Assessment of catches in shore angling competitions from the border region of the Eastern Cape, South Africa

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Seventeen years (1982–1998) of competitive shore angling catch and effort data from the Border region (Great Fish River–Kei River) of the Eastern Cape of South Africa were analysed. Of a total of 34 species recorded, the most commonly caught were *Rhinobatos annulatus* (36 %), *Argyrosomus japonicus* (22 %) and *Dasyatis chrysonota chrysonota* (13 %). By mass, most of the catch was made up of *R. annulatus* (24 %), *D. c. chrysonota* (19 %), *Carcharius taurus* (16 %) and *A. japonicus* (13 %). These species constituted the most important species during each year of the study period. Mean annual catch per unit effort (CPUE) by number and mass has decreased slightly over the 17 years. Only *R. annulatus* and *D. c. chrysonota* showed a significant ($P < 0.05$) change in mean annual mass, with the mean sizes of other species remaining relatively constant. Although all recorded specimens were larger than applicable legal minimum size limits, the majority of recorded *A. japonicus* (99 %), *Lithognathus lithognathus* (73 %), *Triakis megalopterus* (92 %) and *C. taurus* (97 %) were immature. It is apparent that, with a limited number of exceptions, the status of the Border competitive shore fishery, in terms of catch composition and CPUE, has remained relatively constant over the period 1982–1998.

Key words: competitive shore fishery, fish composition, catch per unit effort.

INTRODUCTION

Shore-based angling is one of the most popular forms of marine fishing in the world (Hickley & Tompkins 1998). In South Africa, there are an estimated 412 000 shore-based marine anglers (McGrath *et al.* 1997), who are responsible for an annual catch of approximately 4.5 million fish weighing 3000 tonnes (Brouwer *et al.* 1997). The marine shore-based fishery in South Africa is of a recreational nature, and is composed of competitive and social sectors (Van der Elst 1989). Organized competitive shore angling is controlled by the South African Shore Angling Association (SASAA), a national body with regional constituents. Given the current SASAA membership of 3780 anglers (E. Holmes, pers. comm.) and the high frequency of competitions, organized angling can generate a large amount of high-quality catch and effort data, which, over time, can be used as an indicator to assess the status of the shore fishery.

Competition records have previously been identified as an under-utilized source of fisheries catch and effort data for the KwaZulu-Natal linefishery (Pradervand & Govender 1999), and in the light of the financial limitations challenging contemporary fisheries research in South Africa, such cost-effective data could well serve to supplement the more costly traditional methods of research such as creel and access-point surveys (Joubert 1981; Clarke & Buxton 1989; Brouwer *et al.* 1997). Previous studies that used competition data to assess various regions of the South African marine shore fishery included work by Van der Elst (1979), Coetzee & Baird (1981), Van der Elst & De Freitas (1988), Coetzee *et al.* (1989), Bennett (1991), Bennett (1993a), Bennett *et al.* (1994) and Attwood & Bennett (1995). However, none of these studies have examined the shore fishery in that part of the Eastern Cape known as the Border region (Great Fish to Kei Rivers). The present study provides an assessment of the marine shore fishery in the area between the Great Fish and Kei Rivers.

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METHODS

The present study is based on shore angling competition data of 11 angling clubs from the Border Rock and Surf Angling Association (BRSAA) for the period 1982–1998. The sites and dates for competitions were determined *a priori* at the onset of each fishing year, and competitors fished for a

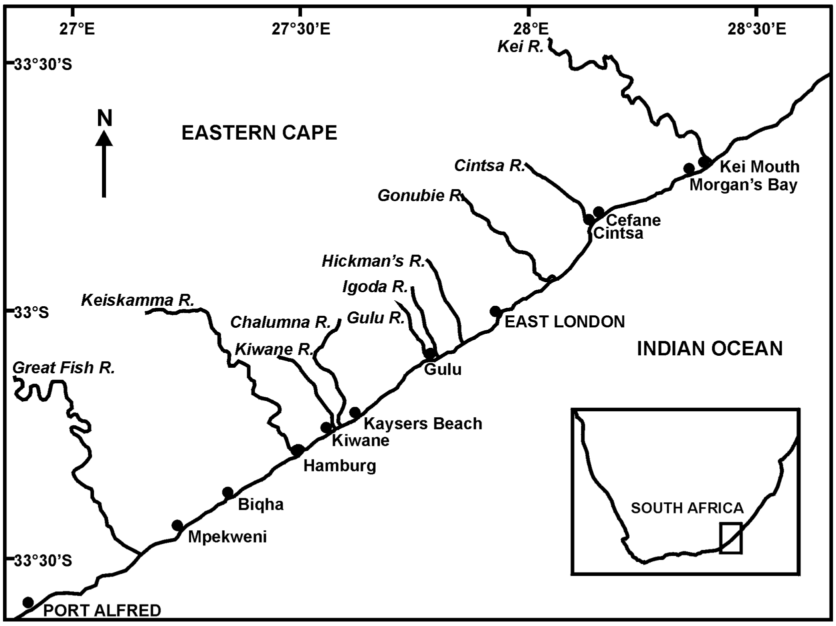

Fig. 1. Map of the study area showing locations of the individual fishing sites.

fixed 8-hour period (either 07:00–15:00 or 06:00–14:00) on one day, irrespective of weather conditions. The data are from 10 sites between the Great Fish and Kei River Rivers (Fig. 1), and were received in the format of BRSAA weigh sheets. The data were captured to an MS Access database, and validated for transcription accuracy prior to analysis. The format of shore angling competitions in the study area remained constant throughout the study period. Anglers had the choice of weighing fish on the beach, and then releasing them, or killing the fish and weighing them at a central weigh-in venue after each respective competition. Teleosts above the legal minimum size were usually killed, while elasmobranchs were mostly weighed and released. A minimum BRSAA weigh-in requirement of 1 kg for teleosts and 2 kg for elasmobranchs was maintained throughout the study period. Eligible fish were individually weighed on a certified scale and the weight recorded on a weigh sheet. In some instances, batch-weighing of species occurred, and these

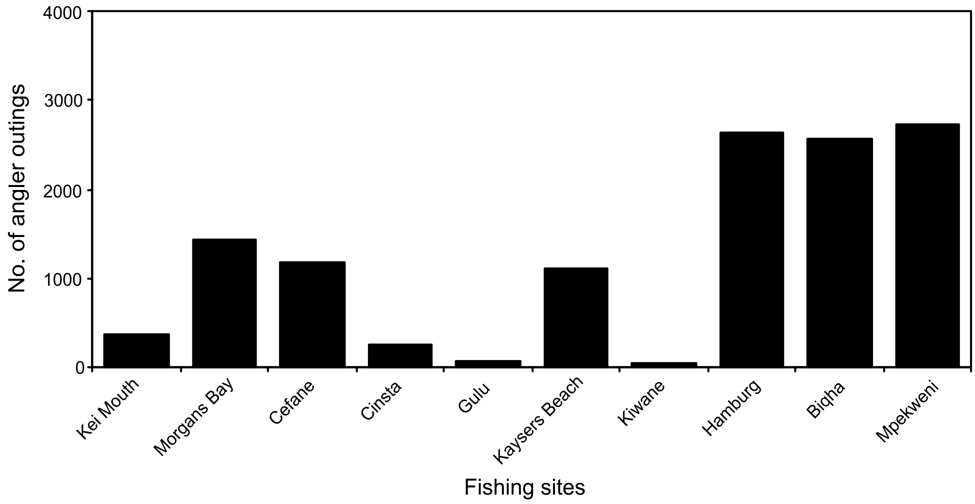

Fig. 2. Spatial distribution of recorded data from the ten fishing sites for the period 1982–1998.

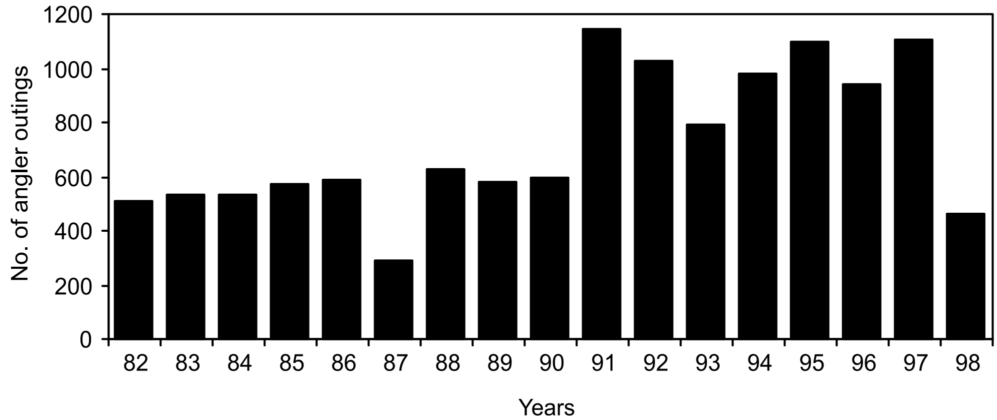

Fig. 3. Annual distribution of sampled angling effort for the period 1982–1998.

data were excluded from size composition analyses. Both successful and unsuccessful outings were noted on the weigh sheets. Subsequent to the introduction of national linefish size restrictions in 1985 (Government Gazette No. 9543 of 31 December 1984), fish smaller than the minimum legal size limits, but larger than the BRSAA minimum sizes, could still be recorded if the fish were released.

For purposes of determining the proportion of fish that were smaller than their relevant legal minimum size limits, and to determine their maturity status, individual weights were converted to lengths using standard length/mass regressions given by Mann (2000). Least squares regressions were fitted to mean annual catch per unit effort (CPUE) and mass values to assess temporal trends. Species-specific CPUE was calculated on the assumption that angling effort was equally directed at all species.

RESULTS

Fishing effort

A total of 12 386 individual angler outings, representing 99 088 hours of angling from 128 competitions over the period 1982–1998, was analysed. Spatial distribution of data was not uniform, with most of the data (in terms of individual angler outings) originating from the Mpekweni (22 %), Biqha (21 %) and Hamburg (21 %) sites (Fig. 2). Temporal distribution of the data was, however, relatively uniform for the periods 1982–1990 and 1991–1997 (Fig. 3). Monthly distribution of analysed data was also uniform, with most competitions having been held in the consecutive summer, autumn and spring months of each respective year.

Catch composition

Thirty-four species representing 24 families were positively identified in anglers' catches from all sites from 1982 to 1998 (Table 1). Numerically, the most important species were *Rhinobatos annulatus* (36 %), *Argyrosomus japonicus* (22 %) and *Dasyatis chrysonota chrysonota* (13 %) (Fig. 4). By

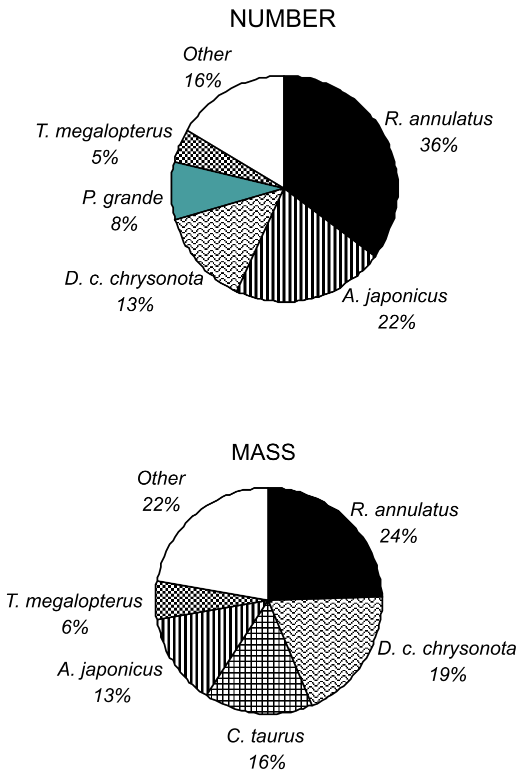

Fig. 4. Percentage catch composition by number (n = 19 434) and mass (84 407 kg) for the top five teleost and elasmobranch species for the period 1982–1998.

Table 1. Species composition of catches by competitive shore anglers in the Border region for the period 1982–1998. Percentage contribution is given in parentheses. Species are arranged in phylogenetic order according to Smith & Heemstra (1986).

Family	Scientific name	Common name	Number	Mass (kg)
CHONDRICHTHYES				
HEXANCHIDAE	Notorynchus *cepedianus*	Cowshark	92 (0.5)	2385.5 (2.9)
SQUALIDAE		Unspecified dogshark	3 (<0.1)	8.8 (<0.1)
ORECTOLOBIDAE	*Stegostoma fasciatum*	Zebra shark	10 (0.1)	21.7 (<0.1)
CARCHARHINIDAE	*Carcharhinus limbatus*	Blackfin shark	7 (<0.1)	31.1 (<0.1)
	Rhizoprionodon acutus	Milk shark	1 (<0.1)	18.0 (<0.1)
	Carcharhinus brachyurus + *Carcharhinus obscurus*	Mixed shark	445 (2.3)	2 926.9 (3.6)
TRIAKIDAE	*Mustelus* spp.	Unspecified houndshark	28 (0.1)	197.0 (0.2)
	Triakis megalopterus	Spotted gullyshark	914 (4.7)	4 690.6 (5.7)
SCYLIORHINIDAE	*Poroderma africanum*	Striped catshark	165 (0.8)	805.7 (1.0)
		Unspecified catshark	11 (0.1)	27.2 (<0.1)
	Haploblepharus edwardsii	Puffadder shyshark	2 (<0.1)	4.4 (<0.1)
SPHYRNIDAE	*Sphyrna* spp.	Unspecified hammerhead shark	31 (0.2)	229.5 (0.3)
ODONTASPIDIDAE	*Carcharius taurus*	Spotted raggedtooth shark	572 (2.9)	12 789.6 (15.5)
TORPEDINIDAE	*Torpedo sinuspersici*	Marbled electric ray	15 (0.1)	63.4 (0.1)
RAJIDAE	*Raja alba*	Spearnose skate	17 (0.1)	268.3 (0.3)
RHINODATIDAE	*Rhinobatos annulatus*	Lesser sandshark	6 862 (35.3)	20 238.2 (24.5)
DASYATIDAE	*Dasyatis chrysonota chrysonota*	Blue stingray	2 607 (13.4)	15 545.6 (18.9)
	Gymnura natalensis	Diamond ray	132 (0.7)	2 201.6 (2.7)
	Myliobatus aquila + *Pteromylaeus bovinus*	Mixed ray	531 (2.7)	4 020.8 (4.9)
		Unspecified shark	3 (<0.1)	28.2 (<0.1)
		Unspecified ray	1 (<0.1)	2.2 (<0.1)
OSTEICHTHYES				
ELOPIDAE	*Elops machnata*	Springer	1 (<0.1)	1.2 (<0.1)
ARIIDAE	*Galeichthys* spp.	Unspecified seabarbel	1 (<0.1)	2.0 (<0.1)
PLOTOSIDAE	*Plotosus nkunga*	Eeltail barbel	1 (<0.1)	2.0 (<0.1)
SERRANIDAE	*Epinephelus andersoni*	Catface rockcod	2 (<0.1)	2.5 (<0.1)
	Epinephelus marginatus	Yellowbelly rockcod	7 (<0.1)	10.1 (<0.1)
		Unspecified rockcod	11 (<0.1)	18.7 (<0.1)
POMATOMIDAE	*Pomatomus saltatrix*	Elf	238 (1.2)	312.9 (0.4)
HAEMULIDAE	*Pomodasys commersonnii*	Spotted grunter	136 (0.7)	246.2 (0.3)
SPARIDAE	*Cymatoceps nasutus*	Poenskop	78 (0.4)	182.9 (0.2)
	Diplodus cervinus hottentotus	Zebra	37 (0.2)	48.4 (0.1)
	Diplodus sargus capensis	Blacktail	82 (0.4)	91.2 (0.1)
	Lithognathus lithognathus	White steenbras	269 (1.4)	940.5 (1.1)
	Pachymetopon grande	Bronze bream	1 638 (8.4)	2643.8 (3.2)
	Rhabdosargus holubi	Cape stumpnose	9 (<0.1)	10.1 (<0.1)
	Sparodon durbanensis	White musselcracker	55 (0.3)	222.1 (0.3)
	Cheimerius nufar	Santer	1 (<0.1)	1.1 (<0.1)
CORACINIDAE	*Dichistius capensis*	Galjoen	48 (0.2)	73.3 (0.1)
SCORPIDIDAE	*Neoscorpis lithophilus*	Stonebream	108 (0.6)	143.4 (0.2)
SCIAENIDAE	*Argyrosomus japonicus*	Dusky kob	4 209 (21.7)	10 849.9 (13.2)
	Umbrina spp.	Unspecified baardman	28 (0.1)	63.6 (0.1)
CARANGIDAE	*Caranx sem*	Blacktip kingfish	1 (<0.1)	7.0 (<0.1)
	Lichia amia	Leervis	3 (<0.1)	8.6 (<0.1)
	Trachinotus africanus	Southern pompano	1 (<0.1)	1.2 (<0.1)
	Trachurus trachurus	Maasbanker	2 (<0.1)	2.1 (<0.1)
MUGILIDAE		Unspecified mullet	13 (0.1)	14.7 (<0.1)
		Unidentified fish	10 (0.1)	33.8 (<0.1)
TOTAL			19438	82437.5

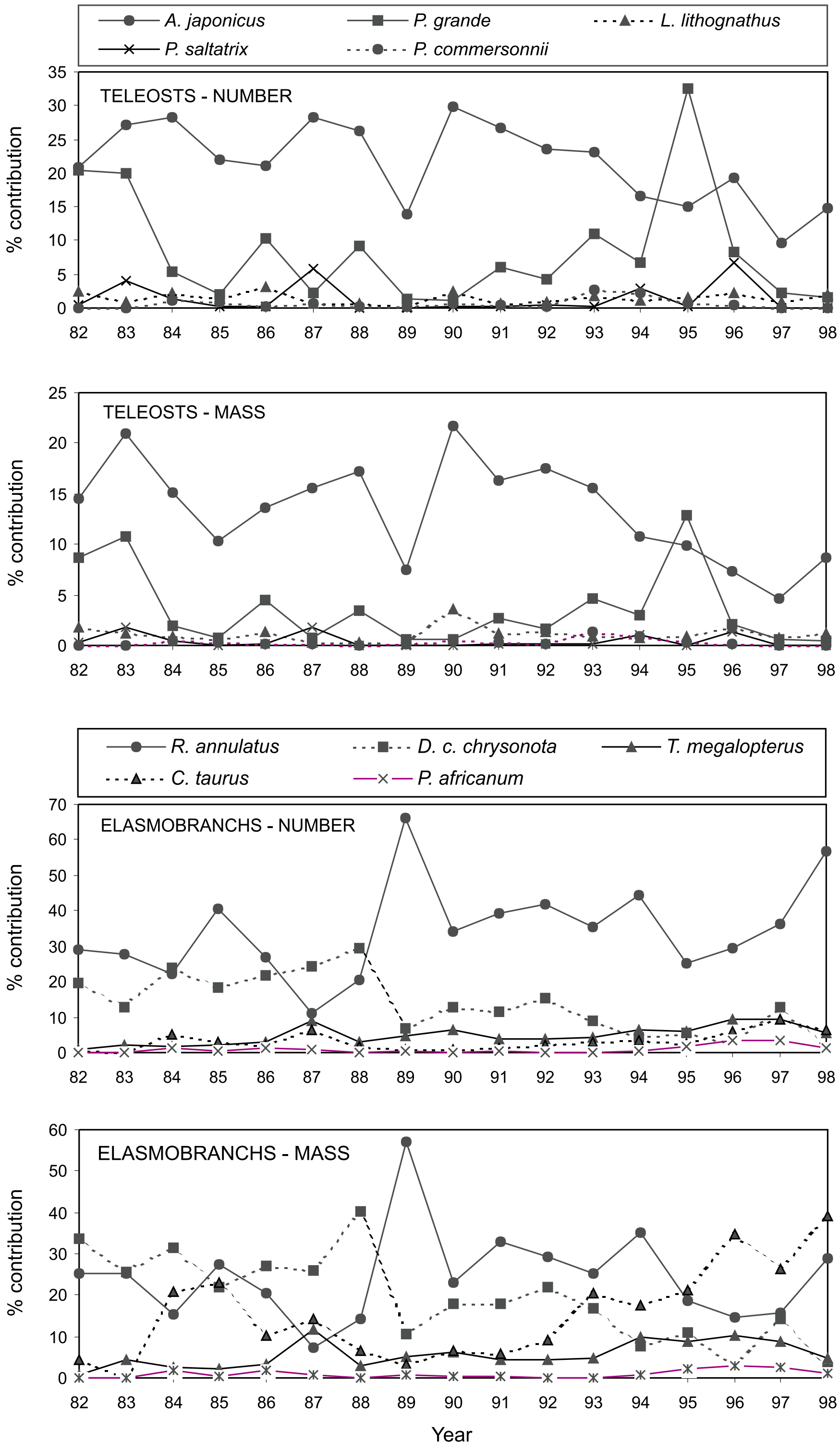

Fig. 5. Annual percentage contribution by number and mass of the top five teleost and elasmobranch species to the total catch for the period 1982–1998.

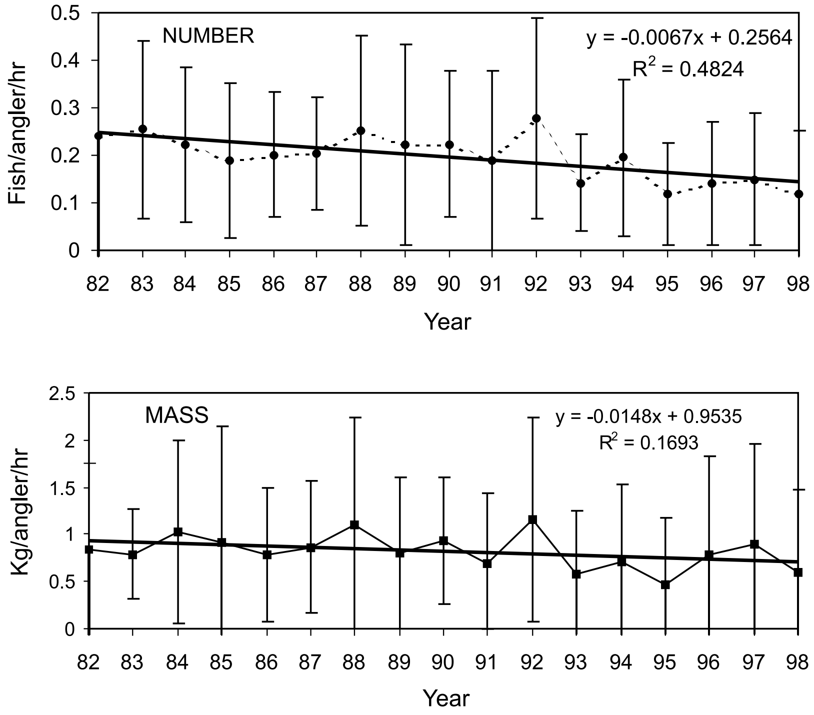

Fig. 6. Temporal trends in CPUE by number and mass for all species combined for the period 1982–1998.

mass, most of the catch was made up of *R. annulatus* (24 %), *D. c. chrysonota* (19 %), *Carcharius taurus* (16 %) and *A. japonicus* (13 %) (Fig. 4). Although their annual contributions varied, these species were the most important throughout most of the study period (Fig. 5). *A. japonicus,* which dominated annual teleost catches throughout most of the period, declined in contribution by number and mass from 1991–1998. *R. annulatus,* which dominated annual elasmobranch catches during most years, showed an increase in contribution by number from 1989–1998. *D. c. chrysonota,* the second most commonly caught elasmobranch, showed a decrease in contribution by number and mass over the same period. Although not evident in terms of number, the proportion of the catch contributed by *C. taurus* by mass showed a notable increase during the period 1984–1985 and 1993–1998.

Catch per unit effort

The mean overall annual CPUE by number decreased significantly ($P < 0.05$) from 1982 to 1998 (Fig. 6). Although annual CPUE by mass also showed a declining trend over the period, the decrease was not significant ($P > 0.05$). Examination of the CPUE for the five most commonly caught teleost species showed that *A. japonicus* had a marked decline in CPUE by number and mass from 1993–1998 (Fig. 7). The remaining top four teleost species exhibited relatively constant CPUE throughout the study period, except for a notable peak in catches of *P. grande* in 1995. Of the top five elasmobranchs, *R. annulatus* and *D. c. chrysonota* exhibited a decreasing CPUE trend from 1989–1998, both in terms of number and mass of fish caught. CPUE by number for *C. taurus* remained relatively constant throughout the period, however, in terms of mass, CPUE for this species showed a marked increase in 1984 and 1985, and again from 1996–1998.

Size composition

The mass frequency distribution of the catch of the five most commonly caught teleost and elasmobranch species is given in Fig. 8. Conversion of mass measurements to lengths revealed that most of the recorded *A. japonicus* (99 %), *Lithognathus lithognathus* (73 %), *Triakis megalopterus* (92 %) and *C. taurus* (97 %) were immature specimens (Table 2). The catches of the remaining top five teleost and elasmobranch species, with the exception of *D. c. chrysonota* (17 % of specimens were immature), were composed entirely of

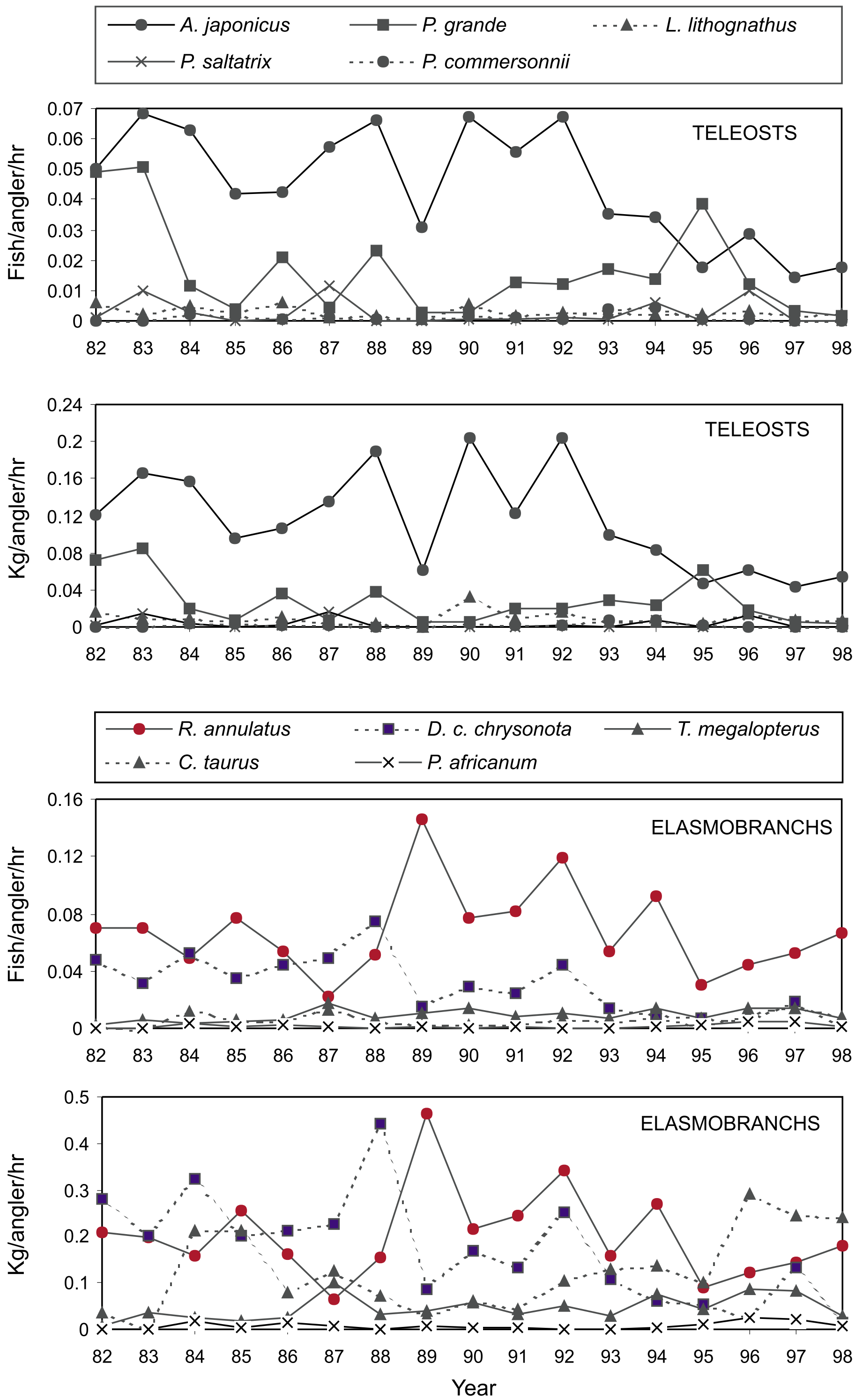

Fig 7. Temporal trends in CPUE by number and mass for the top five teleost and elasmobranch species for the period 1982–1998.

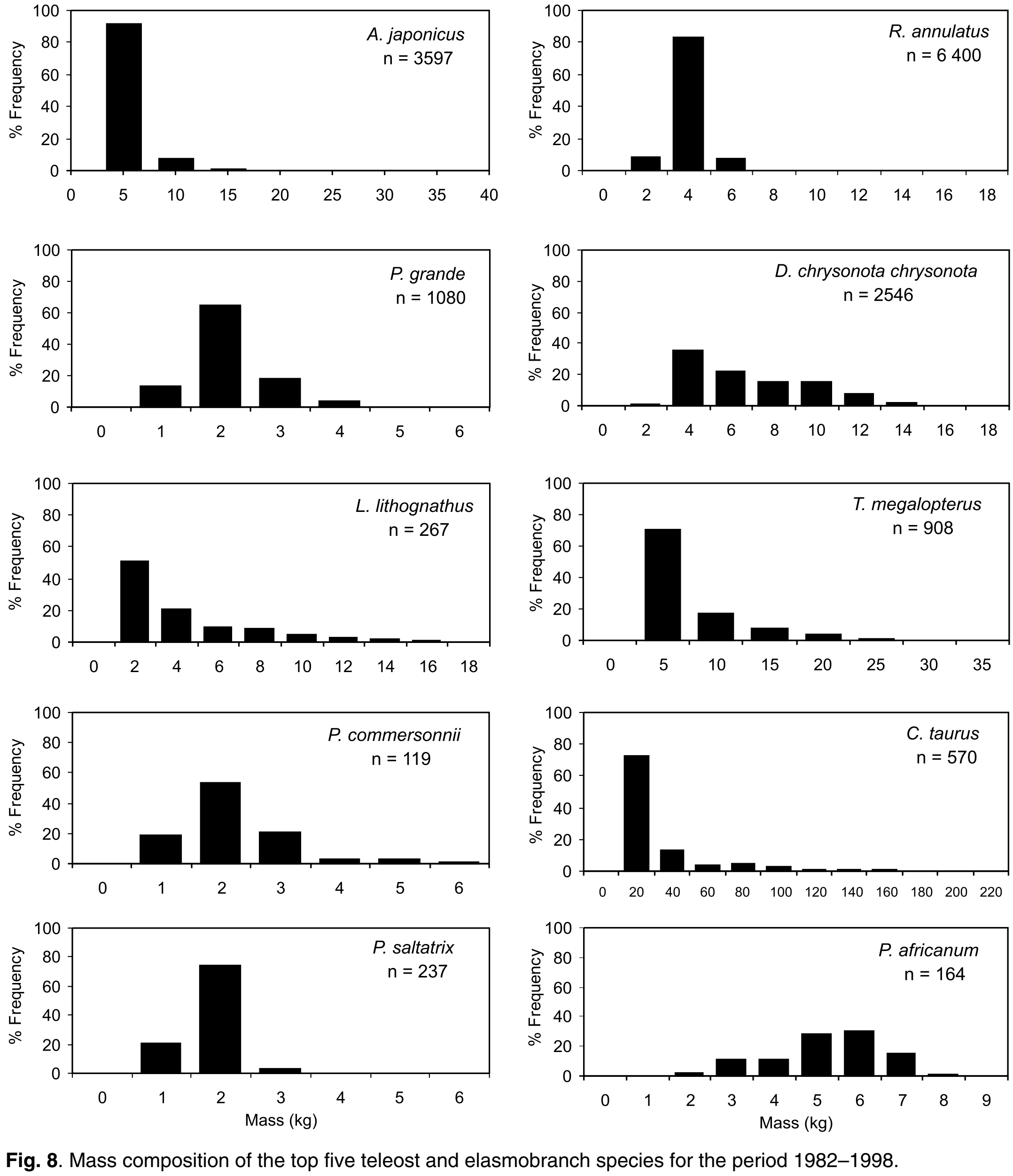

Fig. 8. Mass composition of the top five teleost and elasmobranch species for the period 1982–1998.

mature specimens. None of the recorded specimens of the five most commonly caught teleost species were smaller than the relevant legal minimum size limit.

Regression analyses of the temporal trends in the mean mass of species for which >500 measurements were available are presented in Fig. 9. *R. annulatus* showed a significant ($P < 0.05$) decrease in mean mass over the period 1982–1998, and *D. c. chrysonota* ($P < 0.05$) a significant increase. The changes in mean mass of these two species was not substantial. None of the other species showed any significant trends in size over the study period.

DISCUSSION

Although official shore angling competition records can be an extensive and reliable source of fisheries catch and effort data, there are inherent biases associated with the use of such data.

Table 2. Mean mass (kg) and SD of the top five teleost and elasmobranch species in the catch. The proportion of immature specimens is also presented.

Species	Mean mass (kg)	S.D.	Min. BRSAA mass (kg)	Min. mass (kg)	Max. mass (kg)	*n*	Immature (%)*	Minimum legal size limit
A. japonicus	2.6	2.4	1.0	1.0	35.0	3 597	99	40 cm TL (0.7 kg)
P. grande	1.7	0.6	1.0	1.0	4.9	1 080	0	30 cm TL (0.6 kg)
L. lithognathus	3.5	3.2	1.0	1.0	16.0	267	73	<1995 40 cm TL (1.0 kg) >1995 60 cm TL (3.3 kg)
P. commersonnii	1.8	0.9	1.0	1.0	5.7	119	0	40 cm TL (0.7 kg)
P. saltatrix	1.3	0.4	1.0	1.0	5.1	237	0	30 cm TL (0.2 kg)
R. annulatus	2.9	0.8	2.0	2.0	16.3	6 400	0	NA
D. c. chrysonota	6.0	2.8	2.0	2.0	16.0	2 546	17	NA
T. megalopterus	5.1	4.5	2.0	2.0	30.0	908	92	NA
C. taurus	22.4	28.9	2.0	2.0	203.0	570	97	NA
P. africanum	4.9	1.3	2.0	2.0	8.6	165	0	NA

*Maturity values taken from Mann (2000).

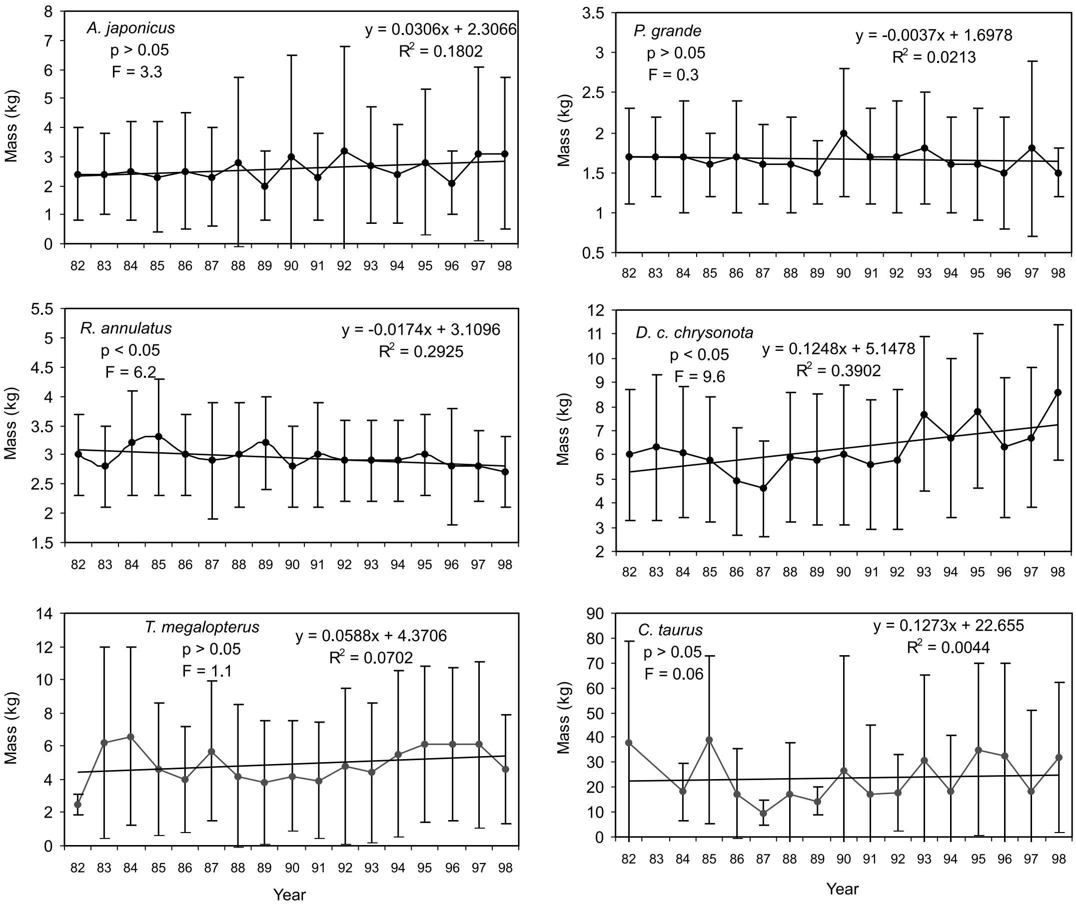

Fig. 9. Temporal trends in mean mass of species for which >500 measurements were available for the period 1982–1998.

Competition anglers are generally more avid and skilled anglers (Clark & Buxton 1989; Coetzee *et al.* 1989; Bennett 1991), and consequently their catches are not representative of social angling, which is practised by the majority of shore anglers (Van der Elst 1989). Also, because of minimum weight limits and scoring systems employed by SASAA and its regional associations, in most competitions, competitors tend to target the larger and heavier elasmobranch species in preference to teleost species (Clark 1988; Clark & Buxton 1989; Coetzee *et al.* 1989). Furthermore, as a result of incorrect identification and the use of unofficial common names, the taxonomic integrity of the data are often compromised (Coetzee *et al.* 1989). In the present study, this problem was manifested in the inability of anglers and consequently the authors to distinguish between *Carcharhinus brachyurus* and *Carcharhinus obscurus,* and *Myliobatus aquila* and *Pteromylaeus bovinus* in the data set. As a result of this, the reported total of 34 positively identified species in the overall catch was less than the actual species diversity of the catch.

A number of indicators can be used to assess the status of a fishery. These include analyses of changes in catch composition, changes in CPUE and fluctuations in species-specific size composition over time. Changes in catch composition may be indicative of once dominant species decreasing in abundance, and correspondingly being replaced by other species. Such changes are often concomitant with fluctuations in species CPUE, which can be used as an index of stock abundance (Gulland 1983; Punt 1993). Changes in the size distribution of a fish species over time can provide an indication of exploitation levels, with mean size of fish landed tending to decrease with increasing exploitation (Butterworth *et al.* 1989). The present data set allowed for the use of all three approaches in assessing the state of the competitive Border shore fishery over the period 1982–1998.

In terms of catch composition, a limited number of species made up the majority of the catch. *R. annulatus*, *A. japonicus*, *D. c. chrysonota* and *P. grande* made up 70 % of the catch by number, whilst *R. annulatus, D. c. chrysonota, C. taurus* and *A. japonicus* made up 72 % by mass. This dominance by a few species in catches of a multi-species linefishery has also being reported for most other sectors of the South African linefishery (Brouwer *et al.* 1997; Mann *et al.* 1997b; Penney *et al.* 1999; Griffiths 2000; Pradervand & Baird, in press), and arguably reflects abundance and catchability of species, as well as the targeting efforts of anglers concerned.

Previous studies that have assessed shore angling catches along the Eastern Cape coast (Brouwer *et al.* 1997) and in the Port Elizabeth area (Clarke & Buxton 1989) showed that small-sized species such as *Sarpa salpa, Pomatomus saltatrix, Pomadasys olivaceum* and *Diplodus sargus capensis* dominated catches. These studies surveyed primarily social, non-competitive anglers who tend to target edible teleost species (Brouwer & Buxton, in press). Coetzee & Baird (1981), who reported on shore anglers' catches off St Croix Island in Algoa Bay, also indicated a markedly different catch composition compared to the present study, in that species such *Cheimerius nufar, Chrysoblephus laticeps* and *C. cristiceps* dominated the catch. This is to be expected, given the island's protected status and the close proximity of deep water. However, there were similarities to the catch composition reported by Coetzee *et al.* (1989) for the shore fishery in the western section of the Eastern Cape (Plettenberg Bay to the Great Fish River). These authors based their analyses partly on competition data similar to that used in the present study, and consequently their reported catch comprised mostly large-sized species such as *A. japonicus, C. taurus* and members of the Triakidae.

The dichotomy in catch composition between social and competitive anglers is also clearly evident in the KwaZulu-Natal shore fishery, where catches by social anglers are composed primarily of small-sized teleosts (Joubert 1981; Brouwer *et al.* 1997) and catches by competitive anglers mainly of larger-sized elasmobranchs (Pradervand 1999a). This discrepancy in catch composition between two components of the same fishery indicates the effect that targeting has on catch composition.

In contrast to findings by Van der Elst (1979) and Coetzee *et al.* (1989), who reported a marked decrease in the contribution of teleosts in favour of elasmobranch species over time in the KwaZulu-Natal and Eastern Cape competitive shore fisheries respectively, the present study indicated that the contribution by each group remained relatively constant over the study period (Fig. 10). Variation in catch composition over time can be interpreted as a sign of decreasing abundance of traditionally-targeted linefish species (Bennett *et al.* 1994), but may also reflect changes in targeting and fishing techniques used by anglers (Bennett 1991).

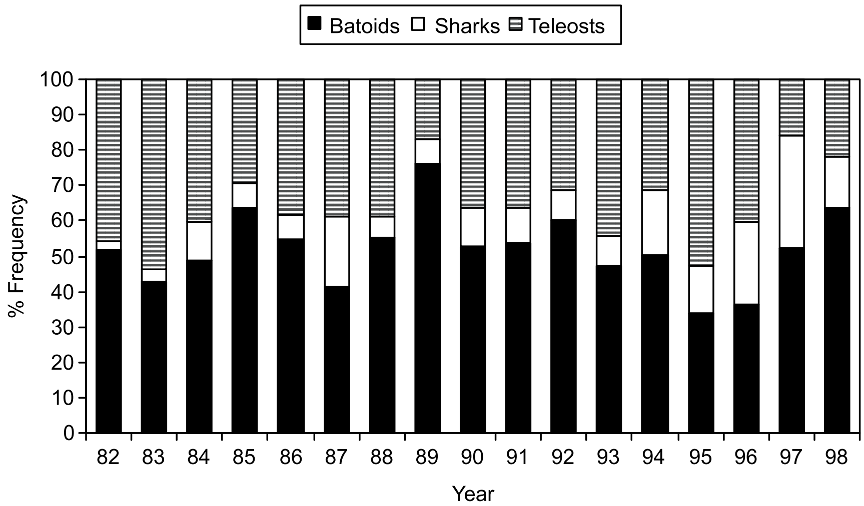

Fig. 10. Temporal trends in the percentage contribution by number of batoids, sharks and teleosts to competitive shore angling catches for the period 1982–1998.

Similar to other studies that have assessed long-term catches by shore anglers (Van der Elst 1979; Coetzee *et al.* 1989; Bennett 1991), overall CPUE by number and mass showed a decreasing trend over time. In the present study, the decreasing trend was the result of decreasing CPUE of all the important species, both teleosts and elasmobranchs, with the exception of *C. taurus,* which increased, and *P. grande,* which remained relatively constant. In previous studies, it was primarily a reduction in teleost catches that caused a decrease in overall CPUE. Unfortunately, comparison of actual CPUE values obtained in the present study with those from previous studies on competitive shore angling was not possible, as such values were not presented. However, examination of the mean CPUE for the KwaZulu-Natal competitive shore fishery for the period 1982–1998 (National Marine Linefish System, unpubl. data) revealed slightly higher mean CPUE values (0.23 fish/angler/h and 1.06 kg angler/h) than the present study (0.20 fish/angler/h/ and 0.82 kg/angler/h).

Indications are that anglers switched from targeting large-sized species to small-sized species when catches of the former decreased to levels that were perceived as unproductive for the purposes of competitive fishing (i.e. scoring maximum points). This is evidenced by high catches of *P. grande* coinciding with low catches of *L. lithognathus* and *A. japonicus,* and high catches of *R. annulatus* coinciding with low catches of larger sized elasmobranchs such as *C. taurus* and *T. megalopterus.* A similar switching of effort from more desirable species to less desirable species exists in the KwaZulu-Natal shore fishery, where anglers fishing for *P. saltatrix* tend to target *S. salpa* when catches of the former decrease to low levels (Mann *et al.* 1997a). Consequently, shore-based catches of *S. salpa* along the KwaZulu-Natal coast are high when catches of *P. saltatrix* are low, and *vice versa* (Pradervand & Govender 1999).

Analyses of temporal changes in the mean mass of the more common species indicated that only two species, *R. annulatus* and *D. c. chrysonota,* experienced a significant change in mean mass over the period 1982–1998. This is in contrast to the finding of Coetzee *et al.* (1989) and Bennett *et al.* (1994), who reported no significant changes in the mean size of fish landed in the Eastern Cape and southwestern Cape competitive shore fisheries, respectively. Although the absence of significant temporal changes in the mean sizes of species listed in these previous studies, and the limited changes recorded in the present study, may indicate that exploitation levels are not having an effect on the status of these species, consideration of the current stock status of most of these species (Mann 2000), especially the teleosts, suggests the contrary to be true.

Analyses of the size composition of catches showed that the majority of *A. japonicus, L. lithognathus, C. taurus* and *T. megalopterus* were immature. This suggests that the inshore region of the studied area is being used as a nursery area for these species, as was noted by Griffiths (1996) for

A. japonicus, Bennett (1993b) for *L. lithognathus,* Bass *et al.* (1975) for *C. taurus* and Goosen and Smale (1997) for *T. megalopterus.* A large proportion of immature specimens in catches is cause for concern, since, if such fish are retained by anglers, they are not given the opportunity to breed before been removed. This has serious consequences for the well-being of the stock, as was demonstrated by Griffiths (1997), who showed the current low status of the *A. japonicus* stock (2.3 % of pristine spawner biomass per recruit) to primarily be a result of recruitment overfishing in the estuarine and inshore environment.

The minimum size limits that were in place during most of the study period offered little protection to *A. japonicus* and *L. lithognathus,* as their size limits (both 400 mm TL) were much smaller than sizes at maturity (1000 mm and 650 mm TL, respectively; Griffiths 1997, Bennett 1993b). Consequently, the majority of legally-harvestable *A. japonicus* (99 %) and *L. lithognathus* (73 %) catches in the Border shore fishery were immature, similar to what was noted of *A. japonicus* catches in the Eastern Cape estuarine fishery (Pradervand & Baird, in press) and catches of *L. lithognathus* in the southern Cape shore fishery (Bennett 1993a). In response to the proven ineffectiveness of minimum size limits set beneath the size at maturity (Bennett 1993a; Attwood & Bennett 1995), the size limit of *L. lithognathus* was increased from 40 cm TL to 60 cm TL in 1995. The same increase in size limit for *A. japonicus,* coupled with a decrease in bag limit to one fish/person/day for both *A. japonicus* and *L. lithognathus,* has recently been recommended (Griffiths 1999). Clearly, for management measures such as minimum size limits and daily bag limits to be effective, they need to be based on sound scientific data, and their effectiveness assessed on a regular basis (Bennett 1993a; Attwood & Bennett 1995; Pradervand 1999b; Pradervand & Baird, in press). Analysis of fishing competition data is one method of assessing the effectiveness of these types of regulations.

It is apparent that the status of the competitive Border shore fishery has changed somewhat over the period 1982–1998, both in terms of a decrease in overall CPUE, a change in the contribution of certain species, and a change in the size composition of two of the dominant species. Previous studies that have detected similar trends for other sectors of the South African shore fishery have cited decreasing stocks of target species, primarily as a result of overexploitation, as well as changes in fishing patterns, as the main causes of such changes. Considering that the areas fished, fishing methods, bait usage, vehicle access to beaches and general targeting preferences of anglers are regarded to have remained relatively constant throughout the study period (C. Scheepers, pers. comm.), suggests that factors other than fluctuations in fishing patterns may be responsible for the observed changes.

The only major changes that did affect the South African competitive shore fishery during the study period (mainly from 1990–1995) have to do with the tackle involved, and these changes included the increased use of graphite rods, hook-on grapnel sinkers and thinner, but stronger, monofilament line (D. Bennett, pers. comm.). These advancements to fishing equipment have enhanced fishing efficiency (Hutchings 1993), and arguably have counteracted decreasing CPUE to the extent that the reported decrease in CPUE is probably not as drastic as it should be. In addition to these technological advancements in fishing equipment, the increasing adoption of catch and release fishing (especially in terms of elasmobranchs) and the promulgation of the 1985 daily bag and size restrictions (Government Gazette No. 9543 of 31 December 1984) are the only two other major changes affecting the studied fishery. Because SASAA minimum size limits were generally larger than the legal minimum size limits, and anglers had the option of weighing and releasing any fish caught in excess of a daily bag limit, these factors are not likely to have influenced the results of the present study. Therefore, taking cognisance of the current stock status of species such as *A. japonicus* (Griffiths 1997) and *L. lithognathus* (Bennett 1993a), which made up the bulk of the teleost catches in the present study, the depleted abundance of these linefish species is a likely reason for the decrease in overall CPUE and the observed changes in species and size composition in the present study. However, cognisance should also be taken of environmental changes such as estuarine degradation, increased sedimentation and pollution (Breen & McKenzie 2001). Such factors, which are difficult to quantify, undoubtably have more of an impact on the stock status of estuarine-dependent linefish species such as *L. lithognathus* and *A. japonicus,* than on species that are not regarded as estuarine-dependent i.e. *R. annulatus, D. c. chrysonota* and *P. grande.* Considering the complex life histories of most of South

Africa's important linefish species (Mann 2000), and the multitude of factors that influence recruitment, it is likely that there are a number of factors responsible for the decreased abundance of certain species. Consequently, a holistic approach addressing all phases of species life histories, as emphasized by Griffiths (1996, 1997) for *A. japonicus*, needs to be incorporated into linefish management.

Considering the popularity of competitive angling in all sectors of the linefishery (i.e. shore, skiboat, estuarine, spearfishing), and the format in which most official competitions are structured, the data that are generated by such events represent a large source of recreational fisheries catch and effort data. Fisheries management agencies and angling associations like SASAA, and its counterparts in other linefish sectors, would do well to ensure that all the competition data generated in South Africa are in a suitable format and made available to Marine and Coastal Management, in order to allow researchers to utilize these data to their full potential. Failure to do so effectively represents a loss of valuable information that could assist in ensuring the sustainability of linefish stocks and the future of sportfishing in South Africa.

It must be acknowledged that competitive shore angling under the auspices of the SASAA has progressed considerably over time, both in terms of fostering a good ethic of catch and release fishing (especially with elasmobranchs) and maintaining high-quality catch records. Other sectors of the national linefishery are strongly encouraged to follow suit.

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