The ichthyofauna associated with *Zostera capensis* Setchell in the Swartkops estuary, South Africa

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The ichthyofauna associated with *Zostera* beds in the lower reaches of the Swartkops estuary was examined by means of haul seine netting over 15 months. Thirty-nine fish species were caught in the *Zostera* beds and the small shoaling species, *Hepsetia breviceps* and *Gilchristella aestuarius*, constituted 55% of the total catch in terms of numbers. Juveniles of six mullet species occurred in the *Zostera* and recruitment took place throughout the year. Sparids such as *Rhabdosargus holubi* and *Diplodus sargus* showed marked spring and summer recruitment. The recruitment patterns of juveniles to the *Zostera* beds is correlated with documented breeding cycles of adults, particularly those breeding in the shallow inshore marine environment. The Swartkops *Zostera* beds were found to form an integral and important part of the nursery function of the estuary.

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Die visgemeenskap in die *Zostera*-beddens van die Swartkops-riviermonding is deur middel van treknetvangste oor 15 maande bestudeer. Nege-en-dertig spesies is gevang en 55% van die aantal vis wat gevang is, het uit die twee spesies *Hepsetia breviceps* en *Gilchristella aestuarius* bestaan. Kleintjies van ses Mugilidae-spesies het in die *Zostera* voorgekom en rekrutering het gedurende die hele jaar plaasgevind. Sparidae soos *Rhabdosargus holubi* en *Diplodus sargus* het rekrutering gedurende lente en somer vertoon. Die rekruteringspatroon van klein vissies tot die *Zostera*-beddens is gekorreleer met gedokumenteerde teelsiklusse van volwassenes, in besonder, die spesies wat in die vlak kuswaters voortplant. Die studie het bewys dat die Swartkops *Zostera*-beddens 'n integrale en belangrike deel van die kweekfunksie van die getyrivier uitmaak.

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Studies on the ichthyofauna of the Swartkops estuary near Port Elizabeth (33°58′S/25°37′E) have recently been undertaken to follow up the pioneer surveys by Gilchrist (1918). Work by Winter (1979), Marais & Baird (1980a, b) and Melville-Smith & Baird (1980) has provided information on the species composition, seasonal abundance and size frequency distribution of the adult, juvenile and larval fish occurring in the main channel of the estuary.

Two relatively large creeks, Modderspruit and Tippers Creek, are located in the lower reaches of the 16-km long Swartkops estuary (Figure 1). The creeks support about 9 ha (B. Talbot, pers. comm.) of the seagrass *Zostera capensis*. The importance of seagrasses such as *Zostera, Posidonia* and *Thalassia* as nursery areas for juvenile fish is well documented (Adams 1976; Weinstein & Heck 1979; Young 1981) and is emphasized by Kikuchi (1980) in his review of faunal relationships in temperate seagrass beds.

The present study was aimed at determining the significance of *Zostera* beds in the Swartkops estuary as nursery areas for juvenile fish and thereby supplementing the results of earlier workers who did not effectively sample the vegetated creeks of the lower reaches. The study forms part of a comparative programme on juvenile marine fish in estuaries and the nearshore coastal region. Concurrent with the present study were investigations of the invertebrates associated with *Zostera* beds in the Swartkops estuary (Nusch 1981; Emmerson, Watling & Watling 1982) and the Kromme estuary (Hanekom 1982).

Methods

Fish were collected monthly from January 1980 through March 1981 by means of a small haul-seine net (10,5 m × 2,5 m) with a stretched mesh size of 2 mm. At low tide a haul covering about 60 m^2 was made through the *Zostera* at each of two stations in Tippers Creek and at one station in Modderspruit (Figure 1). A further haul was made in an area with no subtidal *Zostera* along the bank of the main channel of the estuary between the two creeks. Surface-water temperature and salinity were measured in the creeks on each sampling occasion.

Catches were kept frozen until sorted, identified and counted, and total lengths of specimens measured in mm. As the small shoaling species *Hepsetia breviceps* (Cuvier) and *Gilchristella aestuarius* (Gilchrist) were the subject of

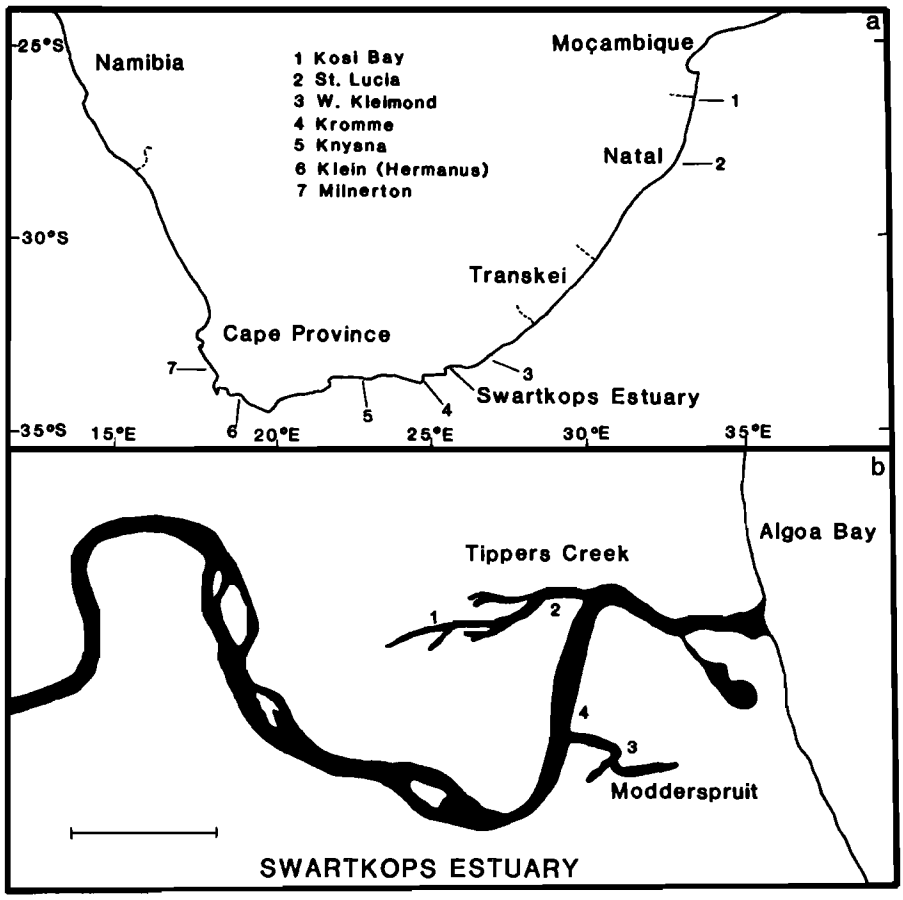

Figure 1 (a) Map of Southern Africa showing the geographical position of the Swartkops estuary and other areas mentioned in the text. (b) The middle and lower reaches of the Swartkops estuary showing the sampling stations in the creeks (1 – 3) and channel (4).

a separate study by Talbot (1982) only a subsample of 100 specimens of these two species was measured from each station each month. Juvenile mullet were identified from dentition characteristics (van der Elst & Wallace 1976) but as it often proved difficult to identify mullet of less than 30 mm with confidence all mullet of this size class were grouped together.

Results

Moddersruit and Tippers Creek in the lower reaches of the Swartkops estuary experience semidiurnal tides with a mean spring range of 1,6 m (Beckley & McLachlan 1979) and a time lag of about 1 h after predicted times for Algoa Bay. Salinity varies from 30 – 35‰ except after heavy rains. As the creeks are shallow (< 2 m depth) water temperature is variable and often differs considerably from that of the main channel of the estuary and the adjacent sea (Figure 2).

Haul seining proved to be an effective sampling technique for juvenile fish as during the 15-month study period, 62 020 fish were caught at the three *Zostera* stations and 4 371 at the channel station. Mean catch per haul was 1 328 (SE ± 296) fish for the *Zostera* stations and only 291 (SE ± 43) fish at the channel station. Total combined catch per month for the three *Zostera* stations varied greatly, ranging from 481 to 11 437 fish depending largely on the catch of the small shoaling species *H. breviceps* (Figure 3).

Thirty-nine species were recorded from the creek stations and 30 species from the channel station (Table 1). Four species recorded in the channel area were not captured in the *Zostera*, giving a total of 43 species caught during the study period. The number of species captured in the *Zostera* each month varied between 12 and 28 with more species being caught in the summer months (Figure 3).

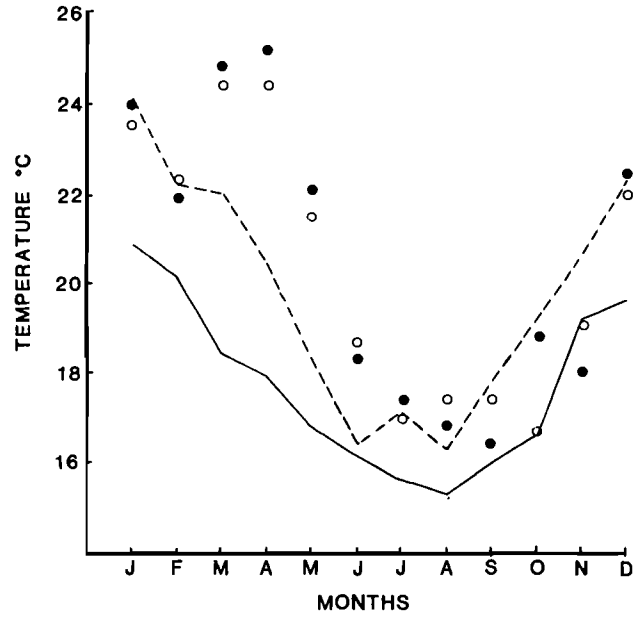

Figure 2 Water temperatures measured in Moddersruit (●) and Tippers Creek (○) during the study period compared with mean monthly water temperature for the lower reaches of the estuary (- - - - after Marais & Baird 1980b) and Algoa Bay (____ after Beckley & McLachlan 1979).

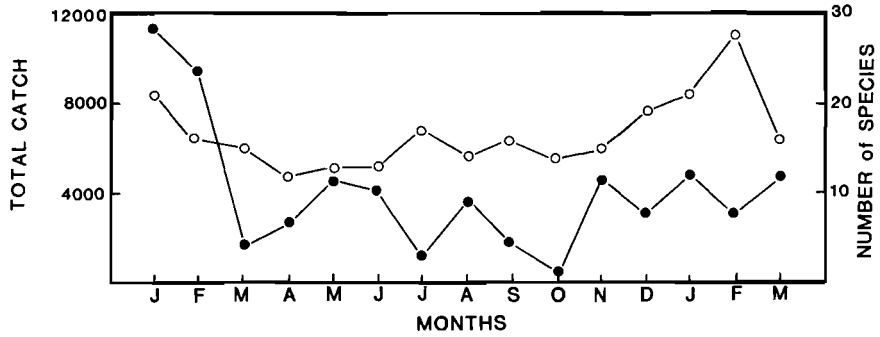

Figure 3 Total monthly catch by seine netting at the three Swartkops creek *Zostera* stations (●———●) and total number of species captured in the *Zostera* each month (o———o).

Table 1 List of fish species captured by haul seine netting during 1980/81 in the lower reaches of the Swartkops estuary. Lengths given in mm, Z indicates occurrence in *Zostera* beds and C indicates occurrence at the channel station.

Species	Length range	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M
Ambassis natalensis Gilchrist & Thompson	17				Z											
	22							C								
Amblyrhynchotes honckenii (Bloch)	21 – 32	Z												Z	Z	
	23 – 77			C										C	C	
Arothron hispidus (Lacépède)	34 – 54							Z							Z	
Arothron immaculatus (Bloch-Schneider)	15 – 25	Z														
Caffrogobius multifasciatus (Smith)	12 – 102	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
	13 – 61	C	C	C	C	C		C	C	C	C	C	C	C	C	C
Clinus superciliosus (Linnaeus)	26 – 81	Z								Z		Z	Z			
	38 – 98											C	C		C	
Diplodus cervinus (Valenciennes)	9 – 80	Z	Z							Z	Z	Z	Z	Z	Z	
	9 – 41											C	C	C	C	
Diplodus sargus Linnaeus	10 – 134	Z	Z		Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
	10 – 93				C	C				C		C	C	C	C	C
Engraulis capensis Gilchrist	36	C														
Epinephelus guaza (Linnaeus)	57														Z	
Etrumeus teres (Dekay)	31 – 36											C				
Gilchristella aestuarius (Gilchrist)	17 – 50	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
	27 – 52	C	C			C		C		C	C			C	C	
Hepsetia breviceps (Cuvier)	12 – 68	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
	12 – 75	C	C		C	C		C	C	C	C			C	C	C
Heteromycteris capensis Kaup	7 – 44	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
	8 – 56	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
Lichia amia (Linnaeus)	46 – 98	Z											Z			
Lithognathus mormyrus (Linnaeus)	68											C				
Liza dumerili (Steindachner)	13 – 221		Z	Z	Z	Z	Z	Z	Z	Z	Z		Z	Z	Z	Z
	11 – 237				C	C	C		C		C		C			C
Liza richardsoni (Smith)	11 – 160		Z	Z	Z	Z		Z	Z		Z	Z	Z	Z	Z	Z
	28 – 180							C						C		C
Liza tricuspidens (Smith)	17 – 116	Z	Z	Z	Z		Z	Z	Z		Z		Z	Z	Z	Z
	29 – 126	C	C			C							C	C	C	C
Lophodiodon calori (Bianconi)	11													Z		
Lutjanus fulviflamma (Forsskäl)	17 – 21														Z	Z
Monodactylus falciformes (Lacépède)	7 – 28	Z											Z	Z	Z	
	11 – 17	C														
Mugil cephalus Linnaeus	7 – 153	Z	Z	Z	Z	Z	Z	Z	Z	Z			Z	Z	Z	
	8 – 172	C	C	C	C	C	C	C	C	C						
Myxus capensis (Valenciennes)	24 – 29			Z											Z	
Omobranchus woodi (Gilchrist & Thompson)	19 – 20	Z												Z		
	18 – 19													C	C	
Pelates quadrilineatus (Bloch)	22													Z		

Table 1 (continued)

Species	Length range	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M
Platycephalus indicus (Linnaeus)	224 – 300			Z								Z				
	206									C						
Pomadasys commersonni (Lacépède)	36 – 323			Z												Z
	15 – 17		C													
Pomadasys olivaceum Day	21 – 96	Z	Z			Z			Z					Z	Z	Z
	30 – 58				C					C			C	C	C	
Psammogobius knysnaensis Smith	8 – 47	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
	10 – 53	C	C	C	C	C	C	C		C	C	C	C	C	C	C
Pseudupeneus pleurotaenia (Playfair)	45														Z	
Rhabdosargus globiceps (Cuvier)	12 – 68	Z	Z									Z	Z	Z		
	10 – 56	C	C		C							C	C			C
Rhabdosargus holubi (Steindachner)	10 – 200	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
	10 – 173	C		C	C	C			C	C		C	C	C	C	C
Sarpa salpa (Linnaeus)	13 – 80							Z	Z	Z					Z	
Solea bleekeri Boulenger	11 – 80	Z	Z	Z		Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	
	21 – 73	C			C	C		C	C		C		C		C	
Sparodon durbanensis (Castelnau)	18														Z	
Spondyliosoma emarginatum (Cuvier)	10 – 71	Z	Z								Z	Z	Z	Z	Z	Z
	11 – 35											C	C			
Stephanolepis auratus (Castelnau)	21 – 97														Z	Z
	38															C
Stolephorus commersonii (Lacépède)	39					Z										
	18 – 55		C	C												
Stolephorus holodon (Boulenger)	39														C	
Syngnathus acus Linnaeus	53 – 224	Z	Z	Z		Z	Z	Z	Z	Z	Z	Z	Z	Z	Z	Z
	52 – 177	C	C	C	C	C		C					C	C		
Trachurus capensis Castelnau	37															Z
Valamugil buchanani (Bleeker)	17 – 20							Z		Z						

Figure 4 illustrates by means of a pie diagram the composition of the fish community caught in the *Zostera* beds over the sampling period. *H. breviceps* dominated the catches and constituted 46,1% of the total catch.

The size range of *H. breviceps* was 12 – 68 mm with the smaller size classes particularly abundant in the late summer months. *G. aestuarius,* another small shoaling species, constituted 9,0% of the catch and ranged in size from 17 – 50 mm.

Six species of mullet were recorded from the *Zostera* areas. Of these, *Myxus capensis* Valenciennes and *Valamugil buchanani* (Bleeker) were only recorded on two occasions in very low numbers (totals of five and two specimens respectively). About half the mullet captured (Figure 5) were unidentified specimens < 30 mm whilst those > 30 mm were identified as *Mugil cephalus* Linnaeus, *Liza dumerili*

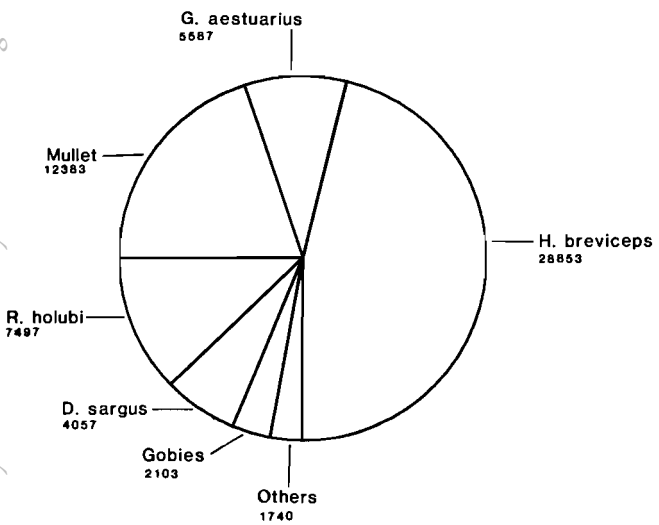

Figure 4 Pie diagram of fish catch composition in the Swartkops creek *Zostera* beds.

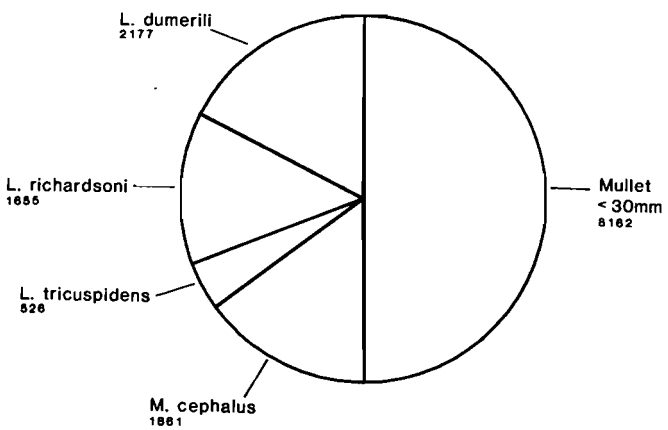

Figure 5 Composition of total mullet catch in the Swartkops creek *Zostera* beds.

(Steindachner), *Liza richardsoni* (Smith) and *Liza tricuspidens* (Smith). The predominance of small mullet is clearly illustrated in the size frequency histogram for total catch of mullet in the *Zostera* (Figure 6); the peaks in abundance of small mullet occurring in June and November 1980 (Figure 7).

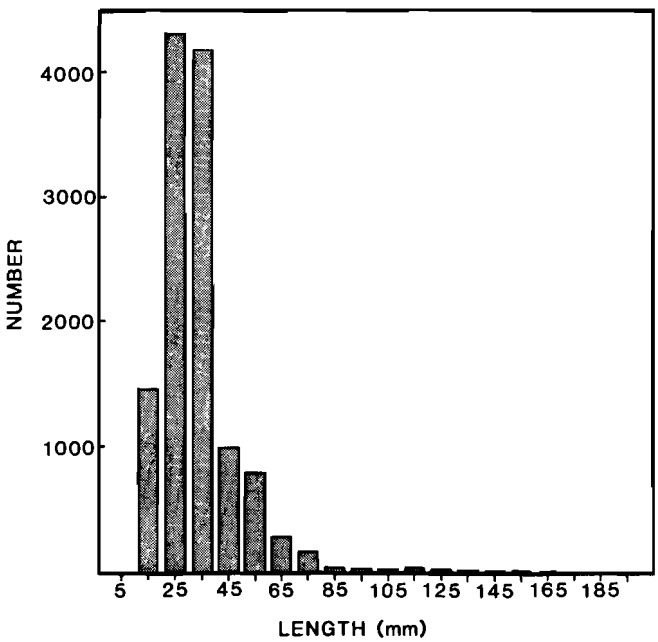

Figure 6 Size frequency histogram for total mullet catch in the Swartkops creek *Zostera* beds (n = 12383).

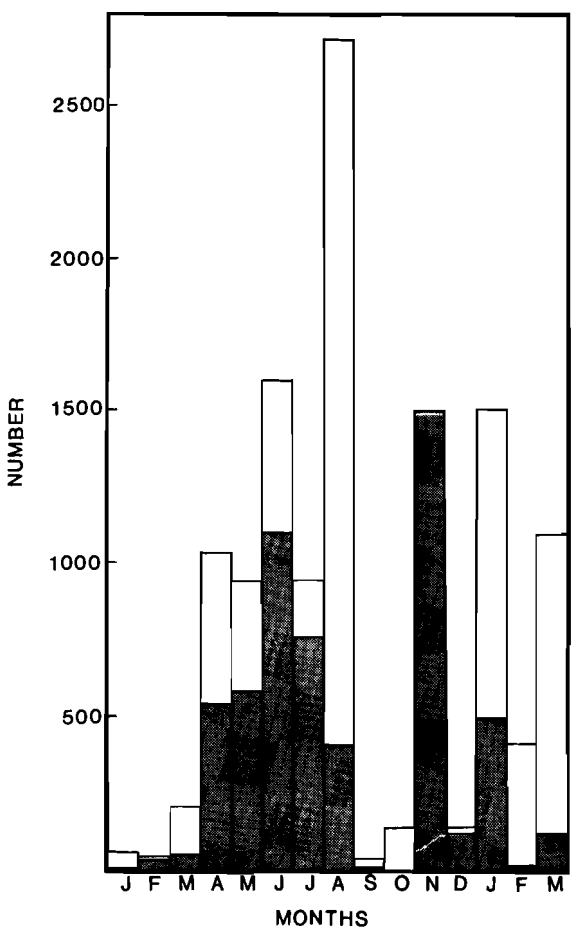

Figure 7 Monthly mullet catches in the Swartkops creek *Zostera* beds. Shaded sections indicate mullet of < 30 mm total length (n = 12383).

Rhabdosargus holubi (Steindachner) constituted 12% of the total catch in the creek *Zostera* beds with small juveniles dominating the catch. Figure 8 shows monthly size frequency histograms and a marked spring and summer influx of juveniles is clear. Similarly, *Diplodus sargus* (Valenciennes) which constituted 6,5% of the *Zostera* bed catch, showed a distinct spring and summer influx of juveniles (Figure 9).

Of the two species of Gobiidae (3,3% of the *Zostera* catch), *Caffrogobius multifasciatus* (Smith) was usually more abundant than *Psammogobius knysnaensis* (Smith). Figure 10 shows combined size frequency histograms for the two species over the study period. Recruitment of juvenile gobies occurred throughout the year with a definite peak for *P. knysnaensis* between March and May.

The remaining 2,8% of the catch in the creek *Zostera* consisted of 27 species. Twenty of these species occurred in very low numbers with total catch per species being less than 25 specimens during the study period. The remaining seven species consisted of *Pomadasys olivaceum* Day, three sparids, two soles and a pipefish.

P. olivaceum and the three sparids, *Spondyliosoma emarginatum* (Cuvier), *Rhabdosargus globiceps* (Cuvier) and *Diplodus cervinus* (Valenciennes) showed the same marked spring and summer recruitment pattern as *R. holubi* and *D. sargus*. The two small soles *Heteromycteris capensis* Kaup and *Solea bleekeri* Boulenger occurred throughout the year in the creeks as did the pipefish *Syngnathus acus* Linnaeus. Adult male pipefish carrying larvae were found intermittently throughout the year.

Discussion

The results illustrate that the creek *Zostera* beds in the lower reaches of the Swartkops estuary provide an important habitat for juvenile fish. These findings support the statement by Wallace & van der Elst (1975) that the nursery function of estuaries is most important during the first year of life and is intimately related to aquatic plant communities.

A crude estimate of total standing stock of fish in the creek *Zostera* of the lower reaches of the Swartkops estuary can be obtained by extrapolation of the mean catch per seine-net haul. This yields a total of two million fishes for the 9 ha of creek *Zostera* and amounts to 22 fish m^{-2} as opposed to only 5 fish m^{-2} for the channel station.

Ten species of fish caught during the study period may be described as tropical strays and the capture of *Ambassis natalensis* Gilchrist & Thompson, *Arothron hispidus* (Lacépède), *Lutjanus fulviflamma* (Forskäl) and *Pelates quadrilineatus* (Bloch) in the Swartkops creek *Zostera* extends the southern distribution limit for these species (Smith 1965; Day, Blaber & Wallace 1981; van der Elst 1981). Local species not usually associated with estuaries but caught during the present sampling included the rocky shore residents, *Epinephalus guaza* (Linnaeus) and *Sparodon durbanensis* (Castelnau) and the pelagic species *Trachurus capensis* Castelnau, *Engraulis capensis* Gilchrist and *Etrumeus teres* (Dekay).

Noticeably absent from the *Zostera* areas were juveniles of the kob, *Argyrosomus hololepidotus* (Lacépède) and the white steenbras, *Lithognathus lithognathus* (Cuvier) which are popular angling species in the estuary (Marais & Baird

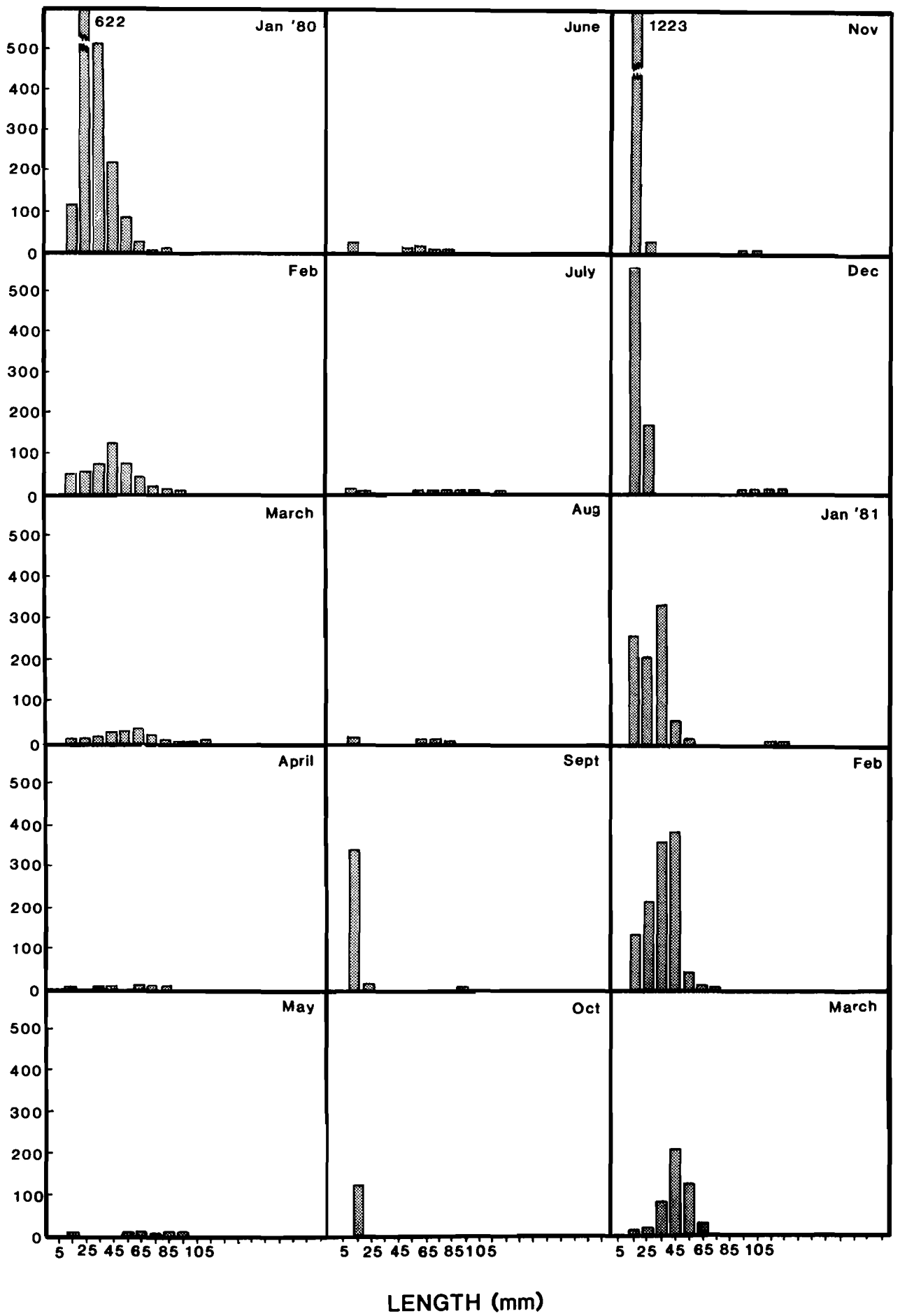

Figure 8 Monthly size frequency histograms for *Rhabdosargus holubi* in the Swartkops creek *Zostera* beds (n = 7497).

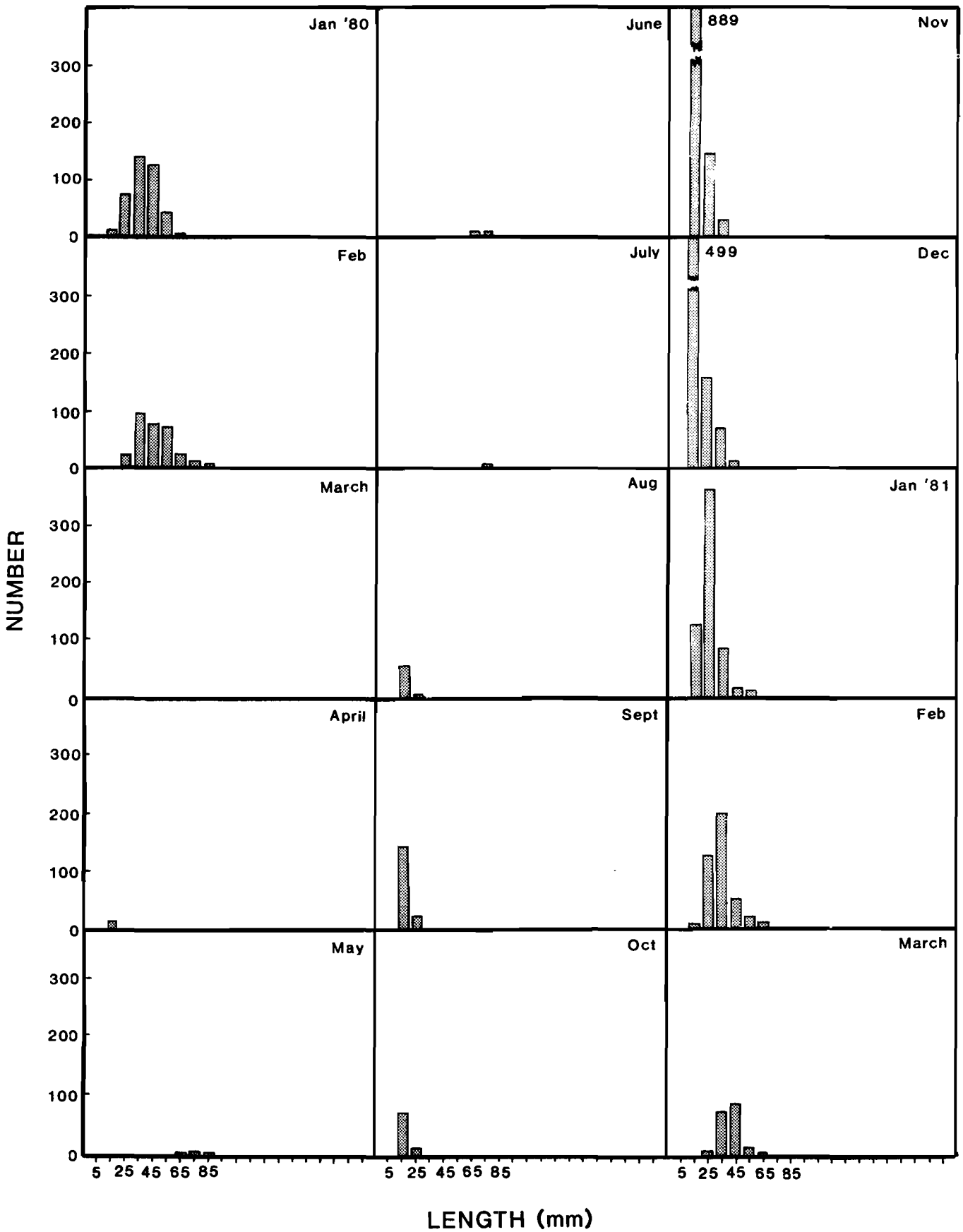

Figure 9 Monthly size frequency histograms for *Diplodus sargus* in the Swartkops creek *Zostera* beds (n = 4057).

1980a). Melville-Smith & Baird (1980) have recorded *A. hololepidotus* larvae ranging in length from 2 – 16 mm in the Swartkops ichthyoplankton, and whilst Winter (1979) did catch juveniles of 120 – 280 mm (standard length), Wallace & van der Elst (1975) report that this species prefers deeper parts of estuaries. Winter (1979) has also recorded *L. lithognathus* of 20 – 200 mm (standard length) from the main channel of the Swartkops estuary.

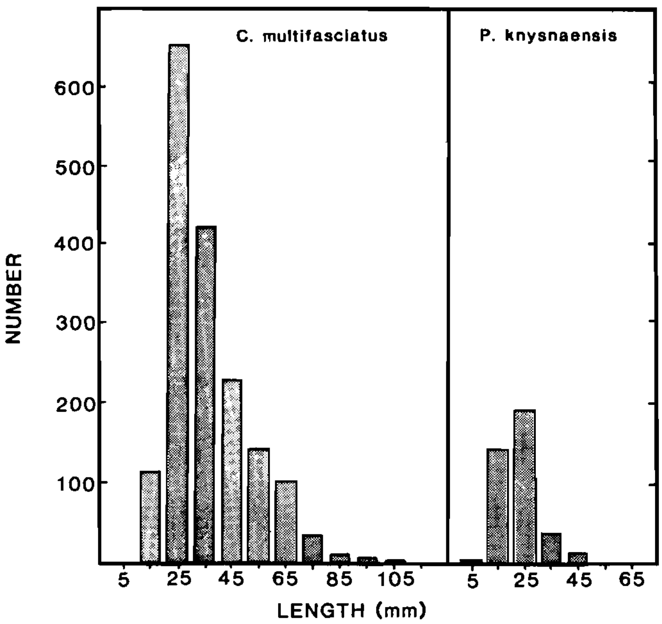

Figure 10 Size frequency histograms for the total catch of the two gobies *Caffrogobius multifasciatus* and *Psammogobius knysnaensis* in the Swartkops creek *Zostera* beds (n = 2103).

During the present study few juveniles of another two popular estuarine angling fish, the leervis, *Lichia amia* (Linnaeus) and the spotted grunter *Pomadasys commersonni* (Lacépède) were caught in the creek *Zostera* although Wallace & van der Elst (1975) have reported large numbers of the latter in St. Lucia *Zostera* beds. In total, only three juvenile *L. amia* (46, 56 and 98 mm), two juvenile *P. commersonni* (36 and 46 mm) and two larger *P. commersonni* (310 and 323 mm) were captured. Winter (1979) recorded *L. amia* juveniles from 45 mm (standard length) in the estuary and distinguished two size groups of *P. commersonni.* The two groups consisted of juveniles of 50 – 170 mm (standard length) and adults of over 300 mm (standard length).

Hepsetia breviceps is abundant in bays and estuaries along the Cape coast where it is preyed upon by birds and larger fish (Day *et al.* 1981). The numerical abundance of this species is clearly illustrated by the present study as well as those of Els (1979) and Winter (1979). Lasiak (1982) reported that at Kings Beach, a sheltered sandy beach in Algoa Bay about 15 km south of the Swartkops estuary mouth, *H. breviceps* constituted 49,5% of surf-zone catches with a seine net of the same dimensions and mesh size as that used by Winter (1979). Although *H. breviceps* is recorded breeding in estuaries in summer (Day *et al.* 1981), Melville-Smith & Baird (1980) do not include it in a list of species which spawn in the Swartkops estuary. Furthermore, Lasiak (1982) has reported adults in a sexually ripe condition in the Kings Beach surf zone from August to December. As the size range of specimens caught in the *Zostera* beds was 12 – 68 mm and those at Kings Beach, 34 – 110 mm with adult fish of 70 – 100 mm predominating (Lasiak 1982), it appears that in Algoa Bay *H. breviceps* spawns in the shallow inshore marine environment and larvae, juveniles and some adults enter and frequent the mouth and lower reaches of estuaries.

Gilchristella aestuarius, an estuarine fish, undergoes its complete life cycle in the estuary and consequently is represented in estuaries through its entire length range (Wallace 1975a; Blaber 1979; Talbot 1982). In the Swartkops estuary this small filter-feeding species numerically dominates catches in the middle and upper reaches (Winter 1979; Talbot 1982) while Melville-Smith & Baird (1980) found that *G. aestuarius* larvae constituted 31% of the Swartkops ichthyoplankton. This species spawns in the upper reaches from October through January and as the larvae grow their distribution extends towards the mouth and into the *Zostera* beds of the lower reaches (Melville-Smith & Baird 1980; Talbot 1982).

In the Swartkops creek *Zostera,* the combination of shoals of *Hepsetia* and *Gilchristella,* with respective origins in the nearshore marine environment and the upper reaches of the estuary, constitutes 55% of the total creek fish community.

The four mullet species abundant as juveniles in the *Zostera* are also numerous as larger specimens in the main channel of the estuary (Marais 1976; Winter 1979; Marais & Baird 1980b). These species do not occur in the estuary as larvae (Melville-Smith & Baird 1980). Recruitment of juvenile mullet < 30 mm occurred throughout the year in the creek *Zostera,* implying that, collectively, the four species probably spawn throughout the year. The work of van der Horst & Erasmus (1981) has shown that *Liza dumerili* spawns from December through February near the mouth of the Swartkops river whilst Lasiak (1982) has similarly shown that *Liza richardsoni* spawns from September through March in Algoa Bay. Wallace (1975b) reports the spawning period for *Mugil cephalus* to be from May to September in Natal waters and as Brownell (1979) has recorded eggs of this species off the Cape peninsula from July through October it would appear that spawning time is similar in East Cape waters. *Liza tricuspidens* spawns from August through November in Natal (Wallace 1975b) but this spawning period has not been confirmed in Cape waters.

Rhabdosargus holubi was the second most abundant species in the Swartkops *Zostera* beds and Winter (1979) also found this from seine netting throughout the estuary. *R. holubi* juveniles have been shown to feed on plant material such as *Ruppia spiralis* Linnaeus and *Zostera capensis* but only the epiphytic diatoms and algae and epifauna of those macrophytes are digested (Blaber 1974a; Whitfield 1980).

Day *et al.* (1981) record the presence of *R. holubi* juveniles in estuaries from Kosi Bay to Milnerton lagoon. Both the present study and that of Melville-Smith & Baird (1980) recorded specimens < 20 mm throughout the year with a marked influx of juveniles in early summer. In the Swartkops creek *Zostera*, growth is rapid to about 80 mm when numbers become too low to follow the cohort in the creeks. *R. holubi* larger than this are still abundant in the main channel of the estuary until they reach about 150 mm and return to the sea (Winter 1979). The majority captured by Lasiak (1982) in the surf zone were 170 – 230 mm in length. Growth studies by Wallace & van der Elst (1975) in Natal estuaries and Winter (1979) in the Swartkops estuary indicate growth of about 100 mm in the first year for this species. Blaber (1974b), however, found growth of only 60 mm in the first year for the closed West Kleinmond estuary north of Algoa

Bay.

The blacktail, *Diplodus sargus,* is primarily an inshore species favouring rocky shores (van der Elst 1981). It has a long breeding season with peak spawning activity from July through September, and though tidal pools and inshore reefs serve as nursery areas for these species (Joubert 1981; van der Elst 1981; Lasiak 1982), juveniles have been recorded in estuaries from Kosi Bay to Hermanus lagoon (Day *et al.* 1981). The influx of juveniles recorded in the Swartkops *Zostera* in spring and early summer corresponds to the breeding season described above. Winter (1979) has noted the juvenile *D. sargus* are usually associated with *Zostera* in the lower reaches of the Swartkops estuary and recorded that after floods small *D. sargus* were absent from the estuary until *Zostera* became re-established some three to four months after the floods.

Only two of the three species of goby common in the Swartkops estuary were captured in the present study, but as Malan (1979) found *Glossogobius giuris* (Hamilton-Buchanan) to be confined to the upper reaches, the absence of this species in the creek *Zostera* of the lower reaches was to be expected. Melville-Smith & Baird (1980) report that goby larvae constitute 59,4% of the Swartkops estuary ichthyoplankton and occur throughout the year. Juvenile gobies of less than 20 mm were captured each month in the creek *Zostera* and the peak of small *Psammogobius knysnaensis* from March to May coincides with the period of maximum recruitment recorded in the main channel by Malan (1979). *P. knysnaensis* breeds in estuaries (Day *et al.* 1981).

The three sparids, *Spondyliosoma emarginatum, Diplodus cervinus* and *Rhabdosargus globiceps* were only recorded from September through March in the *Zostera* beds and adults are known to breed in spring and summer (Talbot 1955; Brownell 1979; van der Elst 1981). *S. emarginatum* is a common reef fish along the Cape east and south coasts (van der Elst 1981). Winter (1979) did not record any *S. emarginatum* in the main channel of the Swartkops estuary but Hanekom (1982) has found this species in *Zostera* beds in the Kromme estuary. *D. cervinus* is also a common reef fish in the eastern Cape and was also recorded seasonally in summer in the Swartkops estuary by Winter (1979). *R. globiceps* is abundant in the southern Cape and Talbot (1955) has investigated the biology of this species in the Klein estuary. Juveniles were abundant in *Zostera* and *Ruppia* beds and stayed in the estuary for two years before returning to the sea (Talbot 1955). Lasiak (1982) only caught juveniles in the surf zone in Algoa Bay and whilst Winter (1979) did not capture *R. globiceps* in the Swartkops estuary, Marais & Baird (1980a) record the occurrence of a few large specimens in anglers' catches in this estuary. Another juvenile sparid recorded in low numbers from the Swartkops estuary *Zostera* was *Sarpa salpa* (Linnaeus). Joubert (1981) has proposed that adult *S. salpa* migrate to Natal to breed in deep water off the coast and the fry drift southwards with the Agulhas current to the Cape where they occur in tidal pools and estuaries, in particular, the Knysna estuary. Lasiak (1982) captured numerous juveniles of 20 – 30 mm and only one ripe male specimen in 24 months of surf zone netting.

The pomadasid, *Pomadasys olivaceum,* also showed a summer influx of juveniles into the Swartkops *Zostera* but occasional specimens were caught throughout the year. Winter (1979) recorded the same trend in the main channel of the estuary and Joubert (1981) has found that in Natal waters this species has a long breeding season. Lasiak (1982) has found Kings Beach to be an important nursery area for juveniles of this species which spawns in inshore waters.

The sole, *Solea bleekeri,* is known to breed in estuaries (Wallace 1975a; Melville-Smith & Baird 1980; Whitfield 1980) as well as in the sea (Day *et al.* 1981). *Heteromycteris capensis* breeds at sea (Melville-Smith 1978; Brownell 1979) and Lasiak (1982) has found ripe specimens throughout the year in the surf. The pipefish *Syngnathus acus* also breeds in estuaries and the sea (Day *et al.* 1981) and Melville-Smith (1978) collected metamorphosed larvae of 10 – 14 mm in the Swartkops ichthyoplankton. *S. acus* was most abundant during the summer months in the creek *Zostera.*

The spring/summer influx of juveniles of numerous fish species in the Swartkops estuary coincides with an increase in standing crop of *Zostera* itself. Emmerson *et al.* (1982), in an investigation of Swartkops *Zostera* beds, found that the high summer standing crop of 160 g (dry mass) m^{-2} dropped off to 40 g (dry mass) m^{-2} in winter. This is owing to the die-off of aerial shoots after flowering whilst the rhizomes are persistent, remaining buried in the substrate (Edgcumbe 1980). Nienhuis & Bree (1980) have recorded a similar summer increase for *Zostera marina* (Linnaeus) standing crop in Holland.

In conclusion, it appears that the creek *Zostera* beds in the lower reaches of the Swartkops estuary form an important and integral part of the nursery function of the estuary by providing a sheltered, food-rich habitat. Consequently, it is essential that the vegetated marginal areas of estuaries be included in estuarine management programmes. Though numerous species occurred in the *Zostera*, juveniles of *H. breviceps, R. holubi, L. dumerili, L. richardsoni, M. cephalus* and *D. sargus* were numerically dominant. Other workers have recorded spawning of these species in the shallow marine environment. In the present study extremely small fish (< 20 mm) were also captured at the main channel station but juveniles of all species, except those which can be termed the true estuarine complement of *G. aestuarius,* gobies and soles, were more abundant in the *Zostera* than the main channel. Finally, it is apparent that the use of a small mesh seine net for sampling facilitated the capture of extremely small juveniles (< 20 mm) not previously recorded from the estuary.

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