

TRENDS IN COMMERCIAL HANDLINE CATCHES OF REDFISHES ALONG THE SOUTHERN CAPE COAST, REPUBLIC OF SOUTH AFRICA

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Abstract — During the period 1898-1906 red romans *Chrysolephus laticeps* dominated redfish landings at Strand and Hermanus, Republic of South Africa, ports subject to cool upwelling conditions. Red stumpnoses *C. gibbiceps* were the main species along the eastern Cape Peninsula and seventy-fours *Polysteganus undulosus* at most harbours east of Cape Agulhas. By the late 1970's romans were dominant between Kalk Bay and Arniston and also important contributors elsewhere, but seventy-fours were only recorded in any significant quantities from Port Alfred. Interpretation of these trends is complicated by a lumping of catches, but the possibility of an environmental change favouring romans (cooler water) at the expense of seventy-fours (warmer water) cannot be discounted. Other marine forms having a biology associated with cooler waters have also increased along the southern Cape coast in recent years. Redfish resources at Gans Bay and Struis Bay are not currently overexploited, but provide a valuable source of remuneration for local fishermen when preferred target species are absent. Limited data collected in the Tsitsikamma Coastal National Park indicate that dageraad *C. cristiceps* populations could deteriorate rapidly if subjected to high fishing pressure. The contribution of dageraads to combined redfish landings is currently highest in areas of low exploitation.

Introduction

A wide variety of species contribute to the landings of commercial handline and skiboat fisheries along South Africa's southern Cape coast. A number of these fishes are seasonally abundant and when available attract a large proportion of the fishing effort. Examples include snoek *Thyrsites atun*, yellowtail *Seriola lalandi*,

Cape salmon or geelbek *Atractoscion aequidens*, kob *Argyrosomus hololepidonus* and tuna *Thunnus* spp., many of which are pelagic or mesopelagic predators (De Jager, Nepgen & Van Wyk 1963; Nepgen 1970, 1979). Others, such as silverfish *Argyrosoma argyrosoma* and the redfishes, are frequently associated with subtidal, rocky reefs and may also be trawled demersally (Nepgen 1977). This report outlines trends in catches of six of the more prominent redfishes, all belonging to the family Sparidae or sea breams, namely, roman *Chrysoblephus laticeps*, red stumpnose *C. gibbiceps*, dageraad *C. cristiceps*, soldier or santer *Cheimerius nufar*, seventy-four *Polysteganus undulosus* and red steenbras *Petrus rupestris*.

For the purposes of this paper the southern Cape coast is regarded as the region bounded in the west by Cape Point and in the east by the Kei River Mouth. Many harbours suitable for small boats are located along this coastline (Fig. 1). Range limitations of vessels involved in the handline fishery have invariably meant that fish offloaded at any landing locality were caught in its immediate vicinity.

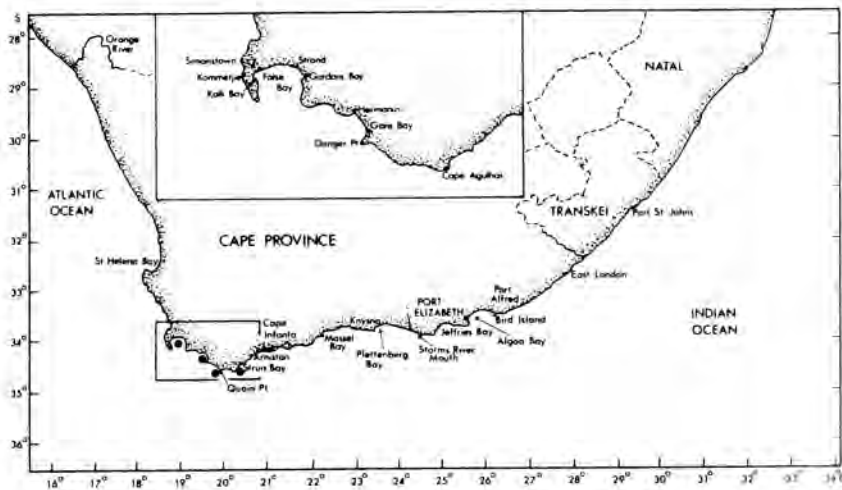


Fig. 1. South Africa's southern Cape coast indicating locations of harbours suitable for handline boats and stations where temperatures were recorded.

The area is influenced in the east by the relatively warm Agulhas Current and in the west by colder water derived from the West Wind Drift, and embraces two marine provinces as recognized by Brown & Jarman (1978). The south coast overlap province stretches from Kommetjie or Cape Point to Cape Agulhas, and the warm, temperate south coast province from Cape Agulhas to between Algoa Bay and Port St. Johns.

Methods

Catch statistics for the period 1898-1906 were obtained from reports of the government biologist of the Cape of Good Hope, and for the period 1965-1980 from

commercial concerns at various landing points. For two of the latter localities records of fishing effort were also available for boats operating from the harbours on a regular basis. At Gans Bay the number of boats fishing in each month was known, and at Struis Bay the number of days per month on which fish was purchased from boat owners. This last series of records was converted to boat-days per month, by taking into account the number of boats belonging to each owner and through a *pro rata* upward adjustment of the regular effort to allow for catches by visiting boats. These were most frequent during the December, January and April holiday periods. In all cases the upward adjustment was based on the combined species catch. Unreported catches may have led to underestimation of effort, but percentage cover is believed to have been similar during all years.

Difficulties involved in the assignment of effort to individual species in mixed-species fisheries have been discussed by Crawford (1981a). At Gans Bay and Struis Bay the effort directed at redfishes during each month was assumed to be proportional to their contribution to the total catch. The annual effort expended on redfishes was then simply calculated by summing over months. However, seasonal trends were examined by allocating the total monthly effort to each species, redfishes being considered as an entity. To have done otherwise would have resulted in identical trends for all species.

Caudal lengths, measured to the nearest millimetre, of romans and dageraads caught in the Tsitsikamma Coastal National Park (TCNP) during the period 1972-1976 were extracted from unpublished data collected by the National Parks Board. Monthly sea surface temperatures at four stations *ca* 5-10 km offshore (Fig. 1) were available for the period January 1964 — July 1967 from unpublished information at the Sea Fisheries Institute. Similar daily readings measured from the shore at 08h00 by dipping an ordinary thermometer into seawater until a stable temperature was obtained were also recorded at Storms River Mouth during the period 1968-1980.

Results

Longterm trends

- Species composition of the landings at eleven localities during the period 1898-1906 are illustrated in Fig. 2, and of the catches offloaded at eight harbours during the period 1976-1980 in Fig. 3. At the turn of the century red stumposes dominated the landings at Simonstown (85%) and Kalk Bay (60%) and were also a major contributor at Strand (46%). Romans were prominent at Kalk Bay (34%), Strand (51%), Hermanus (76%) and Mossel Bay (62%), but at Struis Bay, Knysna and ports further east the bulk of the catch consisted of seventy-fours.

More recently (1976-1980), romans have been the main species at five western harbours (Kalk Bay, Gordons Bay, Gans Bay, Struis Bay and Arniston) and have also formed a significant proportion of landings elsewhere. Dageraads have been especially evident off the TCNP, and on the basis of catch returns red steenbrases have been the major contributor in Algoa Bay and at Port Alfred. Seventy-fours have only been recorded in any significant quantities from Port Alfred.

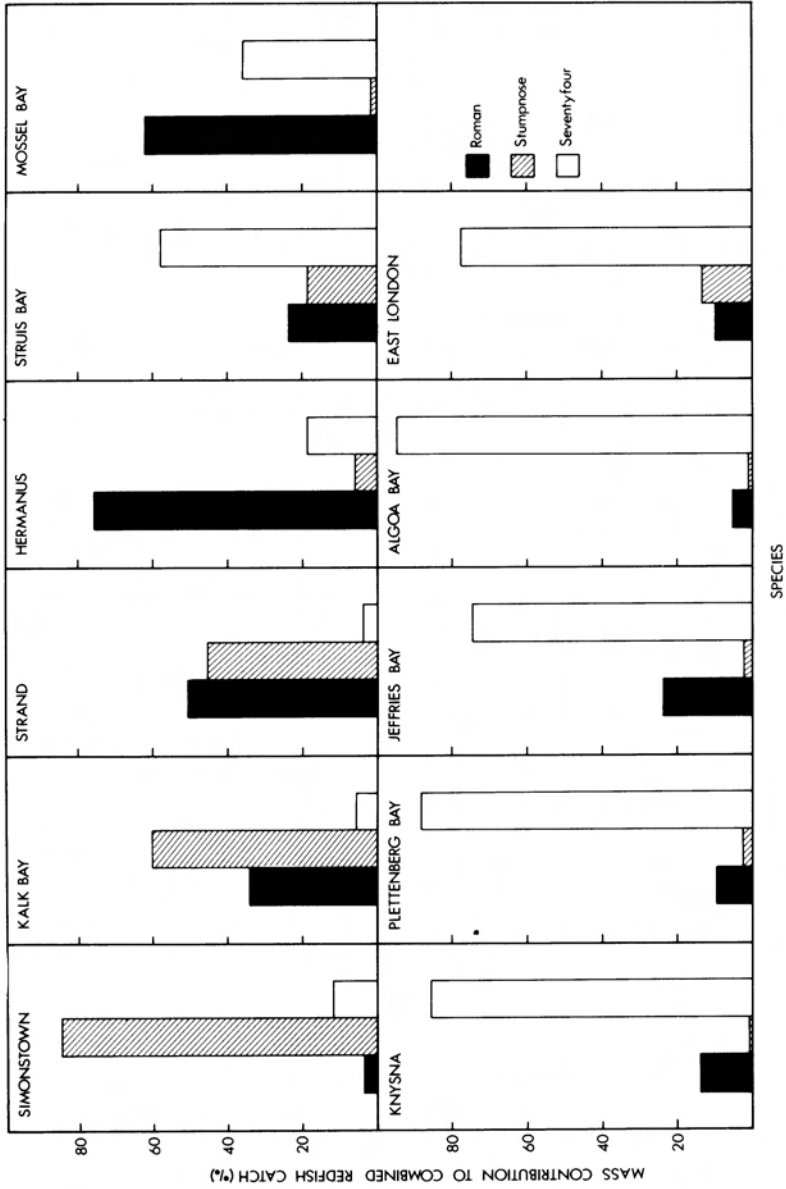


Fig. 2. Species composition of redfish catches at eleven southern Cape harbours during the period 1898-1906.

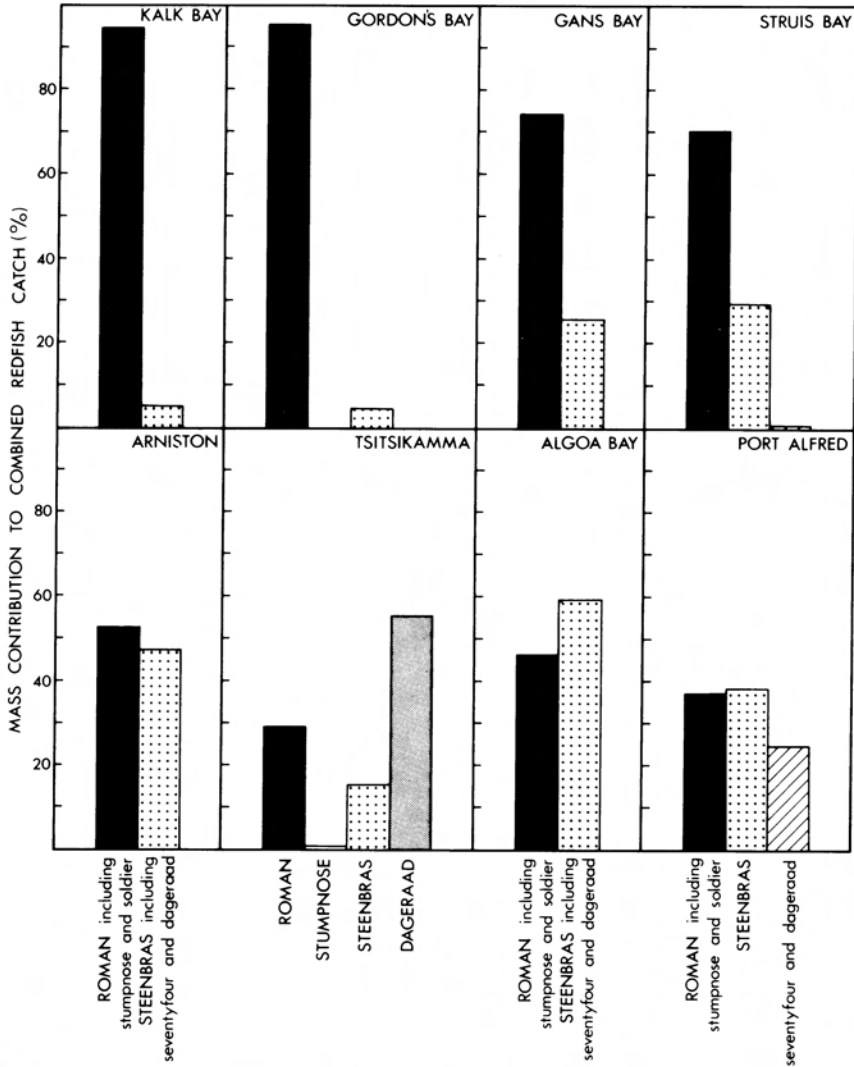


Fig. 3. Species composition of redfish catches at eight southern Cape harbours during the period 1976-1980.

Shortterm trends

(i) Gans Bay

At Gans Bay the combined catch of redfishes fluctuated around a level of 12 tons between 1965 and 1974, but then rose sharply to almost 58 tons by 1977 before declining again to less than 10 tons in 1980 (Table 1). Romans dominated the catch in all years except 1979, when red steenbrases were the major contributor. Catch per unit effort of redfishes decreased from 1965 through 1972, but then climbed rapidly to in excess of one ton per boat-month in 1977 (Fig. 4). It has subsequently declined to earlier levels.

Table 1

Species composition of and percentage contribution of roman to the combined redfish landings at Gans Bay, 1965-1980

Year	Catch (kg)			% Contribution of roman
	Roman*	Red** steenbras	Total	
1965	15 020	972	15 992	93,92
1966	17 954	1 184	19 138	93,81
1967	10 180	1 062	11 242	90,55
1968	10 641	1 019	11 660	91,26
1969	9 792	1 580	11 372	86,11
1970	7 837	2 825	10 662	73,50
1971	13 483	45	13 528	99,67
1972	2 717	674	3 391	80,12
1973	7 852	6 590	14 442	54,36
1974	5 710	316	6 026	94,76
1975	18 120	138	18 258	99,24
1976	30 636	8 024	38 660	79,24
1977	55 336	2 332	57 668	95,96
1978	20 667	7 325	27 992	73,83
1979	13 905	22 264	36 169	38,44
1980	5 698	4 035	9 733	58,54
1965-1980	245 548	60 385	305 933	80,26

* Includes smaller quantities of red stumpnose and soldier

** Includes smaller quantities of seventy-four and dageraad

(ii) Struis Bay

At Struis Bay the combined catch of redfishes fluctuated widely around a mean level of 38 tons between 1968 and 1980, without showing any real trend (Table 2). Romans were again the main species and red steenbras an important contributor. Dageraads were not recorded separately after 1971, nor red stumpnoses, soldiers and seventy-fours after 1977. Landings of these last three species were sporadic but tended to decline towards the mid-'seventies.

The catch per unit effort of redfishes showed a general increase from the late 'sixties through 1979, but decreased sharply in 1980 (Fig. 5).

Table 2

Species composition of and percentage contribution of roman to the combined redfish landings at Struis Bay, 1968-1980

Year	Catch (kg)						% contribution of roman	
	Roman	Red stump-nose	Soldier	Red steen-bras	Seventy-four	Dageraad		Total
1968*	24 637	—	308	13 004	57	198	38 204	64.49
1969	26 061	603	918	11 944	78	22	39 626	65.77
1970	29 156	1 424	639	5 386	—	50	36 655	79.54
1971	42 246	9 829	—	9 022	—	217	61 314	68.90
1972	36 424	8 125	332	14 341	6 075	—	65 297	55.78
1973	8 628	998	1 898	7 799	113	—	19 436	44.39
1974	12 013	1 299	50	9 947	—	—	23 309	51.54
1975	25 813	125	18	8 820	50	—	34 826	74.12
1976	15 768	160	294	9 927	—	—	26 149	60.30
1977	38 283	—	112	12 191	50	—	50 636	75.60
1978	16 341	—	—	2 148	—	—	18 489	88.38
1979	34 086	—	—	19 259	—	—	53 345	63.90
1980	21 800	—	—	10 402	—	—	32 202	67.70
1968-1980	331 256	22 563	4 569	134 190	6 423	487	499 488	66.32

* Information for August — December only.

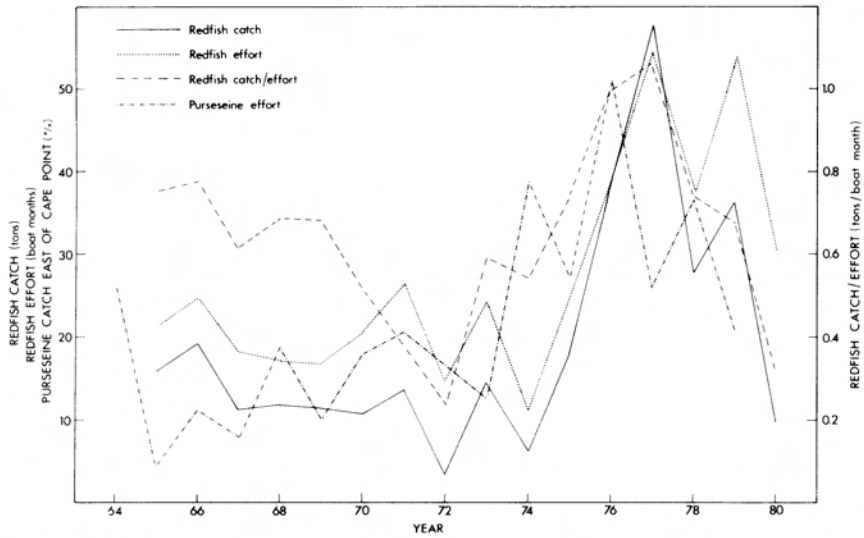


Fig. 4. Catch, effort and catch per unit effort for redfish at Gans Bay and percentage total purse-seine effort expended east of Cape Point (from Crawford & Shelton 1981), 1964-1980.

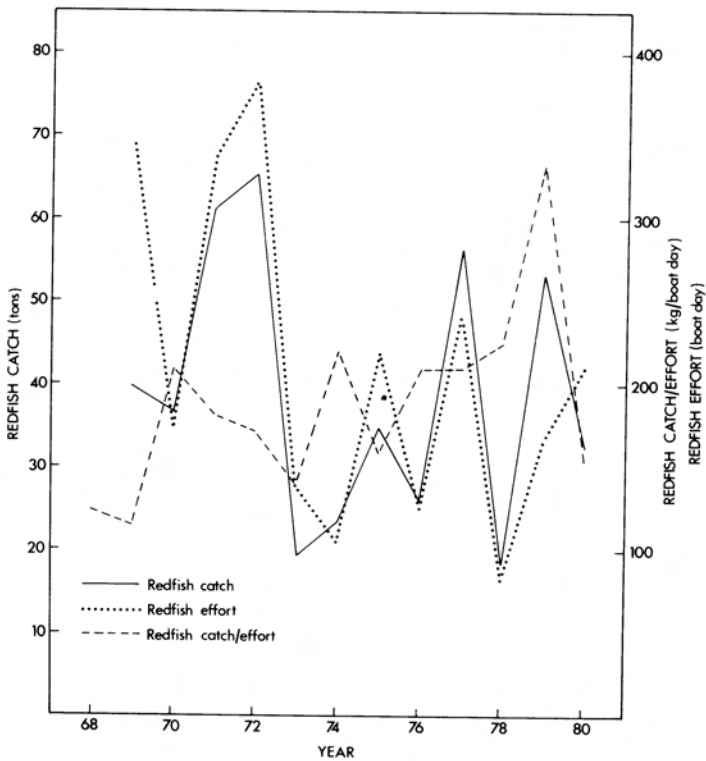


Fig. 5. Catch, effort and catch per unit effort for redfish at Struis Bay, 1968-1980.

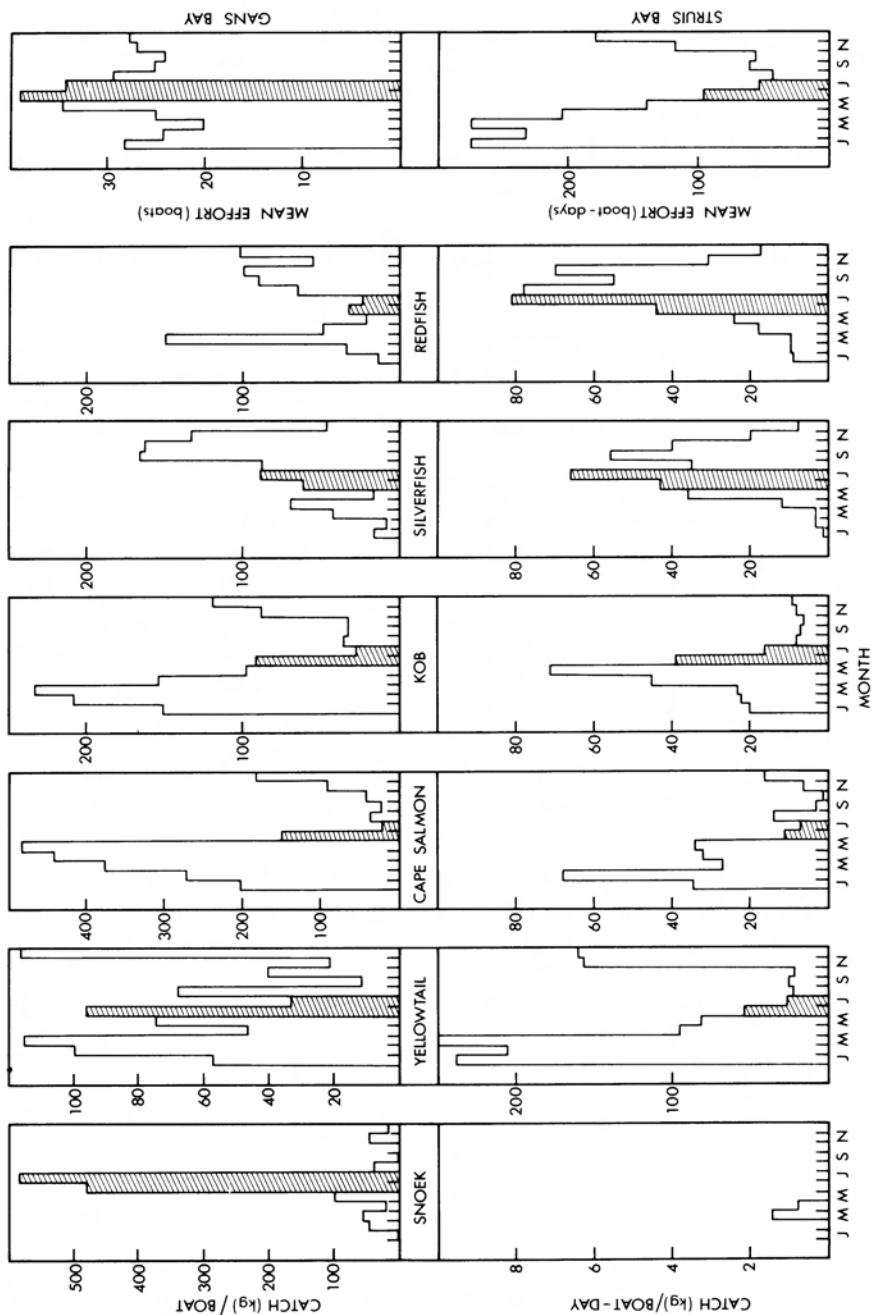


Fig. 6. Mean monthly catch per total effort for the major contributors to the handline fisheries at Gans Bay (1965-1977) and Struis Bay (1968-1980). Mean monthly levels of effort are also indicated.

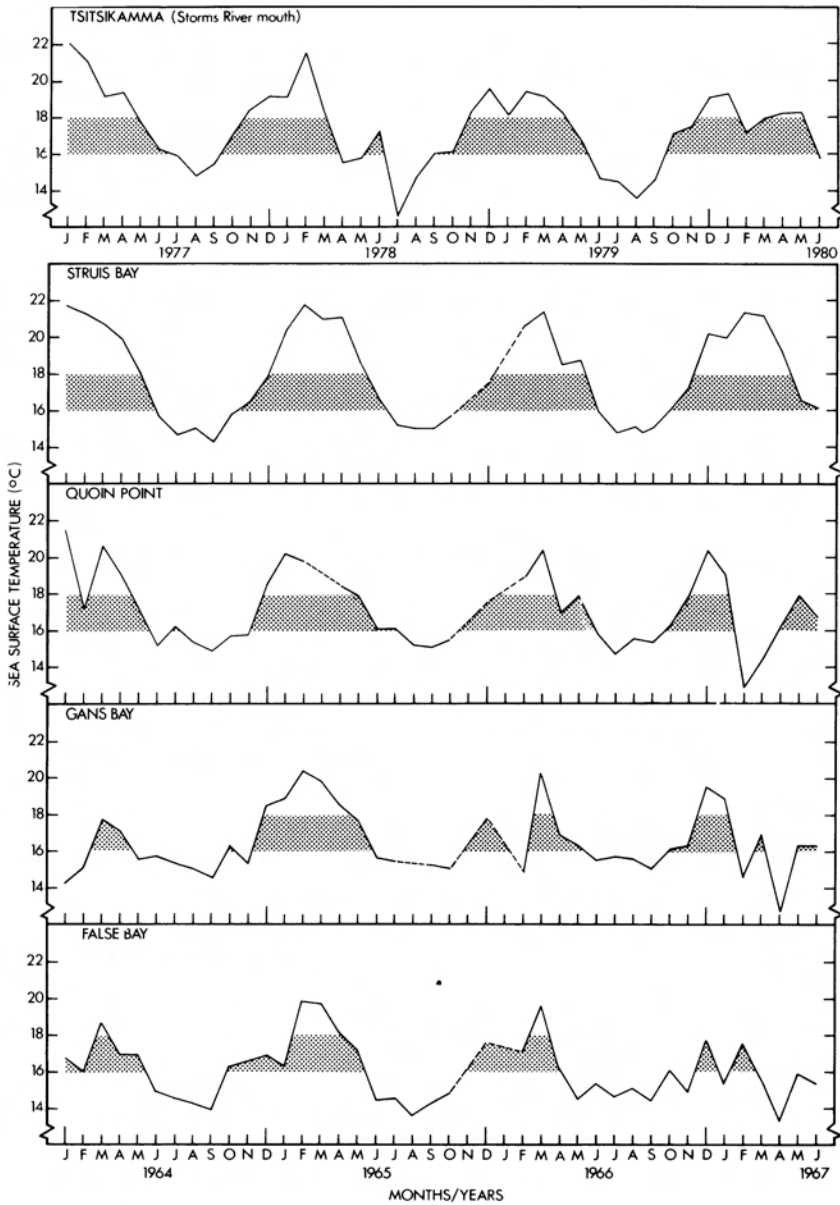


Fig. 7. Monthly sea surface temperatures at five inshore stations along the southern Cape coast. Values shown for Tsitsikamma (1977-1980) are the mean of daily readings, but at other localities (1964-1967) are single recordings. Sitings of stations are indicated in Fig. 1.

Seasonal trends

Monthly levels of catch per total effort for the major contributors to the handline fisheries at Gans Bay (1965-1977) and Struis Bay (1968-1980) are illustrated in Fig. 6. At Gans Bay the redfish indices are high in March and August to December, but relatively low during intervening months. The low from late autumn to mid-winter can be ascribed to the high availability of snoek at this time, snoek having a considerable market in the western Cape and being a preferred species (Nepgen 1979). Similarly Cape salmon or kob or both are encountered in large numbers in late summer or early autumn. Thus redfishes and another non-target species, the silverfish, which shows a similar trend, appear to be available throughout the year.

At Struis Bay the indices for redfishes (and silverfish) are highest from late autumn to late spring. The low levels during other seasons can be attributed especially to the high availability of yellowtail from November to March, but also to good catches of Cape salmon or kob between mid-summer and late autumn. It again appears that redfishes and silverfish are available during all months, but are only intensively exploited when preferred species are less abundant.

Sea surface temperatures at five nearshore localities are illustrated in Fig. 7. A distinct seasonal pattern is evident with warmer water occurring from late spring through mid-autumn, and relatively cool water during the intervening winter months. However, upwelling may cause rapid drops in surface water temperature during all seasons (Crawford, Shelton & Hutchings 1980; Heydorn & Tinley 1980; Schumann, Perrins & Hunter *in press*; and unpublished records of the National Parks Board).

Size composition of catches

Percentage contributions of different length classes to the handline catches of romans and dageraads off the TCNP during 1972-1973 and 1974-1976 are illustrated in Figs 8 and 9. Between these two periods there was little change in the size composition of the catches of romans (dominantly 20-36 cm caudal length). However, there was a noticeable lowering of the modal size of dageraads landed, from 28-32 cm caudal length in 1972-1973 to 24-28 cm in 1974-1976.

Contribution of dageraads to redfish catches

The 1980 percentage contribution of dageraads to the combined redfish landings at 10 localities for which reasonable data were available, is plotted against the mean annual redfish catch during the period 1976-1980 in Fig. 10. Catch figures were not in all instances available for the full five-year period. In cases where estimates of the dageraad contribution varied, the range has been shown. The contribution of dageraads was substantial at localities where exploitation was relatively low (Tsitsikamma and East London), but rapidly decreased as annual redfish catches approached a level of about 10 tons.

Discussion

Upwelling occurs off Cape Hangklip and Danger Point, resulting in a high proportion of cold water species on these rocky promontories (Brown & Jarman 1978). Shallow reefs in their vicinity are also likely to be subject to a greater degree of cool

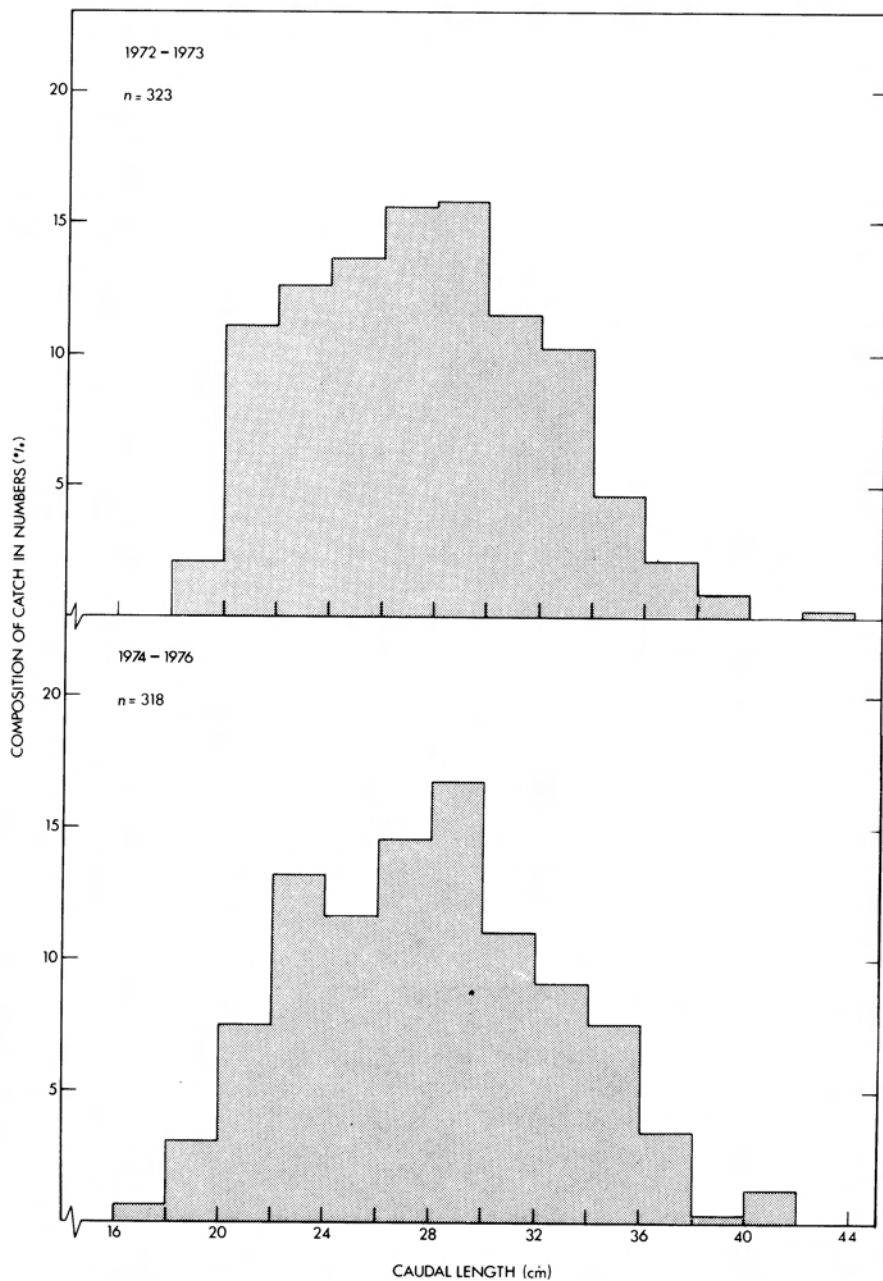


Fig. 8. Frequency of occurrence of size ranges (caudal length) of romans sampled from handline catches in the Tsitsikamma Coastal National Park, 1972-1976.

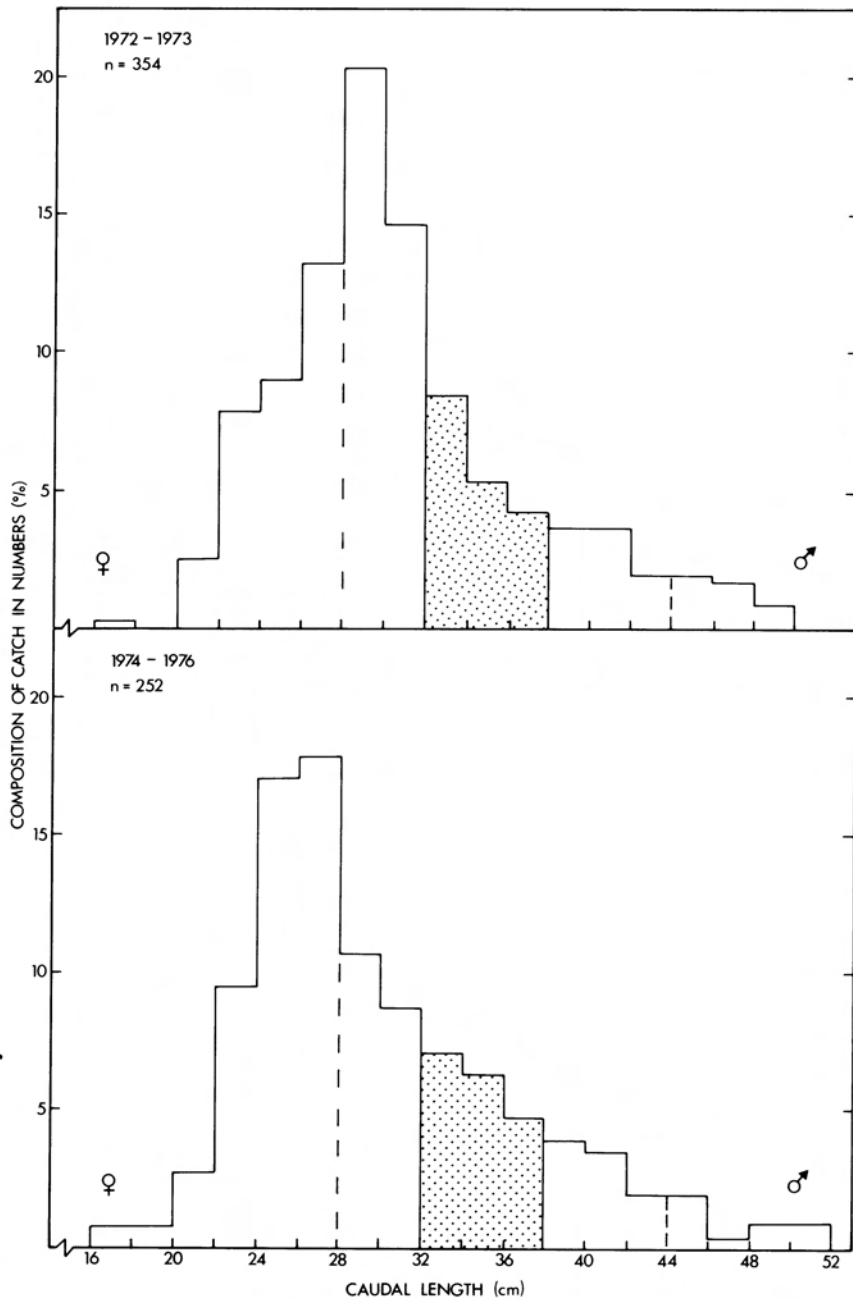


Fig. 9. Frequency of occurrence of size ranges (caudal length) of dageraad sampled from handline catches in the Tsitsikamma Coastal National Park, 1972-1976. Size at sex change is between dashed lines, most frequently in the shaded region (Robinson 1976).

water than those along the western sector of False Bay. At the turn of the century romans dominated the landings of redfishes at Strand and Hermanus, north of Cape Hangklip and Danger Point respectively, whereas at Simonstown and Kalk Bay further west red stumpnoses contributed the bulk of the catches. Seventy-four, a representative of warmer waters (Smith & Smith 1966), was the main species at all ports situated east of Cape Agulhas, with the exception of Mossel Bay. Ahrens (1964) cites Gilchrist (1902) and Thompson (1918) as listing silverfish, bastard silverfish and roode steenbras as alternative vernaculars in use for seventy-four in earlier years. Therefore it is possible that during the period 1898-1906 the government biologist of the Cape of Good Hope lumped catches of red steenbras *P. rupestris* with seventy-fours. However, catches of silverfish *A. argyrozona* were recorded separately (Cape Colony marine biologist 1899-1900; Cape Colony government biologist 1901-1905, 1907).

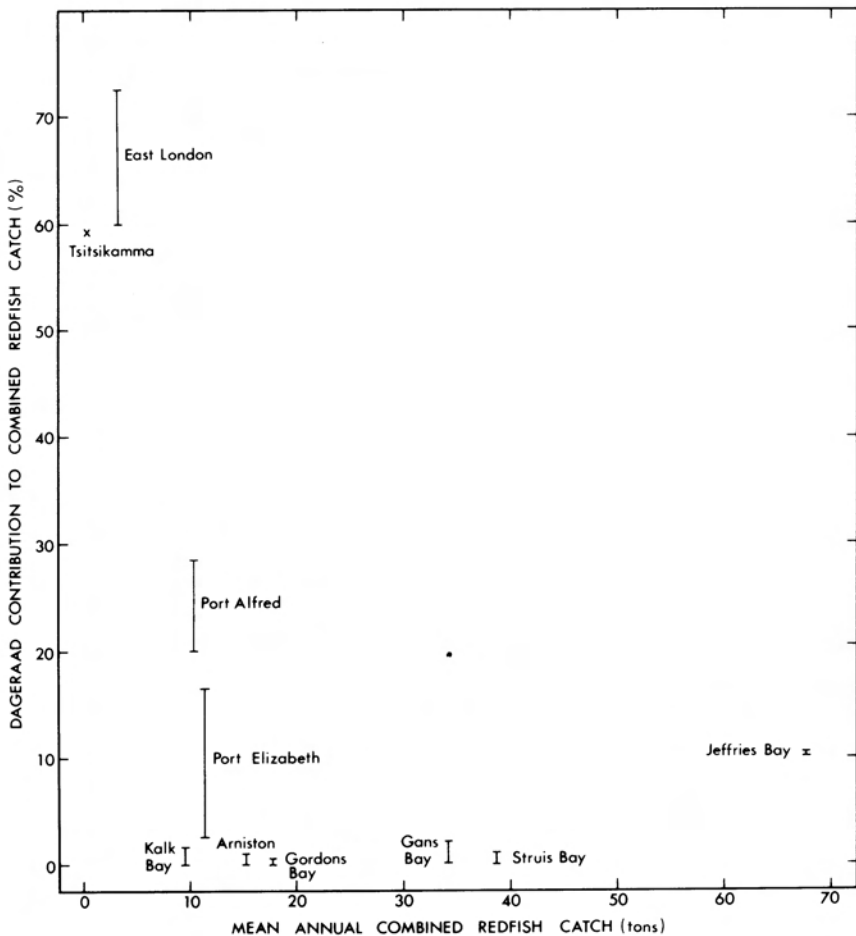


Fig. 10. Percentage contribution of dageraad to combined redfish landings (1980) in comparison to mean level of exploitation during the period 1976-1980. Where estimates could not be accurately ascertained the possible ranges are indicated.

By the late 1970's seventy-fours were noticeably scarce at all localities for which information was available, except at Port Alfred. Conversely red steenbras, not recorded in earlier years, were of importance at Gans Bay and eastwards. A decrease in landings of seventy-fours along the southern Cape coast has been commented upon previously (Smith 1943, 1949; Smith & Smith 1966). Although the trend may have been exaggerated by a former lumping of species, it appears to have been a real phenomenon. Seventy-fours were reported to be abundant on the Agulhas Bank in the early 1900's (Barnard 1927).

Current information lumps the red stumpnose catch with that of romans, but romans are recorded as the major species between Kalk Bay and Arniston and they also contribute significant landings elsewhere.

The overall pattern thus reveals a replacement of red stumpnoses and seventy-fours by romans in the warmer areas of the region under investigation. Lumping of red stumpnoses and soldiers with romans in recent data may have exaggerated this trend, but in all cases romans are currently cited as the dominant species of the trio. Romans have also maintained their pre-eminence in the relatively cool waters neighbouring Cape Hangklip and Danger Point. The increasing importance of romans in the eastern regions may have been influenced by fishing, but suggests too the possibility of some long-term environmental change resulting in generally cooler water temperatures along the southern Cape coast. Temperature is of prime importance in dictating geographical distribution patterns of organisms living in coastal waters (Brown & Jarman 1978), and a substantial drop in inshore water temperature is the most important single factor inducing winter availability of temperate fishes along South Africa's east coast (Heydorn, Bang, Pearce, Flemming, Carter, Schleyer, Berry, Hughes, Bass, Wallace, Van der Elst, Crawford & Shelton 1978). Data do not allow for an in-depth examination of the hypothesis at this stage, but interestingly other species having a biology more generally associated with cooler waters have also increased in abundance along the southern Cape coast in recent years. Thus intensified purse-seine fishing to the east of Cape Point during the mid-1970's closely matched the increases in availability of redfishes (dominantly romans) at Gans Bay and Struis Bay (Figs 4 and 5). Purse-seiners operating east of Cape Point direct their effort primarily at adult pilchards *Sardinops ocellata* and anchovies *Engraulis capensis* (Crawford 1981a). Adult pilchards were formerly caught in large quantities in the St Helena Bay vicinity, but their distribution is now largely restricted to waters east of Cape Point (Crawford 1981b). All major colonies of jackass penguins *Spheniscus demersus* located between the Orange River and Cape Point have declined in recent years, and the decreases appear to have resulted from a diminished availability of pilchards (Crawford & Shelton 1981). by contrast jackass penguins, Cape gannets *Sula capensis* and Cape cormorants *Phalacrocorax capensis* have all increased markedly in numbers at islands east of Cape Point since the mid-1950's (Randall & Ross 1979; Crawford & Shelton 1981).

The Cape gannet, which feeds primarily on small pelagic shoaling fishes (Davies 1955, 1956; Rand 1959; Matthews 1961; Crawford & Shelton 1982), is the only significant producer of guano at Bird Island, Algoa Bay (Randall & Ross 1979). During the period of dominance by seventy-fours of redfish catches east of Cape

Agulhas (1898-1906), guano harvests at this island were lower than at any time subsequently (Fig. 11), suggesting a low availability of pilchards and anchovies. In the 1920's annual guano production at the island rose from *ca* 200 to *ca* 450 tons, then following fluctuations decreased in the late 1940's. A subsequent rise and fall between 1955 and 1965 closely followed a similar trend in the biomass of the South

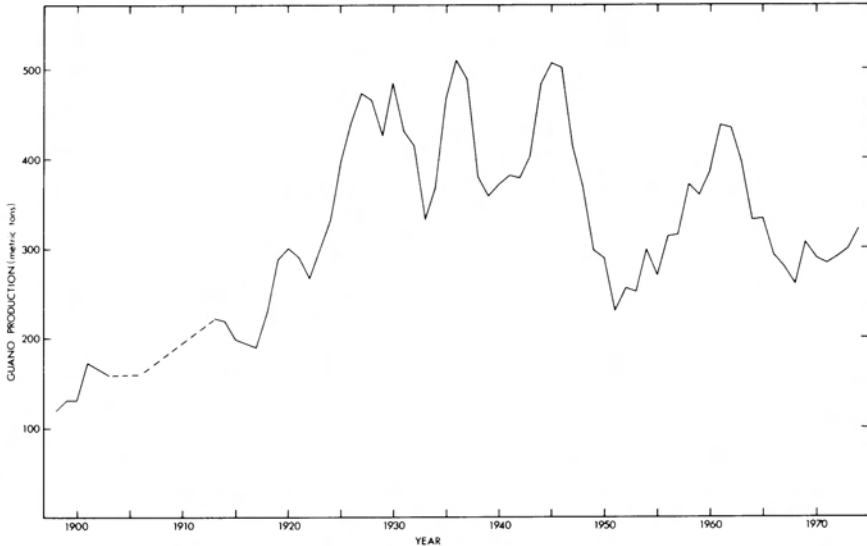


Fig. 11. Annual guano production at Bird Island, Algoa Bay, smoothed by threes 1898-1974 (from Crawford & Shelton 1978).

African pilchard population (Crawford & Shelton 1978). It thus appears that pelagic shoaling fishes increased in abundance along the southern Cape coast through the 1920's. The decline of seventy-fours occurred sometime prior to the early 1940's (Smith 1943).

Pilchards, believed to originate from the Western Cape stock (Baird 1971), are regularly present off the Transkei and Natal coasts during winter, giving rise to the well-known Natal sardine run (Heydorn *et al.* 1978). They are infrequently caught in substantial quantities in the region between Cape Infanta and Transkei and the reason why dense shoals occur during winter so far to the east of the commercial fishing grounds remains a matter for speculation (Crawford 1981b). The species has a biology closely linked to upwelling in the southern Benguela Current region and its associated high primary productivity, although adults spawn in adjacent warmer waters (Crawford *et al.* 1980). Cooler temperatures along the southern Cape coast in earlier years may have favoured a more easterly distribution of pilchards from which the present migratory pattern persists.

That fishing also has an impact on species composition of redfish catches is strongly

suggested by the negative relationship between degree of exploitation and percentage contribution of dageraads to the combined landings (Fig. 10). There is a possibility that the Tsitsikamma, East London and Port Alfred regions provide particularly favourable conditions for dageraads, but the relatively low contribution by this species at the intervening localities of Jeffreys Bay and Port Elizabeth then becomes more difficult to interpret. Furthermore, Robinson (1976) notes that dageraads were once relatively abundant along the south coast between Cape Point and Algoa Bay, and refers to F. Spalmer (*pers. comm.*) as observing a dramatic decline of dageraads at Arniston. Robinson provides no date for this sudden change. At neighbouring Struis Bay, catch records extend back to August 1968 and dageraad landings were recorded separately from 1968-1971 but not subsequently (Table 2). However, at no stage since 1968 has the species featured prominently in the catches off Struis Bay. The major decline is thus likely to have taken place at an earlier date.

Robinson (1976) reports sex reversal in dageraads, smaller individuals being females and larger fish males, and postulates that good catches of the species recorded off the TCNP may be ascribed to the protection that the area is afforded. Low exploitation (and thus low total mortality) would result in a reasonable proportion of males. Handline fishing was conducted off the TCNP during 1972-1976 to obtain material for research into the biology of fishes in the region. Although the total recorded catch of dageraads off Tsitsikamma during 1972-1973 amounted to only 497 kg, this limited exploitation appears to have influenced the size composition of the population decreasing the proportion of larger individuals (Fig. 9). Thus dageraad populations could rapidly deteriorate if subjected to high fishing pressure. Catches of romans off Tsitsikamma during 1972-1973 amounted to 320 kg, but did not noticeably influence size composition of the population in subsequent years (Fig. 8). This species also undergoes sex reversal, but some large males inhabit caves or other forms of rock shelter and are thus unavailable to fishermen (Penrith 1972). The redfish catches at both Gans Bay and Struis Bay have in recent years been dominated by romans (Tables 1 and 2), but at neither locality is there evidence of overfishing (Figs 4 and 5). At Gans Bay the redfish catch declined after a peak in 1977, but only to a level that had prevailed during the decade 1965-1974. Romans thus appear more resilient to exploitation than dageraads.

- Although seventy-fours are migratory, moving to Natal waters in late winter and spring (Ahrens 1964), no seasonal trends in the availability of redfishes could be isolated. At Gans Bay and Struis Bay fishing for these and silverfish appears to be most intense when preferred target species such as snoek and yellowtail are less abundant (Fig. 6). Redfishes and silverfish thus have a significant rôle to play in providing employment and remuneration for local fishermen during periods when pelagic and mesopelagic predatory fishes are absent. Their management should not be neglected, and special attention should be given to protecting species such as the dageraad which are sensitive to overexploitation even at low levels of fishing.

Acknowledgements

We are grateful to C. Buxton, G. de Villiers, M. A. Smale, C. S. de V. Neppen and A. I. L. Payne for commenting on the draft manuscript. We thank L. Knobel

(Struisbaai Visserye), Gansbaai Koöperasie Bpk. and personnel of the Sea Fisheries Institute stationed at south coast harbours for supplying catch information.

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