Fish abundance and distribution in the Gamtoos estuary with notes on the effect of floods

J.F.K. Marais

Zoology Department, University of Port Elizabeth

Gill-nets were used on two occasions during 1980 and from January 1981 to January 1982 to determine the catch per unit effort for fishes in the Gamtoos estuary. The mean of the fish caught was 43 fish per net (33,3 kg), which compares favourably with other larger systems like the Sundays, Bashee and Kei estuaries. All these estuaries are subject to regular floods and have relatively small mud-flats and *Spartina* beds in the mouth areas. Flood conditions, which occurred during seven months in 1981, caused reduced salinities and high turbidity throughout the estuary and were negatively correlated with catch returns. Mullet (Fam. Mugilidae) dominated catches numerically (12 per net) followed by kob *Argyrosomus hololepidotus* (11,4), sea-catfish *Tachysurus feliceps* (10,9) and leervis *Lichia amia* (5,2).

S. Afr. J. Zool. 1983, 18: 103 – 109

Kiefnette is by twee geleenthede gedurende 1980 en vanaf Januarie 1981 tot Januarie 1982 gebruik om vangs per eenheid poging van visse in die Gamtoos-getyrivier te bepaal. Daar is gemiddeld 43 visse per net (33,3 kg) gevang, wat baie goed vergelyk met vangste in soortgelyke groter sisteme soos die Sondags-, Bashee- en Kei-getyriviere. Soos in die geval van die Gamtoos is hierdie getyriviere ook onderhewig aan periodieke vloede en word hulle gekenmerk deur die afwesigheid van modder- en slikmoerasse bedek met *Spartina* gras, behalwe tot 'n geringe mate in die mondgebiede. Vloede, wat 'n drastiese verlaging in soutgehalte en hoë troebelheid van die hele getyrivier tot gevolg gehad het, het gedurende sewe van die 15 opname maande voorgekom en het 'n negatiewe korrelasie t.o.v. vangopbrengs getoon. Die vangste is oorheers deur harder (Fam. Mugilidae) (12 per net) gevolg deur kabeljou *Argyrosomus hololepidotus* (11,4), seebarber *Tachysurus feliceps* (10,9) en leervis *Lichia amia* (5,2).

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J.F.K. Marais

Zoology Department, University of Port Elizabeth, P.O. Box 1600, Port Elizabeth 6000, Republic of South Africa

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Little has been published to date on the Gamtoos estuary, although it is one of the major estuaries of the eastern Cape Province, South Africa. Shewell (1950) only reported on the avifauna of the estuary and a recent synopsis of available unpublished data by Heydorn & Grindley (1981) contains useful information on some abiotic characteristics of the estuary but little on the inhabitant flora and fauna. Day (1981), after brief notes on the estuary, concludes that 'much more information about this unusual estuary is required'.

A study of the major ichthyofauna in the estuary was initiated during 1980 and conducted on a monthly basis through 1981 until January 1982. It was attempted to determine some of the factors which affect fish abundance in estuaries by comparing gill-net catches of this estuary with catches from other Eastern Cape and Transkei estuaries. The flood conditions that prevailed from April 1981 until October 1981 also allowed the evaluation of the effects of floods on fish abundance and distribution in the estuary.

Description of estuary

The catchment area of the Gamtoos (34 438 km^2) is the fourth largest of all Cape rivers and extends into the Great Karoo. The Gamtoos is fed by two tributaries, the Kouga and the Groot Rivers and stretches 75 km to the sea. Most of the catchment area lies in a region of low precipitation but which is periodically subject to episodic rainfall. The mean annual run-off, measured at Patensie, 50 km upstream of the mouth and above the confluence of the Gamtoos River and Loeriespruit, is 184 $\times$ $10^6 m^3$ (Heydorn & Tinley 1980).

Three major dams are found within the Gamtoos catchment area namely the Beervlei Dam near Willowmore, the Paul Sauer Dam on the Kouga River (Figure 1) and the Loeriespruit Dam on the Loeriespruit which joins the estuary 8,5 km from the mouth. These dams can absorb and buffer a large proportion of floodwater inflow, but once these dams are full and the floodgates are opened, extensive flooding occurs on the low-lying floodplain.

According to Alexander (1976), at least seven major floods have occurred since 1847 and on occasion the river can rise 20 m. When this happens overnight, the effect is catastrophic. More than 100 people drowned on the floodplain in 1971 (Heydorn & Grindley 1981) under such circumstances. Since then the river has been in flood again

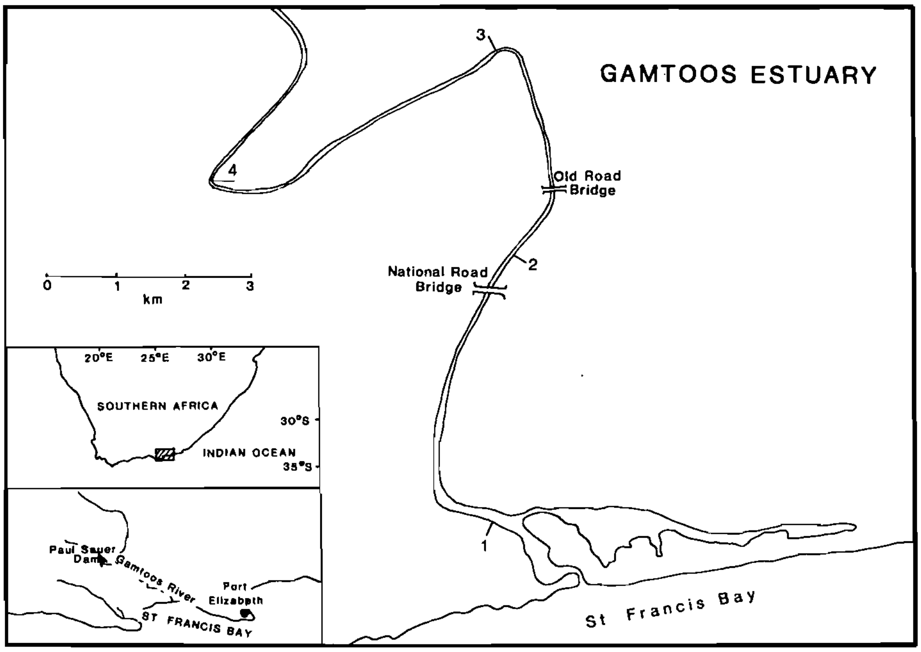

Figure 1 Geographical position of Sundays estuary and position of sampling sites.

in March 1981 and during subsequent months.

In the upper catchment area of the Gamtoos there is extensive stock farming with considerable overgrazing on many farms. Thus, during periods of flooding, the silt load of the tributaries is high (Heydorn & Grindley 1981). A large proportion of the catchment area nearer to the mouth is under the jurisdiction of the Directorate of Forestry. The floodplain from Patensie to the mouth is intensively cultivated with crops such as citrus, tobacco, lucerne and vegetables, all grown under irrigation. Heavy fertilization as well as the use of pesticides undoubtedly affects water quality in the lower reaches. The estuary is naturally channelled by 2 – 4 m high banks which become progressively less prominent as it broadens out 1 – 2 km from the mouth. The position of the mouth is variable. Aerial photographs reveal the presence of a number of old river courses to the west of the present estuary (Heydorn & Grindley 1981). After the 1971 floods the river mouth was located approximately 4,2 km west of the previous mouth resulting in a tidal lagoon (Figure 1).

Methods

Catch per unit effort (CPUE) of fish in the Gamtoos estuary was obtained by means of gill-nets. Each net consisted of five 10-m sections 3 m deep with stretched mesh sizes of 55, 70, 85, 110 and 145 mm. Methods of netting have been described by Marais (1982). One unit of effort is regarded as the number or mass of fish caught by the 150-m^2 net during a 12-h period. Netting was performed during May and August 1980 at Stations 1 – 3 and monthly from January 1981 to January 1982 at Stations 1 – 4. Netting sites are indicated on Figure 1 and are representative of the mouth region (Station 1; 120 m wide; 3,7 ± 0,8 m deep), middle reaches (Station 2; 65 m wide; 2,7 ± 0,6 m deep and Station 3; 45 m wide; 4,6 ± 2,0 m deep) and the upper reaches (Station 4; 55 m wide; 2,2 ± 0,8 m deep).

Salinity and temperature of surface and bottom waters as well as turbidity and water depth were measured every time in the morning prior to lifting of the nets. Methods are outlined in Marais (1983).

Estimated flow data for the Gamtoos River were obtained from the Department of Environmental Affairs for the period January 1981 to January 1982 and may be seen in Table 1. Correlation coefficients for monthly flow and number as well as mean CPUE were determined. Since March catches were made before the floods, the river flow for February 1981 was substituted for March 1981 for determination of the correlation coefficients.

Results

As can be seen in Table 1, the Gamtoos estuary was in spate from March 1981 to October 1981. The volume of water

Table 1 Estimated river flow in Gamtoos river mouth (information kindly supplied by the office of the Director General, Department of Environmental Affairs, Pretoria)

Month	Year	Flow $10^6 m^3$
May	1980	0,19
August	1980	0,37
January	1981	0,50
February	1981	3,64
March	1981	83,16
April	1981	64,76
May	1981	108,28
June	1981	186,24
July	1981	28,09
August	1981	53,81
September	1981	134,80
October	1981	74,36
November	1981	11,06
December	1981	4,40
January	1982	1,77

that passed through the estuary during 1981 (753,1 × 10^6 m^3) is much higher than the annual mean of 184 × 10^6 m^3 (Heydorn & Grindley 1981). Predictably the flood water had a very marked effect on water salinity, temperature and turbidity (Figures 2 – 5 for Stations 1 – 4).

Differences in water temperature between summer and winter were more pronounced with increased distance from the sea. A definite vertical temperature gradient was found at Stations 1 and 2 nearest to the sea. The temperature of bottom water samples varied much less (lower in summer

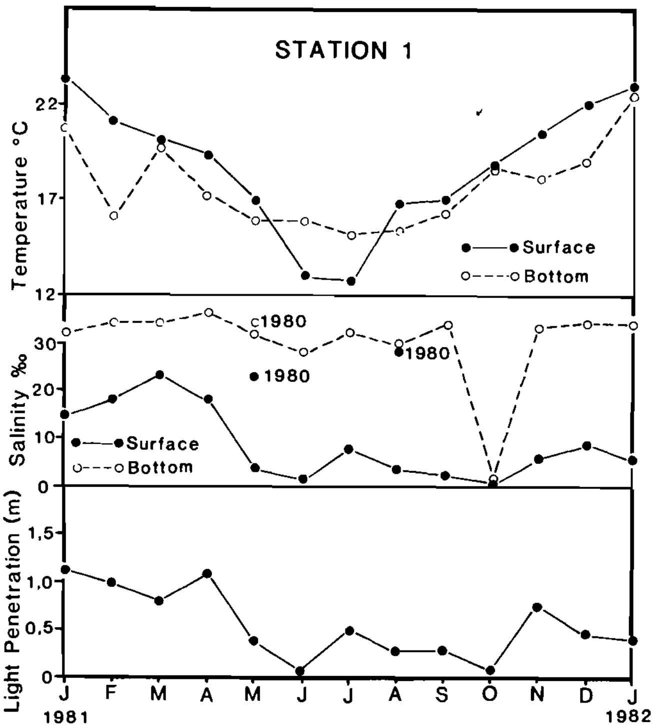

Figure 2 Salinity and temperature values of surface and bottom water as well as secchi-disc recordings at Station 1 in the Gamtoos estuary.

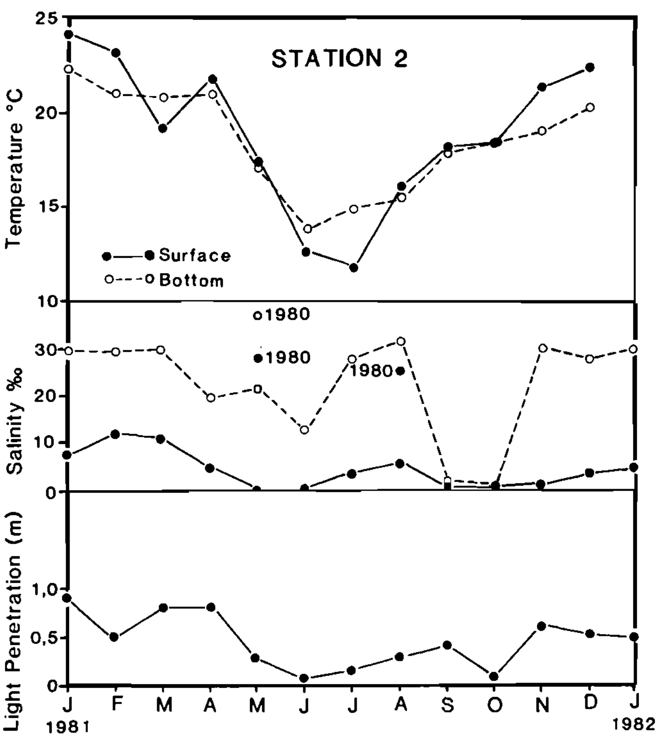

Figure 3 Salinity and temperature values of surface and bottom water as well as secchi-disc recordings at Station 2 in the Gamtoos estuary.

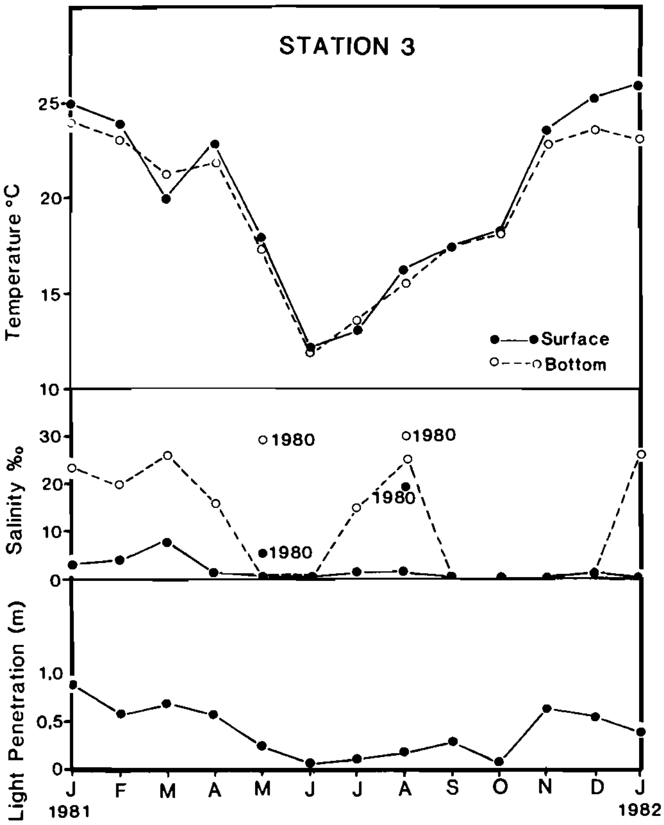

Figure 4 Salinity and temperature values of surface and bottom water as well as secchi-disc recordings at Station 3 in the Gamtoos estuary.

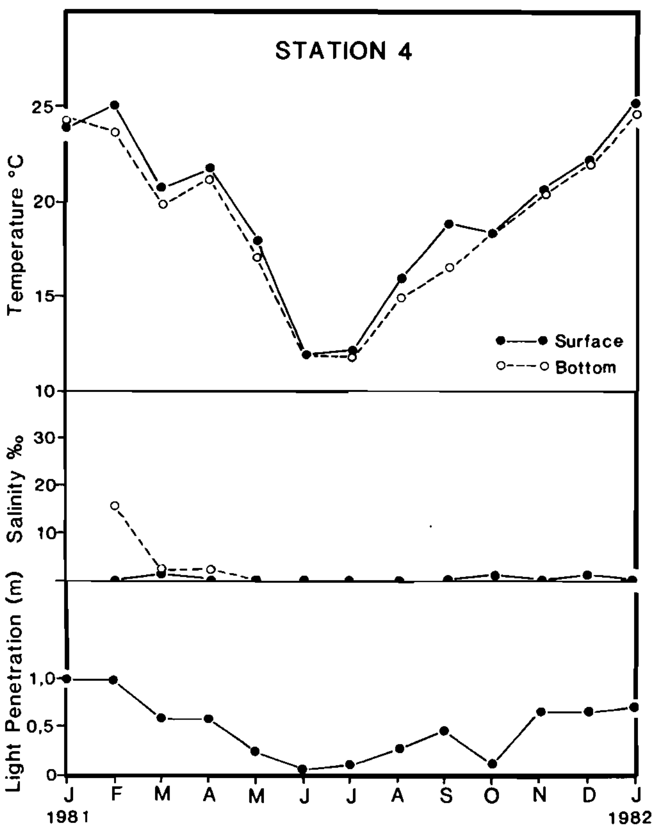

Figure 5 Salinity and temperature values of surface and bottom water as well as secchi-disc recordings at Station 4 in the Gamtoos estuary.

and higher in winter) than the surface water temperature.

A marked salinity gradient existed at Stations 1 – 3. Bottom water salinity averaged 30°/∞ at Stations 1 and 2 when the river was not in flood. The estuary was rendered fresh down to the mouth during October 1981 when bottom water salinity was only 2°/∞. However, this could have occurred on more than one occasion since the estuary was only visited once a month. Water salinity was down to 2°/∞ at Station 2 during September and October 1981 and this also happened from March to June and again from September to December 1981 at Station 3. With the exception of February 1981, bottom water salinity at Station 4 was always close to 0°/∞.

Light penetration was never more than 1 m at Stations 2 and 3. At the mouth (Station 1) and in the upper reaches (Station 4), this occurred on three and two occasions respectively. While the estuary was flooded, the silt-laden waters brought light penetration down to a few centimetres right to the mouth area (Figures 2 – 4).

Members of the family Mugilidae contributed the largest number (699 = 28%) of the total of 2 479 fish caught during the study period. Kob *Argyrosomus hololepidotus* were next in abundance (661 = 27%) followed by sea-catfish *Tachysurus feliceps* (633 = 26%). These two species and mullet contributed 80% to the total catch. If the 300 (12%) leervis *Lichia amia* are also included, the percentage totals 92% of all the fish caught, emphasizing how a few species dominated the gill-net catches in the Gamtoos estuary.

From Table 2 it is clear that larger catches were made at Stations 1 and 2, closest to the sea. The lesser contribution to the total catches at Stations 3 and 4, in the narrower upper regions, could be partly ascribed to the more drastic effect of the fresh water higher up in the estuary.

Major differences were found in species distribution in the estuary. Mullet, especially the flathead mullet, *Mugil cephalus*, and the freshwater mullet, *Myxus capensis*, dominated catches at Stations 3 and 4. *T. feliceps* occurred in largest numbers at Station 1 and decreased in number towards the head of the estuary. This follows the pattern described for the Sundays and the Krom estuaries (Marais 1981 & 1983). Conversely *L. amia*, although of smaller size, was more abundant in the freshwater Station 4 (Table 2) than at Station 1. Fifty *L. amia* caught at Station 4 during January 1982 contributed greatly to the total number of this species registered at Station 4. At this time turbidity at Station 4 was lower than at any of the other four stations (Figures 2 – 5). However, on the basis of mean mass of fish caught per net, Station 4 contributed only 400 g more than Station 1 over the experimental period.

A. hololepidotus was numerically more abundant in the middle reaches of the estuary (Stations 2 and 3), where the water was generally more turbid during non-flood periods than at Stations 1 and 4. The freshwater carp *Cyprinus carpio* and the bream *Oreochromis mossambicus* occurred in the nets on a few occasions.

Mean monthly CPUE, displayed in Table 3, shows that the floods not only markedly affected water salinity and turbidity, but also fish abundance. Fish numbers and mass

Table 2 CPUE (number and mass) of fish caught per gill-net at four localities in the Gamtoos estuary during 1980 – 1982. Total number and mass, mean number and mass per net as well as mean individual body mass are also given

	Station 1 (15)[a]		Station 2 (15)[a]		Station 3 (15)[a]		Station 4 (13)[a]		Total (58)[a]				
Species	*n*	Mass (g)	*n*	Mass (g)	*n*	Mass (g)	*n*	Mass (g)	*n*	Mass (g)	Mean *n* per net	Mass (g) per net	Mean (g) per individual
Myxus capensis	0,4	259	0,4	196	16,5	5985	5,1	2592	326	130286	5,6	2244	400
Mugil cephalus	0,6	190	0,2	244	5,3	1867	9,2	2494	211	66970	3,6	1155	317
Liza richardsoni	0,9	230	0,2	64	1,8	673	4,8	1315	105	31587	1,8	545	301
Liza tricuspidens			0,4	475	0,9	802	1,7	1402	41	37383	0,7	645	912
Liza dumerili					0,1	18	0,7	106	11	1655	0,2	29	150
Valamugil cunnesius					0,3	50			5	745	0,1	13	149
Total Mugilidae	1,9	679	1,2	979	24,9	9395	21,5	7909	699	268626	12,0	4631	384
Argyrosomus hololepidotus	6,3	14597	17,0	26409	12,6	14666	9,3	9056	661	952814	11,4	16428	1441
Tachysurus feliceps	29,3	13842	7,9	3718	3,2	1323	2,4	1170	633	298466	10,9	5146	471
Lichia amia	4,3	5278	3,5	4022	4,1	3345	9,4	5784	300	264835	5,2	4566	883
Pomadasys commersonni	1,7	2300	3,2	3338	1,1	888	0,2	95	93	99101	1,6	1709	1065
Monodactylus falciformis	0,3	21	0,2	13	1,1	67	0,8	57	36	2258	0,6	39	63
Lithognathus lithognathus	0,2	587	0,2	185	0,1	14	0,5	38	14	12294	0,2	212	878
Labeo umbratus					0,3	153	0,5	266	11	5750	0,2	99	523
Oreochromis mossambicus					0,1	55	0,6	272	9	4365	0,2	75	485
Pomatomus saltatrix	0,5	772							7	11574	0,1	200	1653
Cyprinus carpio					0,1	34	0,4	486	6	6839	0,1	118	1139
Myliobatus aquila	0,2	43							3	640	0,1	11	213
Elops machnata	0,1	207			0,1	107			2	4708	0,1	81	2354
Rhabdosargus holubi	0,1	3	0,1	10					2	191	0,1	3	96
Arcanthopagrus berda							0,1	32	1	411	0,1	7	411
Diplodus cervinus			0,1	3					1	45	0,1	1	45
Pomadasys olivaceum	0,1	1							1	15	0,1	1	15
	45,0	38330	33,4	38674	47,6	30047	45,7	25165	2479	1932935	42,7	33326	780

[a]Number of nets.

Table 3 Mean numbers and mass of fish caught per gill-net at four localities in the Gamtoos estuary

	May 1980		Aug 1980		Jan 1981		Feb 1981		Mar 1981		Apr 1981		May 1981		Jun 1981		Jul 1981		Aug 1981		Sep 1981		Oct 1981		Nov 1981		Dec 1981		Jan 1982	
Species	*n*	mass (g)	*n*	mass (g)	*n*	mass (g)	*n*	mass (g)	*n*	mass (g)	*n*	mass (g)	*n*	mass (g)	*n*	mass (g)	*n*	mass (g)	*n*	mass (g)	*n*	mass (g)	*n*	mass (g)	*n*	mass (g)	*n*	mass (g)	*n*	mass (g)
Myxus capensis	2,3	845	0,3	72	35,0	12592	6,5	3381	6,8	3879	5,5	2516			0,8	257	0,8	399					0,5	183	1,3	324	17,6	6552	4,5	1795
Mugil cephalus	1,0	508	6,7	2383	1,3	631	5,5	1252	5,3	1794	0,5	141			3,3	1054	7,3	1424					0,3	99	1,5	337	12,5	4896	9,3	2947
Liza richardsoni	1,0	387	2,0	587	7,0	2460	4,3	1328	3,8	958	0,5	148					1,5	279							0,5	184	0,8	178	5,8	1632
Liza tricuspidens	2,0	2252	1,3	1003	5,0	4373	0,8	606	0,3	322																			1,8	1604
Liza dumerili			0,7	91	0,5	105			0,5	75	0,3	34																	1,0	132
Valamugil cunnesius							1,3	186																						
Total Mugilidae	6,3	3992	11,0	4136	48,8	20161	18,4	6753	16,7	7028	6,8	2839			4,1	1311	9,6	2102					0,8	282	3,3	845	30,9	11626	22,4	8110
Argyrosomus hololepidotus	13,0	28992	11,0	38230	23,0	18200	24,3	26942	31,4	34814	16,7	27245	4,2	12870			1,0	1733	6,2	20380	3,9	9192	0,8	1466	15,0	17123	11,3	10280	8,8	7534
Tachysurus feliceps	4,5	1831	2,7	1519	31,8	13323	15,2	7258	7,0	2362	9,0	2276	10,0	3586	0,5	298	2,2	1164	3,8	2289	6,2	4296	1,7	663	36,3	19240	20,3	11764	8,5	3583
Lichia amia	0,3	1067	3,0	2261	16,0	13800	8,5	6656	3,8	3466	0,3	2396							1,8	3583	0,5	1128			2,5	4396	13,8	9522	25,5	19567
Pomadasys commersonni	0,3	1067	1,0	1233	2,0	1988	8,2	10988	2,8	3823	1,0	1170	0,3	174	0,3	175	1,5	247	0,5	191	0,8	635	1,9	1407					3,0	2265
Monodactylus falciformis	0,3	15			1,3	102	2,8	192	3,0	162							0,3	12							0,5	19	0,3	6	0,8	61
Lithognathus lithognathus							0,5	38					0,3	28	0,3	17	1,3	102			0,3	32	0,3	20						
Labeo umbratus													0,5	238	0,3	110					0,8	312			0,5	256	0,3	307	0,5	215
Oreochromis mossambicus					1,3	506			0,3	65							0,3	207									0,5	314		
Pomatomus saltatrix			1,3	1733															0,5	1282							0,3	312		
Cyprinus carpio																					0,3	129					0,3	269	1,0	1311
Myliobatus aquila	0,3	46			0,3	63	0,3	63																						
Elops machnata			0,3	777																										
Rhabdosargus holubi															0,3	11	0,3	37												
Arcanthopagrus berda							0,3	103																						
Diplodus cervinus																														
Pomadasys olivaceum																	0,3	11											0,3	4
	25,0	37010	30,3	49645	124,5	68143	78,8	59770	65,0	51720	33,8	35926	15,3	16896	5,8	1922	16,8	5615	12,8	27725	12,8	15724	5,5	3838	58,3	41879	78,0	44400	70,8	42651

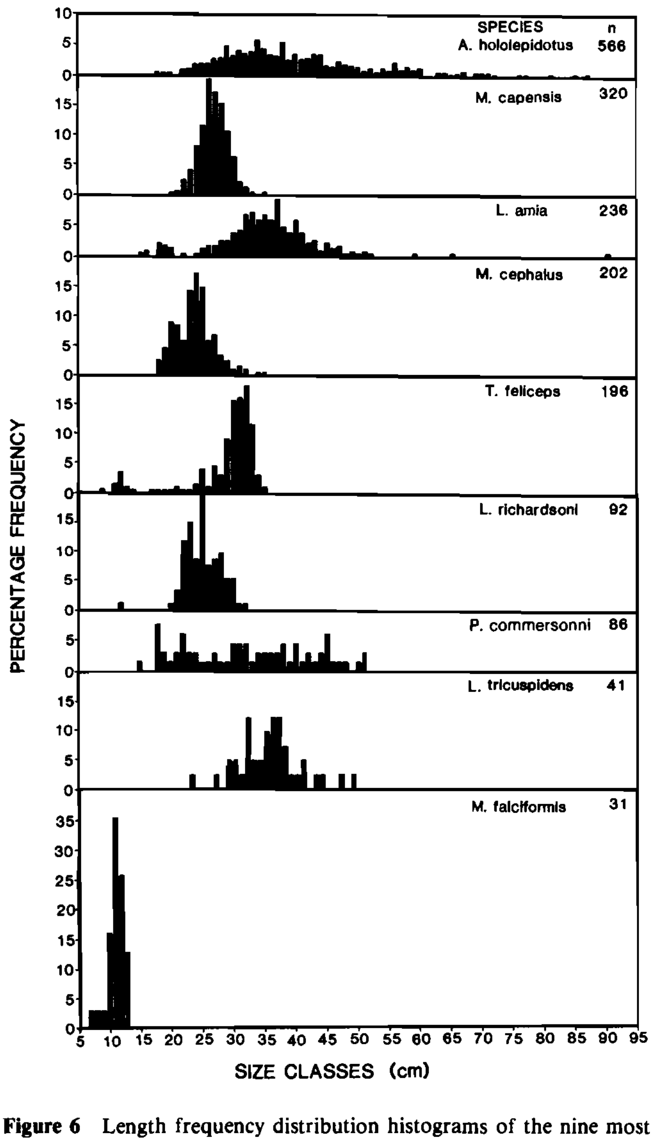

Figure 6 Length frequency distribution histograms of the nine most abundant species caught in the Gamtoos estuary (length = standard length).

declined from April 1981 to October 1981 coinciding with the large volume of fresh water entering the estuary during this period. CPUE for May and August 1980, January to March 1981 (sampling took place three days before the flood in March) and October 1981 to January 1982, was in general considerably higher than during the flood months. The catch of 27,7 kg per net for August 1981 coincided with higher water salinity whereas a kob of 36,4 kg, caught at Station 1, increased the CPUE for the mouth by 9,1 kg. As was expected, monthly water flow and number of fish (r = 0,646; p < 0,01) as well as flow and mean CPUE (r = 0,760; p < 0,01) were both negatively correlated.

Length frequency distribution histograms (Figure 6) show that a more extended size range of larger species such as *A. hololepidotus, L. amia* and *P. commersonni* were caught than of smaller species such as members of the family Mugilidae, *M. falciformis* and *T. feliceps.*

Discussion

Temperature recordings in the Gamtoos estuary confirmed the observations of Day (1964) at Knysna estuary and of Marais & Baird (1980) at Swartkops that the difference between summer and winter extreme temperatures was less near the mouth than at the head of the estuary. The present study also clearly shows that where a thermocline exists (as at Stations 1 and 2), the total temperature variation between summer and winter is 4 – 5 °C less in bottom than surface water.

With regard to salinity, the Gamtoos can be regarded as a partially mixed estuary (Barnes 1974). Large differences existed between surface and bottom water salinity at Stations 1 – 3. Salinity decreased towards the head of the estuary because of the continuous influx of fresh water into the system (Heydorn & Grindley 1981). A similar situation was found in the Sundays estuary (Marais 1981). The severe effect of floods, especially on surface water salinity, was also found in the Swartkops and Sundays estuaries after floods in July and August 1979 (Marais 1982). Hanekom (1982) recorded extremely low salinities down to the mouth of the Krom estuary during the 1981 floods.

In general, turbidity was higher in Gamtoos than in other Eastern Cape estuaries. For example a maximum secchi-disc recording of 2,9 m was registered by McLachlan (1972) in Swartkops estuary. Marais (1982) found a maximum value of 1,8 m and Hecht (1973) a mean value of 2,4 m in the upper reaches of the Krom estuary. The highest measurement during the present study was 1,1 m near the mouth of the Gamtoos estuary (Station 1, Figure 2). During peak flood periods (June and October), secchi-disc recordings varying between 0,06 and 0,08 m were found at the four sampling stations in the Gamtoos estuary. Hanekom (pers. comm.) found values as low as 0,08 – 0,1 m in the Krom estuary during the same period.

Turbidity is dependent on a number of factors such as proximity to the sea and tidal action (Day 1981), discoloration by decomposing vegetable matter (Day 1951), currents that stir up the bottom caused by winds (Hill 1966; McLachlan 1972), deepness of the estuary and the effect of clear fresh water flowing in at the head of the estuary (Hecht 1973). Day (1981) mentions that floods in Transkei and southern Natal cause turbidity values of 0,05 – 0,1 m. This compares favourably with the situation during the floods in the Gamtoos estuary. The generally high turbidity found throughout the Gamtoos estuary during periods of normal flow was owing to phytoplankton blooms which prevailed then, causing green discoloration of the estuarine water.

High nutrient levels (NH_4, PO_4 and NO_3) just above Station 4 are in the same order of magnitude as found in the upper regions of the Swartkops, Sundays and Great Fish Rivers (Watling, pers. comm.). However, NO_2 levels in the Gamtoos estuary (upper reaches) were approximately 20 times higher than in the above-mentioned estuaries. Watling (pers. comm.) is of the opinion that this may be the result of large-scale wash-off of fertilizer.

Presumptive *E. coli* I numbers were found to be 220/100 ml (Watling, pers. comm.), probably originating from faeces of cattle feeding along the river and estuarine banks. High nutrient levels from fertilizer and faecal pollution could be primarily responsible for the excessive phytoplankton growth which causes water discoloration and high turbidity when the river is not in flood.

Fish abundance and distribution follow the same general pattern as was found in the Sundays (Marais 1981), Bashee and Kei (Marais & Prinsloo 1980) estuaries. These estuaries are all channel-like, subjected to regular flooding, do not have extensive mud-flats covered by *Spartina* and have very similar salinity regimes with low salinity at the head and a steady increase towards the mouth.

Day *et al.* (1981) stated that large estuaries like, among others, Bashee and Kei, have a poor fish fauna. According to Day & Grindley (1981) this impoverishment of large estuaries draining the inland areas of the Eastern Cape Province, Transkei and southern Natal, is primarily caused by burial of aquatic macrophytes and macrobenthic fauna when subjected to severe flooding. Day (1981) also stated that the Sundays estuary is a poor estuary for angling and that the poverty is probably because of its steep banks, poor aquatic vegetation and turbid water. These features also characterize the Gamtoos, Kei and Bashee estuaries.

However, contrary to the statements by Day and other workers, the present studies indicate that larger, channel-like systems like the Gamtoos estuary have a richer fish life than smaller clear-water systems with macrophytic vegetation such as the Swartkops, Krom and Nquabara estuaries. Mean CPUE values of the Sundays (20,4 kg per net: Marais 1981), Bashee (33,5 kg: Marais & Prinsloo 1980), Kei (34,4 kg: Marais & Prinsloo 1980) and Gamtoos (33,3 kg) are considerably higher than were recorded in the Swartkops (13,1 kg: Marais & Baird 1980), Nquabara (19,4 kg: Marais & Prinsloo 1980) and Krom (17,5 kg: Marais 1983) estuaries. Large channel-like systems are more difficult to sample by means of commonly used seine and throw-nets than shallower estuaries with mud-flats and *Spartina* beds. Underestimation of some larger systems could have led to the conclusion by Day *et al.* (1981) that 'many of the smaller estuaries have relatively clear water and a rich fauna of small fishes'. Alternatively this may be true of the smaller shallow-water ichthyofaunal component for which no comparative data exist at present. However, the present evidence shows that it does not necessarily apply to the larger fishes in the deeper parts of estuaries.

The highly significant negative correlation between water flow (Table 1) and CPUE (Table 3) shows that the mean CPUE for Gamtoos could have been much higher were it not for the effect of the floods on the fishes of the estuary for seven of the 15 months during which sampling took place.

Mullet dominated catches as was found in the Sundays (Marais 1981), Kei and Bashee (Marais & Prinsloo 1980) estuaries. Considerably reduced mullet numbers were found during the flood months (no mullet during May, August and September), as was also found in the Sundays after heavy floods (Marais 1982). Marais postulated that the mullet disappeared after floods because detritus and silt that accumulated when fresh and saline water mix under 'normal' conditions, were washed away by the floods. Macnae (1957) mentioned that heavy floods tend to clear silt from the Gamtoos estuary while small floods tend to deposit it. Reddering (pers. comm.), who dived in that area of the estuary beneath the National road bridge in January 1981 and in January 1982 using SCUBA, found that a very deep silt deposit in the area was washed away by the floods.

Contrary to the findings of Bok (1979), the freshwater mullet *Myxus capensis*, did not dominate mullet numbers at the freshwater Station 4 (Table 2). However, this species contributed 66% of mullet numbers at the more saline Station 3. *Mugil cephalus* was the most abundant mullet species in the estuary from June to August 1981 when the estuary was flooded.

The dominance of catches in terms of mass by *A. hololepidotus* (19%) was expected for an estuary with a relatively high turbidity. This was also found by Marais (1981) in the Sundays estuary (31% of total catch) and Marais & Prinsloo (1980) in the Kei estuary (30%). Both these estuaries have a relatively high turbidity particularly in the upper regions where the salinity is also low ($<2°/_{oo}$). *A. hololepidotus* dominated catches both numerically and gravimetrically at Station 2 in the Gamtoos estuary and gravimetrically at Station 3. Talbot (1982) found *Gilchristella aestuarius* to be most abundant in the middle reaches of the Swartkops estuary outside its breeding season. *G. aestuarius* was the most important food item found in *A. hololepidotus* stomachs (Marais, unpubl. data). Whitfield & Blaber (1978) also mentioned the importance of sluggish prey such as *G. aestuarius* in the diet of slow-moving fish like *A. hololepidotus*. The turbid middle reaches would thus appear to be a suitable foraging area for *A. hololepidotus*.

The large numbers of *T. feliceps* that were caught per net ($\bar{x}$ = 10,9) especially in the mouth region (29,3), are in accordance with results from other eastern Cape estuaries: the Sundays (4,1: Marais 1981) and the Krom (5,6: Marais 1983). A notable exception occurred in the Swartkops where a mean of only 1,4 *T. feliceps* was caught per net (Marais & Baird 1980). The reasons for the low number in Swartkops estuary are unknown.

The relatively high number of *L. amia* caught (5,2 per net) is surprising when considering that a mean of only one was caught per net in both the Sundays (Marais 1981) and the Kei estuaries (1980). However, in the Bashee, which is also channel-like with a salinity gradient from head to mouth and with fairly clear water in the mouth and middle regions, 3,7 *L. amia* were caught per net. Large numbers of this species (6,9) were caught in the Krom estuary. The same pattern reflecting an increase in numbers during summer in the Krom estuary was also recorded in the Gamtoos.

In conclusion it seems that the channel-like Gamtoos estuary has an extremely rich large-fish fauna despite the effect of major floods on the estuary. The fact that it is not regarded as an angler's paradise could be the result of fish in the Gamtoos estuary not taking bait too readily because of an excess of food available in the water column.

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