Stomach content analysis of the leervis, *Lichia amia* (L.), from the Swartvlei system, southern Cape

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A total of 222 specimens (TL 17,3 to 73,4 cm) of the leervis, *Lichia amia*, were collected at three localities in the Swartvlei estuarine system over the period July 1978 to April 1980. The stomachs of 150 of these contained food. Those from fish collected in the lower reaches of the system contained mostly sand-shrimp and fish, those from the middle reaches predominantly fish, and those from the upper reaches exclusively fish. The most important prey species overall were the estuarine round-herring, *Gilchristella aestuarius*, and the sand-shrimp, *Palaemon pacificus*.

S. Afr. J. Zool. 1982, 17: 177 – 181

'n Totaal van 222 eksemplare (TL 17,3 tot 73,4 cm) van die leervis, *Lichia amia*, is op drie lokaliteite in die Swartvlei-riviermondsisteem oor die tydperk Julie 1978 tot April 1980 versamel. Die pense van 150 eksemplare het voedsel bevat. Pense van vis wat in die onderste gedeeltes van die sisteem versamel is, het meesal sandgarnale en vis bevat, dié in die middelste gedeeltes hoofsaaklik vis, en dié in die boonste gedeeltes uitsluitlik vis. Die belangrikste prooi in die sisteem as geheel was die rivier-rondeharing, *Gilchristella aestuarius*, en die sandgarnaal, *Palaemon pacificus*.

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The popular South African game fish *Lichia amia* (leervis), is an eastern Atlantic species which penetrates around the southern African coast as far as Delagoa Bay (Smith 1965). In South African waters it is most abundant along the Cape coast, and plentiful in the Natal inshore waters during the cooler months (Wallace 1975).

The diet of *L. amia* was studied in the Swartvlei system (Figure 1) from July 1978 to April 1980 as part of a project on the feeding habits of the fish of the Wilderness Lakes (Coetzee 1981, 1982). *L. amia* is the most important game fish in this estuarine system which is situated on the southern Cape coast between the towns of George and Knysna. The Swartvlei system closes off from the sea periodically due to sand bar formation across the mouth, preventing the migration of marine fish into and out of the system. The mouth closed in July 1977 before the present study commenced. It was artificially opened on 4 November 1978, closed again on 4 May 1979 and was subsequently re-opened on 27 July 1979, after which it remained open until after the study was completed.

Material and Methods

Six 100 m long gill nets of different mesh sizes were set once a month at each of three localities (Stations 1, 2 and 3) in the Swartvlei system (Figure 1). The stretched mesh sizes of these nets, which were tied together to form a single unit 600 m long, were 41, 51, 61, 86, 111 and 146 mm. The nets were left overnight at each locality (approximately 16h00 to 08h00). The total lengths (TL) of the collected fish were measured, after which their stomachs were removed and preserved in formalin.

The contents of each stomach were separated into species or groups, and the items belonging to each species or group were then identified and measured as far as possible, before being combined and weighed. These masses were used to calculate the percentage that each species or group formed of the total stomach contents. The results from individual fish were subsequently combined to give the overall percentage composition of the diet of *Lichia amia* at each station and in the system as a whole. The contents of each stomach were also evaluated by means of the occurrence and dominance methods described by Hynes (1950).

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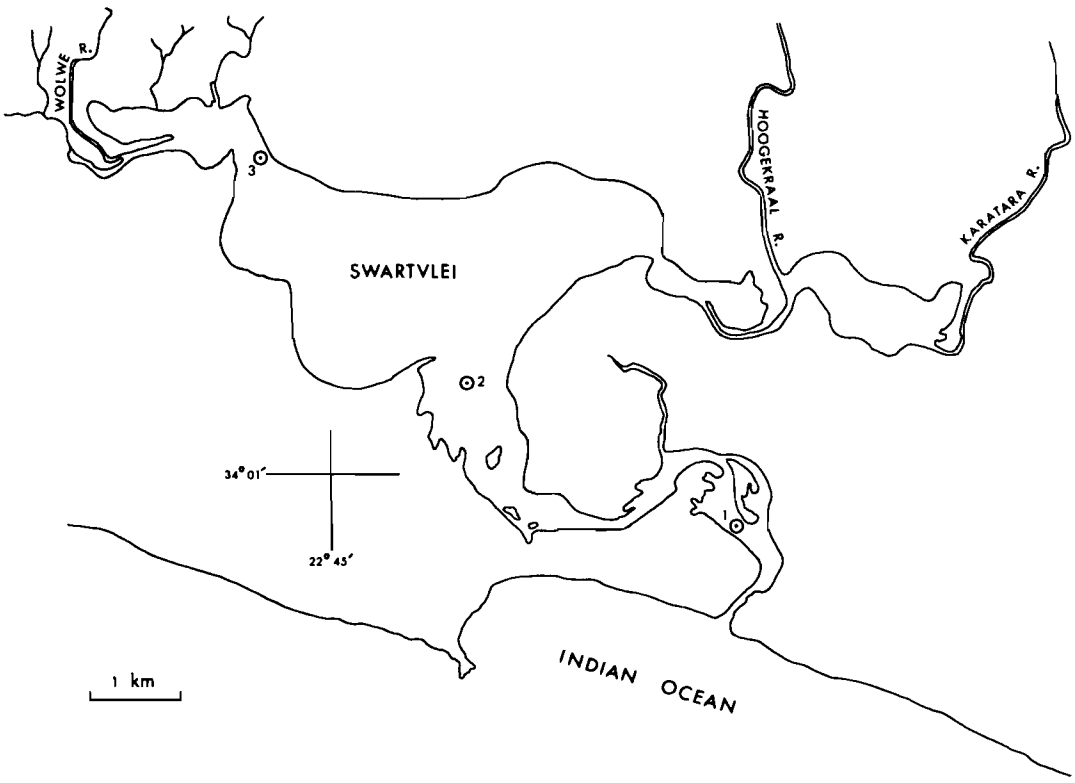

Figure 1 The Swartvlei estuarine system with sampling localities (Stations 1, 2 and 3) indicated.

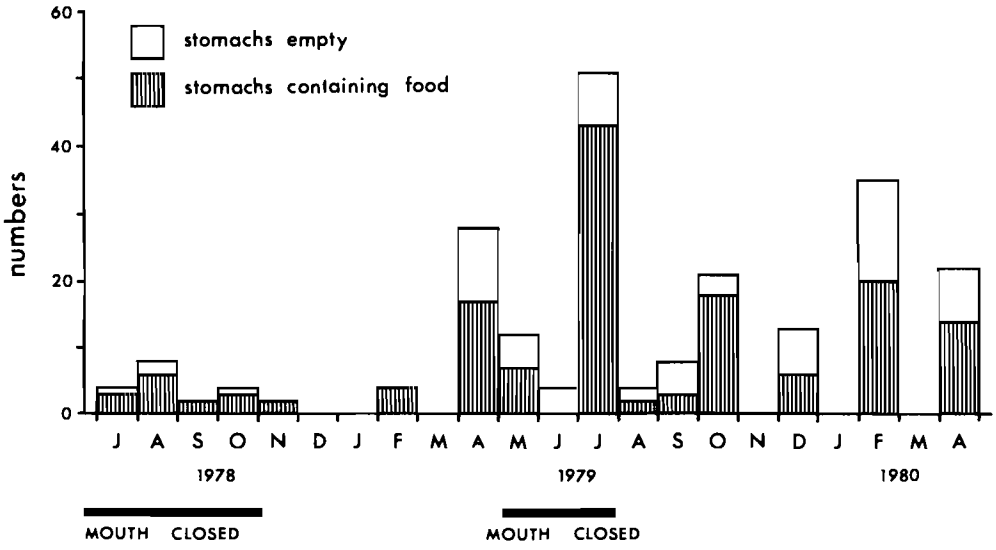

Figure 2 Monthly catches of *Lichia amia* in the Swartvlei system during the period July 1978 to April 1980.

Results

Catches were low initially, but improved later in the study (Figure 2). A total of 222 *L. amia* (TL 17,3 to 73,4 cm) were collected, of which the majority (62,6%) were between 30 and 50 cm long (Figure 3). Average lengths from Stations 1, 2 and 3 were respectively 36,2 cm (n = 70), 40,8 cm (n = 81) and 43,0 cm (n = 71). An analysis of variance provided evidence of size differences amongst the different stations ($P<0,01$). Using the test procedure of least significant differences (Steel & Torrie 1960), no significant differences were obtained, however, when the individual means for the stations were compared, though *L. amia* from Station 3 were almost significantly larger than those from Station 1 ($0,05<P<0,06$). For the stations combined, the mean total length was 40,1 cm (n = 222, S.D. = 11,46).

Of the 222 *L. amia* collected, 150 had food in their stomachs. At Station 1 the sand-shrimp, *Palaemon pacificus,* proved to be the most important prey item (50,6% composition by mass) (Table 1), occurring in stomachs collected between July 1979 (just before the estuary was opened) and February 1980. In contrast, only one stomach from Station 2 and none from Station 3 contained this species. Overall *P. pacificus* was the second most important food item (19,1% composition) in the diet

of *L. amia,* and was ingested by fish from 18,9 to 50,4 cm in total length (Table 2). Relatively undamaged specimens of the sand-shrimp (n = 133), measured from the tip of the rostrum to the tip of the telson, were between 2,9 and 5,3 cm long (Figure 4).

The estuarine round-herring, *Gilchristella aestuarius,* was the most abundant prey item at Station 2 (27,1% composition) and the second most abundant at Station 1 (28,3% composition). It was also the most important component of the diet of *L. amia* in the Swartvlei system as a whole, forming 23,6% of the composition and dominating in 25% of the stomachs which contained food (Table 2). Of the 138 whole *G. aestuarius* measured, 58% were between 4 and 5 cm long (Figure 4). This species was found only in stomachs of leervis ranging from 18,9 to 54,2 cm in total length.

The second most abundant prey item in stomachs from Station 2 was the southern mullet, *Liza richardsoni* (20,4% composition), of which a length range of 2,3 to 25,0 cm was ingested by *Lichia amia.* Station 2 yielded the largest variety of prey organisms, but as with Station 1, some of these (15,2% composition) could not be identified owing to damage or their state of digestion. This was also the case with a large proportion (24% composition) of the stomach contents from Station 3. Overall the unidentifiable material belonged to a minimum of at least three different species. Of the identifiable material from Station 3, the Cape moony, *Monodactylus falciformis,* formed the most important prey item (20,6% composition), followed by gobioids (17,7%) and Cape stumpnose, *Rhabdosargus*

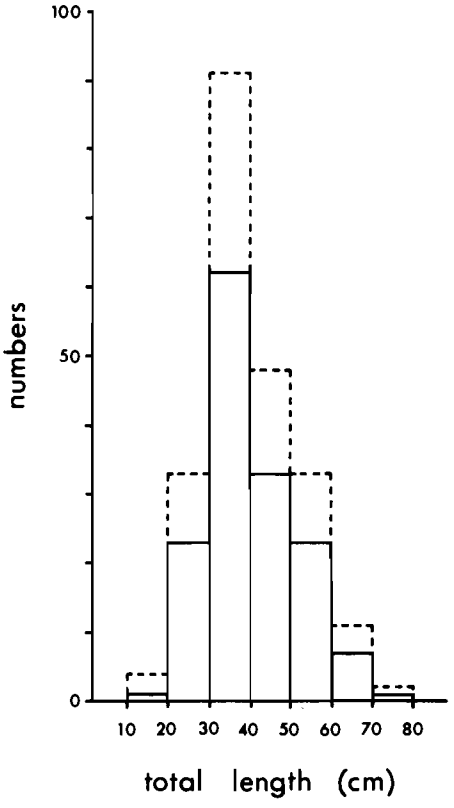

Figure 3 Length distribution of 222 *Lichia amia* collected in the Swartvlei system from July 1978 to April 1980 (broken line represents fish with empty stomachs).

Table 1 Average composition of the stomach contents of 150 *Lichia amia* collected at Stations 1 to 3 in the Swartvlei system from July 1978 to April 1980 (n = number of a specific food item, c = composition by mass, o = occurrence, d = dominance)

	Station 1 (number of stomachs = 56)				Station 2 (number of stomachs = 49)				Station 3 (number of stomachs = 45)			
	n	% c	% o	% d	*n*	% c	% o	% d	*n*	% c	% o	% d
Filamentous algae						1,1	2	2				
Aquatic macrophytes		2,1	11	2		0,3	16	0		<0,05	2	0
Crustacea												
Macrura												
Panaeus sp.					1	0,4	2	0				
Palaemon pacificus	194	50,6	57	50	12	0,5	2	0				
Mollusca												
Gastropoda	1	0,1	2	0								
Osteichthyes												
Clinidae					9	8,5	10	8				
Gobioidea	12	5,8	9	7	10	7,4	10	8	55	17,7	22	18
Gilchristella aestuarius		28,3	34	31		27,1	31	27		13,9	16	16
Hepsetia breviceps		6,7	16	5		4,7	16	6		2,8	7	2
Heterosomata					2	0,8	2	0				
Hyporhamphus capensis					1	0,2	2	0				
Lithognathus lithognathus					1	2,0	2	2				
Liza richardsoni					41	20,4	20	20	2	4,1	4	4
Monodactylus falciformis					2	3,6	4	4	39	20,6	27	20
Rhabdosargus holubi	1	1,7	2	2	4	7,6	8	8	10	16,9	18	18
Pieces of fish (not *G. aestuarius* or *H. breviceps*)		4,8	16	4		15,2	20	14		24,0	29	22

Table 2 Overall composition of the diet of *Lichia amia* in the Swartvlei system over the period July 1978 to April 1980. The length ranges of the *L. amia* which ingested each food item are given in the last column

	% composition	% occurrence	% dominance	Length ranges of *L. amia* (cm)
Filamentous algae	0,4	1	1	29,8
Aquatic macrophytes	0,9	10	1	29,8 – 61,8
Crustacea				
Macrura				
Panaeus sp.	0,1	1	0	39,8
Palaemon pacificus	19,1	22	19	18,9 – 50,4
Mollusca				
Gastropoda	<0,05	1	0	45,2
Osteichthyes				
Clinidae	2,8	3	3	32,9 – 39,8
Gobioidea	9,9	13	11	29,8 – 59,4
Gilchristella aestuarius	23,6	27	25	18,9 – 54,2
Hepsetia breviceps	4,9	13	5	20,5 – 54,2
Heterosomata	0,3	1	0	52,1
Hyporhamphus capensis	0,1	1	0	56,5
Lithognathus lithognathus	0,7	1	1	32,6
Liza richardsoni	7,9	8	8	22,7 – 59,4
Monodactylus falciformis	7,4	9	7	44,6 – 73,4
Rhabdosargus holubi	8,2	9	9	32,0 – 62,1
Pieces of fish (not *G. aestuarius* or *H. breviceps*)	14,2	21	13	23,7 – 63,0

holubi (16,9%). The pieces of aquatic macrophytes and filamentous algae in some of the stomachs were probably incidentally ingested with prey.

The larger *L. amia* (TL > 60 cm, $n = 8$) ingested only *M. falciformis* and *R. holubi,* apart from aquatic macrophytes and some unidentifiable fish material. A low positive correlation was found between total lengths of *L. amia* and the sizes of its fish prey for the Swartvlei system as a whole ($r^2 = 0,14$; $P < 0,001$).

Discussion

Lichia amia fed mainly on *Palaemon pacificus* and fish near the mouth of the Swartvlei estuary, predominantly on fish in the middle reaches, and only on fish in the lake-like upper reaches. *Gilchristella aestuarius* and *Palaemon pacificus* proved to be the two most important prey items in the system as a whole, and together formed 42,7% by mass of the leervis stomach contents. Begg (1976) found that the main prey of *L. amia* in Sandvlei on the south-western Cape coast appear to be juvenile mullet, whilst eleven specimens collected in Lake St Lucia on the east coast of South Africa contained only fish in their stomachs, with mullet forming 43% of the stomach contents (Whitfield & Blaber 1978). Some of the stomachs of 15 *L. amia* collected in Durban Bay contained penaeid prawns or the scales of *Ambassis* sp.; the rest were empty (Day & Morgans 1956).

It is interesting that *Gilchristella aestuarius* is more important in the diet of *L. amia* than *Hepsetia breviceps,* which is superficially similar in appearance and often occurs in mixed shoals with *G. aestuarius.* According to Ratte & Hanekom (1980) *H. breviceps* was more abundant than *G. aestuarius* in the lower and middle reaches of the Swartvlei system during the period October 1978 to November 1979 (during which 62,2% of the leervis for the present study were collected). It would appear, therefore, that *H. breviceps* is less prone to predation by *L. amia* than *G. aestuarius.* The decreasing importance of *G. aestuarius* and *H. breviceps* in the leervis stomach contents from Station 1 to Station 3, agrees with the decrease in numbers of these two species from the lower to the upper reaches of the Swartvlei system found by Ratte & Hanekom (1980).

Unfortunately little is known about the spatial and temporal distribution of *Palaemon pacificus* in the system. Grindley & Wooldridge (1973) collected only one specimen of this species about 1 km upstream from the present Station 1 during a short zooplankton survey in January 1969, although it is often found amongst catches of fish made with small-mesh seine nets in the lower reaches of the Swartvlei system (pers. obs. and T.W. Ratte, pers. comm. November 1981).

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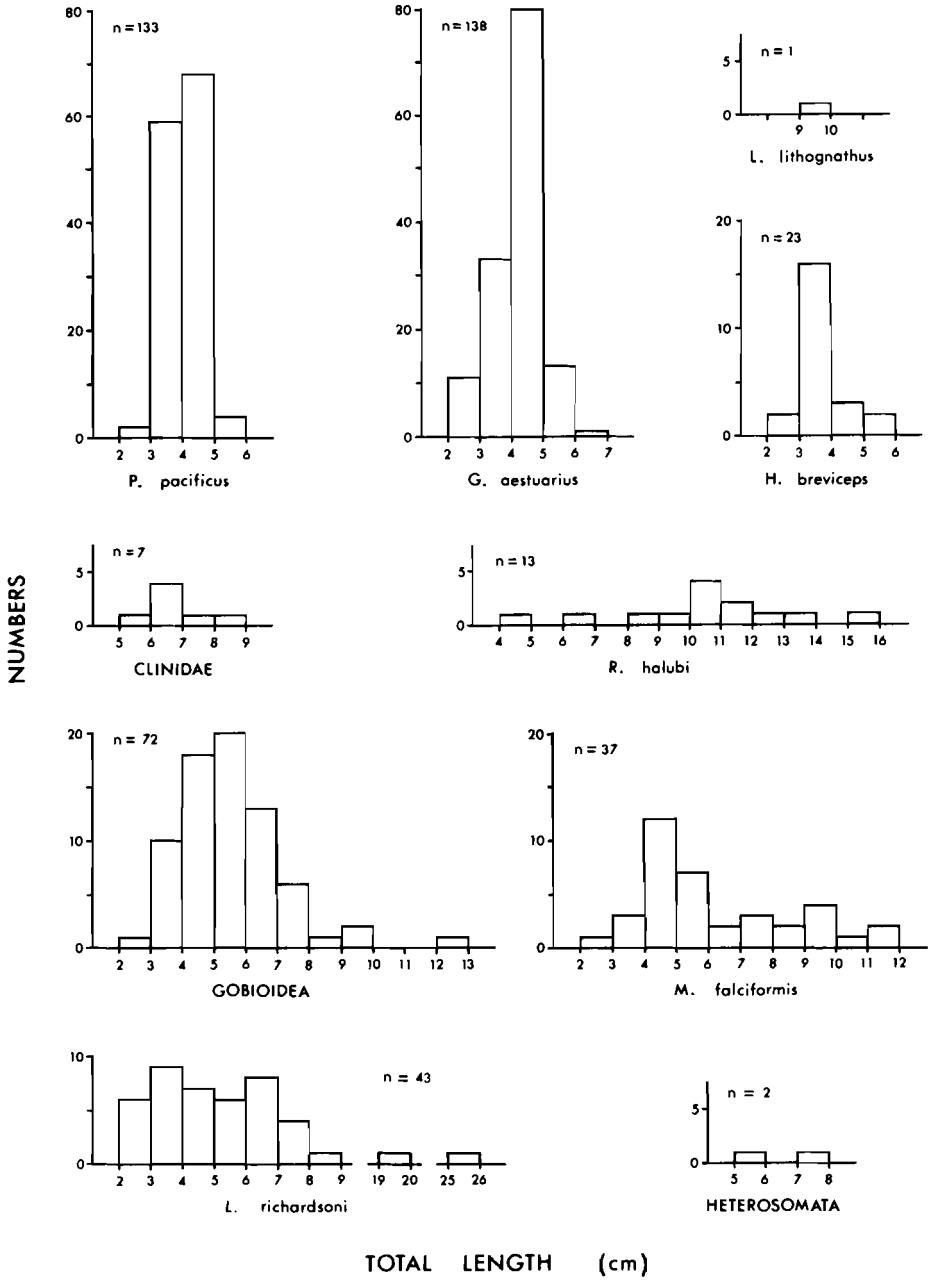

Figure 4 Size-frequency distribution of relatively undamaged prey organisms found in the stomachs of *Lichia amia* in the Swartvlei system from July 1978 to April 1980.

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