

Short Communication**Cape anchovy in swift tern diets and fishery landings in the Benguela upwelling region**

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Swift or crested terns *Sterna bergii* capture smaller Cape anchovy *Engraulis japonicus* closer to the mainland than do boats of a commercial purse-seine fishery in the Saldanha Bay area of the Benguela upwelling region off South Africa. The proportions of Cape anchovies in the diet of the swift terns and in the fishery landings were similar. However, the incidence of anchovy in the swift terns' diet was less variable. There was no relationship between weeks, months or years in the proportion of Cape anchovies in swift tern diets and fishery landings, and hence little direct overlap between the swift tern diet and the purse-seine pelagic fishery is apparent.

Die geelbek-seeswael *Sterna bergii* vang Kaapse ansjovis *Engraulis japonicus* nader aan die vasteland as die kommersiële visserye se saknette in die Benguela-gebied langs die Suid-Afrikaanse kus. Die proporsie Kaapse ansjovis in die seeswael se dieet en dié van die visserye se vangste was gelyksoortig. Kaapse ansjovis in die geelbek-seeswael se dieet was egter minder veranderbaar. Daar was geen verhouding tussen weke, maande en jare in die proporsie ansjovis in die dieet van die seeswael en die visserye se vangste nie en dus is daar weinig direkte ooreenstemming tussen die dieet van die geelbek-seeswael en die kommersiële visserye.

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The swift or crested tern *Sterna bergii* is a widely distributed species with breeding populations on islands along the Namibian and South African coasts (Cooper, Shaughnessy & Clinning 1977; Kriel, Crawford & Shelton 1980; Maclean 1985). Sixty-two per cent of the total estimated southern African population of 5 357 breeding pairs of swift terns is found in the Saldanha Bay area (FitzPatrick Institute unpubl. data). In this area, the diet of the swift tern is primarily Cape anchovy *Engraulis japonicus*, less important items being other pelagic fish, cephalopods and crustaceans (Walter, Cooper & Suter 1987). Since the collapse of the South African pilchard *Sardinops ocellata* fishing industry (Stander & Le Roux 1968), and the subsequent

introduction of small-mesh nets, Cape anchovy has become the most important component of the purse-seine catches in Saldanha Bay (Butterworth 1983). Schaffner (1986) has demonstrated extensive overlap in the size and age compositions of northern anchovy *E. mordax* fed to elegant tern *Sterna elegans* chicks and samples from the pelagic fishery off the coast of California. We examine here the degree of overlap between the diet of the swift tern and the purse-seine catches in Saldanha Bay.

We determined the relative abundances and sizes of Cape anchovy in swift tern diets and fishery landings, at weeks, months and years, in relation to the 'fishing behaviour' of both swift terns and the fishery. We confined our investigation to the Cape anchovy because it is the main target species of both the fishery and swift terns (Walter *et al.* 1987). The same data set collected by Walter *et al.* (1987) from nestling swift terns on islands in Saldanha Bay (33°03'S / 17°56'E), south-western Cape, South Africa, was used for this study. We compared size of fish (fork length) and relative abundance of Cape anchovy in the swift terns' diet and pelagic purse-seine catches (data from Sea Fisheries Research Institute).

For purse-seiners we estimated distances fished offshore from a point at the middle of the mouth of Saldanha Bay. Using shipboard transects from Cape Agulhas (34°50'S/20°01'E), to Lüderitz (26°39'S / 15°09'E), Namibia, during 1983–1985 we determined the relative abundance of swift terns at sea in seven zones: 0–5 km, 5–10 km, 10–20 km, 20–30 km, 30–40 km, 40–50 km and > 50 km offshore.

Cape anchovy constituted $50,4 \pm 26,8$ % ($n = 8$) (by relative abundance) of all regurgitations collected from swift tern chicks between the 14th and 16th week of each year from 1979–1986, and $48,3 \pm 48,2$ % ($n = 8$) of all fishery landings during the same period. Based on these standard deviations, commercial exploitation of Cape anchovy was more variable than exploitation by terns (standard deviation, $\sigma_{n-1}(\text{fishery}) = 51,6$; $\sigma_{n-1}(\text{terns}) = 26,7$).

The relative weekly abundances of Cape anchovy delivered to swift tern chicks and those taken by the fishery from February–April 1984, were not significantly correlated ($r_s = 0,36$; $P > 0,05$; $n = 13$; Figure 1). Cape anchovy relative abundances in April–May, 1979–1986 were not correlated with relative weekly abundance in the fishery during the same period ($r_s = 0,05$; $P > 0,05$; $n = 8$; Figure 2).

Mean sizes of Cape anchovy delivered to swift tern chicks during February, March and April 1984 were: 77 ± 12 mm ($n = 10$); 76 ± 22 mm ($n = 31$); and 70 ± 24 mm ($n = 18$), respectively (Figure 3). Corresponding measurements for the fishery were: 95 ± 5 mm ($n = 1\ 659$); 110 ± 15 mm ($n = 4\ 078\ 742$); and 95 ± 30 mm ($n = 6\ 501\ 113$), respectively (Figure 3). Fish in the commercial catches were significantly larger in all three months (February, $t = 23,4$; $P < 0,001$; March, $t = 12,6$; $P < 0,001$; April, $t = 3,4$; $P < 0,01$).

From February–April 1984, more than 90 % of foraging swift terns occurred within 10 km of the

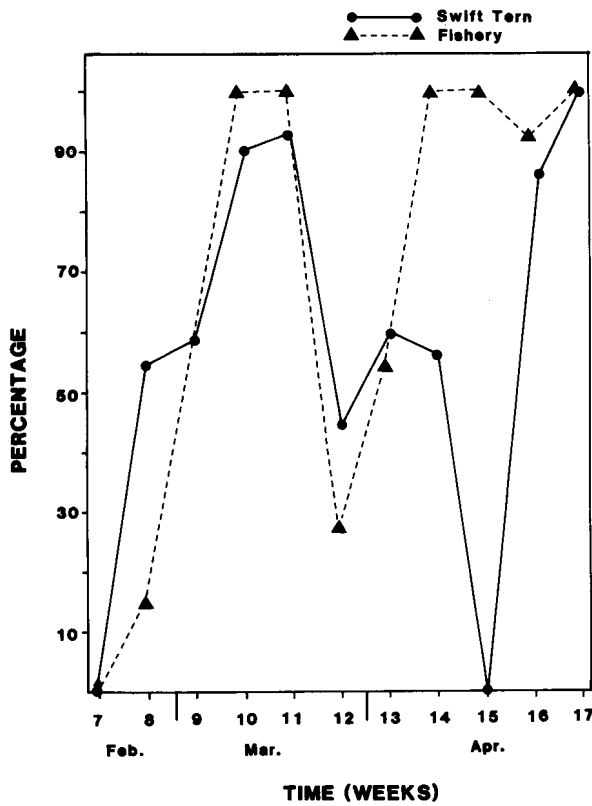


Figure 1 Percentage relative abundance of Cape anchovies in the diet of swift tern chicks and purse-seine catches, February–April 1984.

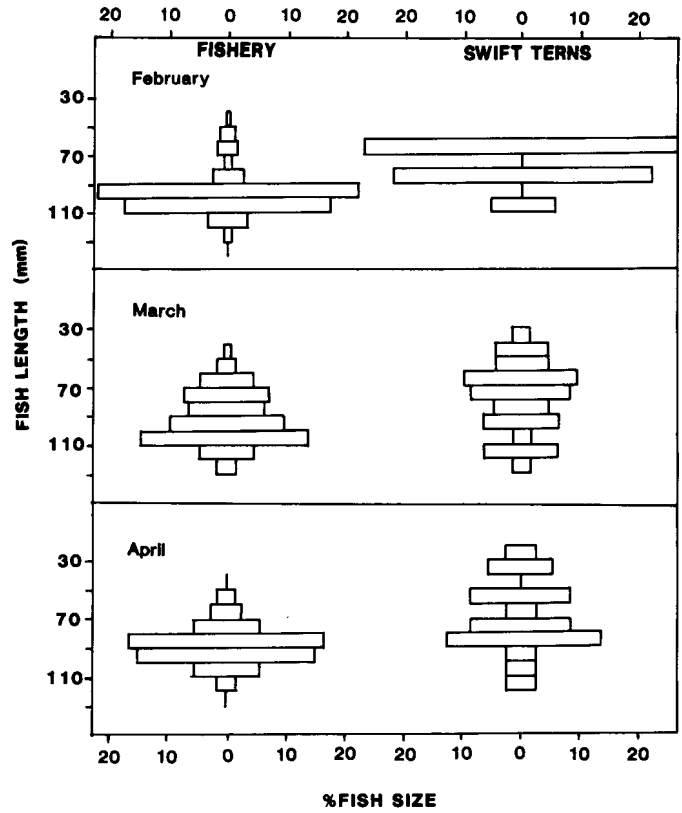


Figure 3 Size of anchovy taken by swift terns and purse-seiners, February–April 1984.

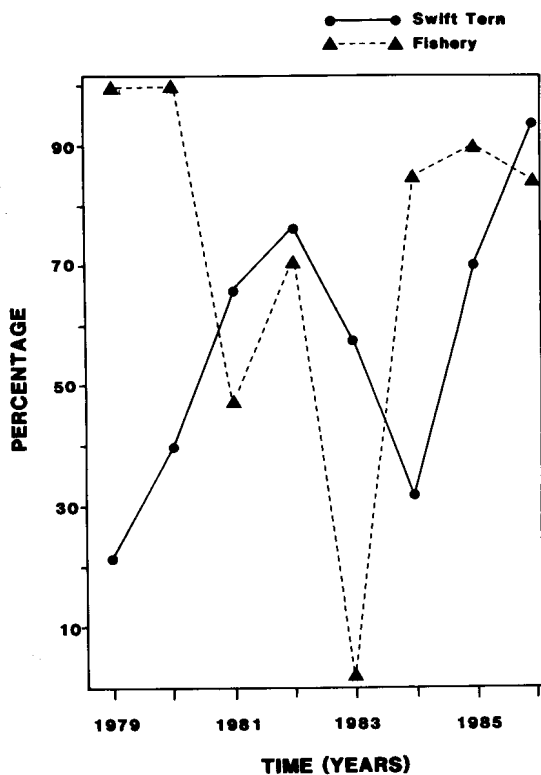


Figure 2 Annual variability in relative abundance of Cape anchovies in the diet of swift tern chicks and weekly purse-seine catches: 1979–1986.

coastline, but there was no purse-seine activity in this zone (Figure 4). Hence, swift terns and the fishing fleet

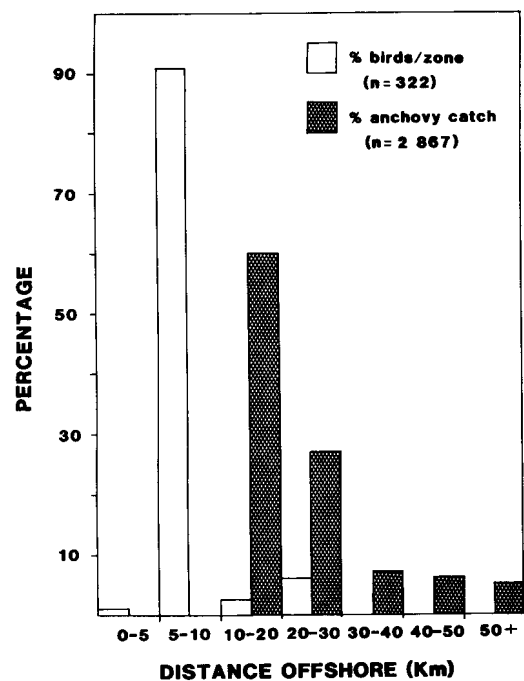


Figure 4 Distribution of swift terns (per cent relative abundance) and anchovy catch (percentage by number of individuals) at increasing distances offshore.

exploited different areas offshore; the mean distances offshore for swift terns and the fishery being 8,5 km and 30,0 km respectively.

Swift terns are inshore foragers (pers. obs.), obtaining

their food only in the top several centimetres of the ocean (Duffy 1982), whereas the purse-seine fishery ranges farther offshore, operating nets from the surface to depths of 65 m (Newman, Crawford & Centurier-Harris 1979). Swift terns do not deliver large Cape anchovies to their chicks, presumably because they have to carry food in their beaks and because their chicks cannot swallow large prey. They are therefore unlikely to be able to capture relatively large individuals of other pelagic species, such as horse-mackerel *Trachurus trachurus* and mackerel *Scomber japonicus*, which purse-seiners exploit regularly (Crawford 1981a,b). Although Cape anchovy forms a large proportion of the swift tern diet and pelagic purse-seine catches, little direct overlap is indicated (*cf.* Schaffner 1986). At the current levels of pelagic fishery exploitation, breeding production and population size of swift terns probably remain unaffected, in contrast to those of elegant terns in California (Schaffner 1986). The certainty of this, however, will not be known, as one requires long-term data on population dynamics, particularly chick production and recruitment, starting prior to the introduction of small-mesh nets.

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