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CHANGES IN THE EASTERN CAPE DEMERSAL INSHORE TRAWL FISHERY BETWEEN 1967 AND 1995

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Changes in the Eastern Cape demersal inshore trawl fishery operating out of Port Elizabeth over a 28-year period from 1967 to 1995 are described. The fishery is restricted to vessels operating between Slangbaai in the west to Port Alfred in the east. The principal target species are the shallow-water Cape hake and Cape horse mackerel. Eight of the more than 80 recorded species caught by the trawlers during the entire period contributed >98% to the total landed catch. These are hake, horse mackerel, panga, Agulhas sole, kingklip, Cape gurnard, silver kob and chokka squid. There was a notable decline in total catch and catch rate over the period reviewed, together with considerable change in the overall catch composition. For the two time-periods for which there are accurate catch data, hake, horse mackerel and panga consistently contributed in excess of 85% to the total annual landings. There were significant decreases in the size-at-(50%) recruitment for hake, horse mackerel and panga. Although at face value it would appear that the fishery is in decline, the causative factors are largely unknown and cannot be quantified properly owing to the paucity of comparable data. The need for further detailed investigation into the population dynamics of principal species in the Eastern Cape is discussed, particularly as it pertains to spawner biomass on the Agulhas Bank.

Demersal trawling on the South African south and east coasts for the Agulhas sole *Austroglossus pectoralis* was initiated in 1878, initially using a steam tug off Port Elizabeth (Lees 1969). Since the late 1950s the South African trawler fleet has been split into two components, an offshore (vessels operating deeper than 110 m) and an inshore component (vessels < 30 m long and < 750 hp and restricted to an effective maximum fishing depth of 120 m). This distinction provided for better control and facilitated management. The inshore trawling fleet is smaller than the offshore component and contributes c. 16% of the combined annual trawl catch (Japp *et al*. 1994). It also employs far fewer people and generates less revenue. Nevertheless, the inshore trawl fishery has, since its inception, been an important contributor to the economy of the Eastern Cape.

Currently, almost all the inshore trawling around the South African coast is in the area east of Cape Agulhas and west of Port Alfred. Mossel Bay and Port Elizabeth are the two major ports which serve the industry. Approximately 14% of the South African inshore trawl catch is landed at Port Elizabeth, the remainder principally at Mossel Bay. Historical records show that, by 1929, the Eastern Cape trawl fishery off Port Elizabeth had four coal-burning side-trawlers, which were replaced by eight diesel-powered trawlers in the mid 1950s (Hecht 1976). Between 1972 and 1975 the fleet was reduced to six diesel-powered side-trawlers. By the early 1980s the number of vessels operating out of Port Elizabeth had increased to 12, but recently market and labour-related problems have resulted in the bulk of the fleet moving to Mossel Bay.

The maintenance of long-term catch records, species composition and length frequency data facilitates the development and implementation of effective management strategies. Unfortunately, few records were kept during the early years of the fishery, and it has only been since January 1967 that one of the companies based at Port Elizabeth, at the request of the Chief Directorate of Sea Fisheries, has maintained accurate records. The primary objective of this study was to provide a description of the fishery operating from Port Elizabeth, as a first step towards the possible development of a fisheries management strategy for the Eastern Cape within the context of a national management strategy for fisheries. To date, the only published quantitative information on the inshore fishery of the Eastern Cape is contained in a paper by Hecht (1977), although broader information on the demersal fishery of the wider South-East Coast is given in a number of papers, including the early one of Payne (1986) and the comprehensive follow-up of Japp *et al*. (1994). Hecht's (1977) paper considered the changes in the fishery during the period 1967 to 1975. The present investigation considers the changes since then in terms of the fleet, its fishing capacity, species composition, catch seasonality, catch per unit effort (*cpue*) and size-at-recruitment over the time periods 1967–1975 and 1985–1995 between Slangbaai and Port Alfred.

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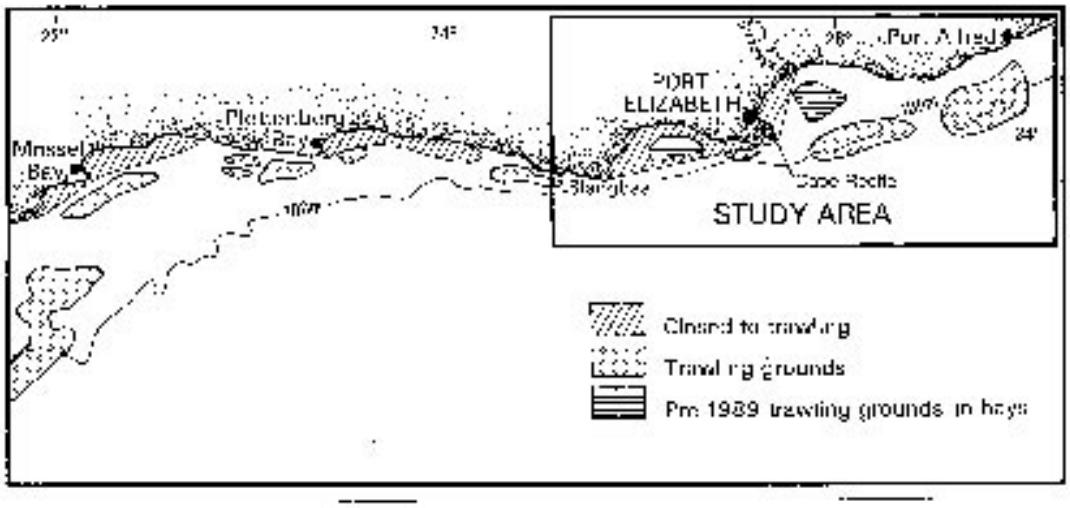

Fig. 1: Map of the eastern Agulhas Bank and East Coast showing the position of the study area, some of the trawling grounds, the bays closed to trawling and some of the places mentioned in text

MATERIAL AND METHODS

Catch composition, monthly catch seasonality, annual *cpue* and size-at-recruitment during the periods 1967–1975 and 1985–1995 were calculated using data obtained from fishing companies in Port Elizabeth and Sea Fisheries (SF). Obtaining a comparative estimate of fishing effort was complicated owing to the lack of accurate data on diesel consumption and other parameters over the entire time-period. A simple method, modified from Punt and Japp (1994), was used in which the total annual catch was divided by the number of vessels operating within the fishery. This general fishery description index, as with other unstandardized *cpue* indices, does not however, account for, *inter alia*, changes in gear technology, fishing strategy and skipper efficiency.

The percentage change in both annual catch and average catch per vessel over the study period was estimated by calculating a *CHANGE* statistic. This statistic was computed by fitting a linear regression to the series of average catch-per-vessel, dividing the slope of the regression by the average catch-per-vessel for the time-period and multiplying by 100. Furthermore, any significant differences between mean average catch-per-vessel for the two time-periods 1967–1975 and 1985–1995 were tested by means of a Mann-Whitney *U* test, because the data were found to be both non-parametric and heteroscedastic.

Length frequency data for shallow-water Cape hake *Merluccius capensis*, Agulhas sole and panga *Pterogymnus laniarius* collected during 1974–1975 and 1995–1996 were analysed to search for any changes in size-at-(50%) recruitment into the fishery. Cape horse mackerel *Trachurus trachurus capensis* were excluded from this analysis because it had been shown previously by Hecht (1990a) that there had been a notable decrease in size-at-(50%) for the species. Recruitment into the fishery was modelled by fitting a logistic ogive to the cumulative percentage length frequency data. The logistic is of the form

$$P_L = \frac{1}{1 + \exp^{-(L-L_{50})/\delta}} \quad ,$$

where P_L is the percentage recruitment at length L, L_{50} the size-at-recruitment and δ the steepness of the ogive. The model parameters were estimated by minimizing the residual sum of squares (the squared difference between the observed and predicted percentage recruitment).

RESULTS AND DISCUSSION

The fishery

Up to approximately 1972, demersal inshore trawling on the south-east coast of South Africa took place between Cape Agulhas in the west (20°E) and East London in the east (28°E). However, because of

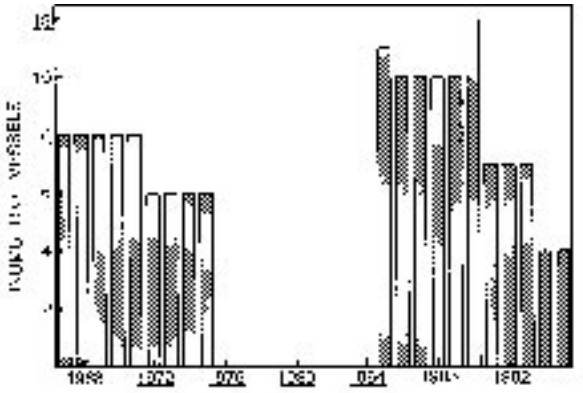

Fig. 2: Number of vessels operating from Port Elizabeth between 1967 and 1975 and between 1985 and 1995

declining catches of hake in the East London area, the inshore trawl fishery of the Eastern Cape has since c. 1972 been operating in the area between Slangbaai and Port Alfred (Fig. 1). West of Slangbaai, the fleet out of Mossel Bay are still very active. Throughout the time-period considered here, the average size and power of the side- and later modified stern-trawlers in the Eastern Cape fleet has been 21.4 ± 3.9 m and 427.3 ± 118.7 hp respectively.

During the period 1967–1995, the number of trawlers operating varied between five and 12, the highest number of being recorded in 1990 (Fig. 2). Several of the side-trawlers fishing in the area during the 1960s only left or retired from the fishery in the early 1990s. They were replaced by two stern-trawlers of approximately the same size and carrying the same number of crew (12 per vessel). Throughout the period reviewed here, the gear has not changed to any great extent; it consists of a standard otter trawl rig (38-m footrope, 25-m headrope, 360 × 75 mm mesh gape, 15-m belly, 6-m codend, a lift of 1 m, and an effective mesh size of 75 mm). The average duration of a drag has remained constant at approximately 2 – 3 hours and trawling speed has also remained constant at approximately 2 – 3 knots. Variable-pitch propellers of the less powerful side-trawlers made it possible to trawl at this speed. The only significant technological changes have occurred in echo-sounding and electronic navigation equipment. During the early 1970s, the most commonly used echo-sounders were colour multipen sounders. These have since been replaced with sophisticated double-beam sounders working at different frequencies, integrated with Global Positioning Systems, autopilots and track plotters. These electronic advances have obviously contributed towards an improved fishing efficiency.

Because of their size the vessels are restricted in terms of gear. Maximum fishing depth is 120 m. Most of the trawling along the coast of the Eastern Cape takes place between the 60 and the 120 m isobaths. The area fished by the inshore fleet at the eastern side of the Agulhas Bank is characterized mainly by flat grounds, both soft and hard (Japp *et al.* 1994). Between 1985 and 1987, many of the bays were closed to trawling, the prohibition principally because of the development of the chokka squid fishery at that time and as a consequency of concern expressed by linefishermen operating in the area. The closed areas are shown in Figure 1.

Although the Eastern Cape inshore demersal trawl fishery started off directed at Agulhas sole it has, since the early 1960s, been directed principally at hake. It was and still is a "wetfish" operation with the trawlers carrying crushed ice when they put to sea. There has been a slight decline in the duration of trips, although the number of fishing days per month has remained fairly constant. During the period 1967–1975, the average duration of a trip was 10 days with a three-day break on shore, whereas during the period 1985–1995 the average trip duration was 7 days, with one day ashore. Overall, therefore, the gear and vessel type has not changed to any great extent, which allows for a comparison of catch and effort during the period under consideration. Influences on the results attributable to skipper efficiency, electronic devices and species targeting were considered as a constant error within the analysis. The fishing areas (apart from the bays closed to trawling) have also not changed to any significant degree; they are shown in Figure 1.

Species composition and annual catch trends

The Eastern Cape demersal inshore trawl fishery is a multispecies fishery dominated by a few commercially important species (Table I).

Throughout the period 1967–1995 six species consistently contributed approximately 95% of the total annual catch. These are Cape horse mackerel, shallow-water Cape hake, panga, Agulhas sole, kingklip *Genypterus capensis* and Cape gurnard *Chelidonichthys capensis*. Silver kob *Argyrosomus inodorus* and chokka squid *Loligo vulgaris reynaudii* were the only other species which regularly contributed to the catch to any degree (Table II). Other species which were landed, if encountered in adequate quantities, were skates *Raja* spp. (wings only) and St Joseph shark *Callorhinchus capensis*. Other com-

mercially undesirable species, such as the majority of the elasmobranchs and smaller teleosts, are most often discarded at sea.

During the period 1967–1975, horse mackerel was the dominant species, contributing an average of 41% to the total annual catch, hake the second most important, contributing 32%, and panga 17%. All other species landed collectively contributed some 10% to the total catch; among those were Agulhas sole, chokka squid and kingklip. Although the landed mass of the last three species was small in comparison to the other species, they contributed significantly to the catch in terms of value. There has been an interesting and marked change in the percentage contribution made by the three principal species between the first and second periods reviewed. The 1985–1995 data show that hake became the dominant species in the catch, contributing some 47% to the total annual catch off the Eastern Cape, whereas the once-dominant horse mackerel now only contributes 35%. A significant drop in percentage contribution was also evident for panga, from the 17% in the period 1967–1975 to 7% in the period 1985–1995. Nevertheless, the same three species still constituted 90% of the total catch during the latter period. There have been marked decreases in the catches of Agulhas sole and kingklip too, but catches of gurnard and other less desirable species, such as St Joseph shark and redspotted tonguefish *Cynoglossus zanzibarensis* have increased.

Both annual catch and average annual catch-per-vessel are illustrated in Figure 3 and summarized in Tables III and IV. Two clear trends are evident. Hake, Cape gurnard and kob showed no notable change in catch rate over the two time-periods. This was shown by the statistically insignificant slopes of the regression equation ($ß_1$) and mean annual catch-per-vessel (Tables III, IV). On the other hand, catch rates of horse mackerel, panga, kingklip and Agulhas sole, as well as the total catch rate of the fishery as a whole, showed significant declines (Fig. 3, Tables III, IV).

Horse mackerel is an important commercial species on the Agulhas Bank, where it constitutes on average 14% of the fish biomass (Japp *et al*. 1994). In the Eastern Cape fishery during the period 1967–1975 it contributed 41% to the average total annual catch despite the fact that skippers were limited to landing a maximum of 8 tons per 10-day trip. The limit was in response to market conditions at the time. Catch rates during the period 1967–1975 were significantly higher than during the period 1985–1995, during which time horse mackerel became a more sought-after species and all the fish caught were landed. It should be noted that the fishery for horse mackerel in the Eastern Cape was directed almost entirely at the spawner biomass (Hecht 1990b), and it was the same component which sustained a brief midwater trawl fishery in the area between 1989 and 1991. The impact of that fishery on the horse mackerel stock is, however, unknown. The interaction and movements between the inshore and considerable shelf-break biomass of horse mackerel (Barange *et al*. 1998) is unknown, but they certainly would have implications for the management of horse mackerel in the region. Taking into consideration the movement of fish between these areas and between the biomass on the central Bank, an overall management strategy would be appropriate if the species is to be managed effectively. It must be noted, however, that, for an effective management procedure to be developed, the distribution and abundance dynamics of horse mackerel over its whole range, including Eastern Cape waters and encompassing both the shelf break and inshore regions, warrants attention. Interaction of the South Coast stock with the horse mackerel caught by purse-seiners and occassionally by trawlers on South Africa's south-west coast would also be relevant in this regard (Naish 1990).

The third most important species within the Eastern Cape demersal trawl fishery is still the panga, despite its percentage contribution to the total annual catch declining by more than half between the two time-periods reviewed here. During the mid and late 1960s, panga were particularly abundant on the grounds west of Jeffreys Bay (Badenhorst and Smale 1991) and east of Plettenberg Bay (Capt. T. Morris, Port Elizabeth, pers. comm.). Panga catches in Eastern Cape waters started to decline after the collapse of the stock on the Agulhas Bank, where it had been subjected to intense fishing pressure (Sato 1980), Booth and Punt (1998) estimate that, by the mid-1970s, the spawner biomass of panga had been reduced to $<20\%$ of pristine levels. However, following the reduction and, in 1992, ultimate removal of the Japanese fleet, which targeted panga on the Agulhas Bank, there is now some evidence of a stock recovery (Booth and Punt 1998). Other factors can also account for the apparent decline in panga catches off the Eastern Cape. These include the possibility of residency by this species and the lack of targeted fishing pressure by the inshore fleet over the past two decades. In addition, the age-structured production model used by Booth and Punt (1998) considers the stock on the Agulhas Bank as a single one with a pooled biomass covering the area between 20 and 27°E.

Kingklip in the Eastern Cape inshore trawl fishery have always been regarded as a valuable by-catch. The species prefers hard bottom and high relief areas, particularly off Capes Recife and St Francis (Hecht

1976, Japp 1989). The species is generally regarded as being difficult to catch, except after strong south-westerly swells whereafter they move onto the trawling grounds (Capt. T. Morris, pers. comm.). Figure 3 and Tables III and IV reflect the apparent depletion of kingklip in the Eastern Cape. The average catch rate for kingklip between the two time-periods has declined from an average of 7 tons to 2.5 tons per vessels per year. The decreasing catch trends of this species support Punt and Japp's (1994) conclusion that the South-East Coast kingklip stock is currently in an over-fished state.

As mentioned earlier, the Eastern Cape fishery was originally directed towards Agulhas sole (Lees 1969). The species is found on muddy grounds in the inshore areas of the South Coast, particularly west of Mossel Bay, on a few muddy areas east of Plettenberg Bay (Le Clus *et al*. 1994), and in a few areas off Bird Island (Hecht 1976). Since the early 1970s, sole have been regarded only as a valuable by-catch by Eastern Cape trawlers. The dataset shows a curvilinear relationship between catch rate and time (Fig. 3), the 14 tons per vessel per year in the late 1960s having been reduced to some 2 tons per vessel per year in 1974. However, catch rates since 1975 have remained fairly constant at around 1.81 tons·vessel^{-1}·year^{-1}. The most notable decline actually took place during the period 1970–1974. Of interest, however, is the fact that the Agulhas sole caught off the Eastern Cape are larger than those landed farther west from Mossel Bay (Japp *et al*. 1994). In addition the size-at-(50%) recruitment appears to have increased (Table V), possibly resulting from the lack of directed effort by the Eastern Cape trawler fleet, closure of some bays and the stable annual Total Allowable Catch (*TAC*). This finding may indicate that the stock of Agulhas sole off the Eastern Cape has stabilized, albeit at a much lower abundance than two decades ago.

Other important, but less valuable, species which are not targeted but caught as incidental by-catch are the Cape gurnard and chokka squid. Fluctuating catch rates are common for chokka squid. It is known to be a short-lived species that is highly dependent on environmental conditions for growth and recruitment success (Augustyn *et al*. 1994). The catch rate data presented here support the squid *cpue* data analysed by Roel (1998), from the inshore, deepsea and foreign trawlers, which also show a slight decline in catch rate. In addition, since the inception of the squid jig fishery in 1984, large catches have been made off the Eastern Cape, and it would seem reasonable that those catches should have had at least some impact on trawl *cpue* in subsequent years.

The silver kob has been an important component of the inshore demersal trawl fishery and the linefishery of the Eastern Cape for decades. For instance, before 1968, large catches were often taken in a single trawl, and fish of 1.5 – 5 kg were not uncommon in the catches (Capt. T. Morris, pers. comm.). Catches since 1968 have been small and infrequent, consisting of immature and subadult fish of < 1 kg (Griffiths 1997a). Although catch rates were comparatively good during the first few years of the period reviewed here, they have declined dramatically from some 24 tons per vessel per year in 1967 to consistently below 11 tons per vessel per year since the early 1970s. This mirrors the findings of Griffiths (1997b), who showed that the stock is currently overfished at unsustainable levels.

Monthly catch trends

Monthly catch trends for seven teleost species and for chokka squid between 1967 and 1975 are illustrated in Figure 4. The monthly landings of "winter" dominant species such as hake, kingklip, silver kob and panga were strongly unimodal with catches peaking around July or August. "Summer" dominant species were Agulhas sole and squid, their catches peaking around December. The third category (horse mackerel and Cape gurnard) seem to display a bimodal catch distribution, with catches peaking in spring and autumn.

Seasonal changes in catch rates (or the movement of fish into the fishing areas) can be attributed to a variety of factors, principally the spawning cycle and feeding migrations (Augustyn *et al*. 1994, Griffiths and Hecht 1995). The two species of interest here that are known to form spawning aggregations are kingklip (Japp 1989) and chokka squid (Sauer *et al*. 1992). In the case of chokka squid, the animals migrate eastwards to spawn on the grounds between Plettenberg Bay and Algoa Bay in spring and summer (September–December), where they remain until a large proportion of the population migrates westwards in autumn (Augustyn *et al*. 1994). Unfortunately, there is limited information available on post-spawning survival of chokka squid on both the spawning grounds and the Agulhas Bank (W. H. H. Sauer, Rhodes University, pers. comm.).

Based on observations that spawning by horse mackerel takes place during the periods of least abundance in the area (Hecht 1990a), at least as gauged by catch rates, the bimodal peaks in abundance of that species can be explained by one or both of the following hypotheses. Fish either migrate westwards out of the Eastern Cape trawling grounds (Hecht 1990a) and/or they migrate vertically into the water column (Barange *et al*. 1998) to spawn, thereby becoming less susceptible to the demersal trawling

gear. This latter hyopthesis is supported by increased demersal abundance in November contrasted with a decrease in pelagic abundance (Barange *et al*. 1998). The coincidence of modes in demersal and pelagic abundance are, however, unclear (Barange *et al*. 1998).

Offshore/onshore movements possibly account for the monthly variation in catches of silver kob and panga. Griffiths (1997a) showed that linefish catches of silver kob were higher in summer than during winter. A simultaneous yet opposite trend is displayed by the trawl catches, suggesting that the same inshore/offshore movements into deeper waters as a preferred temperature range of 13–16°C (Griffiths 1997a) occurs during winter. The migrations were substantiated by tagging data, which have revealed that large adults and not just small juvenile and subadult fish (which currently dominate the kob catches) were caught by trawlers after being tagged inshore (Griffiths 1997a). The data for panga are not as clear as those for kob, although they suggest an inshore movement of fish during winter. Data from research surveys (Hatanaka *et al*. 1983, Uozumi *et al*. 1984, 1985, AJB unpublished data) show that panga availability decreases during autumn and winter, suggesting that fish then move inshore to areas not intensively surveyed. Unfortunately, no directed effort is expended on the panga in the offshore linefishery, because fishermen prefer to target other fish, such as geelbek *Atractoscion aequidens*, kob and other more valuable seabreams, if they are available. It is for this reason that monthly catch data from the linefishery are unsuitable for comparison with the data from the trawl fishery. The possibility of a spawning migration onto areas of the sea bed that are rocky or reef-covered and therefore relatively unfishable by the inshore trawl fleet, proposed by Hecht (1976, 1977), cannot be disregarded despite Booth and Buxton's (1997) findings that panga spawn throughout the year over the entire Agulhas Bank, with no indication of seasonality.

Non-seasonal spawning patterns (A-S. Wood-McPhail, Rhodes University, unpublished data, Booth 1997) and high residency of Cape gurnard possibly account for that species' stable catches. However, the summer peaks in catches of Agulhas sole cannot be fully explained yet.

Size-at-recruitment

Perceived trends in recruitment into a fishery are a combination of two processes: recruitment of fish onto the fishing grounds and the selectivity of the fishing gear to those recruits. The multiplication of both these curves results in a curve depicting the recruitment of fish into the fishery (Sparre *et al*. 1989). From 1967 to 1995 there were hardly any changes in mesh size, trawl size or design and trawling speed. Gear selectivity would therefore not have changed to any notable extent. The shift in the size of fish recruited into the fishery can therefore be attributed to changes in population size structures and areas fished. This scenario has been shown for many fisheries and is attributed to increases or decreases in fishing pressure (Beacham 1983, Jørgensen 1990). Although it can be argued that interannual variability in recruitment patterns can reveal short-term changes in size-at-(50%) recruitment without showing any long-term trend, the change in size-at-(50%) recruitment shown here for more than one species does allow for tentative conclusions to be drawn.

Length frequency histograms of hake, Agulhas sole and panga are shown in Figure 5. Hake and panga now recruit into the fishery at a significantly smaller size than they did two decades ago (Table V). Estimates of the change in size-at-(50%) recruitment for horse mackerel in the fishery have already been examined and published by Hecht (1990a). Unfortunately, no length-frequency data for horse mackerel between 1990 and 1995 are available. Hecht's studies showed that, between 1974/75 and 1988, the size-at-(50%) recruitment decreased from 44.0 to 40.0 cm total length.

The size-at-(50%) recruitment for Agulhas sole increased between the two sampling periods (Table V), from 35.6 to 38.9 cm total length. The reasons for this are probably associated with the scarcity of sole in the area and a concomitant decrease in directed fishing pressure and a stable interannual *TAC* (Badenhorst and Smale 1991, Le Clus *et al*. 1994).

CONCLUSIONS

The data presented in this study document the changes that have taken place in the Eastern Cape demersal inshore trawl fishery over two decades. What emanates from the investigation is a clear need for more research effort on the fisheries resources of the Eastern Cape, although the same statement probably applies to the broader demersal fishery and linefishing too. The data presented clearly show that the Eastern Cape fishery is not a "closed management entity", but is affected by internal fishing strategies, seasonal changes in abundance, the migratory patterns of spawner biomass, inherent environmental variability, and fishing activities elsewhere, e.g. over the shelf break and over the eastern and central regions of the

Agulhas Bank. Therefore, the implications are that the fish stocks off the Eastern Cape cannot be managed in isolation, and that the future of the fishing industry in the region depends on the sustainable management of the stocks throughout their distributional range.

The data presented do show possible indications of overfishing of horse mackerel, panga, kingklip, Agulhas sole and silver kob. This finding is corroborated by changes in the size-at-(50%) recruitment for hake, panga and horse mackerel. The unavailability of adequate long-term data, particularly with regard to accurate diesel consumption and fishing area records unfortunately hampered a more detailed analysis of the *cpue* data with the application of Generalized Linear Modelling, which can remove the effects of vessel fishing power, improved electronic technology, fishing area and season to obtain a standardized estimate of effort. This would have allowed for the assumption that *cpue* is a function of abundance rather than limiting the analysis to use of a general fishing index reflected in the *CHANGE* statistic.

Hecht (1977) concluded that the Eastern Cape fishery as whole (apart from Agulhas sole) was in a relatively "healthy state". It is doubtful whether it can still be regarded as such. The overall annual catch per vessel in the fishery has declined from 399 tons in the period 1967–1975, to 262 tons per vessel per year in the period 1985–1995. The fact that the vessels currently catch only 65% of what they did in the period 1967–75, despite advances in gear and electronic fishing technology, seemingly warrants much greater research effort. Further also, the large proportion of hake and horse mackerel spawner stock caught in the region emphasizes the need for detailed research.

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FIGURE LEGENDS

Fig. 1: Map of the eastern Agulhas Bank and East Coast showing the position of the study area, some of the trawling grounds, the bays closed to trawling and some of the places mentioned in text

Fig. 2: Number of vessels operating from Port Elizabeth between 1967 and 1975 and between 1985 and 1995

Fig. 3: Total annual catch (open circles) and average annual catch-per-vessel (closed squares) for the eight commercially most important species landed in the Eastern Cape inshore trawl fishery operating from Port Elizabeth between 1967 and 1975 and between 1985 and 1995

Fig. 4: Monthly landings (± one standard deviation) for eight commercially important trawled species landed in the Eastern Cape inshore trawl fishery, operating from Port Elizabeth between 1967 and 1975

Fig. 5: Length frequency histograms of panga, Agulhas sole and Cape hake landed in the Eastern Cape inshore trawl fishery operating from Port Elizabeth between 1967 and 1975 and 1995