a	G.f, G.a	–
Copepods	G.f	G.a	G.f, G.r	G.r
Chironomid larvae	–	–	–	G.a
C. fluviatilis	G.r	–	–	G.a
Amphipods	–	–	–	G.r

ferent seasons. These items accounted for 94% (summer), 92% (autumn), 83% (winter) and 69% (spring) of the total food consumed by *G. acinaces* fry. In *G. filamentosus* they made up 99% (summer) and 94% (winter) while in *G. rappi* they were 75% (autumn), 96% (winter) and 95% (spring). Although relatively small numbers of the isopod *Cirolana fluviatilis* and siphon tips of *H. lunulata* were consumed, their high energy value increased their significance.

Food of different size class of fry

The dominant food items taken by the different size groups (5-mm groups) of the three common species of *Gerres* fry present in the Kosi system are shown in Figure 1. Copepods were important in the diet of smaller fish, but progressively less so in larger fish. In *G. acinaces* (Figure 1) copepods were the dominant food of individuals smaller than 21 mm, above which the range of food items increased, and polychaetes were the most important up to 30 mm. From 31 mm upwards no single food item comprised more than 20% of the diet. Copepods were the dominant item taken by *G. filamentosus* (Figure 1) less than 25 mm long but larger fish concentrated mainly on polychaetes. *G. rappi* (Figure 1) differed from the previous two species as copepods were important in all size groups of fry. Above 25 mm the range of food items increased with copepods, amphipods and ostracods being of almost equal importance in the 36–40 mm size class.

The diet of *Gerres* fry (<40 mm S.L.) in the Kosi system

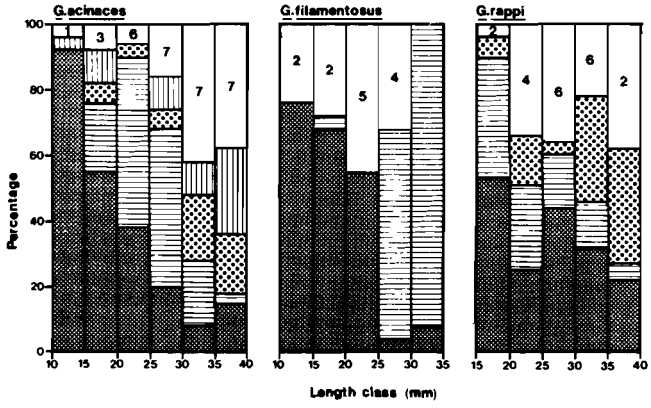

Figure 1 Percentage contribution ('points') of food items to the diet of different size classes of three species of *Gerres* fry in the Kosi system during 1979. (▩ = copepods; ▤ = polychaetes; ⊞ = amphipods; ▥ = cumacea; □ = other; numeral equals number of other items in group).

Table 3 Summary of the percentage energy contribution of the dominant food items in the diet of *Gerres* fry (<40 mm S.L.) in the Kosi system

Species	*G. acinaces*	*G. filamentosus*	*G. rappi*
Hiatula lunulata (siphon tips)	33	–	29
Polychaeta	44	86	22
Copepoda	–	13	31
Chironomidae (larvae)	19	–	–
% contribution of dominant items	96	99	82

is summarized in Table 3. As in the diet of larger individuals (Cyrus & Blaber 1983) no more than three food items made up the greater proportion of the diet. Although all species were not caught during each season, the data available indicates that they feed on different food sources, with no more than two species extensively utilizing any one source. In addition a species may switch to different food sources at different seasons (Table 2).

The diet of *Gerres* fry changed markedly during the early

Table 4 Summary of published information on the diets of Gerreidae (<40 mm S.L.). (P = % 'points'; V = % volumetric analysis; F = % frequency of occurrence; E = estuarine; Ma = mangrove; M = marine; + = present; + + = common; + + + = dominant)

	Food items															
Species	Gastropoda	Bivalves	*H. lunulata* (siphon tips)	Polychaeta	Ostracoda	Copepoda	Amphipoda	Cumacea	Mysidacea	Crustacean larvae	Plant Material	Unidentified	Ana-lysis	Situa-tion	Locality	Reference
Gerres																
G. acinaces	–	–	1	37	–	30	11	8	–	–	–	–	P	E	Kosi System	This study
G. oyena	–	–	2	88	–	2	5	–	–	–	–	–	P	E	Kosi System (4 specimens)	This study
	–	–	–	–	–	94	–	–	–	–	–	–	V	E	Pulicat Lake India	Prabhakara Rao (1968)
	–	11	–	41	41	13	17	–	–	–	–	–	F	M	Moreton Bay E. Australia	Blaber & Blaber (1980)
G. filamentosus	–	–	–	45	–	32	–	–	–	–	–	13	P	E	Kosi System	This study
	–	–	–	–	–	65	–	–	23	–	–	–	V	E	Pulicat Lake India	Prabhakara Rao (1968)
G. rappi	–	–	4	11	10	46	21	–	–	–	–	–	P	E	Kosi System	This Study
	–	–	–	62	–	25	10	–	–	–	–	–	P	E	St Lucia	Cyrus (1980)
	–	–	–	–	92	7	–	7	–	23	–	7	F	E	Mhlanga Est. S.A.	Whitfield (pers. comm.)
G. limbatus	–	–	–	–	–	94	–	–	–	–	–	–	V	E	Pulicat Lake India	Prabhakara Rao (1968)
G. cinereus	3	–	–	–	89	–	–	–	–	–	–	–	P	Ma	Puerto Rico	Austin & Austin (1971)
G. ovatus	25	57	–	24	22	17	62	–	–	–	–	–	F	E	Moreton Bay E. Australia	Blaber & Blaber (1980)
Eucinostomus																
E. argenteus	–	–	–	–	18	46	–	–	–	–	4	15	P	Ma	Puerto Rico	Austin & Austin (1971)
E. gula	–	–	–	46	–	45	–	–	–	–	–	–	V	E	Florida U.S.A.	Carr & Adams (1973)
	–	+	–	+ +	–	+ + +	+	–	–	–	–	–	–	M	Florida U.S.A.	Charles (1975)
Diapterus																
D. rhombeus	–	–	–	1	10	71	–	–	–	–	17	–	P	Ma	Puerto Rico	Austin & Austin (1971)
D. olistostomus	–	–	–	–	+	+ + +	–	–	–	–	+	–	–	Ma	Puerto Rico	Austin & Austin (1971)

stages of growth (Figure 1). Copepods were dominant in individuals smaller than 16 mm S.L., while those more than 35 mm S.L. showed an increase in the number of food types taken and a decrease in importance of copepods. Day & Morgans (1966) state that *G. acinaces* between 45 and 60 mm S.L. caught in Durban Bay contained planktonic copepods and polychaetes, ' . . . suggesting that at this length the fish becomes a bottom feeder . . . '. Kosi results suggest that a change-over takes place from about 21 mm S.L.. Similar results were obtained by Carr & Adams (1973) for the gerrid *Eucinostomus gula* in the estuarine zone of the Crystal river, Florida, U.S.A. They found that individuals smaller than 16 mm S.L. ate only copepods; sizes from 16 – 20 mm S.L. took 80% copepods and 19% polychaetes (volumetric analysis), the latter becoming progressively more dominant until they comprised 80% of the diet of the 36 – 40 mm size class. This change in diet shows a move from a planktonic mode of feeding to a benthic one. The copepods are too large to be collected by filtering and are probably caught individually by the fry. This would mean that vision is as important to the fry as it is to the adults (Cyrus & Blaber 1982). Such a diet change conforms with the general pattern of feeding by fish fry during the period after yolk absorption, when the simple gut tube 'rapidly metamorphoses into the adult type alimentary canal' (Weatherley 1972).

Hiatula lunulata siphon tips which are extensively taken by juvenile and adult *Gerres* (Cyrus & Blaber 1983) are of minor importance in the diet of the fry. Although small numbers are taken by individuals of 21 mm S.L. and upwards, they only become important at lengths greater than 55 mm S.L. The calorific analysis in Table 1 shows that *H. lunulata* siphon tips are important at some sites because they are eaten by larger fry and because of their very high calorific value.

Table 4 summarizes published data on the food of Gerreidae fry (<40 mm S.L.). Although it is impossible to make absolute comparisons because the same methods of analysis were not used by all workers, a number of generalizations are possible. Numerous factors affect the type of food taken by the different species, the most important being the food available

and whether the habitat is a marine, estuarine or mangrove environment. The latter three have been included under the heading 'Situation' in Table 4. Few workers have examined the species investigated in this study, but Gerreidae fry (*Gerres, Eucinostomus* and *Diapterus*) consume mainly copepods, polychaetes and ostracods and to a lesser extent whole bivalves and gastropods.

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Notes on the diet of *Rhabdosargus holubi* (Steindachner) and *Rhabdosargus globiceps* (Cuvier) in the marine environment

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Rhabdosargus holubi (Cape stumpnose) and *Rhabdosargus globiceps* (white stumpnose) are common endemic species in the shallow marine waters of South Africa (Barnard 1925; Smith 1965). Adults of both species are found to a lesser extent in estuaries while juveniles are associated with estuaries, in particular *R. holubi* on the east coast and *R. globiceps* on the west coast (Talbot 1955; Wallace 1975).

Detailed examinations of the feeding habits of these fish have been mainly restricted to the juvenile phase in estuaries (Blaber 1974; Talbot 1955). Blaber (1974, Table 5) does, however, quote the Ecological Survey records of the University of Cape Town which record the diet of adult *R. holubi* in the marine environment close to three South African estuary mouths. Similarly Talbot (1955) presents qualitative results on the feeding of adult *R. globiceps* in the marine waters west of Cape Agulhas. Lasiak (1982) documents the feeding of both species in the surf zone at two study sites in Algoa Bay.

Ninety-eight specimens of *R. globiceps* and 114 of *R. holubi* were taken by the R.V. *Thomas B. Davie* during a small-mesh trawling survey of the inshore marine waters between Mossel Bay and Algoa Bay in 1980. The depth and size distribution of fish caught are given in Table 1 and Figure 1 respectively. Stomach content analysis is presented in Table 2. Prey items were quantified in terms of frequency of occurrence and percentage volume, and were assigned a rank computed as the ratio of fish containing a food item to the number of fish sampled (frequency of occurrence) multiplied by the mean percent that item represented of the diet volume (Hobson 1974).

Fourteen different prey items were recognized for *R. holubi*, the most important of which were *Echinocardium cordatum*, polychaetes and isopods. The polychaetes were represented mostly by empty Chaetopteridae tubes, possibly *Phyllochaetopterus socialis* and *Mesochaetopterus minutus* as well as *Glycera* sp. The occurrence of these species is consistent with the soft bottom from which these fish were sampled. By comparison 15 different prey items were recognized in the diet of *R. globiceps*. Important food items included polychaetes, *E. cordatum*, ophiuroids and isopods. The composition of the diet is essentially similar to that of *R. holubi* although the importance of individual items is slightly different.