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CATCH AND EFFORT OF THE SHORE AND SKIBOAT LINEFISHERIES ALONG THE SOUTH AFRICAN EASTERN CAPE COAST

S. L. BROUWER and C. D. BUXTON*†*

An assessment of catch and effort in the Eastern Cape shore and skiboat linefisheries was undertaken between 1994 and 1996 by means of roving creel and access point surveys. Catch-and-effort data were obtained from direct observation of 3 273 shore-fishers, 172 recreational and 223 commercial skiboat outings. Total effort in the region was high at 903 186 fisher-days year^{-1} in the shore fishery and 64 266 and 24 357 fisher-days year^{-1} in the commercial and recreational skiboat sectors respectively. The fisheries are multispecies in nature. The shore fishery consisted of 66 species, the recreational skiboat fishery 44 species and the commercial skiboat fishery 48 species. Just 10 species accounted for 75, 83 and 90% of the catch of the shore, recreational and commercial skiboat fishery respectively. The average catch per unit effort (*cpue*) was low in all sectors, 1.15 kg fisher^{-1} day^{-1} in the shore fishery, 9.4 kg fisher^{-1} day^{-1} in the recreational skiboat fishery and 21.5 kg fisher^{-1} day^{-1} in the commercial skiboat fishery. Catch data showed that professional and club anglers are more successful fishers. Comparisons with historic records for Port Elizabeth revealed that the *cpue* in the shore fishery had declined markedly, whereas the total effort increase was negligible (0.1%). In addition, the species composition of the fishery has changed.

Key words: access point surveys, catch and effort, linefishery, roving creel survey

The South African inshore commercial and recreational linefishery is a major contributor to the local economy of many coastal areas. McGrath *et al.* (1997) showed that it contributes 1.3% of the gross domestic product of local economies, employs some 131 500 people in fishing-related industries and is estimated to have more than 400 000 participants in the shore-angling sector alone. Management of the fishery is biologically based, using a range of input controls, such as size limits, bag limits and closed seasons. As a consequence, considerable research effort has focused on aspects of the life history of the more important target species (e.g. Smale 1988, Buxton 1989, Buxton and Garratt 1990, Buxton and Clarke 1991, 1992, Smale and Punt 1991, Griffiths 1996a, b, 1997, Mann and Buxton 1997).

Notwithstanding a comprehensive management plan, it has been suggested that catches by shore fishers along the South African coast are declining, primarily as a result of overfishing (Bennett 1991). Similar trends have been identified in the recreational and commercial skiboat fisheries (van der Elst and de Freitas 1988, Hecht and Tilney 1989, Garratt 1993, Pilfold and Pampallis 1993). Overfishing is further evident from changes in the species composition of catches, specifically the decline in the relative proportion of reef-associated teleosts (Crawford and Crous 1982, van der Elst and de Freitas 1988, Hecht and Tilney 1989, Bennett *et al.* 1994, Brouwer *et al.* 1997).

Little is known about catch and effort in the linefishery. For example, in the Eastern Cape, catch-and-effort studies have been confined to individual fishing sectors, usually along a small section of the coast (Coetzee and Baird 1981, Smale and Buxton 1985, Hecht and Tilney 1989, Coetzee *et al.* 1989, Clarke and Buxton 1989). Clearly, more information on catch-and-effort trends is needed in order to gain a better understanding of the fishery.

This study describes catch and effort in the commercial and recreational skiboat and shore-based linefisheries of the Eastern Cape. It forms part of a larger national survey of the South African linefishery describing regional differences in catch and effort, an assessment of fisher attitudes and the socio-economic aspects of the fishery (Brouwer *et al.* 1997, Lamberth *et al.* 1997, Mann *et al.* 1997, McGrath *et al.* 1997, Sauer *et al.* 1997).

MATERIAL AND METHODS

The study area extended from Still Bay (34°25´S, 21°20´E) to Kei Mouth (32°41´S, 28°23´E), covering a 982-km stretch of the south-east coast of South Africa. The entire area was surveyed, but eight locations were selected for frequent sampling. These were Still Bay, Mossel Bay, Plettenberg Bay, Jeffreys Bay, Port Elizabeth, Port Alfred, East London and Kei Mouth (Fig. 1).

* Department of Ichthyology and Fisheries Science, Rhodes University, P. O. Box 94, Grahamstown 6140. Email: s.brouwer@ru.ac.za
† Tasmanian Aquaculture and Fisheries Institute, Nubeena Crescent, Taroona, Hobart, TAS 7053, Australia

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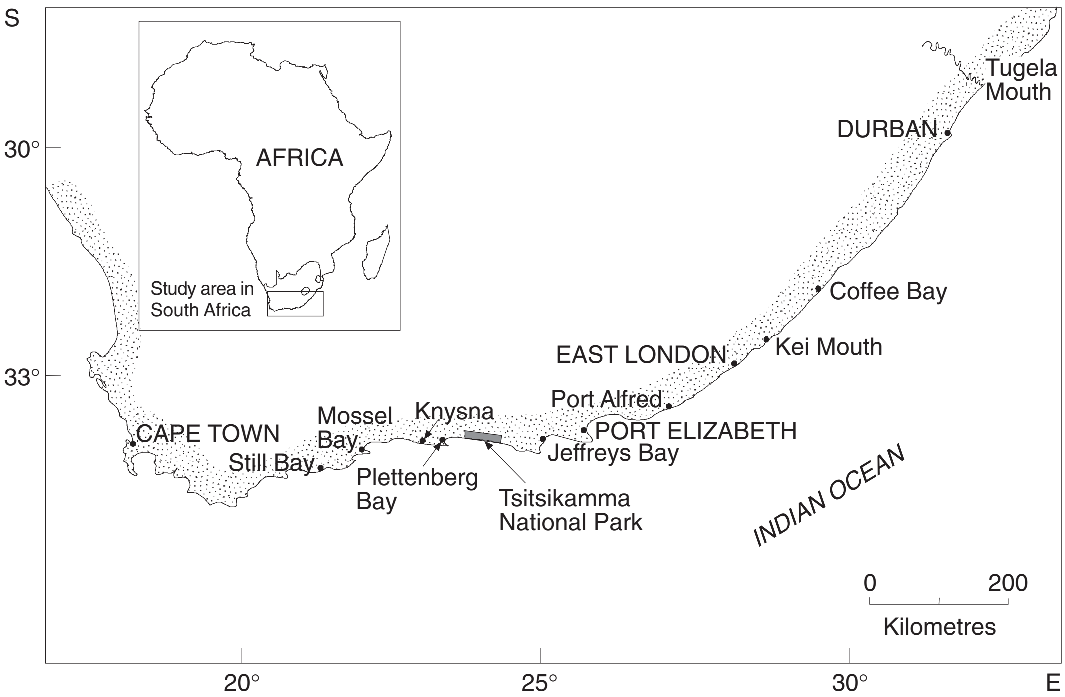

Fig. 1: Map of the Eastern Cape, showing the sampling area and places mentioned in text

Catch-and-effort data were collected at each location between 1994 and 1996 using roving creel and access point surveys for the shore and skiboat fisheries respectively. Fishers were interviewed individually, and all fish were weighed and measured. The information was captured on questionnaires developed for each sector of the fishery (Brouwer *et al.* 1997), covered four sections: Section A dealt with catch-and-effort data, including hours fished, bait used and species targeted, Section B with fisher information, including demographics, experience and regular fishing areas, Section C covered economic information, including trip expenditure and investment in fishing equipment, and Section D dealt with fisher attitudes towards regulations. Only the results on catch and effort are reported here; the remaining information has been reported earlier (Brouwer *et al.* 1997, Mann *et al.* 1997, McGrath *et al.* 1997, Lamberth *et al.* 1997, Sauer *et al.* 1997).

For the shore fishery, the sample areas were not equidistant, but were based on the proportion of coast that could be covered in a vehicle and on foot during a five-hour period. The starting time (06:00, 11:00 or 16:00), place and direction of travel were chosen randomly. At 06:00 and 11:00 the roving creel survey was first completed, then arriving-late skiboats were sampled at an access point until the last boat landed (usually between 18:00 and 21:00). This was reversed at 16:00. Some areas were sampled after dark, but sampling was not extensive.

Skiboat fishing effort

Total effort in the skiboat fishery was calculated using the method developed by Pollock *et al.* (1994):

$$E_{total} = E_{w1} + E_{w2} \quad , \tag{1}$$

where E_{w1} and E_{w2} were weekend and weekday estimates of total effort respectively, calculated by:

$$E_w = \frac{\left(\sum_{i=1}^{n} \mathrm{e}_i\right)}{(d/p)} \quad , \tag{2}$$

where E_w refers to E_{w1} and E_{w2} from Equation 1, e_i is the number of boats on the ith day, d is the number of days sampled and p is the potential number of sample days.

Total skiboat effort was calculated in boat-days. A boat-day is defined as a day on which a boat puts to sea to fish. The time spent at sea varies, as does the number of people fishing. To calculate total effort in terms of fisher-days, E_{total} was multiplied by the average number of crew in the respective fisheries before being used in Equation 4.

The catch per unit effort (*cpue*) was calculated as

$$Cpue = \frac{\sum_{i=1}^{n}\left(C_i / E_i\right)}{n} \quad , \qquad (3)$$

where C_i is the number or weight (kg) of fish retained and E_i is the effort expended by the *i*th fisher.

Total catch C_{total} was estimated by multiplying total effort by the *cpue*.

Shore-fishing effort

Total annual fishing effort for the Eastern Cape shore fishery was calculated in a similar fashion (Brouwer *et. al* 1997). The estimated total effort was then scaled up to account for daily effort (see Appendix 1). Although this factor varies hourly, it averaged out at 2.48 over a period of 24 h.

RESULTS

During the surveys, catch-and-effort data were obtained from 3 668 fishers, 3 273 shore fishers, and 172 recreational and 223 commercial skiboat fishers.

The South African linefishery is multispecies. In the shore fishery, totals of 46 teleost species (18 families) and 18 elasmobranch species (11 families) were recorded (Table App. 2.I). The recreational skiboat fishery consisted of 34 teleost species (14 families) and 10 elasmobranch species (5 families) and the commercial skiboat fishery of 36 teleost species (13 families) and 12 elasmobranch species (6 families – Tables App. 2.II and 2.III). Though each fishery was characterized by a large number of species, few made up the bulk of the catch. Just 10 species contributed 75, 83 and 90% of the catch in the shore, recreational and commercial skiboat sectors respectively.

Shore fishers fished an average of 5 h per day for 63 ± 72 days year^{-1} (n = 3 185), and those considered to be subsistence fishers (who stated that they fished for their livelihood) fished an average of 6 h per day for 198 ± 99 days year^{-1} (n = 88). On average, commercial skiboat fishers fished longer (8.3 ± 2.3 h; n = 223) than recreational fishers (7.2 ± 2.5; n = 172). Commercial fishers also averaged more fishing days per year than recreational fishers (159 ± 88 v. 37 ± 42.3 days year^{-1}).

Total effort in the shore fishery was estimated at 903 186 ± 1 913 fisher-days year^{-1}. Total commercial skiboat effort at the eight landing sites sampled was estimated at 13 571 ± 1 686 boat-days year^{-1} or 64 266 fisher-days year^{-1}, almost double the recreational skiboat effort (7 159 ± 685 boat-days year^{-1} or 24 357 fisher-days year^{-1}). At East London, skiboat estimates were validated with harbour records; there was only a 3.6% difference between the observed and estimated effort estimates.

There are 549 registered commercial skiboats in the Eastern Cape (Sauer *et al.* 1997). Using access-point survey estimates of the ratio of registered to unregistered boat owners, it was estimated that 1 180 recreational skiboats operate in the area.

Figure 2 shows the relative proportion of directed effort in the three sectors. Shore fishers target the widest range of species. Dusky kob *Argyrosomus japonicus*, shad (elf) *Pomatomus saltatrix*, white steenbras *Lithognathus lithognathus* and bronze bream *Pachymetopon grande* were the dominant target species, although a large proportion of anglers did not target any particular species. In both the recreational and commercial skiboat fisheries, silver kob *Argyrosomus inodorus* was the most sought-after species. There was considerable overlap between the commercial and recreational skiboat sectors. Commercial fishers targeted species that yielded the largest catches, such as silver kob, geelbek *Atractoscion aequidens*, carpenter *Argyrozona argyrozona*, hake *Merluccius* spp. and panga *Pterogymnus laniarius*, but they appeared to work on a trade-off between large catches of low-value fish and small catches of high-value fish. Recreational skiboat fishers appeared to spend more time targeting species that were less abundant, such as reef-dwelling sparids (e.g. Roman *Chrysoblephus laticeps*, dageraad *Chrysoblephus cristiceps* and red steenbras *Petrus rupestris*), and spent more time trolling for gamefish such as tuna *Thunnus* spp. and leervis (garrick) *Lichia amia*. Roman, dageraad and red steenbras were also targeted by commercial fishers because of their high value.

Average *cpue* in the shore fishery was low (1.15 ± 7.03 kg fisher^{-1} day^{-1} or 2.06 ± 10.13 fish fisher^{-1} day^{-1}). The average *cpue* of commercial skiboat fishers was 21.5 ± 35.4 kg fisher^{-1} day^{-1} or 15.8 ± 15.9 fish fisher^{-1} day^{-1}, and the recreational skiboat *cpue* 39% was lower at 9.4 ± 14.7 kg fisher^{-1} day^{-1} or 5.3 ± 8.3 fish fisher^{-1} day^{-1}.

The total annual catch in all three sectors was 3 325 tons, the bulk taken by the commercial skiboat sector

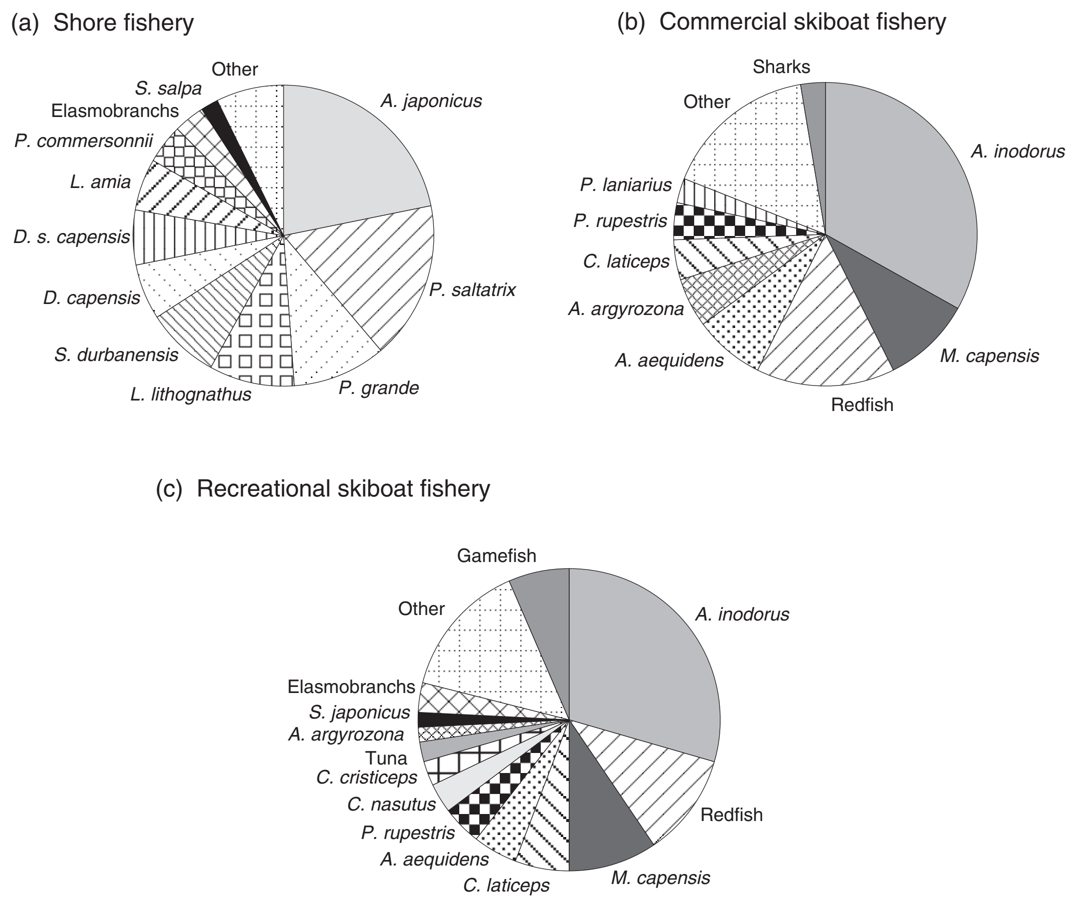

Fig. 2: Relative contribution of species to directed fishing effort between Kei Mouth and Still Bay in (a) the shore fishery, (b) the commercial skiboat fishery and (c) the recreational skiboat fishery

(56%), followed by the shore sector (31%) and the recreational skiboat sector (12% – Table I).

DISCUSSION

Clarke and Buxton (1989) reported a density of 1.2 fishers km^{-1} in the Port Elizabeth area, similar to that estimated for the present study area (1.3 fishers km^{-1}). Although effort was comparable, *cpue* of the more important target species has declined substantially between 1989 and 1996 (Table II). Of concern is that the target species are slow-growing and long-lived (Buxton and Clarke 1991, 1992, Mann and Buxton 1997). A notable exception is the three-fold increase in *cpue* for shad, which concurs with the observations by van der Elst (1987a, b) that that fishery is recovering after a serious decline during the early 1970s.

Another important difference is in the catches taken during Angling Week, a major shore-based competition held annually in the Eastern Cape. In the late 1970s and early 1980s, catches were dominated by teleosts (Coetzee *et al.* 1989), but catches in 1995 and 1996 (this study) were dominated by elasmobranchs and the *cpue* was lower (Fig. 3). Coetzee *et al.* (1989) had already noted that the number of elasmobranchs in the catches had started to increase after the early 1970s. Two issues are of concern. The first is that elasmobranchs are particularly susceptible to overfishing (Compagno and Smale 1989, Hoenig and Gruber 1990) and that such fisheries generally decline

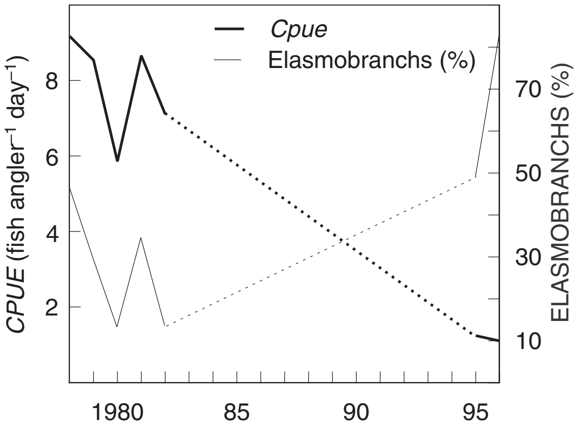

Fig. 3: Changes in *cpue* and the proportion of elasmobranchs from catches taken during Angling Week, 1978–1982 (after Coetzee *et al.* 1989) and during this study, 1994–1996

markedly in a short period of time (Anderson 1990). The other is the replacement of one species group by another, evidence of a serial decline in the fishery. Cribb (1994) reported that, when fish stocks decline, fishing does not cease but rather switches to other species, and the previous target species become occasional captures. To compound this problem, few elasmobranchs are released during angling competitions in the Eastern Cape. If a tag-and-release ethic was instilled in such competitions, overexploitation of the elasmobranch stocks might be avoided.

The present study substantiates observations by Hecht and Tilney (1989) that both silver kob and carpenter catches are declining in the Port Alfred commercial skiboat fishery, whereas panga catches are increasing (Table III). The total *cpue* in the Port Alfred skiboat fishery is currently 71 kg fisher^{-1} month^{-1}, lower than the previous estimate by Hecht and Tilney (1989). Despite suggestions by Booth and Buxton (1997) and Booth and Punt (1998) that panga could be exploited at a rate 420% higher than current levels. This species does not appear to have compensated for

Table I: Total annual catch estimates for the shore fishery, and at eight ports in the recreational and commercial skiboat fisheries sampled between Kei Mouth and Still Bay

Fishery	Mass (tons)	Number of fish
Shore	1 038	1 860 563
Recreational skiboat	410	231 398
Commercial skiboat	1 877	1 379 198

the decreased catch of other species. One contributing factor may be the relative value of the two species. In 1996, boat owners receive approximately R10.50 per kg for silver kob, but only R4 per kg for panga, which are smaller and need to be caught in large numbers for the same economic return.

Some fishers catch more fish than others, but the causes of this variation are little understood (Hilborn 1985). The reasons have been ascribed to varying fisher experience and knowledge of the specific area. Varying levels of skill and knowledge became obvious when club and non-club catches were compared in the present study. Shore fishers belonging to angling clubs caught more fish by weight daily than non-club fishers. For example, excluding the competition data from the calculation, reduces *cpue* in the Eastern Cape from 1.15 kg fisher^{-1} day^{-1} and 2.06 fish fisher^{-1} day^{-1} to 0.9 kg fisher^{-1} day^{-1} and 1.6 fish fisher^{-1} day^{-1}. These values are substantially lower than the *cpue* of competition fishers (6.38 kg fisher^{-1} day^{-1} and 11.82 fish fisher^{-1} day^{-1}). Club fishers target and catch larger fish using more sophisticated equipment, whereas many of the fish caught by non-club fishers were small species, such as blacktail. In contrast, Bennett *et al.* (1994), found that targeting effort and catch rates did not differ between club and non-club anglers in the Western Cape.

In the Eastern Cape, catches of commercial skiboat fishers are notably higher than their recreational counterparts. Not only are commercial skiboat fishers more effective, but their operations are also more efficient because they spend less money and travel shorter distances than recreational skiboat fishers (McGrath *et al.* 1997). Despite this, many commercial skiboat

Table II: *Cpue* of target linefish species between 1989 and 1996 along the Port Elizabeth coast from Flat Rocks to Schoenmakerskop

Species	*Cpue* 1989* (g fisher^{-1} h^{-1})	*Cpue* 1996 (g fisher^{-1} h^{-1})
Pomatomus saltatrix (shad)	74.7	228
Sparodon durbanensis (musselcracker)	30.3	6
Diplodus sargus capensis (blacktail)	19.4	11
Pachymetopon grande (bronze bream)	12.6	9

*From Clarke and Buxton (1989)

Table III: Commercial skiboat *cpue* of target linefish species at Port Alfred between 1989 and 1996

Species	*Cpue* 1989* (g fisher^{-1} h^{-1})	*Cpue* 1996 (g fisher^{-1} h^{-1})
Argyrosomus inodorus (silver kob)	9.5	4.15
Argyrozona argyrozona (carpenter)	5.5	2.3
Pterogymnus laniarius (panga)	2	3.3

*From Hecht and Tilney (1989)

operators cannot run economically viable operations; one-third of commercial skiboat licences change hands each year as operators go bankrupt (R. Zeelie, Marine & Coastal Management, pers. comm.).

Data presented by McGrath *et al.* (1997) showed that effort in the recreational fishery would not drop significantly as a direct consequence of declining catches. In contrast, commercial fishers should theoretically stop fishing, because they are governed by economic forces. While this statement appears to be true on the surface, subsidization of effort in the commercial fishery tends to work against it. The high turnover of owners, many of whom do not reside near the coast, but retaining the same crew, effectively subsidizes effort in the commercial sector. A further cross-subsidization of effort comes from the lucrative chokka squid *Loligo vulgaris reynaudii* fishery. When squid catches are small, these fishers target reef-fish species, an important component of the linefishery (P-J. Schön, formerly Rhodes University, unpublished data).

Fishers in all three sectors were of the opinion that the linefishery had declined, blaming trawlers, pollution and the sector perceived to be their direct competition (Brouwer *et al.* 1997, Sauer *et al.* 1997). The last of these is partly unfounded because there is little overlap in the catch composition between the shore and skiboat fisheries. However, there is considerable overlap between the commercial and recreational skiboat sectors, which is a cause of conflict (Sauer *et al.* 1997). Such animosity has resulted in some skiboat clubs prohibiting commercially licenced boats from using their slipways. However, the likely reason for the overall decline in the fishery is probably a synergistic combination of increased fishing effort in both sectors coupled with the inability of the stock to sustain current levels of effort. Of particular relevance to the former are the biological characteristics of many target species, including slow growth, longevity, sex change and a high degree of residency.

In summary, the present data indicate that effort in the linefisheries has increased slightly over the past two decades (Coetzee *et al.* 1989, Clarke and Buxton 1989, Hecht and Tilney 1989), but *cpue* estimates have concomitantly declined substantially. Worrying trends are the change in species composition of the catches (Coetzee *et al.* 1989, Hecht and Tilney 1989) and the reduced abundance of slow-growing teleost species in the catch. The present results add to a growing body of evidence that indicates that, despite the current management strategies employed, the fishery is in steady decline. Management has to address the issue of unsustainable effort levels across all linefishing sectors if a stock rebuilding programme is to be initiated for the South African linefishery. Methods of ensuring a greater future for the fishery include the options of catch-and-release programmes in the recreational sector and the establishment of marine protected areas as a hedge against stock collapse (Buxton 1993, Attwood and Bennett 1995).

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APPENDIX 1

A method to extrapolate instantaneous observations of shore-angler density to total daily effort

The method developed here is to calculate the probability of finding an angler on the shore at a particular time, given that the angler will be present on the shore at some time during the day. The inverse of this probability is the factor by which the instantaneous count should be multiplied to estimate the total daily effort.

Method

1. Calculate the discrete starting time distribution in hourly increments ($t = 0 \ldots 23$):

$$s_t = \frac{n_t}{N} \quad , \qquad \text{(App.1.1)}$$

where s_t is the probability of starting fishing at time t, n_t the number of surveyed anglers that started at time t and N is the total number of surveyed anglers.

The probabilities must sum to one:

$$\sum_{t=0}^{23} s_t = 1.0 \quad . \qquad \text{(App.1.2)}$$

2. Compute the mean duration of fishing trips, which commences at time t. Add up the times of all surveyed fishing trips that started at time t and divide by n_t to obtain d_t (i.e. the mean duration of fishing trip starting at time t).

3. Calculate the probability of an angler being on the shore at time t.

$$p_t = \sum_{i=0}^{23} \left(s_t a_i \right) \quad , \qquad \text{(App.1.3)}$$

where p_t is the probability of finding an angler on the shore at time t and a_i is a binary step function:

$$a_i = 1 \text{ if } 0 \leq (t - i) \leq d_i \qquad \text{(App.1.4)}$$

$$a_i = 0 \text{ if } 0 \leq d_i < (t - i) \qquad \text{(App.1.5)}$$

$$a_i = 1 \text{ if } 0 > (d_i - 24) \geq (t - i) \qquad \text{(App.1.6)}$$

$$a_i = 0 \text{ if } 0 > (t - i) > (d_i - 24) \qquad \text{(App.1.7)}$$

4. Estimate the total number of anglers present on the shore during the day, from the instantaneous count:

$$A_d = \frac{O_{dt}}{p_t} \quad , \qquad \text{(App.1.8)}$$

where A_d is the number of anglers on the shore on day d and O_{dt} is the number of observed anglers on day d at time t.

APPENDIX 2

Catch data

Table App. 2.I: Total catch and *cpue* by mass and number in the catches of shore fishers sampled between Kei Mouth and Still Bay, 1994–1996. *SD* is given in parenthesis

Species	Total (kg)	Total (number)	*Cpue* (g fisher^{-1} day^{-1})	*Cpue* (fish fisher^{-1} day^{-1})
CHONDRICHTHYES				
Callorhinchidae				
Callorhinchus capensis	3.7	1	0.81 (46.61)	0.0002 (0.012)
Carcharhinidae				
Carcharhinus brachyurus	71.5	6	33.35 (1 154.19)	0.002 (0.07)
C. brevipinna	5.7	1	2.45 (140.19)	0.0004 (0.02)
C. obscurus	62.1	6	127.77 (5 264.10)	0.017 (0.07)
Carcharhinus spp.	24	2	5.61 (229.37)	0.0005 (0.019)
Dasyatidae				
Dasyatis marmorata	r			
Gymnura natalensis	5	1	2.05 (117.38)	0.0004 (0.023)
Myliobatidae				
Myliobatus aquila	r			
Odontaspididae				
Carcharias taurus	r			
Rajidae				
Raja alba	19	1	8.67 (368.94)	0.0006 (0.034)
Rhinobatidae				
Rhinobatos annulatus	25.56	11	18.62 (509.36)	0.007 (0.21)
Scyliorhinidae				
Haploblepharus fuscus	2.6	3	1.40 (59.37)	0.0016 (0.07)
Poroderma africanum	r			
P. pantherium	2	2	1.50 (86.08)	0.002 (0.09)
Sphyrnidae				
Sphyrna zygaena	6.25	1	3.13 (179.34)	0.0005 (0.03)
Squalidae				
Squalus megalops	4	5	1.71 (70.45)	0.002 (0.08)
Triakidae				
Mustelus mustelus	35.1	3	25.37 (1 073.03)	0.002 (0.09)
Triakis megalopterus	r			
OSTEICHTHYES				
Ariidae				
Galeichthys ater	1.5	1	0.70 (28.63)	0.0008 (0.05)
G. feliceps	2.85	8	11.69 (600.07)	0.04 (2.07)
Galeichthys spp.	0.5	1	0.14 (8.20)	0.0003 (0.016)
Carangidae				
Lichia amia	56.64	12	28.97 (587.21)	0.006 (0.11)
Pseudocaranx dentex	1.8	4	0.70 (27.79)	0.001 (0.04)
Seriola lalandi	12.89	2	17.58 (880.15)	0.002 (0.1)
Trachinotus africanus	0.56	4	0.63 (33.56)	0.003 (0.14)
Cheliodactylidae				
Chirodactylus brachydactylus	0.3	3	0.41 (17.83)	0.004 (0.18)
Clinidae				
Clinus superciliosus	r*			
Coracinidae				
Dichistius capensis	23.29	23	10.10 (183.34)	0.009 (0.17)
D. multifasciatus	2.23	4	1.49 (49.19)	0.002 (0.08)
Dinopercidae				
Dinoperca petersi	0.34	1	0.51 (29.27)	0.001 (0.09)
Elopidae				
Elops machnata	1.2	1	0.55 (31.46)	0.0005 (0.03)

(continued)

Table App. 2.I (*continued*)

Species	Total (kg)	Total (number)	*Cpue* (g fisher^{-1} day^{-1})	*Cpue* (fish fisher^{-1} day^{-1})
Gobiesocidae				
Chorisochismus dentex	r			
Haemulidae				
Pomadasys commersonnii	16.24	14	8.82 (182.76)	0.009 (0.185)
P. olivaceum	10.45	265	8.83 (102.90)	0.23 (2.67)
P. striatum	0.1	2	0.07 (3.83)	0.001 (0.08)
Mugilidae				
Liza spp.	4.97	21	3.29 (92.55)	0.013 (0.36)
L. dumerilii	1.6	6	0.33 (14.73)	0.0014 (0.07)
L. richardsonii	24.24	119	14.40 (310.36)	0.08 (1.93)
L. tricuspidens	10.95	26	5.25 (131.25)	0.012 (0.3)
Mugil cephalus	0.51	3	0.15 (8.66)	0.0009 (0.05)
Plotocidae				
Plotosus nkunga	6.97	8	12.94 (414.95)	0.002 (0.055)
Pomatomidae				
Pomatomus saltatrix	340.79	448	304.18 (2 700.31)	0.42 (3.78)
Sciaenidae				
Argyrosomus japonicus	139.45	59	85.64 (1 738.23)	0.04 (0.58)
Umbrina ronchus	11.06	5	11.13 (308.95)	0.006 (0.15)
Scombridae				
Scomber japonicus	2.15	5	0.63 (35.82)	0.0014 (0.08)
Scorpididae				
Neoscorpis lithophilus	27.55	33	17.63 (407.51)	0.019 (0.4)
Serranidae				
Acanthistius sebastoides	0.82	2	0.39 (15.63)	0.001 (0.04)
Epenephelus marginatus	0.78	2	3.63 (196.60)	0.0009 (0.52)
Sparidae				
Boopsoidea inornata	1.57	13	1.07 (32.75)	0.008 (0.23)
Cheimerius nufar	3.99	15	2.02 (52.03)	0.008 (0.22)
Chrysoblephus laticeps	3.65	4	2.79 (125.37)	0.005 (0.23)
Cymatoceps nasutus	4.09	3	1.61 (58.12)	0.0012 (0.04)
Dipolodus cervinus hottentotus	11.25	15	29.69 (1 194.17)	0.028 (1.08)
D. sargus capensis	63.31	161	61.65 (636.25)	0.155 (1.34)
Gymnocrotaphus curvidens	0.55	1	0.33 (18.94)	0.0006 (0.03)
Lithognathus lithognathus	39.3	29	44.94 (750.84)	0.03 (0.52)
L. mormyrus	4.49	53	4.61 (91.67)	0.05 (1.0)
Pachymetopon aeneum	0.91	1	0.39 (22.28)	0.0004 (0.024)
P. grande	108.57	82	75.55 (841.91)	0.057 (0.63)
Pagellus bellottii natalensis	1.96	11	2.72 (103.69)	0.016 (0.58)
Pterogymnus laniarius	1.06	2	0.13 (7.25)	0.0002 (0.01)
Rhabdosargus globiceps	1.65	16	3.23 (129.22)	0.03 (1.08)
R. holubi	11.05	70	14.14 (297.00)	0.08 (1.03)
Sarpa salpa	56.09	490	66.81 (840.96)	0.58 (7.3)
Sparodon durbanensis	64.91	16	60.19 (1 602.77)	0.019 (0.56)
Spondyliosoma emarginatum	1.55	15	1.99 (64.80)	0.018 (0.62)
Tetraodontidae				
Amblyrhynchotes honkenii	r*			
Chelonodon patoca	r*			

r = all released
r* = released or discarded

Table App. 2.II Total catch and *cpue* by mass and number in recreational skiboat catches sampled between Kei Mouth and Still Bay 1994–1996. *SD* is given in parenthesis

Species	Total (kg)	Total (number)	*Cpue* (g fisher^{-1} day^{-1})	*Cpue* (fish fisher^{-1} day^{-1})
CHONDRICHTHYES				
Carcharhinidae				
Carcharhinus brachyurus	136	37	278.31 (1 774.53)	0.076 (0.46)
C. obscurus	9.6	2	20.44 (201.14)	0.004 (0.034)
Carcharhinus spp.	29.5	11	62.50 (504.74)	0.023 (0.188)
Scyliorhinidae				
Poroderma africanum	4.4	1	14.67 (179.63)	0.003 (0.04)
Sphyrnidae				
Sphyrna zygaena	8	2	17.78 (217.73)	0.004 (0.054)
Squalidae				
Squalus megalops	18.72	23	34.46 (308.03)	0.043 (0.39)
Triakidae				
Galeorhinus galeus	20.6	11	42.67 (274.28)	0.023 (0.14)
Mustelus mustelus	40.39	38	377.31 (2 553.75)	0.075 (0.5)
M. palumbes	21.72	5	45.53 (312.97)	0.1 (0.66)
Triakis megalopterus	10.18	1	22.62 (277.06)	0.002 (0.027)
OSTEICHTHYES				
Ariidae				
Galeichthys ater	7.9	17	17.56 (136.56)	0.0367 (0.27)
G. feliceps	11.8	22	19.44 (158.15)	0.036 (0.3)
Galeichthys spp.	29.9	11	10.33 (126.56)	0.018 (0.22)
Carangidae				
Lichia amia	15.8	2	31.22 (278.07)	0.004 (0.038)
Trachurus trachurus capensis	29.3	13	23.28 (186.78)	0.027 (0.22)
Haemulidae				
Pomadasys olivaceum	0.4	2	1.11 (9.78)	0.0056 (0.049)
Merlucciidae				
Merluccius capensis	1 094.3	751	2 219.92 (9 928.52)	1.45 (6.8)
Polyprionidae				
Polyprion americanus	13.4	4	27.00 (169.87)	0.008 (0.052)
Pomatomidae				
Pomatomus saltatrix	20.1	29	26.00 (281.03)	0.048 (0.51)
Sciaenidae				
Argyrosomus inodorus	876.5	450	1 588.16 (4 037.42)	0.96 (2.34)
Atractoscion aequidens	638.6	111	1 072.45 (7 126.19)	0.19 (1.2)
Umbrina canariensis	0.8	1	1.33 (16.33)	0.003 (0.04)
Scombridae				
Katsuwonus pelamis	201.2	66	348.52 (1 463.60)	0.11 (0.47)
Scomber japonicus	55	49	55.45 (594.10)	0.053 (0.48)
Thunnus albacares	494.9	30	846.11 (5 856.74)	0.05 (0.29)
Serranidae				
Acanthistius sebastoides	0.6	2	0.90 (7.82)	0.003 (0.026)
Epinephelus marginatus	36	7	60.11 (323.54)	0.014 (0.068)
Sparidae				
Argyrozona argyrozona	105.2	181	160.49 (542.65)	0.32 (1.03)
Boopsoidea inornata	3.3	12	6.82 (42.95)	0.024 (0.158)
Cheimerius nufar	152.5	178	278.20 (1 243.59)	0.35 (1.78)
Chrysoblephus cristiceps	107.77	65	277.63 (2 133.93)	0.139 (0.625)
C. gibbiceps	58.9	19	97.11 (397.43)	0.031 (0.12)
C. laticeps	118.64	124	262.01 (827.81)	0.26 (0.85)
Diplodus sargus capensis	0.32	1	0.56 (4.87)	0.0018 (0.022)
Pachymetopon aeneum	63.6	69	100.74 (311.84)	0.12 (0.41)
Pagellus bellottii natalensis	5.41	23	12.23 (78.89)	0.051 (0.317)

(*continued*)

Table App. 2.II (*continued*)

Species	Total (kg)	Total (number)	*Cpue* (g fisher^{-1} day^{-1})	*Cpue* (fish fisher^{-1} day^{-1})
Sparidae				
Petrus rupestris	266.6	26	398.49 (2 351.85)	0.042 (0.2)
Polysteganus coeruleopunctatus	1.5	6	3.00 (22.79)	0.012 (0.09)
P. praeorbitalis	6.6	2	14.13 (163.53)	0.004 (0.03)
P. undulosus	93	33	162.91 (836.01)	0.058 (0.29)
Pterogymnus laniarius	245.9	301	256.20 (1 281.48)	0.5 (2.36)
Rhabdosargus globiceps	2	5	4.89 (38.94)	0.012 (0.089)
Spondyliosoma emarginatum	3.7	15	6.73 (42.05)	0.027 (0.2)
Stromateidae				
Stromateus fiatola	1	2	1.67 (20.41)	0.003 (0.04)
Trichiuridae				
Lepidopus caudatus	2	2	5.56 (48.91)	0.006 (0.049)
Triglidae				
Chelidonichthys capensis	9.47	11	20.79 (113.51)	0.023 (0.15)

Table App. 2.III: Total catch and *cpue* by mass and number in commercial skiboat catches sampled between Kei Mouth and Still Bay 1994–1996. *SD* is given in parenthesis

Species	Total (kg)	Total (number)	*Cpue* (g fisher^{-1} day^{-1})	*Cpue* (fish fisher^{-1} day^{-1})
CHONDRICHTHYES				
Callorhinchidae				
Callorhinchus capensis	6.56	3	8.39 (88.32)	0.003 (0.04)
Carcharhinidae				
Carcharhinus brachyurus	149.7	48	198.02 (1 281.05)	0.063 (0.39)
C. brevipinna	12	1	3.03 (44.95)	0.002 (0.02)
C. obscurus	54.6	6	51.03 (482.37)	0.006 (0.05)
Carcharhinus spp.	111.5	3	6.06 (89.89)	0.002 (0.034)
Lamnidae				
Isurus oxyrinchus	4.4	1	5.00 (74.16)	0.001 (0.017)
Sphyrnidae				
Sphyrna zygaena	5.7	2	5.61 (62.76)	0.0019 (0.02)
Squalidae				
Squalus megalops	19.34	20	18.56 (147.64)	0.023 (0.2)
Triakidae				
Galeorhinus galeus	73.2	15	108.91 (852.58)	0.018 (0.11)
Mustelus mustelus	35.98	44	152.83 (817.13)	0.043 (0.22)
M. palumbes	3.27	1	3.72 (55.12)	0.001 (0.017)
Triakis megalopterus	46.93	4	64.90 (555.91)	0.006 (0.05)
OSTEICHTHYES				
Ariidae				
Galeichthys ater	17.1	38	19.25 (117.50)	0.043 (0.234)
G. feliceps	13.1	28	17.16 (120.35)	0.035 (0.26)
Galeichthys spp.	299.7	590	316.27 (1 802.68)	0.583 (3.32)
Carangidae				
Trachurus trachurus capensis	47.9	86	58.68 (273.60)	0.075 (0.33)
Haemulidae				
Pomadasys olivaceum	3.4	20	3.00 (36.87)	0.019 (0.22)
Merlucciidae				
Merluccius capensis	6 257	2 139	2 816.85 (8 981.69)	2.23 (7.86)
Parascorpididae				
Parascorpis typus	1.1	1	0.71 (10.59)	0.0006 (0.01)
Pomatomidae				
Pomatomus saltatrix	204.3	320	174.68 (689.28)	0.268 (1.1)
Sciaenidae				
Argyrosomus inodorus	7 904	4 584	8 887.12 (22 935.42)	4.66 (9.5)
A. japonicus	99	2	109.00 (1 600.00)	0.002 (0.03)
Atractoscion aequidens	252.9	186	595.45 (4 541.00)	0.17 (1.17)
Umbrina canariensis	4.4	9	3.78 (19.76)	0.009 (0.05)
Umbrina spp.	0.2	1	0.45 (6.74)	0.002 (0.033)
Scombridae				
Katsuwonus pelamis	6.2	1	7.05 (104.50)	0.001 (0.017)
Scomber japonicus	178.8	401	169.61 (1 252.47)	0.379 (2.8)
Scorpaenidae				
Helicolenus dactylopterus	1.7	4	1.36 (15.05)	0.003 (0.036)
Serranidae				
Acanthistius sebastoides	4.1	19	3.73 (55.28)	0.017 (0.26)
Epinephelus chabaudi	20.6	3	18.91 (203.11)	0.0027 (0.03)
E. marginatus	132.6	31	102.19 (736.32)	0.031 (0.2)
Sparidae				
Argyrozona argyrozona	2 114	2 885	1 827.38 (6 105.72)	2.429 (7.17)
Boopsoidea inornata	8.1	22	8.20 (42.20)	0.023 (0.12)
Cheimerius nufar	363	450	329.64 (954.59)	0.39 (1.22)

(*continued*)

Table App. 2.III (*continued*)

Species	Total (kg)	Total (number)	*Cpue* (g fisher^{-1} day^{-1})	*Cpue* (fish fisher^{-1} day^{-1})
Sparidae				
Chrysoblephus cristiceps	270.73	177	252.39 (1 087.96)	0.17 (0.63)
C. gibbiceps	120.42	36	98.70 (740.16)	0.029 (0.19)
C. laticeps	214.48	222	190.25 (659.96)	0.2 (0.68)
Cymatoceps nasutus	131.2	23	141.04 (1 056.73)	0.025 (0.14)
Diplodus cervinus hottentotus	0.4	1	0.61 (8.99)	0.002 (0.02)
Lithognathus lithognathus	12	2	11.95 (127.97)	0.002 (0.024)
Pachymetopon aeneum	254	331	232.63 (783.96)	0.297 (0.98)
P. grande	8.1	5	5.00 (43.36)	0.004 (0.03)
Pagellus bellottii natalensis	13.2	29	12.50 (116.49)	0.028 (0.2)
Petrus rupestris	2 555.3	180	2 272.96 (22 106.27)	0.147 (0.99)
Polysteganus praeorbitalis	4.6	4	3.82 (50.31)	0.003 (0.041)
P. undulosus	404.3	48	368.86 (5 115.18)	0.044 (0.57)
Pterogymnus laniarius	1 882	3 525	1 715.76 (3 575.26)	3.07 (6.78)
Rhabdosargus globiceps	10.1	26	10.94 (57.15)	0.029 (0.15)
Spondyliosoma emarginatum	2.7	11	2.23 (13.33)	0.009 (0.05)
Triglidae				
Chelidonichthys capensis	66.75	75	56.94 (212.94)	0.066 (0.25)
Zeidae				
Zeus capensis	2.89	2	3.28 (48.71)	0.002 (0.03)