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1991

DISTRIBUTION OF OFFSHORE DEMERSAL CARTILAGINOUS FISH (CLASS CHONDRICHTHYES) OFF THE WEST COAST OF SOUTHERN AFRICA, WITH NOTES ON THEIR SYSTEMATICS

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The geographic and the bathymetric distribution of offshore demersal cartilaginous fish off the west coast of southern Africa are reviewed. The results were collected during 12 cruises of F.R.S. *Africana* between 1986 and 1990. The area covered was between Walvis Bay (23°S, 14°E) and the Agulhas Bank west of Cape Agulhas (36°S, 20°E) over a depth range of 33–1 016 m. In all, 55 species of cartilaginous fish were collected, including 32 sharks, 17 rays and six chimaeras, on 869 stations and representing 3 092 station records. Computer-generated maps and station lists are presented for the species in the sample, and the distribution records, including records from the literature, are reviewed and discussed for these species and 12 more demersal species not collected during the survey. The survey revealed many range extensions for described species. West Coast demersal cartilaginous fish show zonation by depth and latitude, and groups of species with similar depth and latitudinal distributions were apparent. These groups are defined and discussed, along with summer-winter distributional differences, aggregations of records, sympatry and allopatry in related species, and relative diversity over 50-m depth increments and one-degree latitudinal bands.

Die geografiese en batimetriese verspreiding van aflandige bodemkraakbeenvisse teenoor die weskus van Suider-Afrika word hersien. Die resultate is op 12 vaarte van die VNS. *Africana* tussen 1986 en 1990 verkry. Die ondersoekgebied het van Walvisbaai (23°S, 14°O) tot die Agulhasbank wes van Kaap Agulhas (36°S, 20°O) oor 'n diepteomvang van 33–1 016 m gestrek. Op 869 stasies is altesaam 55 spesies kraakbeenvisse versamel, 32 haaie, 17 rôe en ses chimeras inbegrepe, wat volgens die aantal spesies per stasie 'n totale stasie-vermelding van 3 092 verteenwoordig. Kaarte en stasielyste wat met 'n rekenaar geproduseer is, word vir die spesies in die monster aangebied, en die verspreidings, vermeldinge in die literatuur inbegrepe, word hersien en bespreek vir hierdie spesies en 12 verdere bodemspesies wat nie tydens die opname versamel is nie. Die opname het vele uitbreidings van verspreidingsgebied vir beskrewe spesies aan die lig gebring. Die bodemkraakbeenvisse van die Weskus vertoon sonering volgens diepte en breedtegraad, en daar was duidelike groepe spesies met soortgelyke verspreiding volgens diepte en breedtegraad. Hierdie groepe word gedefinieer en bespreek, tesame met verspreidingsverskille in die somer en die winter, simpatrie en allopatrie in verwante spesies en relatiewe diversiteit oor diepte-intervalle van 50 m en breedtegraadgordels een graad wyd.

The South African Sea Fisheries Research Institute's (SFRI) fisheries research ship *Africana*, based in Cape Town, is currently conducting biannual demersal cruises aimed at stock assessment of the Cape hakes *Merluccius capensis* and *M. paradoxus*. These dominant bottom predators are prey for many other demersal and pelagic species, and are the subject of a major bottom fishery along the west coast of southern Africa (Payne *et al.* 1987). The 3½-week-long hake biomass cruises take place in summer (usually January) and winter (usually July). In addition to the SFRI's biomass studies, researchers are conducting a multifaceted research programme on the demersal communities of the Benguela ecosystem (Macpherson and Roel 1987, Roel 1987), with the aim of yielding information useful for analysis of other commercial fish species. F.R.S. *Africana* also undertook an exploratory mesopelagic cruise (060) off the Western Cape in 1988 to assess the protein resources of the deep-benthic and pelagic zone below 500 m. Since January 1986, members of the Shark Research Centre (SRC) and associate researchers have been participating in these cruises to investigate the biology, distribution, ecology and taxonomy of the chondrichthyan community of the Benguela ecosystem.

There is an extensive but thin and scattered literature on the geographic and bathymetric distribution of West Coast cartilaginous fish. Particularly prominent is the work of pioneering 19th century naturalists such as Andrew Smith and Pieter Bleeker (Smith 1837, 1838, 1849, Bleeker 1860), and the intensive fisheries survey work between the Western Cape and Natal by ichthyologists and fisheries biologists based in Cape Town during the first few decades of the 20th century (Barnard 1923, 1925, Gilchrist 1902, 1921, 1922a, b, Gilchrist and Von Bonde 1924, Gilchrist and Thompson 1911, 1914, 1916, Thompson 1914, Von Bonde 1923, 1933, 1934, Von Bonde and Swart 1923). There was

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Manuscript received: April 1991

Table I: Offshore benthic chondrichthyans from the west coast of southern Africa, collected on *Africana* cruises and listed by depth range in 50-m increments in taxonomic order of text

Species	*n*	Number of species records per 50 m of depth										
		0–49	50–99	100–149	150–199	200–249	250–299	300–349	350–399	400–449	450–499	500–549
Chlamydoselachus anguineus	1										1	
Hexanchus griseus	5				2			2	1			
Centrophorus squamosus	3									2		
Centrophorus granulosus	5								1	3	1	
Centroscyllium fabricii	37										1	
Centroscymnus coelolepis	29											
Centroscymnus crepidater	13										1	
Deania calcea	20										3	
Deania profundorum	10								1	4	4	
Deania quadrispinosum	1										1	
Etmopterus cf. *brachyurus*	41									1	13	3
Etmopterus compagnoi	22										5	1
Etmopterus cf. *granulosus*	25											
Etmopterus pusillus	10									5	3	
Scymnodon squamulosus	2											
Squalus acanthias	108		2	9	19	22	29	12	12	2		1
Squalus megalops	230		1	12	110	71	26	7	2		1	
Squalus cf. *mitsukurii*	173				27	47	31	13	20	12	18	3
Pliotrema warreni	1			1								
Alopias vulpinus	1			1								
Isurus oxyrinchus	1				1							
Apristurus microps	19											
Apristurus saldanha	7										1	2
Aspristurus sp.	20											
Galeus polli	26						4	5	7	7	3	
Halaelurus natalensis	1	1										
Holohalaelurus regani	524		1	17	167	143	74	36	36	23	24	3
Scyliorhinus capensis	70				6	23	10	6	13	3	8	1
Galeorhinus galeus	92		1	13	52	19	7					
Mustelus mustelus	1	1										
Mustelus palumbes	135		7	15	63	31	16	1	1	1		
Prionace glauca	2					1			1			
Rhinobatos annulatus	1	1										
Torpedo nobiliana	15			2	3	4	2		1	2	1	
Bathyraja smithii	39									1	11	2
Cruriraja parcomaculata	84				5	23	18	13	13	2	7	3
Neoraja stehmanni	11										1	
Raja (Dipturus) pullopunctata	102			10	48	29	10	3	3			
Raja (Dipturus) springeri	8		1							3	4	
Raja (Leucoraja) wallacei	123			1	53	39	18	3	6	1	2	
Raja (Malacoraja) spinacidermis	8											
Raja (Raja) cf. *clavata*	401	1	8	34	158	127	55	9	7		2	
Raja (Rajella) caudaspinosa	40							1	3	8	22	2
Raja (Rajella) confundens	68						4	2	17	9	24	
Raja (Rajella) dissimilis	22									2	3	
Raja (Rajella) leopardus	111						3	9	21	19	33	5
Raja (Rajella) ravidula	9										1	
Raja (Rostroraja) alba	30		3	7	15	4	1					
Myliobatis aquila	1	1										
Callorhinchus capensis	334	3	36	58	126	80	25	3	3			
Chimaera sp.	19											
Hydrolagus sp.	16									2	11	1
Harriotta raleighana	6											
Rhinochimaera africana	1											
Rhinochimaera atlantica	7											
Total records	3 092	8	60	180	855	663	333	125	169	113	209	27
Total stations	869	3	36	75	233	170	98	46	57	38	60	8
Diversity index	3,56	2,7	1,7	2,4	3,7	3,9	3,4	2,7	3	3	3,5	3,4

Table I (*continued*)

Number of species records per 50 m of depth										Depth range (m)			
550–599	600–649	650–699	700–749	750–799	800–849	850–899	900–949	950–999	1 000–1 049	Mean	*SD*	Minimum	Maximum
												400	400
										261,4	87,6	150	350
					1					553,0		400	800
										432,4	27,1	350	450
		1	8	5	5	6	9		2	818,0	101,1	450	1 000
		3	4	4	4	5	7		2	825,0	93,3	650	1 000
1			3	3	1	2	2			748,8	121,2	450	900
		2	8	1	3	3				719,4	118,9	450	850
			1							472,8	86,5	350	700
												450	450
2		2	8	3	3	5	1			642,4	153,9	400	900
1		2	6	2		1	4			689,2	152,1	450	900
		2	5	4	3	3	8			812,3	85,6	650	900
		1	1							497,6	108,1	400	700
			2									700	700
										251,7	82,4	50	500
										203,8	50,2	50	450
2										299,5	103,8	150	550
												100	100
												100	100
												150	150
			1	5	2	4	6		1	846,6	72,7	700	1 000
		1	2	1						622,9	113,4	450	750
		2	5	2	3	3	4		1	809,1	89,9	650	1 000
										356,8	93,6	250	450
												0	0
										250,5	89,3	50	500
										299,5	96,7	150	500
										182,3	38,9	50	250
												0	0
										190,6	55,6	50	400
												200	350
												0	0
										260,1	101,8	100	450
		3	5	3	3	6	5			690,8	170,8	400	900
										304,6	90,0	150	500
1		2	3		1	1	2			735,3	134,8	450	900
										202,3	51,7	100	350
										411,1	123,8	50	450
										223,6	64,2	100	499
					2	2	4			879,1	37,1	800	900
										204,8	55,6	0	450
1		1	2							472,0	77,2	300	700
			2		1	5	4			492,9	178,7	250	900
			3	2	2	4	4		2	759,9	187,3	400	1 000
1		2	4	2	4	6	1		1	491,9	162,6	250	1 000
		1	1		1	3	1		1	803,1	142,2	450	1 000
										162,6	45,5	50	250
												0	0
										176,8	59,5	0	350
		1	4	2	3	4	4		1	824,1	88,7	650	1 000
					1	1				515,6	123,4	400	850
						5	1			869,0	16,7	850	900
						1						850	850
					2	3	2			856,7	34,5	800	900
9	0	26	78	39	45	73	69	0	11				
2	0	4	11	5	5	7	9	0	2				
4,5	0	6,5	7,1	7,8	9	10	7,7	0	5,5				

Table II: Offshore benthic chondrichthyans from the west coast of southern Africa, collected on *Africana* cruises and listed by latitude range in one degree bands in taxonomic order of text

Species	*n*	Number of species records per degree band of latitude													
		23	24	25	26	27	28	29	30	31	32	33	34	35	36
Chlamydoselachus anguineus	1					1									
Hexanchus griseus	5	2	1					1			1				
Centrophorus squamosus	3			1		1					1				
Centrophorus granulosus	5			2	1	1			1						
Centroscyllium fabricii	37		1		3		1	4	3	4	3	5	11	2	
Centroscymnus coelolepis	29				2			4	2	3	3	8	5	2	
Centroscymnus crepidater	13	1	1		1			3		1		3	1	2	
Deania calcea	20	1	1			1		3	2	2		4	6		
Deania profundorum	10		2	2	2	1	1		2						
Deania quadrispinosum	1					1									
Etmopterus cf. *brachyurus*	41	1	1		2	1	2	5	3	4	3	10	6	3	
Etmopterus compagnoi	22											8	12	2	
Etmopterus cf. *granulosus*	25									1	3	8	11	2	
Etmopterus pusillus	10	2	2	1	2	2							1		
Scymnodon squamulosus	2	1			1										
Squalus acanthias	108						3	11	23	32	33	5	1		
Squalus megalops	230	2		1		1	5	42	42	12	7	14	29	72	3
Squalus cf. *mitsukurii*	173					1	1	40	48	26	23	12	7	15	
Pliotrema warreni	1													1	
Alopias vulpinus	1										1				
Isurus oxyrinchus	1							1							
Apristurus microps	19								2	3	2	3	7	2	
Aspristurus saldanha	7											1	4	2	
Aspristurus sp.	20				2			3	3	2	1	3	5	1	
Galeus polli	26	4	5	6	8	3									
Halaelurus natalensis	1												1		
Holohalaelurus regani	524					2	9	72	85	85	77	80	43	68	3
Scyliorhinus capensis	70					1	1	10	14	3	4	5	11	19	2
Galeorhinus galeus	92						4	20	11	14	13	14	5	11	
Mustelus mustelus	1												1		
Mustelus palumbes	135					1	7	21	22	19	10	13	11	31	
Prionace glauca	2				1			1							
Rhinobatos annulatus	1												1		
Torpedo nobiliana	15	1			1	1	1			1	1	3	3	3	
Bathyraja smithii	39	1				2	1	3	2	3	3	8	15	1	
Cruriraja parcomaculata	84						1	10	12	11	15	5	17	12	1
Neoraja stehmanni	11							1				4	6		
Raja (Dipturus) pullopunctata	103						1	6	8	6	4	13	22	42	1
Raja (Dipturus) springeri	8					2		1	2	2			1		
Raja (Leucoraja) wallacei	123						3	18	32	19	11		8	31	1
Raja (Malacoraja) spinacidermis	8							2			2	2	2		
Raja (Raja) cf. *clavata*	401	1	1	1	2	1	9	57	56	34	40	90	45	60	4
Raja (Rajella) caudaspinosa	40						1	1	6	7	6	7	8	4	
Raja (Rajella) confundens	68	1	2	3	3	5	3	6	22	6	11	3	3		
Raja (Rajella) dissimilis	22	1			2	1		4	2	2	5		5		
Raja (Rajella) leopardus	111	1	1	1	1	4	2	10	17	23	25	13	8	5	
Raja (Rajella) ravidula	9					1		3	2			1	2		
Raja (Rostroraja) alba	30					1	3	1	1	3	1	6	5	9	
Myliobatis aquila	1												1		
Callorhinchus capensis	334			1		1	21	53	56	56	47	37	26	36	
Chimaera sp.	19				1	1		3	2	1	1	3	7		
Hydrolagus sp.	16					2	1	1	5	3	2			2	
Harriotta raleighana	6				1	1		1	1	2					
Rhinochimaera africana	1									1					
Rhinochimaera atlantica	7				1			1	1	1	2		1		
Total records	3 092	20	18	19	37	41	81	423	490	392	361	391	364	440	15
Total stations	869	6	5	8	11	8	29	114	127	120	126	133	86	92	4
Diversity index	3,56	3,3	3,6	2,4	3,4	5,1	2,8	3,7	3,9	3,3	2,9	2,9	4,2	4,8	3,8

also important research by ichthyologists in the United Kingdom (Regan 1904, 1906, 1908a, 1921, Norman 1922, 1935) and the U.S.A. (Fowler 1925, 1934, 1936a, 1941). More recently there has been considerable work by ichthyologists on the subject, and that has included the efforts of researchers in South Africa and Namibia (Hulley 1966, 1969, 1970, 1971, 1972a, b, 1986, Penrith 1969, 1978, Wallace 1967a–c, Bass *et al.* 1975a–d, 1976), in the Soviet Union (Gubanov *et al.* 1986, Myagkov and Kondyurin 1986, Pinchuk and Permitin 1970, Shcherbachev 1978, Shcherbachev *et al.* 1978, 1982, Trunov 1968, 1972), in Germany (Karrer 1972, 1973, 1975, Krefft 1968a, Stehmann 1971, 1976, 1981) and in Spain. Particularly important and complementary to the present study is the extensive fisheries survey work of Spanish scientists at the Instituto de Ciencias del Mar, Barcelona (Allué *et al.* 1984, Lleonart and Rucabado 1984, Lloris 1986, Turon *et al.* 1986, Mas-Reira and Macpherson 1989), which has greatly elucidated the distribution of offshore cartilaginous fish off Namibia. Compagno (1981) and Stehmann (1981) reviewed the cartilaginous fish fauna of Atlantic Africa from Morocco to northern Namibia. One problem with literature accounts is that distributional records are often inexact and given as ranges, which include broad geographic and bathymetric limits, but often no details of distribution.

Despite the existence of an important offshore demersal fishery along the west coast of South Africa and Namibia, and the considerable attention paid by previous authors to the fisheries resources of the area, the offshore cartilaginous fish fauna is still imperfectly known, particularly at depths greater than 500 m. This situation partly results from the limited interest in cartilaginous fish that commercial fishing companies and fisheries biologists have in southern Africa. A related trend has been the possible shift of attention of fisheries biologists away from the general biological surveys of the first few decades to the biology of important commercial species. The result has been a lack of consistently rigorous attention to the species composition of the cartilaginous fish by-catch of commercial fishing vessels and of research ships by local fisheries biologists, if not by ichthyologists. The notable exception in the past decade has, of course, been the detailed cooperative survey work of Spanish researchers in Namibian waters.

A problem with early surveys was the lesser capability of ships such as the *Pieter Faure*, the *Pickle* and the original *Africana*, with their limited power and smaller, less capable trawls and dredges (particularly in deep water) to collect cartilaginous fish. However, the current generation of large, powerful, modern oceanographic and fisheries research ships, such as the new F.R.S. *Africana*, has offset the limitations of earlier ships. *Africana* can readily tow a large commercial trawl at a depth of 1 000 m. Yet another problem was the chaotic or unsatisfactory state of knowledge on the systematics of certain cartilaginous fish groups until relatively recently, which made it very difficult for fisheries workers to identify members of these groups. Skates (Rajidae) were the most troublesome group until Hulley's (1969, 1970) revisionary work, and problems in their identification and those of other elasmobranchs and chimaeroids make early records either totally useless or of limited value for most species. Only recently did a modern work on fish identification (Smith and Heemstra 1986) and an illustrated field guide to cartilaginous fish (Compagno *et al.* 1989) become available to aid identification of cartilaginous fish in southern African waters. Both have benefitted from information collected by F.R.S. *Africana* and from cooperation between local ichthyologists and fisheries biologists.

Participation in *Africana* cruises by SRC members has permitted a focus on the biology of the offshore cartilaginous fish of the Benguela ecosystem, and has yielded a wealth of information on their geographic and bathymetric distribution. The SRC cartilaginous fish survey aboard F.R.S. *Africana* provided many additions to our knowledge of the distribution of previously known species in the area, including range and depth extensions, as well as new records and even new species. It has also provided extensive collections of many deep-water species that were hitherto poorly known and inadequately represented in collections. The survey also revealed problems with the systematics of several groups, including lanternsharks (*Etmopterus*), spiny dogfish (*Squalus*), demon catsharks (*Apristurus*), biscuit skates (*Raja clavata* group), grey skates (*Raja*, subgenus *Rajella*), and chimaeroids (*Hydrolagus*, *Chimaera* and *Rhinochimaera*). Systematic and distributional works on cartilaginous fish collected on *Africana* have been published recently (Compagno 1988, 1989, Compagno *et al.* 1989, 1990) or are in preparation.

This paper is a report on the geographic and bathymetric distribution of 55 species of offshore and mostly demersal cartilaginous fish, including 32 sharks, 17 rays and six chimaeras collected on 869 stations during 12 West Coast cruises of F.R.S. *Africana*. The collection represents 3 092 station records (species per station). The SRC survey area is the west coast of South Africa from Cape Agulhas (36°S, 20°E) to the Orange River, and southern Namibia north to Walvis Bay (23°S, 14°E), with a depth range of 33–1 016 m. Summaries of depth and latitudinal records are presented in Tables I and II. Distributional records, including literature data, are reviewed and discussed for each species by

family and in taxonomic order in the section headed Species Accounts below, along with *Africana* station lists and depths. Literature co-ordinates and depths for records in the survey area are listed, where available, in each species account; when extensive, as in Spanish Namibian surveys, their range by latitude and depth is presented. Included in the species accounts are 12 additional species of offshore demersal cartilaginous fish with records from the west coast of southern Africa that were not collected by F.R.S. *Africana*. Computer-generated distribution maps of *Africana* species records are presented for each species. The patterns of distribution of West Coast cartilaginous fish are discussed in a separate section (headed Distribution Patterns), and a list of *Africana* stations on which chondrichthyans were collected, together with co-ordinates and depths, is presented in the Appendix.

A complementary study of the distribution of demersal chondrichthyans of the south-east coast of South Africa, between Cape Agulhas and Port Alfred, will be published later.

MATERIALS AND METHODS

Random stratified sampling from bottom trawl stations was conducted between Walvis Bay (23°S, 14°E) and the Agulhas Bank west of Cape Agulhas (36°S, 20°E) over a depth range of 37–1 016 m (Fig. 1). The bathymetric zones covered include the continental shelf from inshore down to 200 m, and the upper continental slope from 200 m downwards. The basic methodology for station selection are given in Payne *et al.* (1984, 1985). Most of the trawls were conducted shallower than 500 m because of the main objective of each survey (hake biomass). The cruises forming the basis of this report are Cruise 039 (January 1986), Cruise 046 (July 1986), Cruise 050 (January 1987), Cruise 054 (July 1987), Cruise 059 (January 1988), Cruise 069 (January 1989), Cruise 075 (July 1989) and Cruise 079 (January 1990). In addition, material from selected stations was received from Cruise 028 (January 1985), Cruise 033 (July 1985) and Cruise 066 (July 1988). Up to six exploratory deep-benthic trawls per cruise were conducted on the standard hake biomass trips to investigate the resource potential between 600 and 1 000 m of water. All trawling took place during daylight, with the exception of the experimental deep bottom trawls, which were conducted at night. During Cruise 060 in March 1988, *Africana* engaged in a two-week, 24-hour-per-day session of deep-benthic and pelagic trawling in limited sectors off Cape Columbine and Cape Town, and pelagic trawling for squid off the outer Agulhas Bank. The

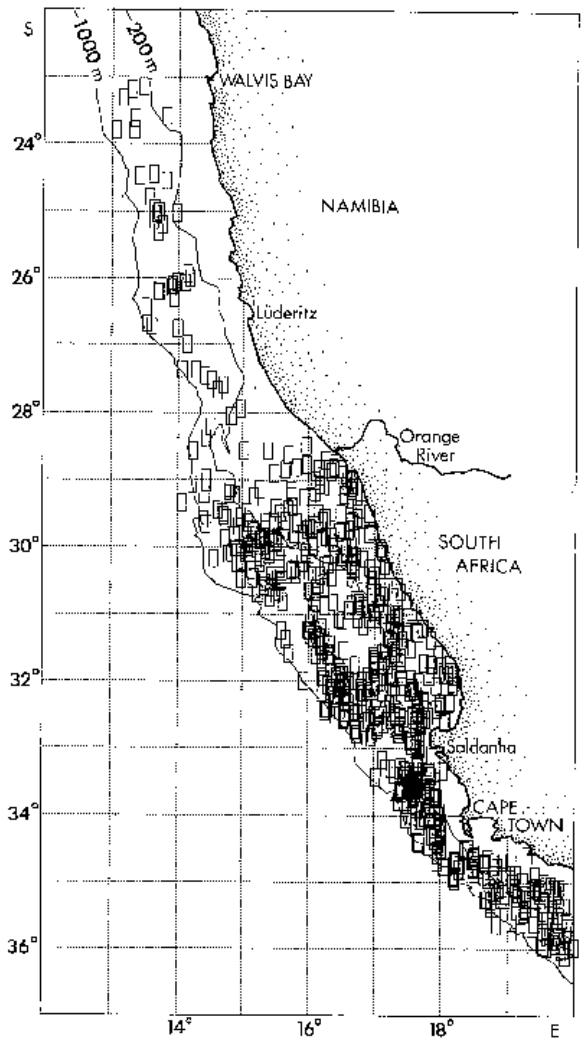

Fig. 1: Map of the west coast of southern Africa from Walvis Bay to Cape Agulhas, with records of 869 F.R.S. *Africana* demersal trawl stations which collected cartilaginous fish indicated by hollow rectangles

gear used in all benthic trawling was a 180′ German bottom trawl, which caught almost all of the cartilaginous fish on the 864 stations reported herein. A large Engels pelagic trawl used to sample epibenthic fish up to approximately 30 m from the bottom during Cruise 060 collected cartilaginous fish in small numbers and low variety on five additional stations. Warp length (2 600 m per drum) on *Africana* limited trawling depth with bottom and Engels trawls to approximately 1 000 m.

A typical *Africana* summer hake biomass cruise

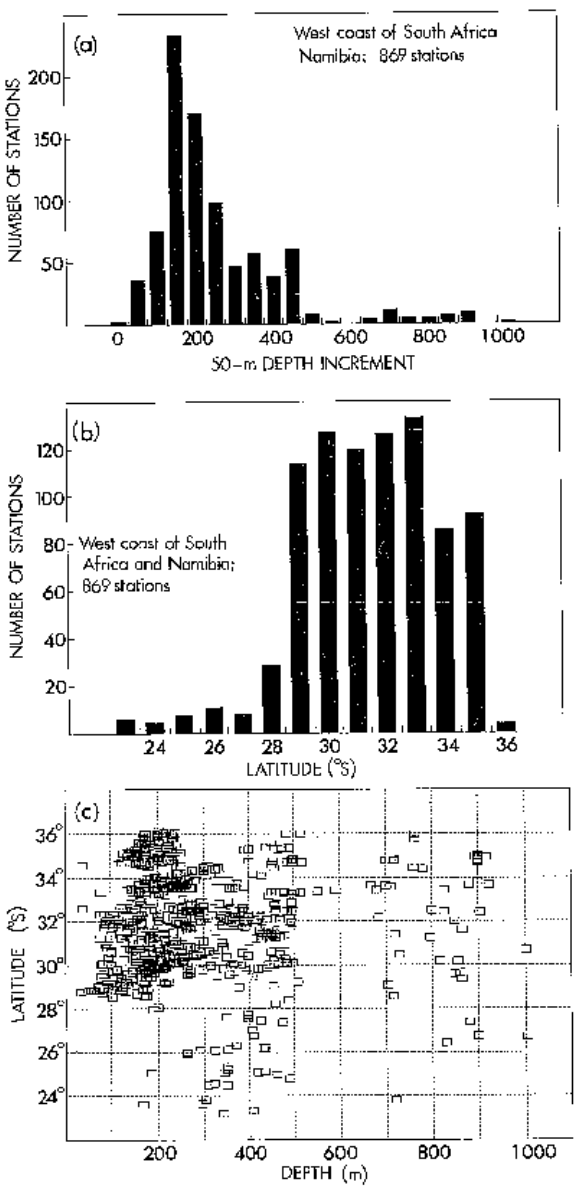

Fig. 2: Histograms of F.R.S. *Africana* West Coast stations with chondrichthyan records (869) plotted by (a) depth (50-m increment) and (b) latitude (one-degree increments); (c) scatter plot of latitude and depth of stations

(039) had at least one species of cartilaginous fish at 88 per cent (106 of 120) of its total trawl stations, whereas a winter cruise (046) had cartilaginous fish at 91 per cent (90 of 99) of its total stations.

All distributional surveys of cartilaginous fish have problems with areal coverage and with gear selectivity, and this survey is no exception. The SRC chondrichthyan survey was and is for the most part an *ad hoc* addition to an existing fisheries project, which concentrates most of its trawling effort on the hake resources in South African waters between 100 and 500 m. This gave good coverage of demersal cartilaginous fish on the hake grounds, but the coverage is much thinner for deeper water and off Namibia (Fig. 2). Namibian stations were generally occupied during summer between the Orange River and Walvis Bay in cooperation with a Spanish and once a Soviet commercial trawler equipped for research. Deep trawls were made on those cruises too. Cruise 060, with a series of deep exploratory bottom trawls off Cape Columbine and Cape Town, was very useful for supplementing the deep-trawl data collected during West Coast hake cruises.

The present SRC survey is clearly not comparable with the regular grid trawl surveys of Spanish researchers off Namibia (Allué *et al.* 1984, Lleonart and Rucabado 1984, Turon *et al.* 1986, Mas-Reira and Macpherson 1989). A histogram of *Africana* chondrichthyan trawl stations with depth (Fig. 2a) shows decreasing coverage from a mode at the 150-m increment to very little coverage in the transitional depths at 550–700 m that bridge the hake-dominated outer shelf and uppermost slope and the hakeless deep-slope fauna. Also, for reasons of inclement sea bed, very few inshore stations shallower than 50 m were occupied, probably accounting for the paucity of records of those elasmobranchs in the area that would normally be found in water shallower than 100 m. A histogram of trawl stations with latitude (Fig. 2b) shows the limited Namibian coverage (north of 29°S), the relatively even coverage from 29 to 35°S latitude bands, and limited coverage in the extreme south-east of the area. A scatterplot of the 869 stations by depth and latitude (Fig. 2c) exemplifies the uneven density of chondrichthyan stations in the survey area.

Africana bottom trawls caught mostly small demersal cartilaginous fish of <10 kg individual mass. The largest individuals caught regularly were adult soupfin sharks *Galeorhinus galeus* of 20–30 kg and, less frequently, adult spearnose skates (*Raja* (*Rostroraja*) *alba*) up to 96 kg. Large demersal sharks, such as adult sixgill cowsharks *Hexanchus griseus*, were never captured, although juvenile sixgills were, and the young of large pelagic and littoral sharks were rarely caught, as might be expected. Smaller sharks including dogfish (Squalidae) and catsharks (Scyliorhinidae), skates (Rajidae) and the St Joseph *Callorhinchus capensis* constituted the bulk of *Africana* cartilaginous fish catches. *Africana* bottom stations were made on trawlable grounds, and there is a possi-

bility that some demersal cartilaginous fish may favour rough bottom or rugged topography that cannot be sampled effectively with a bottom trawl. Big sharks, that utilize the bottom for feeding, or demersal elasmobranchs that range well off the bottom may be only occasional catches of conventional bottom trawl gear, because they may be able to evade the net or could be out of its range when it passes through their habitat. A regular programme of deep-set longlining, trapping and gillnetting in the area, combined with a photographic survey from deep-diving submersibles, may well reveal that some large demersal or epibenthic sharks and rays (e.g. *Hexanchus griseus*, *Somniosus microcephalus*, *Echinorhinus brucus*, *Mitsukurina owstoni*, *Torpedo nobiliana*) that seem to be rare or accidental catches in conventional trawls and other gear are more abundant and more widely distributed over the bottom in the area than indicated by current records.

Sampling of the species encountered by the SRC survey is also very uneven. Four species have over 200 records, giving a reasonable picture of their bathymetric and geographic distribution off the Western Cape. Another 10 species have over 100 records, but 21 species have less than 10 records and 28 species (over half) have less than 20 records (Table 1). In addition, several demersal offshore species with literature records from the area were not collected by *Africana*. The sporadic species, depth and locality coverage of the SRC survey indicated caution in case of overinterpretation of the present data beyond its gross features, particularly for the species with few records. However, further sampling by F.R.S. *Africana*, particularly at depths and in areas not well covered to date, may well supplement the current survey data and fill its obvious gaps and deficiencies.

It should be emphasized that cartilaginous fish are active, mobile animals that can respond to local conditions by moving in and out of limited areas (habitat choice), as well as by moving along the coast or up and down the shelf and slope in relation to seasonal changes and to changes in their life stages (migration). Therefore, bathymetric and geographic movements of regular or irregular nature can be expected among West Coast species of demersal chondrichthyans, but the details of these movements can be obscured by relatively sketchy, long-term distributional surveys such as this one. In addition, cartilaginous fish are sometimes found out of their normal depth and geographic ranges as vagrants, and they may also respond to unusual conditions such as El Niño influxes of warm water by shifting or extending their ranges. Cartilaginous fish are also social animals and often occur very unevenly in groups in a suitable area. The present survey data should not be interpreted as rigidly circumscribing a fixed distributional pattern for each species, because the fish involved do not have the relative immobility of sessile marine invertebrates or of bony fish with very limited microhabitat requirements. There may be geographic and bathymetric distributional limits for many species, including the numerous southern African endemics, but the boundaries of these limits and the areal distribution of cartilaginous fish within these limits may fluctuate over time in regular or unpredictably chaotic patterns. Also, many deep-slope species are only sketchily known, and their distributional ranges will continue to expand with continued deep-sea exploration.

The SRC survey was limited by the abilities of SRC personnel (one or two people per cruise) to cope with the sheer number and bulk of cartilaginous fish collected by F.R.S. *Africana* during its normal bottom-trawling operations. Hence, numbers, lengths and masses were not regularly recorded for all specimens of all species. Masses were collected in aggregate per species for SFRI records, and selected specimens were measured and worked for biological data and/or saved for further analysis ashore or for preservation as museum material. The intensity of SFRI sampling, often with six trawls a day, and the limited freezer space compared to the capacity of the ship to collect chondrichthyans and other fish, made for quick decision-making on what samples of which species should be collected, worked for biological data, or discarded after weighing. In the past few years, soupfin sharks and other sharks, if alive and active, were fitted with Oceanographic Research Institute (ORI) tags and released. From Cruise 069 onwards, a laptop computer was used to capture station record and biological data on the database program dBase III on board ship as it was collected, but for the most part data were entered on microcomputers from field sheets after the cruise was complete. A SRC field sheet was kept for each station in addition to the standard SFRI records, with entries for species and for morphometric, meristic and biological data.

Species data on dBase III and IV were combined with depth and co-ordinate data as copied from the *Africana*'s log, sorted to family and species by dBase, and translated to the advanced graphics spreadsheet Quattro Pro for additional sorting, analysis and plotting. Digital maps were created by Quattro Pro on a laser printer, using station records and a West Coast digital map database which was extracted and simplified from the bathymetric map of southern Africa of Dingle *et al.* (1987) using the coastline, 200 and 1 000 m isobaths.

Extensive collections of cartilaginous fish from *Africana* West Coast cruises have been preserved intact or skeletonized. They are now deposited at either the

South African Museum in Cape Town or the J. L. B. Smith Institute of Ichthyology in Grahamstown.

SPECIES ACCOUNTS

SUBCLASS ELASMOBRANCHII — SHARKS AND RAYS

SHARKS

ORDER HEXANCHIFORMES

FAMILY CHLAMYDOSELACHIDAE — FRILLED SHARKS

Chlamydoselachus anguineus Garman, 1884 — frilled shark

Chlamydoselachus anguineus — Garman 1884: 47 ("Japanese seas"); Smith 1951: 87 (sight record of angler's catch from the Port Alfred pier, Eastern Cape, South Africa); Smith 1965: 511, Fig. 3b (Port Alfred); Smith 1967a: 105, Pls 19–23 (Walvis Bay, Namibia, Port Alfred record); Trunov 1968: 137, Fig. 3 (Namibia, from north coast to north-west of Walvis Bay, 18°53′S, 11°31′E, 363 m; 19°03′S, 11°50′E, 310 m; 20°25′S, 12°25′E, 260 m; 21°22′S, 12°36′E, 500 m); Bass *et al.* 1975d, 16, Fig. 9, Pl. 6 (Namibia, including Walvis Bay, possibly Port Alfred, Eastern Cape); Domanevskiy 1975: 1117, Fig. (Angola to Cape); Tumokhin 1980: 125 (south-western Indian Ocean, 1200–1440 m), Allué *et al.* 1984: 124 (northern Namibia, 18°30,0′S, 11°26,0′E, 406–412 m); Compagno 1984: 14, ill. (Angola, northern Namibia, possibly Eastern Cape, world distribution); Bass 1986: 47, Fig. 3.1 (Namibia and Angola), Lloris 1986: 86, Figs 17–18 (northern Namibia, 18°30′S, 11°26′E, 406–412 m); Compagno *et al.* 1989: 20, ill. (Namibia, possibly Port Alfred and off Transkei, 260 m); Ebert 1990: 67, Fig. 3.71, Tab. 2.1 (summary of world distribution, Angola, Transkei and possible Natal records; Namibia, 19°59′S, 11°40′E).

Africana demersal trawl stations (n = 1):

Cruise 059 — A6949, 27°27,4′S, 14°25,0′E, 425 m.

Distribution — The frilled shark has a wide but sporadic range in most temperate and tropical seas. Off southern Africa, there are records from Angola and from north-central Namibia from near the Cunene River to north-west of Walvis Bay at depths of 260–500 m. In the survey area it was collected by F.R.S. *Africana* south-west of Lüderitz (Fig. 3a) as a southern range extension for the species. There are no records from the west coast of South Africa from *Africana* hauls, previous surveys, or other sources, suggesting that it may be absent or rare south of the Orange River or may occur in small numbers at greater depths than those adequately sampled by *Africana*. On the east coast of southern Africa it has been reported from off Transkei and possibly Port Alfred and Natal (Ebert 1990), suggesting that it may have a bicoastal distribution in southern Africa, from Angola to south-central Namibia on the west coast and from the Eastern Cape north to at least Natal on the east. With the paucity of sampling stations deeper than 1 000 m and between 500 and 600 m in the survey area, and its occurrence down to 1 440 m elsewhere, it may still be collected off the Western Cape.

The frilled shark is usually caught on or near the bottom of the upper slope between 200 and 1 000 m, but it rarely occurs on the surface or close inshore and has been captured down to 1 440 m. Few frilled sharks have been recorded off southern Africa or anywhere else, except off Japan (Gudger and Smith 1933, Tanaka *et al.* 1990), where it is relatively common, and in the eastern North Atlantic from Morocco to the United Kingdom and Norway (Wheeler 1962, pers. comm.).

FAMILY HEXANCHIDAE — COWSHARKS

Heptranchias perlo (Bonnaterre, 1788) — sharpnose sevengill cowshark

Squalus perlo — Bonnaterre 1788: 10 ("La Méditerranée").

Heptranchias perlo — Bigelow and Schroeder 1948b: 88 (Cape of Good Hope, South Africa); Poll 1951: 16, Figs 2–3, Pl. 1, Figs 1–2 (Angola, from off Banana to off Baie des Tigres, 110–250 m); Smith 1965, 511 (South Africa); Bass *et al.* 1975d, 11, Fig. 7, Pl. 4 (Natal, 275 m, and southern Moçambique, 300–450 m); Karrer 1973: 194 (northern Namibia south-west of Rocky Point, 19°00′S, 11°36′E, 270 m); Penrith 1978: 180 (Baia dos Tigres, southern Angola); Allué *et al.* 1984: 124 (northern Namibia from off Cape Frio to Rocky Point, 4 stations from 18°01,0′S, 11°26,0′E to 19°15,0′S, 11°31,0′E, 295–417 m); Compagno 1984: 17, ill. (Morocco to Angola, east coast of South Africa, Moçambique and Aldabra); Bass *et al.* 1986b: 45, Fig. 2.1 (Natal, southern Moçambique,

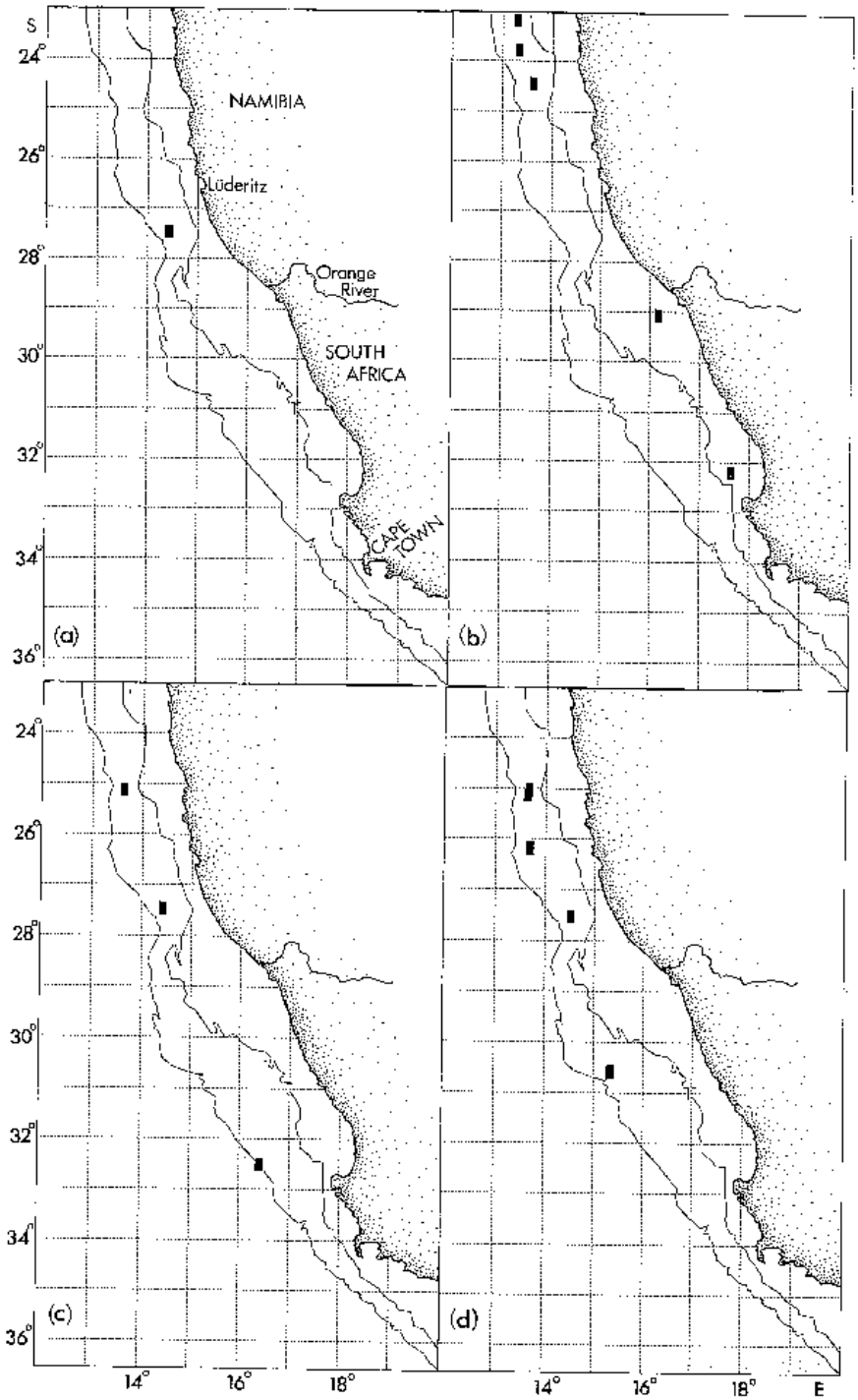

Fig. 3: *Africana* demersal trawl stations at which (a) frilled shark (*Chlamydoselachus anguineus*, $n = 1$), (b) sixgill cowshark (*Hexanchus griseus*, $n = 5$), (c) leafscale gulper shark (*Centrophorus squamosus*, $n = 3$), (d) gulper shark (*Centrophorus granulosus*, $n = 5$) were taken, 1986–1990

Namibia); Lloris 1986: 90, Fig. 20 (Namibia off Walvis Bay, 22°41′S, 12°52′E, 409–420 m); Compagno *et al.* 1989: 18, ill. (northern and central Namibia, Natal, 100–450 m); Ebert 1990, 69, Fig., Tab. 2.2 (summary of world distribution, southern African material from off Moçambique and Natal).

Heptanchus cinereus — Dumeril 1865: 432, Pl. 4, Figs 1–4 (Cape of Good Hope).

Africana demersal trawl stations: none.

Distribution — The sharpnose sevengill cowshark, or perlon shark, has a wide distribution in warm-temperate and tropical seas (see Ebert 1990). It occurs in the eastern Atlantic from Morocco to Angola and north-central Namibia, where it is found on or near the bottom on the uppermost continental slope at depths of 295–420 m. It seems to drop out just north of the survey area off Walvis Bay and has not been collected by F.R.S. *Africana* or by Spanish research vessels south of 22°S off Namibia, nor has it been recorded in this or previous surveys in appropriate depths off the west coast of South Africa, despite a few nominal literature records from the Cape of Good Hope. It was reported as being common off Natal and Moçambique (Bass *et al.* 1975d) in shrimp-trawl catches, but has not been collected off the Eastern Cape between Cape Agulhas and Port Alfred by F.R.S. *Africana* or other research ships. Hence, the distribution of this species off southern Africa may be warm-temperate or subtropical bicoastal, with a possible gap between Walvis Bay and Natal that could partly be filled by further survey work below 200 m off the Eastern Cape and Transkei.

Hexanchus griseus (Bonnaterre, 1788) — sixgill cowshark

Squalus griseus — Bonnaterre 1788: 9 ("La Méditerranée").

Hexanchus griseus — Norman 1922: 319 (Natal record); Barnard 1925: 22 (Agulhas Bank, south-western Cape, Natal coast); Fowler 1936b: 26 (Agulhas Bank to Natal); Fowler 1941: 11 (South Africa, Agulhas Bank and Natal); Barnard 1947: 9 (Agulhas Bank and Natal); Bigelow and Schroeder 1948b: 80 (South Africa); Smith 1949: 38, Fig. 1 (South Africa, south to Mossel Bay, widespread, down to 366 m); Bass *et al.* 1975d: 8, Fig. 5, Pl. 1 (Namibia; Port Elizabeth area, Eastern Cape, in 70 m; off Durban, Natal; southern Moçambique, 445 m); Penrith 1978: 180 (Moçamedes, southern Angola); Lleonart and Rucabado 1984: 40 (central Namibia off Walvis Bay, 22°25,4′S, 13°27,5′E, 200 m); Alluć *et al.* 1984: 124 (central Namibia north-west to west of Walvis Bay, 3 stations from 21°18,0′S, 12°38,0′E to 22°44,0′S, 13°00,0′E, 274–370 m), Compagno 1984, 19, ill. (east coast of South Africa, Moçambique, Madagascar, Aldabra, Comores); Bass *et al.* 1986b: 46, Fig. 2.2 (Namibia, Port Elizabeth, Durban, southern Moçambique); Lloris 1986: 88, Fig. 19 (Namibia, from north of Walvis Bay to off Lüderitz, 21°18′S, 12°38′E, 360–370 m; 21°29′S, 12°54′E, 274 m; 22°57′S, 13°04′E, 400–500 m; 22°41′S, 12°52′E, 409–420 m; 26°40′S, 13°52′E, 415 m); Turon *et al.* 1986 (Namibia from south-west of the Cunene River to off the Orange River, 14 stations from 18°43,2′S, 11°19,6′E to 28°55,9′S, 15°53,4′E, 172–604 m); Van der Elst and Vermeulen 1986: 5, ill. (central Namibia to Moçambique, to 2 000 m); Compagno *et al.* 1989: 18, ill. (southern Africa); Ebert 1990: Tab. 2.2 (summary of world distribution, off Walvis Bay; off Lüderitz, 26°44′S, 14°30′E; 26°51′S, 14°31′E; 26°58′S, 14°29′E; 27°04′S, 14°28′E; St Helena Bay, 32°31′S, 18°20′E; Langebaan, 33°06′S, 18°03′E; west of Cape Columbine, 32°12,6′S, 17°38,4′E).

Africana demersal trawl stations ($n = 5$):

Cruise 059 — A6900, 162 m.
Cruise 069 — A8369, 342 m; A8373, 303 m; A8378, 350 m.
Cruise 075 — A9117, 150 m.

Station latitude and depth range — 23°11,0′S, 13°17,1′E to 32°12,6′S, 17°38,4′E, 150–350 m.

Distribution — This giant shark has one of the broadest bathymetric and geographic ranges of any marine vertebrate (Ebert 1990), and it is found in all seas except the Arctic and Antarctic. Although a deep-water shark of the continental and insular slopes, it is regularly found on the shelves and ranges inshore at the heads of submarine canyons, in enclosed bays and off open coastline. It seems to be widespread in the study area and off southern Africa, but it was seldom collected by F.R.S. *Africana* (south-west of Walvis Bay, south-west of the Orange River at 150 m, and north-west of St Helena Bay at 162 m). It seems to be far more commonly encountered off north-central Namibia at depths of 172–604 m than off South Africa. Ebert (op. cit.) reported many small specimens from off Lüderitz, Namibia, collected by the Spanish commercial fishing fleet; the upper slope in the vicinity of Lüderitz and Walvis Bay appears to be a local pupping ground for the species.

The sixgill cowshark is only sketchily known on the west coast of South Africa south of the Orange River, with catches by F.R.S. *Africana* among the few substantiated records (Fig. 3b). Earlier fisheries surveys missed the species, possibly because of gear selectivity. Fishing companies based in Cape Town were not cooperative in supplying sixgill sharks or other shark

specimens, unlike the Namibia-based Pescanova, so it is not known if sixgill sharks are regularly caught by Western Cape trawlers.

Large subadult and adult sixgills (over 3 m total length *TL*) were never collected by *Africana* in the area, although their presence is suggested by records of newborn and early juvenile sixgills there.

ORDER SQUALIFORMES

FAMILY ECHINORHINIDAE — BRAMBLE SHARKS

Echinorhinus brucus (Bonnaterre, 1788) — bramble shark

Squalus brucus — Bonnaterre 1788: 11 ("L'Océan" = Eastern North Atlantic).

Echinorhinus brucus — Fowler 1936b: 88, Fig. 32 (Saldanha and Table bays, Agulhas Bank, 55–91 m); Fowler 1941: 277 (South Africa); Bigelow and Schroeder 1948b: 527 (South Africa); Smith 1949: 56, Fig. 44 (widespread, South Africa, 18–183 m); Bigelow and Schroeder 1957: 136 (South Africa); Smith 1965: 56, Fig. 44 (South Africa); Bass *et al.* 1976: 51, Fig. 36, Pl. 11 (Namibia; Eastern Cape; St Michaels, southern Natal); Penrith, 1978: 182 (Moçamedes, southern Angola); Compagno 1984: 26, ill. (Namibia, South Africa, Moçambique, world distribution); Bass and Compagno 1986: 63, Fig. 6.1 (Namibia to southern Natal, 10–400 m); Lloris 1986: 91, Fig. 21 (Namibia between Lüderitz and the Orange River mouth, 27°25′S, 14°50′E, 285 m); Turon *et al.* 1986: 172 (Namibia, locality cited by Lloris 1986); Compagno *et al.* 1989: 20, ill. (Namibia to Natal, close inshore to deep water, 18–900 m).

Echinorhinus obesus — Smith 1849: Pl. 1 (Cape of Good Hope).

Echinorhinus spinosus — Dumeril 1865: 459 (Cape of Good Hope); Gilchrist 1902: 166 (South Africa, Cape seas); Thompson 1914: 151 (Cape seas, South Africa); Barnard 1925, 46, Pl. 2, Fig. 6 (Saldanha Bay, Table Bay, Agulhas Bank, 55–92 m); Barnard 1947: 16, Pl. 3, Fig. 3 (not uncommon on Agulhas Bank).

Africana demersal trawl stations: none.

Distribution — The bramble shark has a wide but sporadic distribution in the temperate and tropical Western Atlantic, the Eastern Atlantic from the United Kingdom and the Mediterranean Sea to South Africa, the Indian Ocean, and the Western Pacific. In southern Africa it ranges from Angola and Namibia to the Western and Eastern Cape, Natal and southern Moçambique, but there are few detailed records. In the area, it is known from south-central Namibia, from Saldanha and Table bays, and off the Agulhas Bank, in depths of 55–285 m. Very little is known of the local distribution of the bramble shark, with records from southern Namibia from the uppermost slope, but with catches at moderate depths on the shelf. F.R.S. *Africana* collected this shark once, just east of the area off Cape Infanta at 37 m during a south-east coast cruise (036), and specimens have been examined from Mossel Bay and in the area from Walker Bay near Hermanus at 81–82 m and from southern Namibia. Anglers occasionally catch it from the shore off the Western Cape. Most records in the area are from the inner shelf above 100 m, which makes its absence from *Africana* catches perplexing and possibly a result of rarity, gear selectivity, or problems in sampling topographic features of the bottom such as submarine canyons that it might favour.

FAMILY SQUALIDAE — DOGFISH SHARKS

Centrophorus granulosus (Bloch & Schneider, 1801) — gulper shark

Squalus granulosus — Bloch and Schneider 1801: 135.

Centrophorus granulosus — Karrer 1975: 64 (northern Namibia, south-west of Cunene River mouth, 18°36′S, 11°29′E, 275 m); Bass *et al.* 1986a: 50, Fig. 5.1 (Walvis Bay, southern Moçambique, 274–457 m); ?Lloris 1986: 93, Fig. 22 (northern Namibia, 18°12′S, 11°30′E, 273–300 m; 18°01′S, 11°24′E, 309–410 m); ?Turon *et al.* 1986: 62 (Namibia, 18°01′S, station cited by Lloris 1986).

?*Squalus uyato* — Rafinesque 1810: 13, Pl. 14, Fig. 2 (Sicily, Mediterranean Sea). Possibly based on a species of *Squalus*, according to Muñoz-Chápuli and Ramos 1989a: 77.

Centrophorus uyato — Poll 1951: 64, Figs 33–34 (Angolan records; also Namibia off Rocky Point, 19°52′S, 12°20′E, 220 m); Bass *et al.* 1976: 31, Figs 22, 24e–f, Pl. 7 (southern Moçambique, 274–457 m); Allué *et al.* 1984: 125 (north-central Namibia from the Cunene River to west of Walvis Bay, 18 stations from 18°01,0′S, 11°26,0′E to 22°43,0′S, 12°51,0′E,

275–508 m); Compagno 1984: 45, ill. (northern Namibia, southern Moçambique); Lloris 1986: 96, Fig. 24 (northern Namibia, 20°21′S, 11°56′E, 395 m); Turon *et al.* 1986: 63, 172, 228, 294 (Namibia, 9 stations from the Cunene River to south-west of Lüderitz, 17°32,9′S, 11°21,0′E to 27°37,5′S, 14°35,0′E, 333–468 m); Compagno *et al.* 1989: 24, ill. (Namibia to Hondeklip Bay, South Africa, also southern Moçambique, 274–480 m).

Africana demersal trawl stations ($n = 5$):

Cruise 039 — A3442, 420 m; A3447, 431 m.
Cruise 046 — A4368, 480 m.
Cruise 059 — A6948, 397 m.
Cruise 069 — A8392, 434 m.

Station latitude and depth range — 25°02,4′S, 13°39,6′E to 30°35,2′S, 15°19,5′E, 397–480 m.

Distribution — Two very similar members of the genus *Centrophorus*, the gulper shark *Centrophorus granulosus* and the little gulper shark *C. uyato* (Rafinesque, 1810), have been reported from southern African waters, and it is unclear if one or two species of this difficult group occur in the area. Therefore, records of both species are provisionally included in aggregate in discussing their distribution off southern Africa. Both species are reported as having wide distributions in the Western and Eastern Atlantic, Indian Ocean and Western Pacific. Records of members of this group off the west coast of southern Africa are mostly from off north-central Namibia from the Cunene River to off Lüderitz, and often they have insufficient detail to distinguish species. *Africana* seldom encountered these gulper sharks and had four records from the vicinity of Lüderitz at 397–434 m, but the survey extended its distribution into South African waters, with a single record from west of Hondeklip Bay in 480 m of water (Fig. 3d). These sharks were taken singly at trawl stations, and they seem to be rare in the area at the depths they were collected, if compared with *Deania* species or *Squalus* cf. *mitsukurii*.

Classification — Bass *et al.* (1986a) is followed in using *C. granulosus* for the member or members of the *C. granulosus* group of *Centrophorus* occurring off southern Africa. There is a problem with the validity of *C. uyato* (see Bass *et al.* op. cit., Muñoz-Chápuli and Ramos 1989a), which may originally have been based on a species of *Squalus* from the Mediterranean Sea. There is also no current agreement on whether the *C. granulosus* group includes a large species (*C. granulosus*) and a small one (*C. "uyato"*), or if these are growth stages of a single species. Use of *Centrophorus granulosus* here is a temporary expedient pending further study of the systematics of *Centrophorus* off southern Africa.

Centrophorus squamosus (Bonnaterre, 1788) — leafscale gulper shark

Squalus squamosus — Bonnaterre 1788: 12 (no locality).

Centrophorus squamosus — Hulley 1971: 267, Fig. 1 (Western Cape west of Cape Peninsula, 548 m); Bass *et al.* 1976: 28, Figs 19, 20, 24a, Pl. 5 (compilation of records from Western and Eastern Cape); Cadenat and Blache 1981: 63 (South Africa); Allué *et al.* 1984: 125 (north-central Namibia off the Cunene River and west of Walvis Bay, 17°42,0′S, 11°20,0′E and 22°26,0′S, 12°48,0′E, 430–520 m); Compagno 1984: 43, ill. (Namibia, South Africa, Aldabra, world distribution); Bass *et al.* 1986a: 51, Fig. 5.4 (Walvis Bay; Western Cape at 370–648 m; Algoa Bay, 3 m); Lloris 1986: 94, Fig. 23 (Namibia north-west of Walvis Bay, 22°07′S, 12°41′E, 421–425 m; 22°31′S, 12°47′E, 545–710 m); Turon *et al.* 1986: 62, 136, 172, 228, 294 (Namibia from the Cunene River to the Orange River mouth, 40 stations from 17°35,8′S, 11°20,0′E to 28°31,3′S, 14°18,4′E, 389-809 m); Compagno *et al.* 1989: 24, ill. (Namibia to Eastern Cape, northern Natal, usually 400–750 m).

Lepidorhinus squamosus — Penrith 1969: 64 (west coast of southern Africa, 549 m); Karrer 1975: 65 (Namibia, south-west of Walvis Bay, 24°26′S, 13°30E, 370 m); Lleonart and Rucabado 1984: 41 (central Namibia off Walvis Bay, 22°31,3–53,0′S, 12°46,6–58,1′E, 545–717 m).

Enchiridiodon hendersoni — Smith 1967b: 129, Pls 24–27 (collected dead by a spearfisherman in the surf near Port Elizabeth, Eastern Cape, depth about 3–4 m, possibly a trawl or longline discard that washed inshore); Cadenat and Blache 1981: 100 (South Africa).

Africana demersal trawl stations ($n = 3$):

Cruise 050 — A5249, 800 m.
Cruise 059 — A6949, 425 m.
Cruise 069 — A8392, 434 m.

Station latitude and depth range — 25°07,2′S, 13°38,1′E to 32°30,5′S, 16°24,3′E, 425–800 m.

Distribution — The leafscale gulper shark has a broad

distribution in the Eastern Atlantic from Iceland and the United Kingdom south to South Africa, and it also occurs in the south-eastern Indian Ocean off the Eastern Cape and Natal (where the current authors have collected it with deep-set longlines off the R.S. *Meiring Naude*), off Aldabra Island, and in the Western Pacific. In the area, most records are from Namibian waters at 370–809 m, but it was also reported from west of the Cape Peninsula. It was seldom collected by *Africana*, with two records from north-west and south-west of Lüderitz at 425–434 m and one west of Cape Columbine at 800 m (Fig. 3c). It seems to be rare off the Western Cape compared to *Centroscyllium fabricii*, *Centroscymnus coelolepis*, *C. crepidater* and the larger *Etmopterus* species.

Classification — See note on *Centroscymnus fuscus* in the account of *Centroscymnus coelolepis* below.

Centroscyllium fabricii (Reinhardt, 1825) — black dogfish

Spinax fabricii — Reinhardt 1825: 3 (Julianehaab, West Greenland).

Centroscyllium sp. (*C. fabricii*?) — Pinchuk and Permitin 1970: 275 (Namibia, off Walvis Bay, 21°28′S, 12°39′E, 605–625 m).

Centroscyllium fabricii — Bass *et al.* 1976: 21 (Namibia near Walvis Bay, 605–625 m); Cadenat and Blache 1981: 30 (Walvis Bay); Lloris and Rucabado 1984: 40 (central Namibia north-west of Walvis Bay, 2 stations at 21°30,5′S, 12°34,1′E and 22°31,3′S, 12°46,6′E, 510–717 m); Allué *et al.* 1984: 126 (central Namibia west of Walvis Bay, 22°26,0′S, 12°48,0′E, 460–502 m); Compagno 1984: 47, ill. (Namibia and south-western Cape coast of South Africa); Bass *et al.* 1986a: 52, Fig. 5.5 (Walvis Bay, 605–625 m); Lloris 1986: 97, Fig. 25 (Namibia, off Walvis Bay, 22°27′S, 13°04′E, 400–500 m); Turon *et al.* 1986: 63, 136, 172 (Namibia from the Cunene River to the Orange River mouth, 21 stations from 17°41,2′S, 11°17,4′E to 28°31,3′S, 14°18,4′E, 399–823 m); Compagno *et al.* 1989: 28, ill. (west coast from Namibia to Quoin Point, 700–1 016 m).

Africana demersal trawl stations (n = 37):

Cruise 039 — A3342, 764 m; A3358, 826 m; A3467, 716 m.
Cruise 046 — A4310, 760 m; A4361, 850 m.
Cruise 050 — A5280, 780 m; A5311, 704 m.
Cruise 054 — A5867, 763 m; A5895, 685 m; A5896, 719 m.
Cruise 059 — A6892, 903 m; A6951, 864 m; A6956, 849 m; A6964, 817 m; A6971, 1 000 m.
Cruise 060 — A6988, 900 m; A6999, 923 m; A7011, 880 m; A7012, 700 m; A7024, 894 m; A7026, 717 m; A7027, 901 m; A7036, 710 m; A7037, 903 m; A7038, 917 m; A7039, 719 m.
Cruise 066 — A7550, 900 m; A7655, 865 m.
Cruise 069 — A8379, 490 m; A8411, 830 m; A8413, 900 m; A8414, 1 005 m.
Cruise 075 — A9030, 900 m; A9142, 730 m; A9151, 825 m;
Cruise 079 — A9812, 861 m; A9827, 796 m.

Station latitude and depth range — 24°47,0′S, 13°33,2′E to 35°56,2′S, 19°22,0′E, 490 — 1 005 m.

Distribution — The black dogfish is primarily known from high latitudes on the deep slopes of the North Atlantic (Georges Bank to Greenland, Iceland and southern Norway), but it has been recorded off the west coast of southern Africa from the Cunene River to the Orange River off Namibia, in 299–823 m. It is the most wide-ranging and consistently common of deep-slope dogfish in the area. *Africana* collected it from a few stations between Walvis Bay and Lüderitz to the Orange River mouth off Namibia, and from many stations on the western South African slope from the Orange River to south-west of Cape Agulhas (Fig. 4a). Most stations with *C. fabricii* were deeper than 700 m. The species has not been taken on the East Coast, but it is to be expected east of Cape Agulhas because its faunal associates *Rhinochimaera atlantica* and *Etmopterus compagnoi* have been collected there.

Centroscymnus coelolepis Bocage and Capello, 1864 — Portuguese shark

Centroscymnus coelolepis — Bocage and Capello 1864: 263, Fig. 4 (off Portugal); Yano and Tanaka 1983: 208, Figs 2–3 (world distribution, North Atlantic, Mediterranean and Japan); Compagno 1984: 55, ill. (southern Namibia to south-western Cape coast of South Africa); Lloris 1986: 99, Fig. 26 (Namibia, off Walvis Bay, 22°31′S, 12°47′E, 545–710 m); Turon *et al.* 1986: 63, 136 (Namibia from the Cunene River to off the Orange River mouth, 6 stations from 17°41,2′S, 11°17,4′E to 28°19,0′S, 14°18,6′E, 622–809 m); Compagno *et al.* 1989: 32, ill. (Namibia to Quoin Point, 400–900 m).

?*Centroscymnus fuscus* — Gilchrist and Von Bonde 1924: 2 (R.V. *Pickle* #336, 32°3,00′S, 16°2,00′E, off St Helena Bay, 658 m); Barnard 1925: 51 (St Helena Bay); Smith 1949: 58 (Saldanha Bay); Smith 1965: 58 (Saldanha Bay).

?*Centrophorus squamosus* — Hulley 1971: 267, Fig. 1 (in part, for synonymy of *C. fuscus* with this species); Bass *et al.* 1976: 28 (in part, for synonymy of *C. fuscus* with this species).

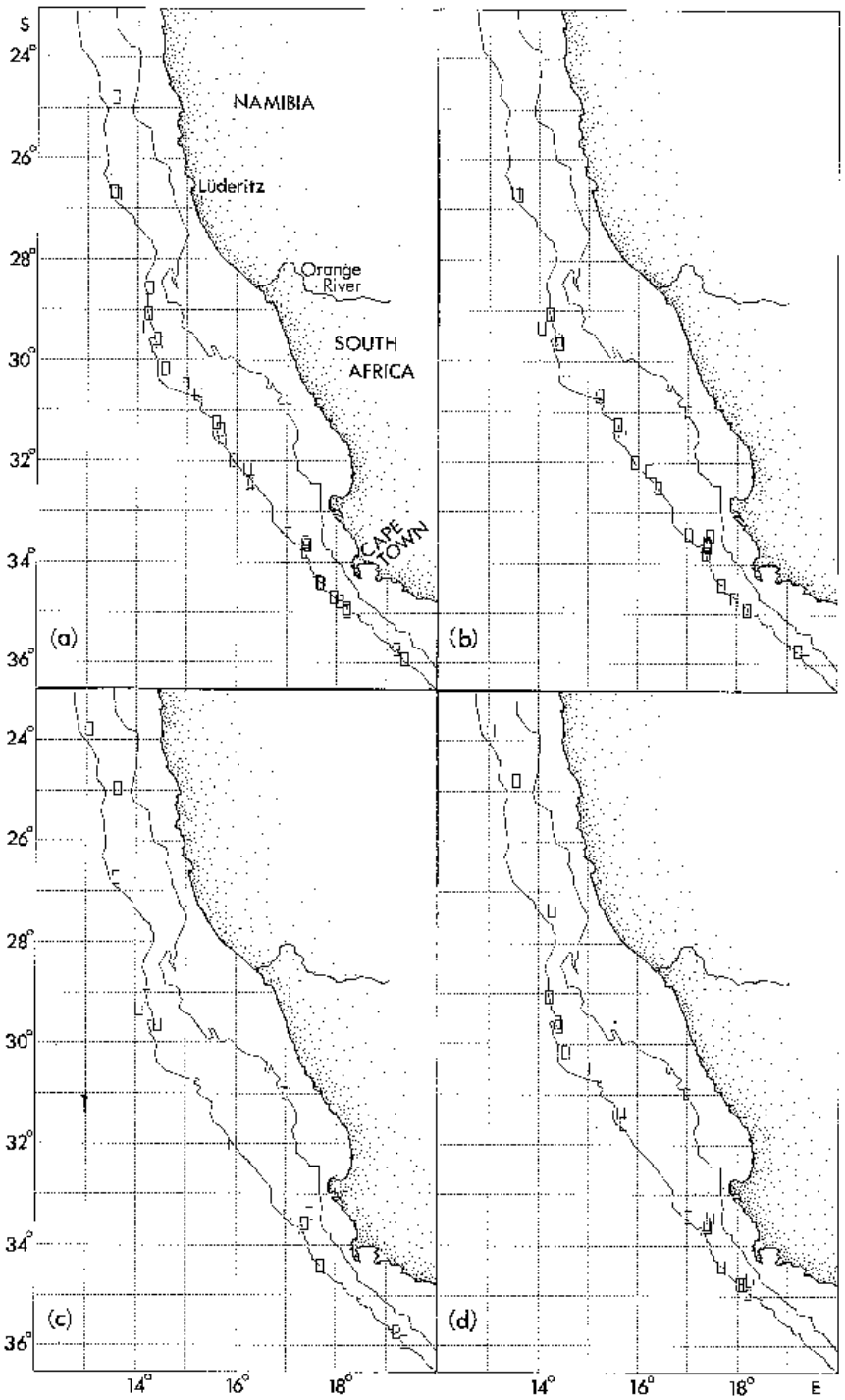

Fig. 4: *Africana* demersal trawl stations at which (a) black dogfish (*Centroscyllium fabricii*, $n = 37$), (b) Portuguese shark (*Centroscymnus coelolepis*, $n = 29$), (c) longnose velvet dogfish (*Centroscymnus crepidater*, $n = 13$), (d) birdbeak dogfish (*Deania calcea*, $n = 20$) were taken, 1986–1990

Africana demersal trawl stations ($n = 29$):

Cruise 039 — A3342, 764 m; A3358, 826 m.
Cruise 046 — A4310, 760 m; A4361, 850 m.
Cruise 050 — A5249, 800 m; A5311, 704 m.
Cruise 054 — A5867, 763 m; A5895, 685 m; A5896, 719 m.
Cruise 059 — A6892, 903 m; A6951, 864 m; A6956, 849 m; A6964, 817 m; A6971, 1 000 m.
Cruise 060 — A6987, 710 m; A6988, 900 m; A6989, 680 m; A6999, 923 m; A7002, 668 m; A7011, 880 m; A7012, 700 m; A7024, 894 m; A7037, 903 m.
Cruise 066 — A7550, 900 m.
Cruise 069 — A8413, 900 m; A8414, 1 005 m.
Cruise 075 — A9030, 900 m.
Cruise 079 — A9812, 861 m; A9827, 796 m.

Station latitude and depth range — 26°40,6′S, 13°31,8′E to 35°56,2′S, 19°22,0′E, 462–1 005 m.

Distribution — This wide-ranging deep-slope dogfish was until recently known only from the North Atlantic (U.S.A. north to Nova Scotia, Iceland, and southwards to the western Mediterranean and Senegal), but it has subsequently turned up off southern Africa and in the Western Pacific. Off Namibia it was previously recorded from the Cunene River to the Orange River at 545–809 m. In the present survey *Africana* collected it from a few stations west of Lüderitz and off the Orange River mouth, but most records were along the western South African slope from the Orange River to south-west of Cape Agulhas off the Agulhas Bank (Fig. 4b). In South African waters it proved to be the most ubiquitous deep-slope dogfish after the smaller *Centroscyllium fabricii*, although usually present in fewer numbers than the latter species at each station. Most records were from deeper than 700 m. There may be earlier records of this species in South Africa off St Helena Bay and Saldanha, provided *Centroscymnus coelolepis* is a senior synonym of *C. fuscus*.

Classification — *Centroscymnus fuscus* from off St Helena Bay was recognized as a valid species until Hulley (1971) and Bass *et al.* (1976) tentatively synonymized it with *Centrophorus squamosus*. Details of its original description by Gilchrist and Von Bonde (1924), including fin shape and position and tooth morphology, suggest that *C. fuscus* is a synonym of *C. coelolepis* rather than *Centrophorus squamosus*. The latter is rare south of Namibia, while the former is common near where the type of *C. fuscus* was collected. Unfortunately, *C. fuscus* was never illustrated and the holotype of *C. fuscus*, a 1,1 m specimen, is probably lost. Hence, *C. fuscus* is provisionally placed in synonymy of *C. coelolepis*.

Centroscymnus crepidater (Bocage and Capello, 1864) — longnose velvet dogfish

Centrophorus crepidater — Bocage and Capello 1864: 262, Fig. 3 (off Portugal).

Centroscymnus crepidater — Pinchuk and Permitin 1970: 273, Fig. 1 (Namibia, off Walvis Bay, 21°28′S, 12°39′E, 605–625 m); Karrer 1973: 197 (Namibia, south-south-west of Walvis Bay, 24°22′S, 13°17′E, 608–570 m); Bass *et al.* 1976: 33, Fig. 25 (Namibia); Lleonart and Rucabado 1984: 40 (central Namibia off Walvis Bay, 22°31,3′S, 12°46,6′E, 545–717 m); Compagno 1984: 56, ill. (Namibia, Aldabra, world range); Bass *et al.* 1986a: 52, Fig. 5.6 (Namibia 605–625 m; tropical western Indian Ocean); Lloris 1986: 100, Fig. 27 (Namibia, from north-west of Walvis Bay to south-west of Lüderitz, 21°02′S, 12°21′E, 607 m; 21°36′S, 12°34′E, 542 m; 22°57′S, 13°04′E, 400–500 m; 27°29′S, 14°19′E, 604 m); Turon *et al.* 1986: 64, 173, 228, 294 (Namibia from south-west of the Cunene River to south-west of Lüderitz, 27 stations from 18°43,2′S, 11°19,6′E to 27°29,6′S, 14°18,7′E, 403–651 m); Compagno *et al.* 1989: 32, ill. (Namibia to Quoin Point, 400–900 m).

Centroscymnus owstoni — Forster *et al.* 1970: 394 (Aldabra Island, redet. by Bass *et al.* 1986a).

Africana demersal trawl stations ($n = 13$):

Cruise 039: A3342, 764 m; A3358, 826 m.
Cruise 046: A4310, 760 m; A4361, 850 m.
Cruise 050: A5311, 704 m.
Cruise 054: A5867, 763 m.
Cruise 059: A6951, 864 m.
Cruise 060: A6986, 552 m; A6987, 710 m.
Cruise 069: A8374, 718 m; A8391, 462 m; A8413, 900 m.
Cruise 079: A9812, 861 m.

Station latitude and depth range — 23°47,0′S, 13°04,0′E to 35°56,2′S, 19°22,0′E, 462–900 m.

Distribution — The longnose velvet dogfish has a wide range on the continental and insular slopes of the world's oceans, but it has a very sporadic distribution, like other slope cartilaginous fish. It is known from the Eastern Atlantic from Iceland to Senegal, also from the west coast of southern Africa, Aldabra Island in the south-west Indian Ocean, and the Western and Eastern South Pacific. Locally, *Centroscymnus crepidater* was recorded from many records in north-central Namibian waters, from the Cunene River to south-west of Lüderitz at 403–717 m. *Africana* collected it

from south-west of Walvis Bay to west of Lüderitz off Namibia, but the survey extended its known range southwards to off the Orange River mouth and from several stations along the western South African slope to south-west of Cape Agulhas off the Agulhas Bank (Fig. 4c). The species is a faunal associate of *C. coelolepis* and was caught at many of the same trawl stations as its larger congener, but it was less frequently encountered. An interesting aspect of its distribution is that it has not been collected off the Eastern Cape, Natal or southern Moçambique at present, but it does occur off Aldabra Island.

Deania calcea (Lowe, 1839) — birdbeak dogfish

Acanthidium calceum — Lowe 1839: 92 (Madeira, Eastern North Atlantic).

Deania calcea — Penrith 1969: 62 (west coast of southern Africa, 457–640 m); Bass *et al.* 1976: 36, Figs 28, 31a (south-south-west of Port Elizabeth, 475 m, Algoa Bay area, Eastern Cape, west of Cape Point, Western Cape); Compagno 1984: 65, ill. (Namibia, east coast of South Africa, world distribution); Turon *et al.* 1986: 64–65, 136, 173, 229, 295 (Namibia, 84 stations from 17°35,7′S, 11°20,0′E to 29°18,8′S, 14°30,3′E, 293–823 m, likely to include specimens of *D. profundorum* and possibly also *D. quadrispinosum* as well as *D. calcea*); Compagno *et al.* 1989: 26, ill. (Namibia to Algoa Bay, Eastern Cape, 475–894 m).

Deania calceus — Lleonart and Rucabado 1984: 40 (central Namibia north-west and west of Walvis Bay, 4 stations from 21°30,5′S, 12°34,1′E to 22°50,7′S, 13°04,2′E, 400–800 m, including other species?); Allué *et al.* 1984: 126 (north-central Namibia from the Cunene River to west of Walvis Bay, 9 stations from 18°01,0′S, 11°25,0′E to 22°43,0′S, 12°51,0′E, 360–520 m, including other species?); Bass *et al.* 1986a: 53, Fig. 5.8 (west of Cape Point and off Algoa Bay, 400–500 m); Lloris 1986: 102, Fig. 28 (Namibia, off Walvis Bay and north-west of Lüderitz, 22°57′S, 13°04′E, 400–500 m; 25°54′S, 13°45′E, 398–400 m).

Africana demersal trawl stations (n = 20):

Cruise 039 — A3358, 826 m.
Cruise 046 — A4310, 760 m.
Cruise 050 — A5311, 704 m.
Cruise 054 — A5896, 719 m.
Cruise 059 — A6950, 475 m; A6956, 849 m; A6964, 817 m.
Cruise 060 — A6987, 710 m; A6989, 680 m; A7002, 668 m; A7023, 700 m; A7024, 894 m; A7026, 717 m; A7039, 719 m; A7040, 486 m.
Cruise 066 — A7655, 865 m.
Cruise 069 — A8374, 718 m; A8379, 490 m.
Cruise 075 — A9142, 730 m.
Cruise 079 — A9812, 861 m.

Station latitude and depth range — 23°47,0′S, 13°04,0′E to 34°56,5′S, 18°12,8′E, 475–894 m.

Distribution — The birdbeak dogfish has a wide distribution on the upper continental and insular slopes of most seas, including the Eastern North Atlantic from Iceland and Norway to Senegal, both coasts of southern Africa, the Western Pacific, and the Eastern South Pacific. In the area now being researched, there was a record from South Africa west of Cape Point, but most records from the west coast of southern Africa are from off Namibia, from the Cunene River to the Orange River. Spanish records of *Deania calcea* from Namibian waters (Lleonart and Rucabado 1984, Allué *et al.* 1984, Turon *et al.* 1986) may include other species (E. Macpherson, Instituto de Ciencias del Mar, Barcelona, pers. comm.). *Africana* collected birdbeak dogfish (often in considerable numbers, suggesting schooling or aggregates) from several stations in the area from south-west of Walvis Bay to off the Orange River mouth, but also southwards along the continental slope of South Africa to south-west of Cape Point (Fig. 4d). The birdbeak dogfish is recorded from off Algoa Bay in the Eastern Cape, and is to be expected elsewhere from the East Coast.

Deania profundorum (Smith and Radcliffe, 1912) — arrowhead dogfish

Nasisqualus profundorum — Smith and Radcliffe, in Smith 1912: 681, Fig. 3, Pl. 53 (between Leyte and Mindanao, Philippine Islands, 1 347 m).

Deania profundorum — Bass *et al.* 1976: 38, Figs 30, 31b (Namibia, 275 m); Compagno 1984: 67, ill. (Namibia, east coast of South Africa); Bass *et al.* 1986a: 54, Fig. 5.9 (Namibia and Natal, 275–608 m); Compagno *et al.* 1989: 26, ill. (Namibia to Hondeklip Bay, South Africa, also Natal, 205–608 m).

Deania cremouxi — Cadenat 1960b: 312, Figs 1–16 (Senegal, 250–550 m).

Deania eglantina — Smith 1949: 58, Fig. 49 (in part, *Acanthidium natalense* in synonymy, east coast of South Africa); Smith 1965: 58, Fig. 49 (in part,

South Africa).

Acanthidium natalense — Gilchrist 1922b: 49, Pl. 7, Fig. 2 (off Illovo River, Natal, 293 m): Barnard 1925: 51, Pl. 3, Fig. 1 (Natal coast, 293 m); Smith 1937: 170 (of uncertain validity).

Deania natalense — Bigelow and Schroeder 1957: 106 (South Africa, Natal).

Deania natalensis — Penrith 1969: 62 (redescription of holotype from Illovo River, Natal).

Deania quadrispinosa — Karrer 1973: 197 (Namibia, south-west of Walvis Bay to west of Lüderitz, 24°22′S, 13°17′E, 608–570 m; 26°18′S, 13°46′E, original "23°46′E", probably an error, 500 m; identified as *D. profundorum* because of subcaudal keels).

?*Deania* sp. — Karrer 1975: 66 (north-central Namibia, south-west of Cunene River mouth and south-west of Walvis Bay, 18°49′S, 11°26′E, 350 m; 24°26′S, 13°30′E, 370 m).

Africana demersal trawl stations (n = 10):

Cruise 039 — A3442, 420 m; A3447, 431 m; A3467, 716 m.
Cruise 046 — A4367, 385 m; A4368, 480 m.
Cruise 059 — A6950, 475 m.
Cruise 069 — A8379, 490 m; A8391, 462 m; A8392, 434 m; A8409, 435 m.

Station latitude and depth range — 24°47,0′S, 13°33,2′E to 30°35,2′S, 15°19,5′E, 385–716 m.

Distribution — The arrowhead dogfish has a wide but sporadic range in temperate and tropical seas, and is known from the Western North Atlantic coast of the U.S.A., the Eastern North Atlantic off Senegal southwards to Nigeria, Gabon, Zaire and Namibia, from Natal, South Africa, and the Western Pacific off the Philippines. In the present study area it has been recorded from north-central Namibia off the Cunene River mouth to west of Lüderitz at 500–608 m. *Africana* collected this shark in a scattering of eight stations in Namibian waters from south-west of Walvis Bay to west of the Orange River along the upper slope, but also collected it in two stations between Port Nolloth and Doring Bay to extend its range to the west coast of South Africa (Fig. 5a). Most station records are from between 400 and 500 m. Although arrowhead dogfish were infrequently encountered, they were sometimes collected in large numbers, suggesting that they form schools or aggregates.

Deania quadrispinosum (McCulloch, 1915) — longsnout dogfish

Acanthidium quadrispinosum — McCulloch 1915: 100, Pl. 14, Figs 5–8 (south of Gabo Island, Victoria, Australia).

Deania quadrispinosum — Bass *et al.* 1976: 37, Figs 29, 31c (Walvis Bay, Namibia, Algoa Bay, Eastern Cape, southern Moçambique, 275–640 m); Compagno 1984: 68, ill. (Namibia and South Africa); Compagno *et al.* 1989: 26, ill. (Namibia, Algoa Bay, Natal and southern Moçambique, 275–640 m).

Deania quadrispinosus — Bass *et al.* 1986a: 54, Fig. 5.1 (northern Namibia to southern Moçambique, 275–640 m).

Deania quadrispinosa — Penrith 1969: 62 (west of Cape Point, South Africa, 457–640 m); Pinchuk and Permitin 1970: 275, Fig. 2 (Namibia, off Walvis Bay, 21°28′S, 12°39′E, 605–625 m).

Acanthidium quadrispinosum — Smith 1937: 168, Fig. 1 (first South African record, Algoa Bay, 275 m).

A[canthidium] quadrispinis — Gilchrist 1922b: 50 (erroneous spelling).

Deania eglantina — Smith 1949: 58, Fig. 49 (in part, *Acanthidium quadrispinosum* in synonymy, east coast of South Africa); Bigelow and Schroeder 1957: 107 (South Africa); Smith 1965: 58, Fig. 49 (in part, east coast of South Africa).

Africana demersal trawl stations (n = 1):

Cruise 059 — A6950, 27°22,2′S, 14°16,2′E, 475 m.

Distribution — The longsnout dogfish has a limited and peculiar range off southern Africa, from Namibia to Moçambique, and off southern Australia. In the area, it is known off Walvis Bay and west of Cape Point, but from very few records. *Africana* collected it once off Lüderitz in Namibian waters (Fig. 5b), but close examination of several hundred *Deania* from other stations yielded only *D. calcea* and *D. profundorum*, which may be commoner than *D. quadrispinosum* in the area. On the east coast of southern Africa, there are very few records of this dogfish from off

Algoa Bay and from southern Moçambique.

Etmopterus cf. *brachyurus* Smith and Radcliffe, 1912 — sculpted lanternshark

Probably not *Etmopterus brachyurus* Smith and Radcliffe, in Smith 1912: 679, Fig. 2, Pl. 52 (off Jolo Light, Jolo Island, Philippine Islands, 481 m).

Etmopterus lucifer — Gilchrist 1922b: 49 (off Natal, 275–457 m); Barnard 1925: 50 (off Natal, 207–279 m); Smith 1949: 59, Fig. 52 (Cape, Algoa Bay and Natal); Bigelow and Schroeder 1957: 56 (South Africa); Smith 1965: 59, Fig. 52 (Cape, Algoa Bay and Natal); Karrer 1973: 199 (Namibia, south-west of Walvis Bay to west of Lüderitz, 24°25′S, 13°22′E, 500–520 m; 26°18′S, 13°46′E, 500 m); Bass *et al.* 1976: 25, Figs 17, 18c (west of Cape Town, Natal, 275–430 m; Moçambique, 240–600 m); Lleonart and Rucabado 1984: 41 (central Namibia off Walvis Bay, 22°31,3′S, 12°46,6′E, 545–717 m); Allué *et al.* 1984: 126 (north-central Namibia off the Cunene River and north-west of Walvis Bay, 18°11,0′S, 11°20,0′E and 22°26,0′S, 12°48,0′E, 460–800 m); Compagno 1984: 79 (South Africa); Lloris 1986: 103, Fig. 29 (Namibia, off Walvis Bay and off the Orange River mouth, 22°31′S, 12°47′E, 545–710 m; 28°35′S, 14°20′E, 531–534 m); Turon *et al.* 1986: 65, 137, 173, 229, 295 (Namibia and South Africa from north-west of Walvis Bay to south-west of the Orange River mouth, 37 stations from 21°32,6′S, 11°29,6′E to 29°31,6′S, 14°33,1′E, 381–933 m); Van der Elst and Vermeulen 1986: 6 (central Namibia to Moçambique, to 820 m).

Spinax lucifer — Norman 1935: 37 (South Africa south-west of Cape Town, 34°08′S, 17°33′E, 402–?548 m).

Etmopterus brachyurus — Bass *et al.* 1986a: 55, Fig. 5.11 (Western Cape, Natal and southern Moçambique, 420–430 m); Compagno *et al.* 1989: 30, ill. (Namibia to Moçambique, 451–900 m).

Africana demersal trawl stations ($n = 41$):

Cruise 033 —	A2771, 517 m.		
Cruise 039 —	A3348, 456 m;	A3356, 479 m;	A3358, 826 m;
	A3465, 458 m;	A3466, 488 m.	
Cruise 046 —	A4310, 760 m;	A4361, 850 m.	
Cruise 050 —	A5286, 591 m;	A5306, 509 m;	A5307, 454 m;
	A5311, 704 m.		
Cruise 054 —	A5867, 763 m;	A5895, 685 m;	A5896, 719 m.
Cruise 059 —	A6854, 520 m;	A6950, 475 m;	A6951, 864 m;
	A6964, 817 m.		
Cruise 060 —	A6986, 552 m;	A6987, 710 m;	A6989, 680 m;
	A6990, 480 m;	A6992, 461 m;	A7012, 700 m;
	A7013, 451 m;	A7022, 498 m;	A7036, 710 m;
	A7039, 719 m.		
Cruise 066 —	A7548, 473 m;	A7625, 855 m;	A7655, 865 m;
	A7663, 495 m.		
Cruise 069 —	A8374, 718 m;	A8379, 490 m;	A8409, 435 m;
	A8413, 900 m.		
Cruise 075 —	A9142, 730 m;	A9151, 825 m.	
Cruise 079 —	A9812, 861 m;	A9827, 796 m.	

Station latitude and depth range — 23°47,0′S, 13°04,0′E to 35°58,0′S, 19°32,0′E, 435–900 m.

Distribution — This is the local representative of the *Etmopterus lucifer* group of lanternsharks, which usually has been ascribed to *E. lucifer* but which is probably not that species. It is the widest-ranging member of its genus off southern Africa, and occurs from Namibia to Moçambique. This survey recorded it from south-west of Walvis Bay, Namibia to south of Quoin Point, South Africa, in a regular series of stations along the upper continental slope (Fig. 5c).

Classification — Comparison of specimens of this lanternshark with the holotypes of *E. brachyurus* and *E. lucifer* and with recently collected material of *E. brachyurus* from Taiwan suggest that it may not belong to either species, although it is a member of the *lucifer* group. As its species name is uncertain, it is here termed *E.* cf. *brachyurus*, indicating morphological similarity to that species. Owing to the prominent large linear denticles over its entire body that give it the appearance of a carving or sculpture, it is here named the sculpted lanternshark. Its classification will be considered elsewhere.

Etmopterus compagnoi Fricke and Koch, 1990 — brown lanternshark

Etmopterus compagnoi — Fricke and Koch 1990: 2, Figs 1, 2a (off Cape Town, South Africa, 34°41′S, 18°37′E, ? depth).

Not *Etmopterus gracilispinis* — Krefft 1968b: 3, Figs 2, 3a, 4, 5a (off Uruguay).

Etmopterus gracilispinis — Karrer 1973: 199 (South Africa, west of Cape Town, 33°54′S, 17°28′E, 440–488 m); Shcherbachev *et al.* 1978: 186 (South Africa, Agulhas Bank south of Plettenberg Bay, 1 000 m);

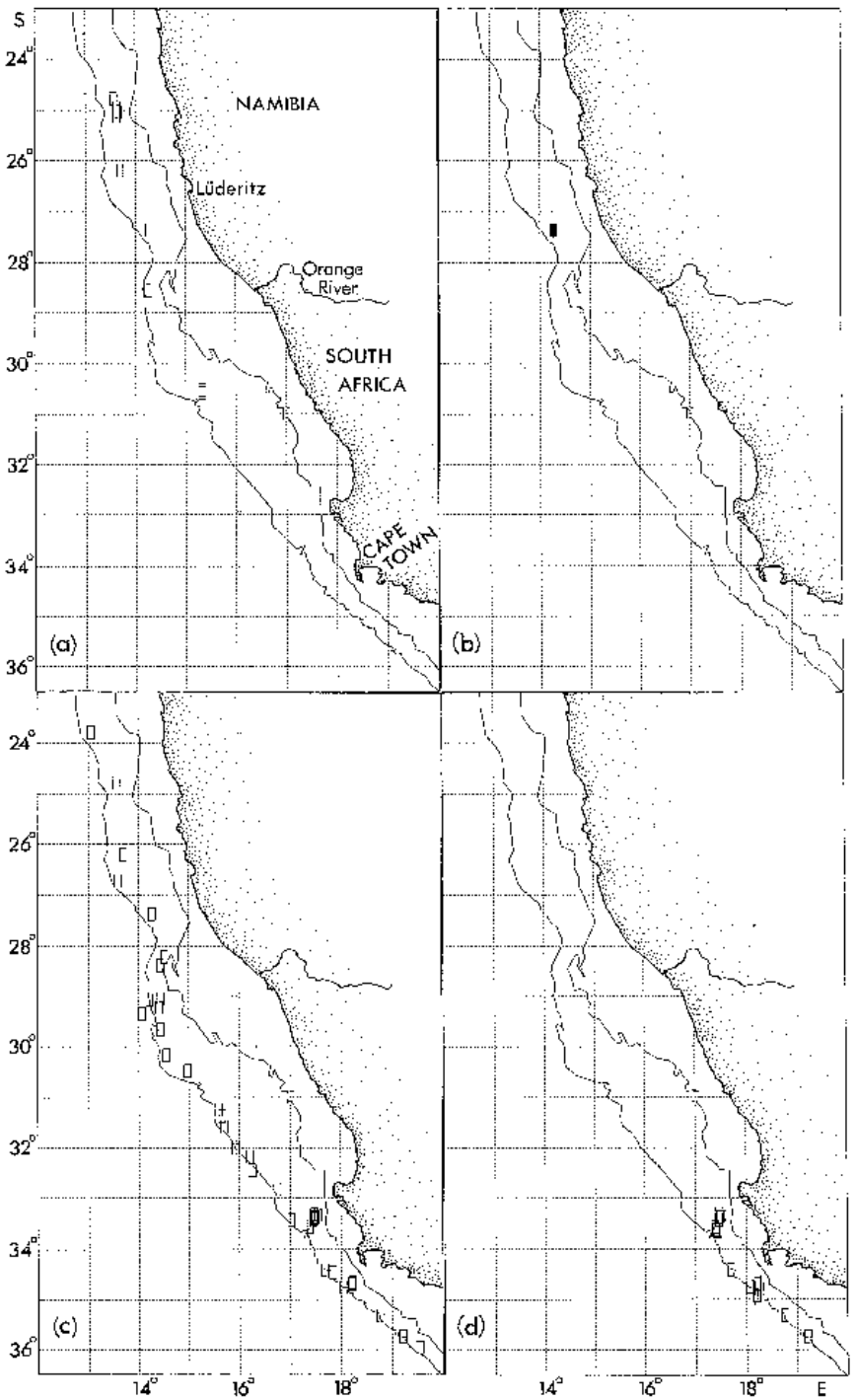

Fig. 5: *Africana* demersal trawl stations at which (a) arrowhead dogfish (*Deania profundorum*, n = 10), (b) longsnout dogfish (*Deania quadrispinosum*, n = 1), (c) sculpted lanternshark (*Etmopterus* cf. *brachyurus*, n = 41), (d) brown lanternshark (*Etmopterus compagnoi*, n = 22) were taken, 1986–1990

Compagno 1984: 76 (South Africa); Compagno *et al.* 1989: 28, ill. (southern Namibia to Cape Agulhas, 479–923 m).

Etmopterus spinax — Gilchrist 1922b: 49 (R.V. *Pickle* #42, 33°32,00′S, 17°10,30′E, west of Cape Town, 763 m); Barnard 1925: 49 (off Cape Point, 763 m); Fowler 1936b: 80 (South Africa, off Cape Point); Fowler 1941: 251 (South Africa); Barnard 1947: 20, Pl. 3, Fig. 5 (South Africa, off Cape Point); Smith 1949: 59, Fig. 51 (Cape Point, 732 m); Smith 1965: 59, Fig. 51 (Cape Point); Cadenat and Blache 1981: 39 (South Africa); Compagno 1984: 85 (Cape Province, South Africa).

Spinax spinax — Norman 1935: 37 (South Africa, south-west of Cape Town, 34°08′S, 17°33′E, 402–?548 m).

Etmopterus sp. — Bass *et al.* 1986a: 57, Fig. 5.16 (south-western Cape Province, northern Natal).

Africana demersal trawl stations ($n = 22$):

Cruise 039 —	A3356, 479 m.		
Cruise 046 —	A4307, 495 m;	A4310, 760 m.	
Cruise 054 —	A5867, 763 m.		
Cruise 059 —	A6854, 520 m.		
Cruise 060 —	A6986, 552 m;	A6987, 710 m;	A6989, 680 m;
	A6990, 480 m;	A6999, 923 m;	A7002, 668 m;
	A7012, 700 m;	A7022, 498 m;	A7023, 700 m;
	A7024, 894 m;	A7026, 717 m;	A7027, 901 m;
	A7036, 710 m;	A7037, 903 m;	A7038, 917 m;
	A7039, 719 m.		
Cruise 066 —	A7548, 473 m.		

Station latitude and depth range — 33°18,6′S, 17°28,7′E to 35°44,4′S, 19°12,2′E, 473–923 m.

Distribution — This lanternshark may be a South African endemic, with most of the records from the extreme Western Cape, but with one possible record off Plettenberg Bay. During the *Africana* surveys it was encountered at many stations, mostly off Saldanha Bay and off the Cape Peninsula during Cruise 060, but also south-west of Quoin Point (Fig. 5d). Depths of capture generally exceeded 600 m. Catches ranged from a few individuals to hundreds of specimens. *Africana* has also collected this shark between Cape Agulhas and Port Alfred (Compagno *et al.* in prep.).

Classification — This large lanternshark was, until recently, confused with the Eastern North Atlantic and Mediterranean *E. spinax* (Linnaeus, 1758), and the Western Atlantic *E. gracilispinis* Krefft, 1968. Comparison of a paratype of *E. gracilispinis* and *E. spinax* material with the present species convinced the present authors that it did not belong to either species. In the meantime, Fricke and Koch (1990) described it as *E. compagnoi*. It is here termed the brown lanternshark in reference to a field character that distinguishes it from the blackish giant lanternshark, which was often caught in the same trawl. *E. compagnoi* needs to be compared critically with the closely similar *E. unicolor* (Engelhardt, 1912) from Japan and the recently described *E. litvinovi* Parin and Kotlyar, in Kotlyar 1990, from the Eastern South Pacific.

Etmopterus cf. *granulosus* (Günther, 1880) — giant lanternshark

Probably not *Spinax granulosus* — Günther 1880: 19, Pl. 2c (off Chile, 220 m).

Etmopterus granulosus — Gilchrist 1922b: 49 (R.V. *Pickle* #86, 33°53,30′S, 17°25,00′E, west of Cape Town, 983 m); Barnard 1925: 49, Pl. 2, Fig. 8 (off Cape Point, 458–1 464 m); Smith 1949: 58, Fig. 50 (Cape Point, 366–1 464 m); Bigelow and Schroeder 1957: 55 (South Africa, Natal coast, ?error); Smith 1965: 58, Fig. 50 (Cape Point); Cadenat and Blache 1981: 45 (Cape of Good Hope); Compagno 1984: 77 (Cape of Good Hope, South Africa); Bass *et al.* 1986a: 55 (366–1 464 m off Cape Point, Western Cape); Compagno *et al.* 1989: 28, ill. (Cape Columbine to Cape Point, 668–923 m); Tachikawa *et al.* 1989: 235 (*E. baxteri* from New Zealand synonymized with this species).

Spinax granulosus — Norman 1935: 37 (South Africa south-west of Cape Town, 34°08′S, 17°33′E, 402–?548 m).

Africana demersal trawl stations ($n = 25$):

Cruise 039 —	A3342, 764 m;	A3358, 826 m.	
Cruise 046 —	A4310, 760 m.		
Cruise 050 —	A5249, 800 m;	A5280, 780 m.	
Cruise 054 —	A5867, 763 m.		
Cruise 059 —	A6892, 903 m.		
Cruise 060 —	A6987, 710 m;	A6988, 900 m;	A6989, 680 m;
	A6999, 923 m;	A7002, 668 m;	A7011, 880 m;
	A7012, 700 m;	A7024, 894 m;	A7026, 717 m;
	A7027, 901 m;	A7036, 710 m;	A7037, 903 m;
	A7038, 917 m;	A7039, 719 m.	
Cruise 066 —	A7550, 900 m;	A7655, 865 m.	
Cruise 075 —	A9030, 900 m;	A9151, 825 m.	

Station latitude and depth range — 31°35,0′S, 15°42,9′E to 35°56,2′S, 19°22,0′E, 668–923 m.

Distribution — This is the largest and deepest-dwel-

ling lanternshark in the area, which from the literature was positively recorded from off the Western Cape coast of South Africa. *Africana* encountered it in numbers from many deep demersal stations south-west of Doring Bay to south-west of Quoin Point, South Africa (Fig. 6a), but not elsewhere during this survey. Most records are from deeper than 700 m.

Classification — This shark has usually been ascribed to the South American *Etmopterus granulosus*, but a comparison of the holotype of *E. granulosus* with material of South African "*granulosus*" suggested that the two are distinct species. Here, this species is termed the giant lanternshark (as distinguished from the southern lanternshark *E. granulosus*), because adult females can exceed 800 mm *TL*. The giant lanternshark is referred to *E.* cf. *granulosus* as an interim measure until its status can be determined. It is very close to *E. princeps* Collett, 1904 of the North Atlantic and *E. baxteri* Garrick, 1957 from New Zealand, and it will be compared in detail with these species elsewhere.

Etmopterus pusillus (Lowe, 1839) — smooth lanternshark

Acanthidium pusillum — Lowe 1839: 91 (Madeira, Eastern North Atlantic).

Etmopterus pusillus — Krefft 1968a: 54, Pl. 3b (Angola, 440–360 m, also specimens from Madeira and Japan); Bass *et al.* 1976: 23, Figs 16, 18b (central Natal, 274–421 m); Krefft 1980: 3 (South Atlantic oceanic records, including one about 1 700 km west-south-west of Cape Town at 38°14′S, 01°15′E, 110–0 m in water approximately 2 700 m deep); Lleonart and Rucabado 1984: 41 (central Namibia west of Walvis Bay, 22°53,0′S, 12°58,1′E, 470–650 m); Allué *et al.* 1984: 126 (central Namibia, 22°26,0′S, 12°48,0′E, 460–502 m); Compagno 1984: 82, ill. (Angola, Namibia, South Africa); Bass *et al.* 1986a: 56, Fig. 5.14 (Natal, 274–421 m); Lloris 1986: 105, Fig. 30 (Namibia, north-west to west of Walvis Bay, 21°40′S, 12°40′E, 417–421 m; 22°29′S, 12°48′E, 460–502 m; 22°53′S, 12°58′E, 470–650 m); Turon *et al.* 1986: 65, 173, 229, 295 (Namibia from south-west of Rocky Point to off the Orange River mouth, 13 stations from 19°43,9′S, 11°29,6′E to 28°47,6′S, 14°22,9′E, 399–615 m); Compagno *et al.* 1989: 30, ill. (off Namibia and Cape Point, Natal and Moçambique; 274–708 m).

Africana demersal trawl stations ($n = 9$):

Cruise 039 — A3447, 431 m.
Cruise 059 — A6949, 425 m; A6950, 475 m.
Cruise 069 — A8370, 407 m; A8374, 718 m; A8379, 490 m; A8391, 462 m; A8392, 434 m; A8409, 435 m.

Africana pelagic trawl station ($n = 1$, Engels midwater trawl c. 30 m off bottom):

Cruise 060 — A7029, 34°47,1′S, 18°03,9′E, 699 m.

Station latitude and depth range — 23°19,1′S, 13°09,9′E to 34°47,1′S, 18°03,9′E, 407–718 m).

Distribution — The smooth lanternshark has a broad range on the continental slopes of most temperate and tropical seas, with records from the Western Atlantic, Central South Atlantic, the Eastern Atlantic from Portugal and Madeira to Namibia, the western Indian Ocean off Natal, the Western Pacific, and the Eastern South Pacific. Off southern Africa, it is known from several records off Namibia and extends into the area from Walvis Bay to the Orange River mouth. *Africana* collected it in demersal trawls from south-west of Walvis Bay to south-west of Lüderitz, most being between 400 and 500 m deep. In addition, *Africana* caught two specimens in an Engels pelagic trawl off the bottom south-west of Cape Point (the first Western Cape record of this species), but not from any bottom trawl station off South Africa (Fig. 6b). Krefft (1980) collected this species in the epipelagic zone in the South-Central Atlantic, far from land and over the ocean basin, which suggests that *E. pusillus* may have a broader range off southern Africa than more strictly benthic or epibenthic lanternsharks.

Euprotomicroides zantedeschia Hulley and Penrith, 1966 — taillight shark

Euprotomicroides zantedeschia — Hulley and Penrith 1966: 222, Figs 1–4 (west of Cape Town in 457–640 m in bottom trawl); Bass *et al.* 1976: 50, Fig. 32h (South African record); Krefft 1980: 7 (Western South Atlantic east of Uruguay); Cadenat and Blache 1981: 113 (South Africa); Compagno 1984: 89, ill. (west of Cape Town); Bass *et al.* 1986a: 57, Fig. 5.17 (Cape Town, south-west Atlantic); Stehmann and Krefft 1988: 1, Figs 1–13 (redescription, east of Uruguay and west of Cape Town); Compagno *et al.* 1989: 34, ill. (off Cape Town).

Africana trawl stations: none.

Distribution — The taillight shark is currently known only from two specimens from the South Atlantic. The first was collected in a bottom trawl on the continental slope off Cape Town, and the second was caught in a pelagic trawl near the surface in oceanic waters east of Uruguay. No material of this species

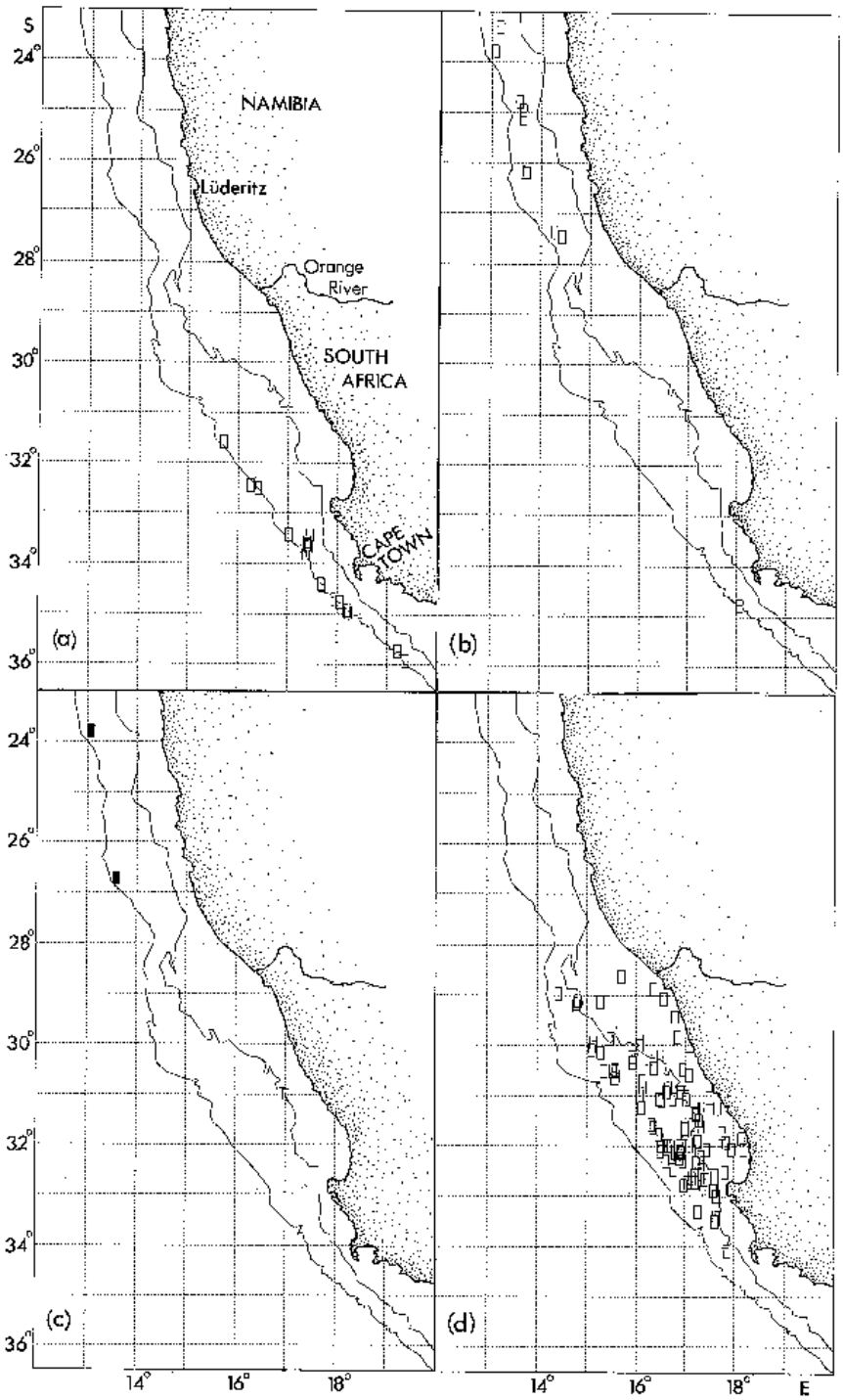

Fig. 6: *Africana* demersal and pelagic trawl stations at which (a) giant lanternshark (*Etmopterus* cf. *granulosus*, $n = 25$), (b) smooth lanternshark (*Etmopterus pusillus*, $n = 10$, including one from a pelagic trawl off Cape Town), (c) velvet dogfish (*Scymnodon squamulosus*, $n = 2$), (d) spotted spiny dogfish (*Squalus acanthias*, $n = 108$) were taken, 1986–1990

turned up in *Africana* bottom trawls in the area, nor was it caught in epibenthic pelagic trawls during Cruise 060 off the Western Cape. It could be an epipelagic or mesopelagic species that was accidentally caught on or near the bottom off Cape Town, and not a shark of the deep slopes.

Scymnodon squamulosus (Günther, 1877) — velvet dogfish

Centrophorus squamulosus — Günther 1877: 433 (Japan, 631 m).

Scymnodon squamulosus — Yano and Tanaka 1984: 352, Fig. 8 (Japan, Australia, Surinam; *S. obscurus* from Eastern Atlantic a junior synonym); Compagno *et al.* 1989: 32, ill. (Namibia, Natal, 430–900 m).

Zameus squamulosus — Taniuchi and Garrick 1986: 129, Fig. 3 (review of distribution, Japan, Okinawa Trough, South China Sea, New Zealand, Australia, Durban, South Africa, tropical East and South-Central Atlantic, Surinam, French Guiana).

Centroscymnus obscurus — Vaillant 1888: 67, Pl. 2, Fig. 2 ("Côtes du Soudan", 1 400–1 435 m); Bass *et al.* 1986a: 53, Fig. 5.7 (Durban).

Scymnodon ?obscurus — Bass *et al.* 1976: 35 (from stomach of sperm whale harpooned 112 km south-east of Durban, Natal).

Scymnodon obscurus — Krefft 1980: 3, Fig. 1 (South Atlantic and North Atlantic off Cape Verde Is.); Allué *et al.* 1984: 126 (northern Namibia off Cunene River, 17°42,0′S, 11°20,0′E, 430–520 m); Compagno 1984: 98, ill. (east coast of South Africa); Lloris 1986: 109, Fig. 33 (Namibia north of Walvis Bay, 17°42′S, 11°20′E, 430–520 m; 19°44′S, 11°30′E, 615 m; 21°36′S, 12°34′E, 542 m); Turon *et al.* 1986: 66 (central Namibia from north-west of Walvis Bay to south-west of Lüderitz, 4 stations from 21°36,5′S, 11°34,6′E to 27°29,6′S, 14°18,7′E, 421–651 m).

Africana demersal trawl stations ($n = 2$):

Cruise 069: A8374, 718 m; A8413, 900 m.

Station latitude and depth range — 23°47,0′S, 13°04,0′E to 26°43,6′S, 13°36,0′E, 718–900 m.

Distribution — The velvet dogfish has a wide range in the Western Atlantic, Eastern North Atlantic from Iceland to Senegal, South-Central Atlantic, southern Africa off Namibia and possibly Natal, and the Western Pacific. There are relatively few records along the west coast of southern Africa, and these are from south-central Namibia from north-west of Walvis Bay to south-west of Lüderitz. The present survey generated only two records in the area from the deep slope south-west of Walvis Bay and south-west of Lüderitz (Fig. 6c), each with a single specimen among other, more numerous sharks. The species was not caught in demersal trawl stations from the vicinity of the Orange River southwards to off Cape Agulhas, suggesting that it is rare or possibly absent at least on the bottom off the west coast of South Africa. Specimens recorded by Krefft (1980) from pelagic trawls off Uruguay, the Cape Verde Islands, and the central South Atlantic in oceanic waters suggests that this species is partly epipelagic, as is *Etmopterus pusillus*, and not restricted to the slopes, and that it could occur more widely in the area. Partly digested specimens from the stomach of a sperm whale harpooned off Durban are the only record of this species from the east coast of South Africa.

Somniosus cf. *microcephalus* (Bloch and Schneider, 1801) — Greenland shark

Squalus microcephalus — Bloch and Schneider 1801: 135 ("habitat in mari glaciali", = Arctic seas).

Somniosus microcephalus — Bass *et al.* 1976: 43 (32°50′S, off Cape Columbine, 677 m); Compagno 1984: 103, ill. (Cape Columbine, South Africa); Bass *et al.* 1986a: 60, Fig. 5.23 (Cape Columbine); Francis *et al.* 1988: 401 (Cape Columbine, discussion of southern hemisphere records, possibly *S. pacificus*); Compagno *et al.* 1989: 32, ill. (Cape Columbine); Compagno 1990: 84, Fig. 2 (Cape Columbine specimen, discussion of southern hemisphere records).

Africana demersal trawl stations: none.

Distribution — This shark is known only from a single large individual caught by a commercial trawler off Cape Columbine and mounted in the South African Museum. *Africana* did not encounter young or adults, and its distributional status in the area remains uncertain.

Squalus acanthias Linnaeus, 1758 — spotted spiny dogfish

Squalus acanthias — Linnaeus 1758: 233 ("Habitat in Oceano Europaeo."); Gilchrist 1922b: 48 (R.V.

Pickle #341, 26°42,15′S, 14°10,20′E, west of Lüderitz, Namibia, 366 m; common in deep water off Table Bay); Barnard 1925: 47, Pl. 2, Fig. 7 (Table Bay and Natal Coast); Norman 1935: 36 (South Africa, west of Cape Town, 33°53′S, 17°38′E, 310 m); Fowler 1936b: 69, Figs 19–20 (South Africa); Fowler 1941: 257 (South African records); Smith 1949: 60, Fig. 64, 36" individual (Atlantic coast of southern Africa); Barnard 1947: 20 (Table Bay and Natal); Bigelow and Schroeder 1948b: 455 (South Africa); Bigelow and Schroeder 1957: 31 (South Africa); Smith 1965: 60, Fig. 64, 36" individual (southern Africa); Day *et al.* 1970: 89 (False Bay, Beira–Walvis Bay, >50 m); ?Penrith 1978: 182 (Porto Alexandre, southern Angola?); Van der Elst 1981: 61 (in part, not figure, possibly = *S. megalops*; Saldanha Bay to Port Elizabeth); Bass *et al.* 1976: 13, Figs 6a, 8e–g, 9, Pl. 1 (west of Cape Town, 494 m, possibly not present off Namibia, possibly off Eastern Cape, Port Elizabeth, but not common if present); Cadenat and Blache, 1981: 47 (South Africa); Compagno, 1984: 111, ill. (Cape coast of South Africa); Bass *et al.* 1986: southern and south-western Cape, east to Port Elizabeth); Lloris 1986: 110, Fig. 34 (South Africa between Port Nolloth and Orange River mouth, 29°43′S, 14°52′E, 396–401 m); Turon *et al.* 1986: 173, 229, 295 (central Namibia and South Africa from Walvis Bay to just south of the Orange River mouth, 16 stations from 23°27,0′S, 13°18,5′E to 29°40,4′S, 14°45,5′E, 165–458 m); Van der Elst and Vermeulen 1986: 7, ill. (St Helena to Algoa Bay, to 800 m); Van der Elst 1988: 76 (in part, South-Western and South-Eastern Cape); Compagno *et al.* 1989: 22, ill. (Port Nolloth to Cape Point, South Africa, possibly Eastern Cape and Natal, 124–515 m).

Squalus acanthias africana — Myagkov and Kondyurin 1986: 5 (28°S, 17°E, "Wolffish Bay", but co-ordinates indicate Port Nolloth, South Africa, rather than Walvis Bay).

Acanthias vulgaris — Bleeker 1860: 57, 79 (Cape of Good Hope, skin from large specimen 670 lines long); Thompson 1914: 149 (Cape seas, South Africa, in part?).

Africana demersal trawl stations (n = 108):

Cruise 028 —	A2335, 194 m;	A2336, 204 m.	
Cruise 033 —	A2777, 195 m;	A2782, 353 m;	A2783, 301 m;
	A2784, 291 m;	A2786, 364 m;	A2788, 260 m;
	A2805, 121 m;	A2834, 119 m.	
Cruise 039 —	A3324, 239 m;	A3352, 245 m;	A3355, 212 m;
	A3357, 515 m;	A3366, 247 m;	A3367, 272 m;
	A3372, 231 m;	A3380, 159 m;	A3381, 213 m;
	A3382, 244 m;	A3383, 271 m;	A3387, 281 m;
	A3388, 308 m;	A3389, 345 m;	A3390, 362 m;
	A3395, 299 m;	A3401, 294 m;	A3427, 199 m;
	A3428, 255 m;	A3429, 365 m.	
Cruise 046 —	A4326, 300 m;	A4327, 285 m;	A4328, 300 m;
	A4329, 335 m;	A4335, 270 m;	A4346, 124 m;
	A4351, 215 m;	A4369, 330 m;	A4383, 372 m;
	A4384, 374 m;	A4385, 335 m.	
Cruise 050 —	A5239, 252 m;	A5240, 173 m;	A5244, 252 m;
	A5250, 370 m;	A5252, 424 m;	A5255, 217 m;
	A5256, 296 m;	A5257, 277 m;	A5259, 264 m;
	A5261, 166 m;	A5262, 226 m;	A5291, 152 m;
	A5293, 100 m;	A5298, 170 m;	A5308, 377 m;
	A5309, 215 m;	A5310, 216 m;	A5318, 172 m;
	A5324, 183 m;	A5325, 184 m;	A5327, 188 m;
	A5336, 217 m;	A5339, 190 m.	
Cruise 054 —	A5889, 275 m;	A5890, 270 m;	A5907, 83 m;
	A5910, 115 m;	A5930, 107 m;	A5936, 396 m;
	A5940, 282 m;	A5943, 341 m;	A5944, 270 m;
	A5950, 222 m.		
Cruise 059 —	A6882, 296 m;	A6894, 276 m;	A6895, 292 m;
	A6896, 356 m;	A6901, 199 m;	A6902, 164 m;
	A6908, 95 m;	A6912, 184 m;	A6915, 131 m;
	A6942, 156 m;	A6954, 224 m;	A6970, 323 m;
	A6974, 189 m;	A6977, 243 m;	A6978, 250 m.
Cruise 060 —	A7000, 254 m.		
Cruise 069 —	A8325, 280 m;	A8326, 265 m;	A8328, 288 m;
	A8329, 345 m;	A8342, 200 m.	
Cruise 075 —	A9033, 284 m;	A9053, 121 m;	A9116, 113 m;
	A9150, 351 m;	A9154, 372 m.	
Cruise 079 —	A9771, 152 m;	A9816, 315 m;	A9819, 224 m;
	A9821, 227 m;	A9822, 207 m;	A9824, 288 m;
	A9825, 442 m;	A9829, 238 m.	

Station latitude and depth range — 28°37,8′S, 15°41,8′E to 34°06,0′S, 17°50,9′E, 83–515 m.

Distribution — A problem in interpreting previous work on the distribution of spiny dogfish (genus *Squalus*) in the area is that, until the present survey, only two species were generally recognized on the west coast of southern Africa. *Squalus acanthias* is distinctive and was often (but not always) correctly identified by previous authors, but the other species, *S. megalops* and *S.* cf. *mitsukurii*, were usually not distinguished from each other. During the present survey, the three species were common in the area, albeit with differences in distribution patterns, and two or three species could occur in the same trawl. Moreover, mixes of similar-sized young of the large *S.* cf. *mitsukurii* and adult and subadults of the small *S. megalops* in the same haul necessitated careful sorting to distinguish the two. This makes various literature records of spiny dogfish from the area suspect unless sufficient evidence in the form of morphometrics, good illustra-

tions of local material, or adequate descriptions were provided to differentiate these species.

The spotted spiny dogfish is a wide-ranging cool-temperate, active, epibenthic shark of the continental and insular shelves and uppermost slope, with a bipolar or amphitemperate distribution in all seas. Populations exist in the North Atlantic, off the Atlantic and Pacific coasts of South America, off southern Africa from Angola to Natal, the Western South Pacific, and the North Pacific.

Off the west coast of southern Africa, the spotted spiny dogfish is apparently an offshore species of the outer shelf and upper slope, although it has been recorded inshore from False Bay (possibly as a misidentification of *S. megalops*?). There is a record from Angola which requires confirmation, as do more recent nominal records from central Namibia. During this survey, *Africana* collected it just north-west of the Orange River in Namibian waters and southwards along the continental shelf and uppermost slope of South Africa to west of the Cape Peninsula (Fig. 6d). The species was not collected farther south-east to Cape Agulhas (unlike the other two species), and did not show up off Walvis Bay and Lüderitz on Namibian stations. Depths where *S. acanthias* was collected were mostly between 150 and 400 m deep; the species prefers somewhat deeper water than *S. megalops* and shallower than *S.* cf. *mitsukurii*. A latitude-depth summer-winter plot (see Fig. 19a) reveals a loose scattering of records, with no obvious aggregations or summer-winter movements in the area. The spotted spiny dogfish appears to be less abundant than its two congeners in the area, in terms of both records and numbers of individuals caught at each station. Records of this species from the Eastern Cape and Natal will be discussed by Compagno *et al.* (in prep.).

Squalus megalops (Macleay, 1881) — shortnose spiny dogfish

Acanthias megalops — Macleay 1881: 303 ("Port Jackson", = Sydney Harbour, New South Wales, Australia).

Acanthias blainvillei — Gilchrist 1902: 165 (South Africa, Cape of Good Hope, in part?); Thompson 1914: 149 (Cape seas, South Africa, in part?); ?Day *et al.* 1970: 89 (in part?, False Bay, Beira–Walvis Bay, >25 m).

Squalus acutipinnis — Regan 1908a: 248, Pl. 37 (Natal, Mauritius, Table Bay, Cape of Good Hope); Regan 1921: 412 (Natal); Barnard 1925, 48 (in part, Table Bay to Natal, probably including *S.* cf. *mitsukurii*); Norman 1935: 37 (South Africa, west of Cape Town, 33°48′S, 17°33′E, 311 m; 34°00′S, 17°58′E, 210–173 m); Barnard 1947: 20, Pl. 3, Fig. 4 (South Africa); Krefft 1968a: 51, Pl. 3a (Namibia, inside Walvis Bay, 6 m; also South African type series from Bird Island, Eastern Cape, Table Bay, and Cape of Good Hope); Karrer 1973: 196 (Namibia, north-west and south-south-west of Walvis Bay, 22°40′S, 13°08′E, 270-275 m; 24°20′S, 13°55′E, 270–280 m).

Squalus fernandinus — Gilchrist 1922b: 48 (in part, east coast of South Africa, probably including *S.* cf. *mitsukurii*); Von Bonde 1923: 5 (in part, South Africa, 68–176 m, probably including *S. megalops*); Fowler 1936b: 71 (in part, South Africa); Smith 1949: 60 (in part, *Squalus acutipinnis* and *S. megalops* in synonymy, southern Africa); Smith 1965: 60 (in part, *Squalus acutipinnis* and *S. megalops* in synonymy, southern Africa).

Squalus megalops — Bass *et al.* 1976: 16 (Namibia to southern Moçambique, 50–450 m); Van der Elst 1981: 62 (in part, possibly not ill., Namibia to Moçambique); Compagno 1984: 118, ill. (Namibia, South Africa, Moçambique); Bass *et al.* 1986a: 62, Fig. 5.26 (Namibia, Algoa Bay to Natal); Van der Elst and Vermeulen 1986: 8, ill. (Namibia to Natal, to 730 m); Seret 1987: 1 (off Tulear, Madagascar, 425–500 m); Van der Elst 1988: 77 (in part, possibly not ill., Namibia to Moçambique); Compagno *et al.* 1989: 22, ill. (Namibia to northern Natal, close inshore to 450 m).

Squalus acanthias — Smith 1949: 60, Fig. 64, 18" individual (in part, Atlantic coast of southern Africa); Smith 1965: 60, Fig. 64, 18" individual (in part, Atlantic coast of southern Africa); Van der Elst 1988: 76 (in part, figure possibly = *S. megalops*).

?*Squalus probatovi* — Myagkov and Kondyurin 1986: 10, Figs 1c, g, i (off Cunene River, Angola).

Africana demersal ($n = 226$) and Engels pelagic ($n = 4$) trawl stations:

Cruise 028 — A2226, 174 m; A2231, 162 m; A2233, 165 m; A2362, 176 m; A2363, 200 m; A2364, 203 m; A2371, 250 m; A2373, 284 m.

Cruise 033 — A2745, 198 m; A2746, 182 m; A2747, 202 m; A2748, 236 m; A2750, 192 m; A2752, 238 m; A2759, 235 m; A2762, 159 m; A2763, 161 m; A2764, 160 m; A2765, 163 m; A2766, 170 m; A2767, 213 m; A2768, 175 m; A2769, 201 m; A2770, 200 m; A2772, 154 m; A2773, 159 m; A2774, 138 m; A2775, 144 m; A2784, 291 m; A2787, 342 m; A2788, 260 m; A2809, 123 m; A2839, 231 m; A2841, 207 m; A2842, 200 m;

A2843, 202 m.
Cruise 039 — A3325, 225 m; A3326, 187 m; A3327, 178 m; A3328, 171 m; A3329, 157 m; A3330, 139 m; A3332, 189 m; A3333, 171 m; A3334, 148 m; A3336, 169 m; A3337, 174 m; A3338, 200 m; A3339, 200 m; A3340, 230 m; A3343, 172 m; A3344, 209 m; A3355, 212 m; A3389, 345 m; A3390, 362 m; A3401, 294 m; A3402, 262 m; A3403, 236 m; A3404, 208 m; A3425, 175 m; A3426, 182 m; A3427, 199 m; A3428, 255 m; A3430, 217 m.
Cruise 046 — A4288, 190 m; A4289, 170 m; A4290, 170 m; A4291, 217 m; A4292, 235 m; A4293, 175 m; A4294, 160 m; A4295, 230 m; A4296, 165 m; A4297, 180 m; A4298, 135 m; A4299, 145 m; A4300, 155 m; A4301, 151 m; A4302, 175 m; A4303, 200 m; A4304, 240 m; A4357, 163 m; A4362, 219 m; A4369, 330 m; A4370, 295 m.
Cruise 050 — A5227, 173 m; A5228, 230 m; A5230, 220 m; A5231, 169 m; A5232, 153 m; A5232, 133 m; A5234, 137 m; A5235, 186 m; A5236, 167 m; A5237, 155 m; A5238, 160 m; A5254, 265 m; A5255, 217 m; A5257, 277 m; A5258, 236 m; A5259, 264 m; A5261, 166 m; A5263, 162 m; A5282, 175 m; A5297, 165 m; A5299, 173 m; A5303, 270 m; A5304, 270 m; A5305, 266 m; A5309, 215 m; A5319, 185 m; A5320, 179 m; A5321, 200 m; A5322, 209 m; A5323, 204 m; A5324, 183 m; A5325, 184 m; A5326, 204 m.
Cruise 054 — A5851, 181 m; A5854, 170 m; A5855, 200 m; A5856, 222 m; A5857, 190 m; A5858, 117 m; A5859, 151 m; A5863, 174 m; A5864, 205 m; A5865, 230 m; A5866, 224 m; A5872, 173 m; A5889, 275 m; A5899, 460 m; A5932, 329 m; A5937, 192 m; A5940, 282 m; A5941, 235 m; A5943, 341 m; A5945, 205 m; A5950, 222 m; A5951, 270 m.
Cruise 059 — A6837, 171 m; A6838, 206 m; A6839, 203 m; A6840, 175 m; A6841, 161 m; A6844, 158 m; A6845, 170 m; A6846, 176 m; A6847, 230 m; A6848, 228 m; A6851, 174 m; A6852, 180 m; A6853, 251 m; A6861, 196 m; A6867, 77 m; A6873, 256 m; A6879, 265 m; A6901, 199 m; A6933, 191 m; A6934, 186 m; A6936, 175 m; A6941, 168 m; A6942, 156 m; A6943, 177 m; A6944, 170 m; A6954, 224 m; A6958, 238 m; A6959, 223 m; A6960, 198 m; A6961, 209 m; A6967, 286 m; A6968, 245 m; A6969, 257 m; A6970, 323 m.
Cruise 060, demersal — A7045, 156 m. Engels pelagic — A7048, 157 m; A7049, 158 m; A7050, 157 m; A7051, 157 m.
Cruise 069 — A8365, 169 m; A8372, 295 m; A8394, 185 m; A8421, 190 m; A8422, 199 m.
Cruise 075 — A8993, 181 m; A9000, 242 m; A9002, 238 m; A9012, 234 m; A9013, 238 m; A9014, 170 m; A9015, 184 m; A9016, 174 m; A9017, 152 m; A9018, 127 m; A9019, 154 m; A9020, 139 m; A9022, 186 m; A9023, 158 m; A9024, 123 m; A9034, 187 m; A9035, 168 m; A9068, 218 m; A9069, 227 m; A9081, 155 m; A9082, 173 m; A9122, 185 m; A9123, 177 m; A9123, 177 m; A9124, 188 m; A9125, 181 m; A9126, 211 m; A9131, 227 m; A9132, 220 m; A9133, 248 m; A9140, 350 m; A9144, 253 m; A9146, 280 m.
Cruise 079 — A9795, 182 m; A9800, 213 m; A9801, 191 m; A9802, 195 m; A9803, 189 m; A9804, 191 m; A9815, 240 m; A9816, 315 m; A9819, 224 m; A9820, 218 m; A9821, 227 m; A9822, 207 m; A9824, 288 m; A9829, 238 m.

Station latitude and depth range — 23°35,3′S, 13°49,0′E to 36°06,8′S, 19°50,7′E, 77–460 m.

Distribution — The shortnose spiny dogfish occurs off southern Africa from Namibia to Natal and possibly Moçambique, and also in the Eastern North Atlantic, western Mediterranean Sea and Western Pacific. It is the smallest and most abundant dogfish in the area, but confusion with other species in the literature makes its published distribution sketchy at best. During the survey, *Africana* made a few bottom trawl stations that reported this species from south-west of Walvis Bay to the Orange River mouth in Namibia, but most of the records are from south-west of the Orange River south along the outer shelf and upper slope of South Africa to south of Cape Agulhas on the edge of the Agulhas Bank (Fig. 7a). Depth of capture of *S. megalops* averaged less than its congeners. The map and a latitude-depth summer-winter plot (see Fig. 19b) show a distinct bimodal clumping of the records in the north on the outer shelf and upper slope between Port Nolloth and Doring Bay, and in the south from Cape Point southwards to Cape Agulhas, but is not informative of seasonal movements.

An interesting facet of the distribution of this dogfish came to light during a series of four stations with the Engels pelagic trawl during *Africana* Cruise 060. These were on the outer shelf south of Quoin Point, with a bottom depth of 157–158 m and co-ordinates of approximately 35°05′S, 19°25′W. Stations were conducted from the surface to near the bottom, and in all cases brought up large numbers of newborn *S. megalops* along with a few adults (mostly males). This suggests that the outer Agulhas Bank may be a pupping ground for the species, and that the young are pelagic and active from the surface to near the bottom.

Classification — The sketchily described *Squalus probatovi* from off the Cunene River, southern Angola,

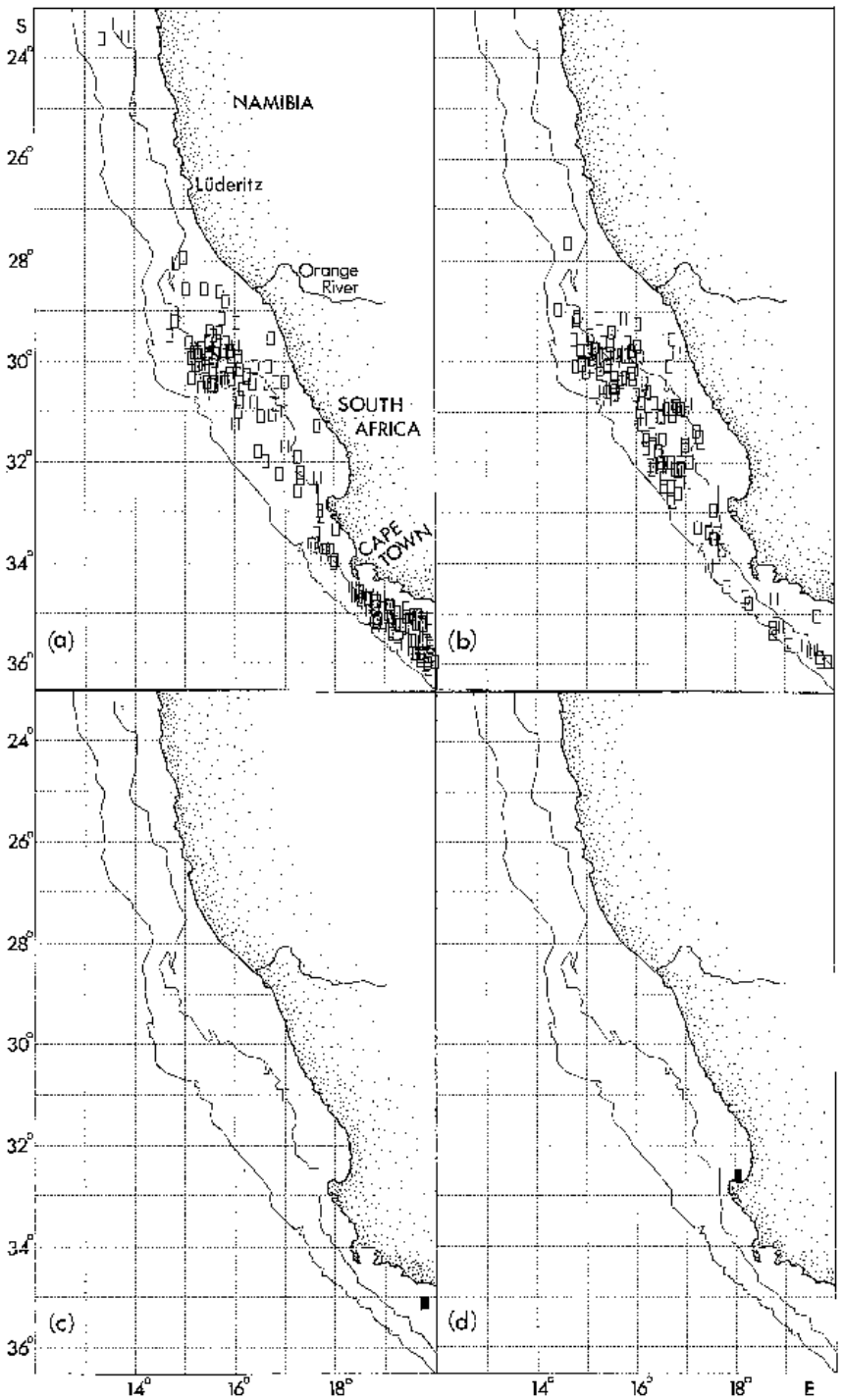

Fig. 7: *Africana* demersal and pelagic trawl stations at which (a) shortnose spiny dogfish (*Squalus megalops*, $n = 230$, including 4 pelagic trawls), (b) shortspine spiny dogfish (*Squalus* cf. *mitsukurii*, $n = 173$), (c) sixgill sawshark (*Pliotrema warreni*, $n = 1$), (d) thresher shark (*Alopias vulpinus*, $n = 1$) were taken, 1986–1990

may refer to this species, because it is said to be adult at 54 cm (Myagkov and Kondyurin 1986). Members of the *S. megalops* group from southern Africa need to be critically compared with those from the Western Pacific and Eastern North Atlantic. Some authors have ranked the southern African representatives of the *megalops* group as a separate species, *S. acutipinnis*, but most authors consider it a synonym of *S. megalops*, following Bass *et al.* (1976). Muñoz-Chápuli and Ramos (1989b) discussed the classification of *S. megalops* in the Eastern Atlantic, and presented northern range extensions of the species from Mauritania to Portugal and from the Western Mediterranean.

Squalus cf. *mitsukurii* Jordan and Snyder, 1903 — shortspine spiny dogfish

?Squalus mitsukurii — Jordan and Snyder, in Jordan and Fowler 1903: 629 (Misaki, Japan); Compagno 1984: 121, ill. (east coast of South Africa, Moçambique); Bass *et al.* 1986a: 62, Fig. 5.27 (Algoa Bay to tropics); Compagno *et al.* 1989: 22, ill. (Namibia to Natal, 159–552 m).

Squalus acutipinnis — Thompson 1914: 152 (Cape seas, South Africa, in part?); Barnard 1925, 48 (in part, Table Bay to Natal, probably including *S. megalops*).

?Acanthias blainville — Risso 1826: 133, Pl. 3, Fig. 6, also plate legend, p. 478 as *Acanthias blainvillii*.

Acanthias blainvillei — Bleeker 1860: 57, 80 (Cape of Good Hope, skin from large specimen 655 lines long); Gilchrist 1902: 166 (South Africa, Cape of Good Hope, in part); Thompson 1914: 149 (Cape seas, South Africa, in part?).

Squalus blainvillei — ?Poll 1951: 59 (Angolan records; specimens from off Rocky Point, northern Namibia, 19°52′S, 12°20′E, 220 m possibly this species or *S. megalops*); Bass *et al.* 1976: 15 (in part, Beira to Algoa Bay, 50–740 m, probably including two species); ?Penrith 1978: 182 (Baia dos Tigres, southern Angola, identity uncertain); Lleonart and Rucabado 1984: 40 (central Namibia north-west of Walvis Bay, 4 stations from 21°03,9′S, 12°58,9′E to 22°18,2′S, 13°07,1′E, 180–305 m, including *S. megalops*?); Alluć *et al.* 1984: 125 (north-central Namibia from the Cunene River to north-west of Walvis Bay, 18 stations from 17°30,0′S, 11°32,0′E to 22°03,0′S, 13°12,0′E, 70–360 m, including *S. megalops*?); Lloris 1986: 112, Fig. 35 (Namibia, Angolan border to off Walvis Bay, 18°12′S, 11°30′E, 273–300 m; 22°18′S, 13°07′E, 240 m; 22°57′S, 13°04′E, 400–500 m); ?Turon *et al.* 1986: 36, 66, 174, 230, 295 (Namibia and South Africa from the Cunene River to just south of the Orange River mouth, 84 stations from 17°29′S, 11°23′E to 29°47,0′S, 14°37,5′E, 24–615 m, likely to include specimens of *S. megalops* as well as *S.* cf. *mitsukurii*).

Squalus fernandinus — Gilchrist 1922b: 48 (in part, east coast of South Africa); Von Bonde 1923: 5 (in part, South Africa, 68–176 m); Smith 1949: 60 (in part, southern Africa); Bigelow and Schroeder 1957: 32 (South Africa, in part?).

Africana demersal trawl stations ($n = 173$):

Cruise 028 — A2367, 497 m; A2374, 307 m.
Cruise 033 — A2783, 301 m; A2786, 364 m.
Cruise 039 — A3338, 200 m; A3339, 200 m; A3340, 230 m; A3348, 456 m; A3351, 430 m; A3355, 212 m; A3357, 515 m; A3359, 359 m; A3360, 379 m; A3361, 500 m; A3362, 398 m; A3380, 159 m; A3381, 213 m; A3383, 271 m; A3387, 281 m; A3388, 308 m; A3389, 345 m; A3390, 362 m; A3395, 299 m; A3397, 443 m; A3398, 455 m; A3400, 312 m; A3401, 294 m; A3402, 262 m; A3403, 236 m; A3404, 208 m; A3428, 255 m; A3429, 365 m; A3430, 217 m; A3468, 411 m.
Cruise 046 — A4305, 490 m; A4307, 495 m; A4325, 230 m; A4335, 270 m; A4359, 417 m; A4362, 219 m; A4363, 432 m; A4368, 480 m; A4369, 330 m; A4371, 368 m; A4372, 360 m; A4373, 461 m; A4382, 233 m; A4383, 372 m; A4384, 374 m; A4385, 335 m; A4386, 380 m; A4387, 469 m; A4389, 176 m.
Cruise 050 — A5228, 230 m; A5229, 450 m; A5230, 220 m; A5250, 370 m; A5251, 430 m; A5254, 265 m; A5255, 217 m; A5256, 296 m; A5257, 277 m; A5258, 236 m; A5262, 226 m; A5286, 591 m; A5297, 165 m; A5298, 170 m; A5299, 173 m; A5303, 270 m; A5304, 270 m; A5305, 266 m; A5308, 377 m; A5309, 215 m; A5310, 216 m; A5318, 172 m; A5319, 185 m; A5320, 179 m; A5321, 200 m; A5322, 209 m; A5323, 204 m; A5324, 183 m; A5325, 184 m; A5326, 204 m; A5336, 217 m; A5337, 199 m.
Cruise 054 — A5863, 174 m; A5866, 224 m; A5873, 285 m; A5874, 240 m; A5875, 274 m; A5877, 257 m; A5880, 234 m; A5889, 275 m; A5890, 270 m; A5891, 368 m; A5892, 380 m; A5935, 454 m; A5936, 396 m; A5939, 400 m; A5940, 282 m; A5941, 235 m; A5943, 341 m; A5946, 205 m.
Cruise 059 — A6837, 171 m; A6838, 206 m; A6839, 203 m; A6847, 230 m; A6848, 228 m; A6854, 520 m; A6887, 289 m; A6888, 457 m; A6894, 276 m; A6895, 292 m; A6896, 356 m; A6897, 491 m; A6933, 191 m; A6934, 186 m; A6936, 175 m; A6954, 224 m; A6955, 395 m; A6958, 238 m; A6959, 223 m; A6960, 198 m; A6961, 209 m;

A6967, 286 m; A6969, 257 m; A6970, 323 m; A6977, 243 m; A6978, 250 m.
Cruise 060 — A6985, 247 m; A6986, 552 m; A6990, 480 m; A7022, 498 m; A7035, 499 m.
Cruise 069 — A8329, 345 m; A8342, 200 m; A8346, 327 m; A8348, 425 m; A8351, 426 m; A8357, 297 m; A8359, 174 m; A8420, 397 m.
Cruise 075 — A9027, 438 m; A9028, 400 m; A9036, 462 m; A9067, 183 m; A9068, 218 m; A9122, 185 m; A9123, 177 m; A9124, 188 m; A9129, 345 m; A9131, 227 m; A9138, 465 m; A9139, 481 m; A9144, 253 m; A9146, 280 m; A9154, 372 m.
Cruise 079 — A9800, 213 m; A9801, 194 m; A9802, 195 m; A9803, 189 m; A9804, 191 m; A9809, 178 m; A9810, 265 m; A9815, 240 m; A9816, 315 m; A9818, 250 m; A9821, 227 m; A9822, 207 m; A9824, 288 m; A9825, 442 m; A9829, 238 m; A9830, 234 m.

Station latitude and depth range — 27°40,3′S, 14°36,8′E to 35°59,4′S, 20°00,6′E, 159–591 m.

Distribution — In addition to the small *Squalus megalops*, a large, deeper-dwelling, superficially similar dogfish is widespread off southern Africa and may range from Angola to Moçambique. It is a member of the *Squalus blainvillei* species group, but its distribution north of southern Namibia is unclear because of confusion with *S. megalops*. It is impossible to evaluate Namibian records of what may be this species, except for those collected by *Africana* during the present survey and which were very few and localized on the uppermost slope west and north-west of the Orange River. Most records of the species are from the outer shelf and upper slope of South Africa, extending from the Orange River southwards to south-south-west of Cape Agulhas (Fig. 7b). Most of the records are clumped between Cape Columbine and the Orange River, and they are sparser from Saldanha Bay southwards. Depths for the species average greater than for the other two *Squalus* spp., with most records between 150 and 500 m. A latitude-depth summer-winter plot (see Fig. 19c) does not suggest strong trends for seasonal bathymetric and latitudinal movements.

The species is very common offshore on the uppermost slopes of the west coast of South Africa, at depths equivalent to those at which small *Centrophorus*, particularly *C. granulosus* (*C. "uyato"*) and *C. moluccensis*, are abundant off Natal. The scarcity of small *Centrophorus* on the uppermost shelf off the Western Cape suggests that, for some reason, they are largely replaced by *Squalus* there. Off central and northern Namibia, *Centrophorus* are more common, but as in Natal, large offshore *Squalus* of the *S. blainvillei* group occur at the same depths.

Classification — Using the criteria of Chen *et al.* (1979), the present southern African species, often termed *Squalus fernandinus* or *S. blainvillei* in the local literature, is close to *S. mitsukurii* Jordan and Snyder (1903) from the Western North Pacific rather than *S. blainvillei* Risso (1810). However, Muñoz-Chápuli and Ramos (1989b) suggested that the large-spined, high-finned, heavy-bodied shark termed *S. blainvillei* by Chen *et al.* (op. cit.) may be an undescribed species, and that Risso's (1826) *Acanthias blainville* from the Mediterranean is a short-spined dogfish very close to and possibly identical to *S. mitsukurii* from Japan. The large short-spined dogfish of southern Africa may also be referable to the true *S. blainvillei*, but, until further comparisons are made of *mitsukurii*-like dogfish from southern Africa and elsewhere, the name *Squalus* cf. *mitsukurii* is provisionally assigned for this species, following Bass *et al.* (1986a) and Compagno *et al.* (1989).

FAMILY OXYNOTIDAE — ROUGH SHARKS

Oxynotus shubnikovi Myagkov, 1986 — flatiron shark

Oxynotus shubnikovi — Myagkov in Gubanov *et al.* 1986: 171, Fig. 59 (17°48′S, 11°36′E, south-west of the Cunene River mouth, northern Namibia, ? depth).

Oxynotus centrina — Barnard 1949: 970 (west coast of Cape Peninsula, South Africa, 110 m); Poll 1951: 57, Figs 29–30, Pl. 4, Figs 1–2 (Angolan records off Moita Seca, Ambriz and Margate Head, 100–180 m); Smith 1965: 513, ?Fig. 54a (west coast of South Africa); Penrith 1969: 60 (Cape Peninsula, also off Walvis Bay, Namibia, exact locality and depth uncertain but depth less than 110 m); Karrer 1973: 196 (Namibia, south-west of Walvis Bay, 24°20′S, 13°55′E, 270–280 m); Cadenat and Blache 1981: 78 (Walvis Bay); Compagno 1984: 127 (Angola, Namibia and South Africa); Bass *et al.* 1986a: 59, Fig. 5.21 (between Cape Town and Walvis Bay, 270–280 m); Lloris 1986: 107, Figs 31–32 (northern Namibia, 17°30′S, 11°32′E, 117 m); Turon *et al.* 1986: 36, 66 (north-central Namibia from the Cunene River to off Walvis Bay, 3 stations from 17°46,0′S, 11°30,0′E to 22°50,5′S, 12°52,6′E, 183–651 m); Compagno *et al.* 1989: 20, ill. (northern Namibia to Cape Point, 60–660 m).

Oxynotus sp. — Bass *et al.* 1976: 8, Fig. 5 (summary of southern African records, possibly not *O. centrina*

(Linnaeus, 1758)); Allué *et al.* 1984: 124 (northern Namibia off Cunene River, 17°30,0'S, 11°32,0'E, 117 m).

Africana demersal trawl stations: none.

Distribution — This bizarre shark is a southern African endemic with a range from central Angola south to central Namibia, and exceptionally to off the Cape Peninsula, South Africa. Myagkov (in Gubanov *et al.* 1986), cites a range for the species from the Gulf of Guinea south-east to the southern extremity of Africa and apparently up to Moçambique, but he does not give definite records. Namibian records are from the Cunene River to south-west of Walvis Bay, just entering the survey area, from 117 to 660 m. Considering the large number of trawl stations that F.R.S. *Africana* made in the area at the depth range at which *O. schubnikovi* is known, this small demersal shark may well be very rare off southern Africa south of Walvis Bay and the single specimen from off Cape Point was quite probably a vagrant or a stray. Almost all of the confirmed records of this shark are from Angola and north-central Namibia, where Turon *et al.* (1986: 66) reported one bottom trawl station with 24 individuals from north-west of Walvis Bay.

Classification — *Oxynotus schubnikovi* is provisionally accepted as distinct from the closely similar rough shark *O. centrina* (Linnaeus, 1758) of the Eastern North Atlantic and Mediterranean, but these species need to be critically compared with adequate samples to determine if the morphometric criteria used to separate them are valid.

ORDER PRISTIOPHORIFORMES

FAMILY PRISTIOPHORIDAE — SAWSHARKS

Pliotrema warreni Regan, 1906 — sixgill sawshark

Pliotrema warreni — Regan 1906: 1, Pl. 1 (Natal coast at 73 m, False Bay, South Africa); Thompson 1914: 152 (False Bay, Natal); Gilchrist and Thompson 1916 (Natal and False Bay); Gilchrist 1922b: 50 (False Bay, common off Durban, Natal); Barnard 1925: 53, Pl. 3, Fig. 3 (False Bay to Natal, 55–92 m); Fowler 1925: 192 (Natal); Barnard 1947: 20, Pl. 3, Fig. 6 (False Bay to Natal); Smith 1949: 62, Pl. 3 (Cape to beyond Delagoa Bay, 37–366 m); Smith 1965: 62, Pl. 3 (Cape to beyond Delagoa Bay); Day *et al.* 1970: 89 (False Bay, Beira–False Bay, 50–100 m); Bass *et al.* 1975d: 20, Fig. 11, Pl. 8 (False Bay, to Natal and Moçambique, rare off Western Cape, northern Natal and Moçambique; 60–120 m off Eastern Cape; 110–430 m off Natal); Cadenat and Blache 1981: 114 (South Africa); Compagno 1984: 132, ill. (False Bay to central Natal and southern Moçambique); Bass and Heemstra 1986: 106, Fig. 20.1, Pl. 4 (False Bay to southern Moçambique, 60–430 m); Van der Elst and Vermeulen 1986: 35, ill. (Western Cape to Moçambique, 50–150 m); Compagno *et al.* 1989: 36, ill. (Cape Agulhas to southern Moçambique, Madagascar).

Poliotrema warreni — Seret 1987: 1 (off Tulear, Madagascar, 425–500 m).

?*Pristiophorus cirratus* — Thompson 1914: 153 (on Boulenger's False Bay record, = *Pliotrema warreni*?); Smith 1949: 61 (South Africa); Smith 1965: 61 (South Africa)

Africana demersal trawl stations (n = 1):

Cruise 046 — A4298, 35°07,4'S, 19°45,4'E, 135 m.

Distribution — The sixgill sawshark is a southern African endemic with a primarily East Coast distribution at moderate depths on the continental shelf and uppermost slope at 60–500 m. Its known range is from False Bay to southern Moçambique and Madagascar. It barely enters the area and was only trawled once by *Africana* on the outer shelf near Cape Agulhas during this survey (Fig. 7c). On the east coast between Cape Agulhas and Port Alfred it is regularly caught on *Africana* demersal cruises, and its distribution there will be detailed elsewhere (Compagno *et al.* in prep.).

ORDER LAMNIFORMES

FAMILY MITSUKURINIDAE — GOBLIN SHARKS

Mitsukurina owstoni Jordan, 1898 — goblin shark

Mitsukurina owstoni — Jordan 1898: 200, Pls 11–12 (Japan); Compagno 1984: 223, ill. (South Africa); Stevens and Paxton 1985: 37 (review of distribution, South Africa); Bass and Compagno 1986: 103, Fig. 17.1 (west of Cape Town, 550 m, off Transkei); Compagno *et al.* 1989: 40, ill. (west of Cape Town, off Transkei and Natal, 360–550 m).

Scapanorhynchus owstoni — Bass *et al.* 1975c: 18, Fig. 8, Pl. 7 (trawled west of Cape Town, 549 m); Piotrovskiy and Prut'ko 1980: 124 (off Transkei, "0–1 300 m zone", possibly in pelagic trawl well off bottom).

Africana demersal trawl stations: none.

Distribution — The goblin shark is a deep-benthic inhabitant of the continental slopes that occurs in most seas. It has a very patchy distribution in deep water in the Western North Atlantic (French Guinea and Surinam), Eastern North Atlantic from the Bay of Biscay to Madeira, both coasts of southern Africa, and the Western Pacific. It is apparently rare in most places, with the possible exception of Japan, from where most specimens have been recorded (Stevens and Paxton 1985). Only one specimen was collected in the area by a commercial trawler west of Cape Town, and only four off southern Africa including one examined by the present authors from off Natal. The species has not been collected in *Africana* stations nor was it recorded in previous surveys off the Western Cape or Namibia. According to Stevens and Paxton (op. cit.), most specimens have been collected between 270 and 960 m deep.

FAMILY ALOPIIDAE — THRESHER SHARKS

Alopias vulpinus (Bonnaterre, 1788) — thresher shark

Squalus vulpinus — Bonnaterre 1788: 9 (Mediterranean Sea).

Alopecias vulpes — Gilchrist 1902: 164 (South Africa).

Alopias vulpes — Thompson 1914: 147 (Cape seas, South Africa); Barnard 1925: 34 (Cape and Natal seas); Barnard 1947: 14, Pl. 2, Fig. 3 (South Africa).

Alopias vulpinus — Fowler 1941: 125 (South Africa); Bigelow and Schroeder 1948b: 167 (Cape of Good Hope, South Africa); Smith 1949: 47, Fig. 22 (wide-ranging, Eastern Cape); Smith 1965: 47, Fig. 22 (South Africa); Bass *et al.* 1975c: 35, Fig. 18, Pl. 11 (64 km south of Cape Point, Western Cape; Margate, Natal); Penrith 1978: 180 (Moçamedes, southern Angola); Compagno 1984: 232, ill. (Cape Province, South Africa); Bass 1986: 102, Fig. 16.3 (wide-ranging); Van der Elst and Vermeulen 1986: 15, ill. (wide-ranging off southern Africa); Compagno *et al.* 1989: 42, ill. (Namibia to Natal, surface to 366 m).

Alopias pelagicus — D'Aubrey 1964: 18, Pl. 5 (east coast of South Africa).

Africana demersal trawl stations (n = 1):

Cruise 079 — A9759, 32°36,6′S, 18°03,6′E, 120 m.

Distribution — The thresher shark is a littoral and epipelagic shark with a vast range in all temperate and tropical seas, but details of its distribution are limited in most regions. In the area it ranges from enclosed bays (Saldanha Bay) to the open ocean, and it is probably only a rare and accidental catch of bottom trawls, as with the single juvenile that was caught in one *Africana* demersal trawl haul off St Helena Bay (Fig. 7d). The thresher is not rare off the Western Cape and is sought by light-tackle boat anglers in Saldanha Bay. Threshers are mostly caught by longlines and drift-gillnets in commercial fisheries worldwide.

FAMILY LAMNIDAE — MACKEREL SHARKS

Isurus oxyrinchus Rafinesque, 1810 — shortfin mako

Isurus oxyrinchus — Rafinesque 1810: 12, Pl. 13, Fig. 1 (Sicily, Mediterranean Sea); Bigelow and Schroeder 1948b: 124 (South Africa); Smith 1957c: 94, Fig. 1 (South Africa, incl. *Isurus bideni*, Atlantic round the Cape to India); Smith 1958: 134, Fig. 2 (Algoa Bay); Smith 1965: 511, Fig. 28a (Algoa Bay); Garrick 1967: 674 (South Africa, *I. glaucus*, *I. bideni* and *I. tigris* synonyms); Bass *et al.* 1975c: 27, Figs 13, 14, Pl. 2 (South-Western Cape to Natal, Moçambique and northwards); Penrith 1978: 180 (Moçamedes, southern Angola); Cadenat and Blache 1981: 157 (South Africa); Compagno 1984: 243, ill. (southern Africa); Bass 1986: 99, Fig. 14.2, Pl. 1 (wide-ranging); Van der Elst and Vermeulen 1986: 15, ill. (wide-ranging off southern Africa); Compagno *et al.* 1989: 44, ill. (wide-ranging, surface to 152 m).

Isurus africanus — Smith 1958: 134 (Algoa Bay, Moçambique, Mauritius); Smith 1965: 565, Pl. 108 (Algoa Bay, Natal, Mauritius, Kenya).

Isurus bideni — Phillipps 1932: 227, Fig. 2 (South Africa); Fowler 1941: 104 (South Africa); Barnard 1948: 342 (South Africa, doubtful species).

Isurus glauca — Barnard 1925: 33 (Cape seas; not Pl. 1, Fig. 6, = *Lamna nasus*).

Isurus glaucus — Fowler 1941: 104 (Cape of Good Hope); Barnard 1947: 10, Pl. 2, Fig. 1 (South Africa); Bigelow and Schroeder 1948b: 129 (Cape of Good Hope, South Africa); Smith 1949: 50, Pl. 1 (wide-ranging); Smith 1957c: 94, Fig. 1 (Indo-Pacific includ-

ing South Africa); D'Aubrey 1964: 15, Pl. 3 (east coast of South Africa); Smith 1965: 50, Pl. 1 (South Africa).

Lamna glauca — Gilchrist 1902: 163 (Cape seas); Thompson 1914: 145 (South Africa).

Isurus tigris — Smith 1957c: 94, Fig. 1 (Atlantic, South Africa, India, Australasia).

Isurus tigris africanus — Smith 1957c: 96, Pl. 1 (Algoa Bay, South Africa).

Africana demersal trawl stations (n = 1):

Cruise 079 — A9799, 29°33,0′S, 16°15,0′E, 162 m.

Distribution — The shortfin mako is a swift, neritic and oceanic shark with a circumglobal range in all warm-temperate and tropical seas, and it probably ranges throughout the survey area along the outer continental shelf, although details are few. Makos were sometimes seen jumping by observers aboard *Africana*, and they appeared at least once off the stern nightlights while the ship was drifting in the area. However, they were not caught by demersal trawls except for the single individual south-south-west of the Orange River (Fig. 8a). This specimen could have been caught when the trawl was sinking or rising from the bottom.

ORDER CARCHARHINIFORMES

FAMILY SCYLIORHINIDAE — CAT SHARKS

Apristurus microps (Gilchrist, 1922) — smalleye catshark

Scylliorhinus microps — Gilchrist 1922b: 46, Pl. 7, Fig. 1 (R.V. *Pickle* #253, 33°45,5′S, 17°17,1′E, off Cape Town, 1 446 m, two specimens, both lost); Barnard 1925: 41 (off Table Bay).

Pentanchus microps — Fowler 1941: 61 (South Africa); Smith 1949: 54, Fig. 41 (west coast of South Africa); Smith 1965: 54, Fig. 41 (South Africa).

Apristurus microps — Bigelow and Schroeder 1948b: 221 (South Africa, in key); Bass *et al.* 1975a: 7 (South-Western Cape); Springer 1979: 23 (South Africa; nominal records from 26 to 33°S at 800–1 000 m off Namibia and South Africa from G. Golovan pers. comm. *in litt.*); Compagno 1984: 275, ill. (North Atlantic, South-Western Cape); Bass 1986: 88, Fig. 11.1 (off Table Bay, 1 450 m); Compagno 1988: 170, 172, 174 (Eastern North Atlantic, 1 200–2 200 m; Western Cape, 760–1 000 m); Compagno *et al.* 1989: 46, ill. (Orange River to Cape Agulhas, 700–1 016 m).

Africana demersal trawl stations (n = 19):

Cruise 039 — A3342, 764 m; A3358, 826 m.
Cruise 046 — A4310, 760 m; A4361, 850 m.
Cruise 050 — A5249, 800 m; A5280, 780 m.
Cruise 054 — A5867, 763 m.
Cruise 059 — A6892, 903 m; A6971, 1 000 m.
Cruise 060 — A6999, 923 m; A7011, 880 m; A7023, 700 m; A7027, 901 m; A7037, 903 m; A7038, 917 m.
Cruise 066 — A7550, 900 m; A7625, 855 m; A7655, 865 m.
Cruise 069 — A9827, 796 m.

Station latitude and depth range — 30°10,0′S, 14°33,1′E to 35°56,2′S, 19°22,0′E, 700–1 000 m.

Distribution — This species was until recently known from a single record taken off Cape Town in 1 446 m. Soviet research vessels may have captured this shark off Namibia and South Africa (see Springer 1979), but their records were not documented. The senior author, while visiting the Institut für Seefischerei (ISH) in Hamburg, examined two specimens from south-west of Cape Town (ISH 195/67, 33°49′S, 17°13′E, 1 000 m) that were classified as *A. microps*. Similar sharks from the Eastern and Western North Atlantic were tentatively considered as being conspecific to the South African *A. microps* (see Compagno 1984, 1988).

The present survey found this species to be the commonest of at least three *Apristurus* in the area, and *Africana* collected it in a series of stations on the deep slope of South Africa from south-west of Port Nolloth to south-west of Cape Agulhas on the western edge of the Agulhas Bank (Fig. 8b), sometimes in considerable numbers. Although other species of *Apristurus* were collected on deep-slope stations off Namibia, *A. microps* was only found off the west coast of South Africa.

Classification — Unfortunately, the description of *Apristurus microps* was very brief and the syntypes were lost, so that the assignment of the name *A. microps* to the specimens collected in the above stations is tentative. Similar and possibly conspecific catsharks occur in the North Atlantic and off Australia, and there is a possibility that *Apristurus profundorum* (Goode and Bean, 1896) from the Western North Atlantic is a senior synonym of *A. microps*. Full descriptions of this and other southern African *Apristurus* collected during the survey will be presented elsewhere.

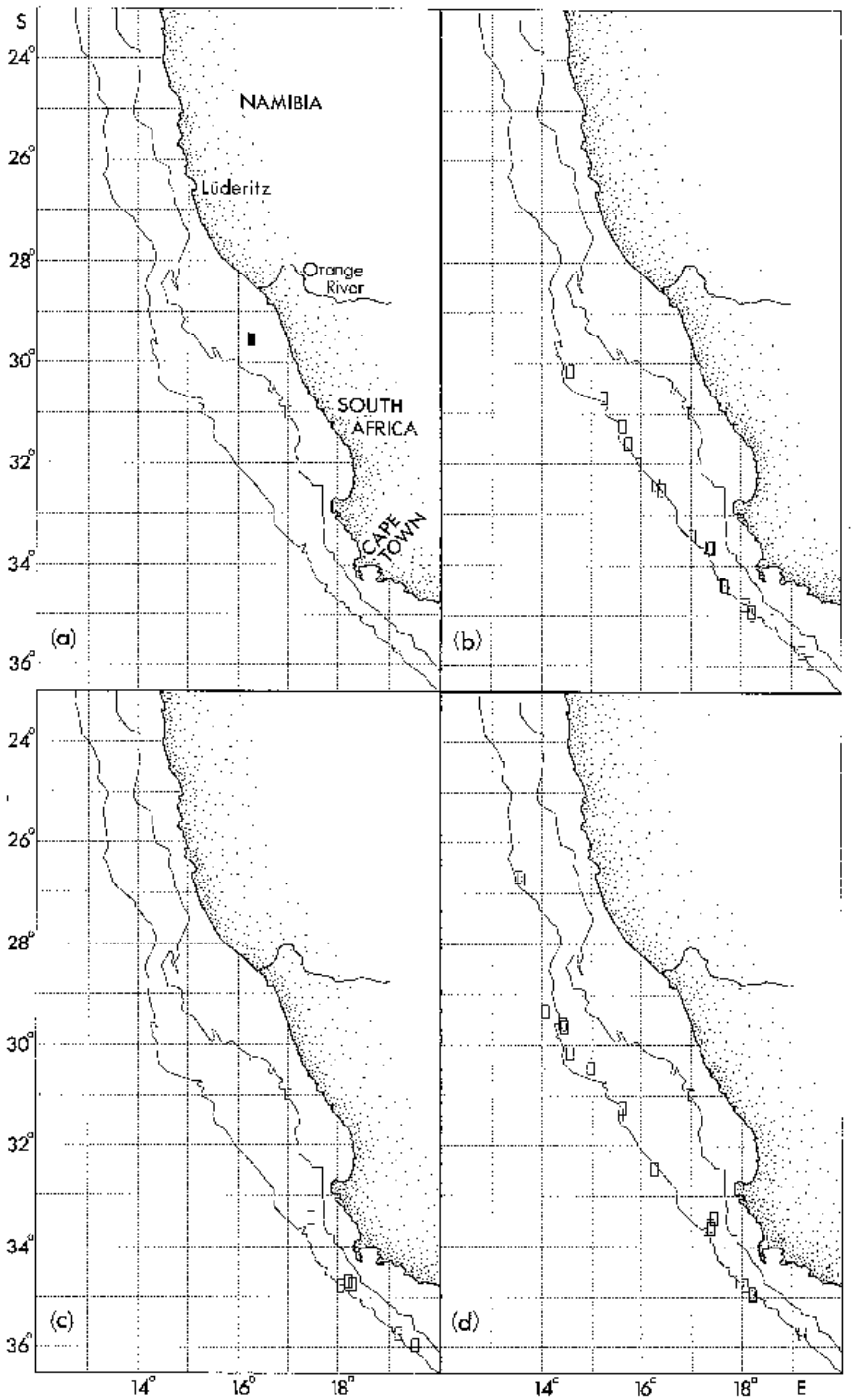

Fig. 8: *Africana* demersal trawl stations at which (a) shortfin mako (*Isurus oxyrinchus*, *n* = 1), (b) smalleye catshark (*Apristurus microps*, *n* = 19) (c) Saldanha catshark (*Apristurus saldanha*, *n* = 7), (d) grey and black wonder catsharks (*Apristurus* sp., *n* = 20) were taken, 1986–1990

***Apristurus saldanha* (Barnard, 1925) — Saldanha catshark**

Scylliorhinus saldanha — Barnard 1925: 45 (off Saldanha Bay, 915 m).

?*Scyliorhinus* (*Apristurus*) *saldanha* — Norman 1935: 36 (South Africa, west of Cape Town, 34°08′S, 17°33′E, 402–?548 m, possibly not this species).

Apristurus saldanha — Bigelow and Schroeder 1948b: 221 (South Africa, in key); Bass *et al.* 1975a: 8, Figs 5?, 20a (South-Western Cape); Springer 1979: 29 (Saldanha Bay, South Africa); Compagno 1984: 282, ill.? (south-western Cape Province, 402–1 000 m); Bass 1986: 89, Fig. 11.2? (South-Western Cape); Compagno 1988: 169, 172, 175 (Western Cape, 453–517 m); Compagno *et al.* 1989: 46, ill. (Cape Columbine to south of False Bay, 453–717 m).

Pentanchus saldanha — Fowler 1941: 59 (South Africa).

Pentanchus microps — Smith 1949: 54 (in part, *Scylliorhinus saldanha* in synonymy); Smith 1965: 54 (in part).

Africana demersal trawl stations ($n = 7$):

Cruise 033 — A2771, 517 m.
Cruise 039 — A3345, 453 m.
Cruise 054 — A5867, 763 m.
Cruise 059 — A6854, 520 m.
Cruise 060 — A6989, 680 m; A7026, 717 m; A7036, 710 m.

Station latitude and depth range — 33°26,2′S, 17°27,5′E to 35°58,0′S, 19°32,0′E, 453–763 m.

Distribution — Previous records of this catshark were from off Saldanha Bay and west of Cape Town. The present survey collected large adult *A. saldanha* on the upper slope from west of Saldanha Bay to south-west of Cape Agulhas (Fig. 8c), usually as single specimens per station. It has also been collected by *Africana* east of Cape Agulhas (Compagno *et al.* in prep.).

Classification — The type of *A. saldanha*, the largest (at 810 mm *TL*) example of its genus recorded at the time, was described briefly by Barnard (1925) without illustration; the type was subsequently lost. Norman (1935) described three small *Apristurus* from off Cape Town that were tentatively ascribed to *A. saldanha* and deposited in the British Museum (Natural History). Bass *et al.* (1975a) and the senior author examined these specimens and noted that there were problems in their identification. More recently, the present survey collected giant grey-brown *Apristurus* adults up to 880 mm *TL* off the Western Cape that fit Barnard's original description in most particulars, and which were classified as *A. saldanha* (Compagno 1988, Compagno *et al.* 1989). These will be described in detail elsewhere. Additional records of juveniles of this species may be included as "grey wonder" catsharks (see *Apristurus* sp. below) and may extend the range of this species to Namibia.

***Apristurus* spp. — "grey wonder" and "black wonder" catsharks**

?*Apristurus* sp. — Karrer 1973: 195 (Namibia south-west of Walvis Bay, 24°22′S, 13°17′E, 608–570 m);

?*Apristurus nasutus* — Golovan 1978: 198 (South Africa, 31°45′S, 350–1 100 m).

?*Apristurus* sp. cf. *nasutus* — Lloris 1986: 132, Fig. 46 (Namibia, near Angolan border to west of Lüderitz, 17°33′S, 11°31′E, 622 m; 17°42′S, 11°20′E, 430–520 m; 18°16′S, 11°35′E, 183–190 m; 26°06′S, 13°39′E, 589–593 m); Turon *et al.* 1986: 69 (Namibia, 3 stations cited by Lloris 1986).

?*Apristurus saldanha*: Allué *et al.* 1984: 128 (northern Namibia south-west of the Cunene River, 17°42,0′S, 11°20,0′E, 430–520 m).

Africana demersal trawl stations ($n = 20$):

Cruise 054 — A5867, 763 m; A5896, 719 m.
Cruise 059 — A6951, 864 m; A6956, 849 m; A6964, 817 m.
Cruise 060 — A6987, 710 m; A6989, 680 m; A7002, 668 m; A7026, 717 m; A7027, 901 m; A7037, 903 m; A7039, 719 m.
Cruise 066 — A7625, 855 m.
Cruise 069 — A8413, 900 m; A8414, 1 005 m.
Cruise 075 — A9030, 900 m; A9142, 730 m; A9151, 825 m.
Cruise 079 — A9812, 861 m; A9827, 796 m.

Station latitude and depth range — 26°40,6′S, 13°31,8′E to 35°44,4′S, 19°12,2′E, 668–1 005 m.

Distribution — A number of authors (Karrer 1973, Golovan 1978, Allué *et al.* 1984, Lloris 1986, Turon *et al.* 1986) have recorded *Apristurus* catsharks of uncertain identity from Namibian waters, and they classified them as *A.* sp., *A. saldanha* or *A. nasutus* de Buen, 1959, an Eastern Pacific species. This survey recorded a number of *Apristurus* of this sort from *Africana* deep-slope stations west of Lüderitz, Namibia, off the Orange River, and along the South African slope to south-west of Cape Agulhas, South Africa (Fig. 8d). The sample may consist of two species, including juvenile *A. saldanha*.

Classification — The present records include a heterogeneous assortment of small *Apristurus* that include mostly "grey wonder" catsharks, which may be juvenile *A. saldanha*, and a few "black wonder" catsharks, adult males of a similar but smaller and much darker *Apristurus* than *A. saldanha*. The status of these specimens is currently under study. Adult male "black wonder" catsharks key to *A. japonicus* Nakaya, 1976 from Japan in the species keys of Springer (1979) and Compagno (1984), but are probably not this species. They also resemble *A. maderensis* Cadenat and Maul, 1966 from Madeira.

Galeus polli Cadenat, 1959 — African sawtail catshark

Galeus polli — Cadenat 1959: 396, Figs 1–4, 7–17 (off Senegal); Springer 1966: 608 (West Africa); Krefft 1968a: 40 (Spanish Guinea, range from Mauritania to Angola); Karrer 1973: 194 (north-central Namibia from west of Palgrave Point to west of Lüderitz, 20°16′S, 12°16′E, 320 m; 22°40′S, 13°08′E, 270–275 m; 24°47′S, 13°46′E, 280–275 m; 26°24′S, 13°54′E, 370–380 m); Springer 1979: 65 (Spanish Morocco to Angola); Cadenat and Blache 1981: 171 (Senegal to Angola); Lleonart and Rucabado 1984: 43 (north-central Namibia north-west to west of Walvis Bay, 12 stations from 20°31,7′S, 12°02,0′E to 23°02,7′S, 13°18,8′E, 540–600 m); Allué *et al.* 1984: 129 (north-central Namibia from the Cunene River to off Walvis Bay, 33 stations from 17°37,0′S, 11°23,0′E to 22°49,0′S, 13°25,0′E, 264–520 m); Compagno 1984: 316, ill. (southern Morocco to Namibia, 200–720 m); Bass 1986: 90, Fig. 11.4 (Spanish Morocco to northern Namibia); Lloris 1986: 134, Figs 47–48a (Namibia north-west of Walvis Bay, 22°18′S, 13°07′E, 240 m); Turon *et al.* 1986: 70, 177, 234, 298 (Namibia from the Cunene River to just north of the Orange River mouth, 130 stations from 17°32,9′S, 11°21,0′E to 28°57,1′S, 15°13,0′E, 159–651 m); Compagno 1988: 139, 141–142 (southern Morocco to Namibia); Compagno *et al.* 1989: 52, ill. (southern Morocco to north-central Namibia, 200–720 m).

Pristiurus polli — Maurin and Bonnet 1970: 131, Fig. 4 (Mauritania and Spanish Sahara to Senegal, Rio de Oro and Angola, 180–720 m).

Galeus melastomus — Poll 1951: 22, Figs 6–7, Pl. 12, Fig. 1 (Angolan records, also Namibia off Rocky Point, 19°52′S, 12°20′E, 220 m).

?*Galeus* sp. cf. *piperatus* — Lloris 1986: 136, Fig. 49 (Namibia west of Lüderitz, 26°35′S, 13°58′E, 400–404 m).

Africana demersal trawl stations ($n = 26$):

Cruise 039 —	A3439, 308 m;	A3442, 420 m;	A3443, 352 m;
	A3446, 353 m;	A3447, 431 m;	A3448, 353 m;
	A3449, 325 m;	A3450, 293 m;	A3452, 263 m.
Cruise 059 —	A6948, 397 m;	A6949, 425 m;	A6950, 475 m.
Cruise 069 —	A8369, 342 m;	A8370, 407 m;	A8372, 295 m;
	A8373, 303 m;	A8378, 350 m;	A8379, 490 m;
	A8382, 322 m;	A8391, 462 m;	A8392, 434 m;
	A8407, 263 m;	A8408, 356 m;	A8409, 435 m;
	A8410, 370 m;	A8417, 409 m.	

Station latitude and depth range — 23°11,0′S, 13°17,1′E to 27°31,6′S, 14°31,3′E, 263–490 m.

Distribution — This endemic Eastern Atlantic catshark occurs on the upper slope and outer shelf from 159 to 702 m, with a range from Morocco to south-central Namibia. In the study area, it seems to drop out at its southern limits between Lüderitz to north-west of the Orange River, and is replaced at similar depths by *Holohalaelurus regani* and *Scyliorhinus capensis*. The present survey found *G. polli* to be common to very abundant from Walvis Bay to south-west of Lüderitz (Fig. 9a), where it was found on a few stations together with *H. regani* or *S. capensis*. It did not occur in *Africana* deep-slope stations deeper than 600 m in Namibian waters or in any stations off South Africa.

Classification — Coloration of this species may be variable, and large adults that lack blotches, but which otherwise seem the same as specimens with colour patterns, have been commonly collected. Lloris (1986) noted that unicolorate *Galeus* from Namibia resemble *G. piperatus* Springer and Wagner, 1966 (an endemic Gulf of California species).

Halaelurus natalensis (Regan, 1904) — tiger catshark

Scyllium natalense — Regan 1904: 128 (Natal, South Africa).

Scylliorhinus natalensis — Gilchrist and Thompson 1911: 55 (Natal, in Durban Museum; description suggests *H. natalensis* rather than *H. lineatus*); Thompson 1914: 138 (Natal and Cape); Gilchrist and Thompson 1916: 283 (Cape coast and Natal); Gilchrist 1921: 56 (Natal); Gilchrist 1922b: 44 (off Durban, Natal, 44–355 m, in part *H. lineatus*?); Von Bonde 1923: 4 (off Durban, Natal, 51 m, in part *H. lineatus*?); Barnard 1925: 43 (Algoa Bay to Natal); Von Bonde 1934: 15 (South Africa, Algoa Bay to Natal); Barnard 1947: 16 (South Africa).

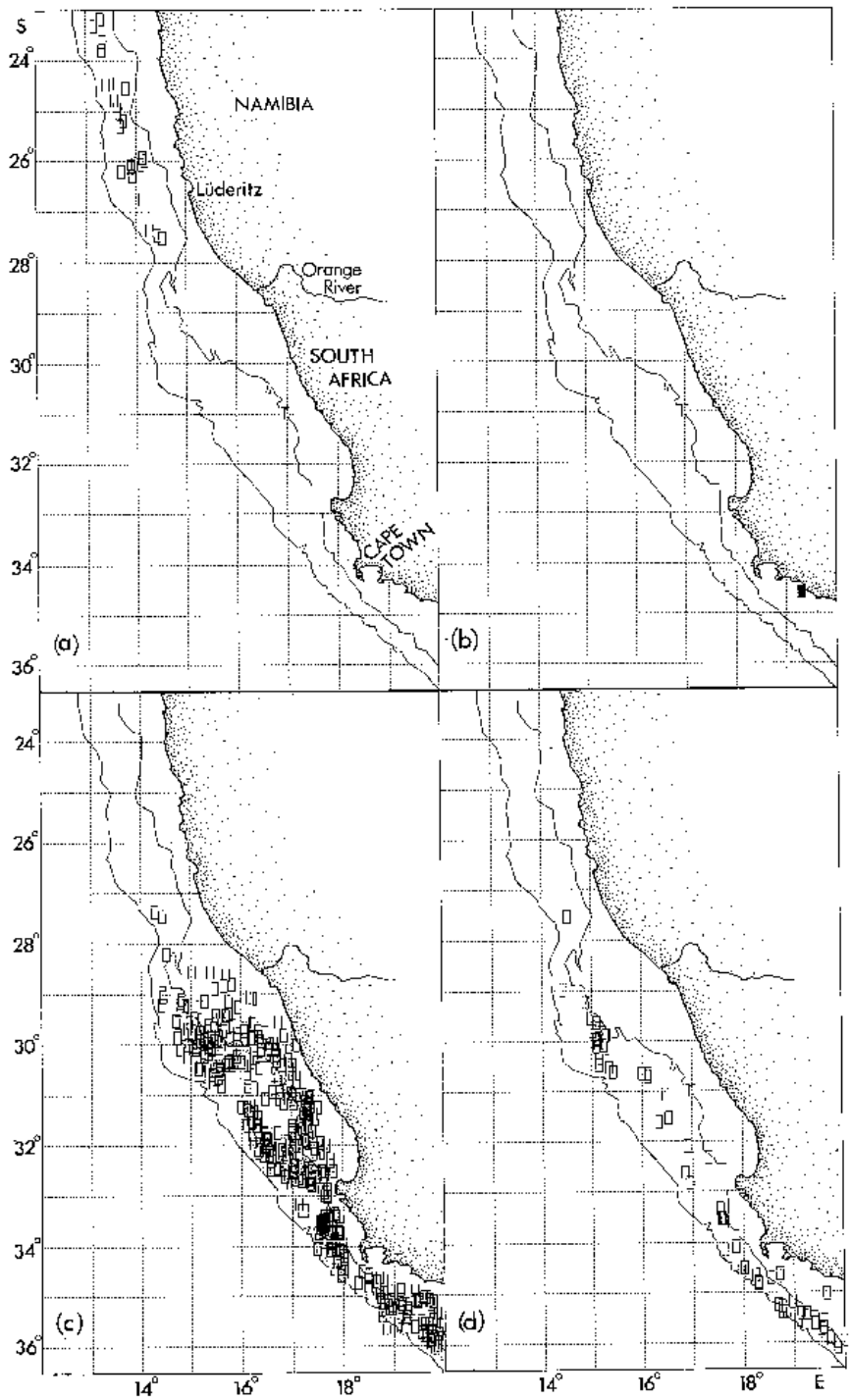

Fig. 9: *Africana* demersal trawl stations at which (a) African sawtail catshark (*Galeus polli*, $n = 26$), (b) tiger catshark (*Halaelurus natalensis*, $n = 1$), (c) Izak catshark (*Holohalaelurus regani*, $n = 524$), (d) yellowspotted catshark (*Scyliorhinus capensis*, $n = 70$) were taken, 1986–1990

Scyliorhinus natalensis — Regan 1908a: 241 (Bird Island, Algoa Bay); Regan 1908b: 461 (Natal and Cape Colony); ?Fowler 1935: 405 (Natal, coloration suggests *H. lineatus*); Fowler 1936a: 361 (off Durban).

Halaelurus natalensis — Garman 1913: 84 (Natal); Fowler 1941: 45 (Algoa Bay to Natal); Smith 1949, 54, Pl. 2 (South Africa, Knysna to Natal, shallow water to 146 m); Smith 1950: 886 (in part, South Africa, records to Beira, Moçambique, probably based on *H. lineatus*?); Smith 1965, 54, Pl. 2 (South Africa); Smith and Smith 1966: 26, ill. (Tsitsikamma Park, Eastern Cape, South Africa); Springer and D'Aubrey 1972: 3 (south-eastern Africa); Bass *et al.* 1975a: 14, Figs 9, 20f (eastern and southern Cape coast, Natal, 25–125 m); Springer 1979: 83, Figs 48–50 (Saldanha Bay, Algoa Bay, Natal); Compagno 1984: 330, ill. (Cape and Natal coasts of South Africa, Moçambique, inshore to 172 m); Bass 1986: 91, Fig. 11.7, Pl. 3 (Saldanha Bay to Algoa Bay, inshore to 125 m); Van der Elst and Vermeulen 1986: 19, ill. (Western Cape to Natal, inshore to 125 m); Compagno 1988: 147–148 (Western Cape to Moçambique, including Eastern Cape and Natal material); Van der Elst 1988: 70, ill. (Cape Columbine to Algoa Bay); Compagno *et al.* 1989: 52, ill. (possibly Saldanha, Cape Agulhas to East London, inshore to 172 m).

Africana demersal trawl stations ($n = 1$):

Cruise 075: A9025. 34°35,0′S, 19°17,3′E, 38 m.

Distribution — The tiger catshark is a South African endemic that occurs primarily on the East Coast from close inshore down to moderate depths (125 m). It has a range from Saldanha Bay to at least East London and probably to Natal, where it has been confused with the similar inshore *H. lineatus* Bass, D'Aubrey and Kistnasamy, 1975 of East London to southern Moçambique. Its range on the west coast of South Africa is poorly known beyond records from Saldanha Bay. It did not show up in an extensive series of *Africana* West Coast stations from Saldanha Bay to the Orange River between 50 and 150 m, but it could be localized in shallow bays and close inshore north of Saldanha Bay. *Africana* collected it once off Gans Bay (Fig. 9b). It is caught regularly on *Africana* East Coast demersal stations shallower than 100 m between Cape Agulhas and Port Alfred (Compagno *et al.* in prep.).

Holohalaelurus punctatus (Gilchrist, 1914) — African spotted catshark

Scylliorhinus punctatus — Gilchrist and Thompson 1914: 129, Fig. (off Cape Point, Western Cape); Thompson 1914: 138 (ref.); Gilchrist 1922b: 46 (off Durban, Natal, 293–320 m); Barnard 1925: 43 (Cape Point).

Halaelurus punctatus — Fowler 1934: 235 (in subgenus *Holohalaelurus*); Fowler 1936a: 361, Fig. 1 (off Durban); Fowler 1941: 42 (South Africa, Natal).

Holohalaelurus punctatus — Smith 1949: 55, Pl. 2 (Cape to Natal, South Africa, 220–458 m); Smith 1965: 55, Pl. 2 (South Africa); Bass *et al.* 1975a: 23, Figs 14, 20j (mostly Natal and southern Moçambique, possibly Zanzibar, caught as a stray off Cape Point; 220–420 m off Natal and southern Moçambique); Springer 1979: 92, Fig. 56 (Natal, Tanzania); Compagno 1984: 337, ill. (South Africa, Moçambique, possibly Tanzania); Bass 1986: 93, Fig. 11.11, Pl. 3 (Natal and southern Moçambique, 220–440 m; Cape Point); Seret 1987: 1 (off Tulear, Madagascar, 425–500 m); Compagno 1988: 156–157 (Natal and southern Moçambique, Cape Point; Tanzania and Kenya specimens possibly an undescribed species); Compagno *et al.* 1989: 54, ill. (Cape Point, Natal and southern Moçambique, 220–420 m).

Africana demersal trawl stations: none.

Distribution — Although first recorded from Cape Point, the African spotted catshark was subsequently reported as being common off Natal and southern Moçambique, but it has not otherwise been collected off the Western or Eastern Cape. In this survey, *Africana* provided intensive demersal trawl coverage at the appropriate depth range (220–420 m) and in the general area where the type of *H. punctatus* was collected. However, the survey did not turn up a single *H. punctatus* among thousands of *H. regani*. The original description by Gilchrist and Thompson (1914) is clearly not based on a specimen of *H. regani* but on the same species which was termed *H. punctatus* off Natal. However, the survey data suggest that the spotted catshark is not normally resident off the Western Cape, and that the first, Cape Point, record of this species may have been based either on a rare East Coast vagrant or on a Natal specimen with erroneous data. Similar catsharks occur off East Africa from Tanzania and Kenya, but these may not be conspecific with *H. punctatus*.

Holohalaelurus regani (Gilchrist, 1922) — Izak catshark

Scylliorhinus regani — Gilchrist 1922b: 45 (R.V. *Pickle* #234, 33°52,09′S, 17°59,05′E, 173 m; #235, 33°49,20′S, 17°51,45′E, 204 m; #241, 33°46,05′S, 17°51,15′E, 240 m; #243, 34°03,50′S, 18°01,50′E, 201 m; west of Cape Town); Barnard 1925: 42 (off

Cape Point and East London); Von Bonde 1934: 15 (Cape Point, East London).

Scyliorhinus (Halaelurus) regani — Norman 1935: 36, Fig. 13 (South Africa, west of Cape Town, 34°00′S, 17°58′E, 210–173 m).

Halaelurus regani — Fowler 1934: 235 (referred to subgenus *Holohalaelurus*); Fowler 1941: 42 (South Africa, Cape Point and East London).

Holohalaelurus regani: Smith 1949: 55, Fig. 43, Pl. 2 (Port Nolloth to Natal, South Africa, 110–458 m); Smith 1965: 55, Fig. 43, Pl. 2 (South Africa); Bass *et al.* 1975a: 25 (South-Western Cape, East London, Natal, and possibly to Zanzibar and Somalia; 160–460 m in Cape waters; 200–420 m off Natal; 240–740 m off southern Moçambique, and 238–658 m off Zanzibar); Springer 1979: 93, Figs 57–58 (Dassen Island, Cape of Good Hope, Moçambique); Compagno 1984: 338, ill. (South Africa, Moçambique, Tanzania, possibly Somalia, 160–740 m); Bass 1986: 93, Fig. 11.12, Pl. 3 (South-Western Cape through Natal, Moçambique, and Zanzibar, 160–740 m); Lloris 1986: 138, Fig. 50 (southern Namibia between Lüderitz and Orange River mouth, 27°34′S, 14°30′E, 415–420 m; 28°10′S, 14°31′E, 434–439 m); Turon *et al.* 1986: 70, 177, 234, 298 (southern Namibia and South Africa from south-west of Lüderitz to south-west of the Orange River mouth, 55 stations from 27°01,9′S, 14°35,2′E to 29°46,6′S, 14°37,0′E, 157–494 m); Compagno 1988: 156–157 (Western Cape, this or related species to Natal, Moçambique, Tanzania and possibly Somalia); Compagno *et al.* 1989: 54, ill. (southern Namibia to Natal and southern Moçambique, 160–740 m).

Africana demersal trawl stations ($n = 524$):

Cruise 028 — A2217, 267 m; A2218, 220 m; A2226, 174 m; A2234, 204 m; A2247, 234 m; A2254, 274 m; A2255, 254 m; A2264, 364 m; A2266, 294 m; A2268, 261 m; A2273, 491 m; A2274, 393 m; A2276, 424 m; A2280, 232 m; A2305, 513 m; A2318, 388 m; A2319, 438 m; A2325, 186 m; A2332, 178 m; A2335, 194 m; A2336, 204 m; A2341, 151 m; A2342, 98 m; A2362, 176 m; A2363, 200 m; A2367, 497 m; A2371, 250 m; A2372, 370 m; A2373, 284 m; A2374, 307 m; A2379, 375 m; A2380, 344 m; A2381, 363 m.

Cruise 033 — A2745, 198 m; A2746, 182 m; A2747, 202 m; A2748, 236 m; A2752, 238 m; A2753, 308 m; A2754, 302 m; A2755, 302 m; A2759, 235 m; A2760, 186 m; A2761, 165 m; A2763, 161 m; A2764, 160 m; A2765, 163 m; A2766, 170 m; A2767, 213 m; A2768, 175 m; A2769, 201 m; A2770, 200 m; A2776, 194 m; A2777, 195 m; A2779, 445 m; A2781, 401 m; A2782, 353 m; A2783, 301 m; A2784, 291 m; A2785, 442 m; A2786, 364 m; A2787, 342 m; A2788, 260 m; A2789, 277 m; A2800, 134 m; A2802, 154 m; A2815, 148 m; A2816, 170 m; A2817, 161 m; A2824, 169 m; A2825, 178 m; A2839, 231 m; A2840, 215 m; A2841, 207 m; A2843, 202 m.

Cruise 039 — A3324, 239 m; A3325, 225 m; A3327, 178 m; A3328, 171 m; A3329, 157 m; A3330, 139 m; A3331, 249 m; A3332, 189 m; A3336, 169 m; A3337, 174 m; A3338, 200 m; A3339, 200 m; A3340, 230 m; A3343, 172 m; A3344, 209 m; A3345, 453 m; A3347, 333 m; A3348, 456 m; A3349, 203 m; A3350, 328 m; A3351, 430 m; A3352, 245 m; A3355, 212 m; A3357, 515 m; A3359, 359 m; A3360, 379 m; A3362, 398 m; A3363, 338 m; A3366, 247 m; A3367, 272 m; A3368, 212 m; A3369, 233 m; A3370, 235 m; A3371, 238 m; A3372, 231 m; A3373, 214 m; A3374, 241 m; A3380, 159 m; A3381, 213 m; A3382, 244 m; A3383, 271 m; A3384, 181 m; A3385, 165 m; A3386, 240 m; A3387, 281 m; A3388, 308 m; A3389, 345 m; A3390, 362 m; A3395, 299 m; A3397, 443 m; A3398, 455 m; A3399, 415 m; A3400, 312 m; A3401, 294 m; A3402, 262 m; A3403, 236 m; A3404, 208 m; A3405, 224 m; A3408, 189 m; A3409, 180 m; A3410, 158 m; A3412, 165 m; A3413, 179 m; A3425, 175 m; A3426, 182 m; A3427, 199 m; A3428, 255 m; A3429, 365 m; A3430, 217 m; A3465, 458 m; A3468, 411 m; A3469, 440 m.

Cruise 046 — A4287, 213 m; A4288, 190 m; A4289, 170 m; A4290, 170 m; A4291, 217 m; A4292, 235 m; A4293, 175 m; A4294, 160 m; A4295, 230 m; A4296, 165 m; A4297, 180 m; A4298, 135 m; A4299, 145 m; A4301, 151 m; A4302, 175 m; A4303, 200 m; A4304, 240 m; A4305, 490 m; A4308, 300 m; A4309, 300 m; A4312, 280 m; A4315, 357 m; A4319, 230 m; A4320, 232 m; A4321, 230 m; A4322, 230 m; A4323, 225 m; A4324, 230 m; A4325, 230 m; A4326, 300 m; A4327, 285 m; A4328, 300 m; A4329, 335 m; A4330, 235 m; A4335, 270 m; A4336, 260 m; A4350, 185 m; A4351, 215 m; A4352, 216 m; A4358, 186 m; A4360, 495 m; A4363, 432 m; A4364, 440 m; A4367, 385 m; A4368, 480 m; A4369, 330 m; A4370, 295 m; A4371, 368 m; A4372, 360 m; A4380, 180 m; A4381, 200 m; A4382, 233 m; A4383, 372 m; A4384, 374 m; A4385, 335 m; A4386, 380 m; A4387, 469 m; A4388, 160 m.

Cruise 050 — A5227, 173 m; A5228, 230 m; A5229, 450 m; A5230, 220 m; A5231, 169 m; A5232, 153 m; A5232, 133 m; A5233, 140 m; A5234, 137 m; A5235, 186 m; A5236, 167 m; A5237, 155 m; A5239, 252 m; A5240, 173 m; A5241, 161 m; A5242, 157 m; A5243, 186 m; A5245, 289 m; A5248, 457 m; A5250, 370 m; A5252, 424 m;

A5253, 450 m; A5256, 296 m; A5257, 277 m;
A5258, 236 m; A5259, 264 m; A5260, 200 m;
A5261, 166 m; A5262, 226 m; A5265, 240 m;
A5266, 271 m; A5269, 243 m; A5270, 223 m;
A5271, 241 m; A5272, 237 m; A5274, 252 m;
A5277, 240 m; A5281, 261 m; A5282, 175 m;
A5283, 175 m; A5284, 214 m; A5291, 152 m;
A5298, 170 m; A5299, 173 m; A5301, 420 m;
A5302, 368 m; A5303, 270 m; A5304, 270 m;
A5305, 266 m; A5306, 509 m; A5307, 454 m;
A5308, 377 m; A5309, 215 m; A5310, 216 m;
A5312, 178 m; A5313, 178 m; A5314, 168 m;
A5318, 172 m; A5320, 179 m; A5321, 200 m;
A5322, 209 m; A5323, 204 m; A5324, 183 m;
A5325, 184 m; A5326, 204 m; A5327, 188 m;
A5336, 217 m; A5337, 199 m; A5338, 160 m;
A5339, 190 m.

Cruise 054 — A5851, 181 m; A5852, 305 m; A5853, 262 m;
A5854, 170 m; A5855, 200 m; A5856, 222 m;
A5857, 190 m; A5858, 117 m; A5859, 151 m;
A5863, 174 m; A5864, 205 m; A5865, 230 m;
A5866, 224 m; A5868, 452 m; A5869, 326 m;
A5870, 410 m; A5871, 144 m; A5872, 173 m;
A5873, 285 m; A5874, 240 m; A5875, 274 m;
A5876, 245 m; A5877, 257 m; A5878, 257 m;
A5879, 270 m; A5880, 234 m; A5885, 390 m;
A5888, 247 m; A5889, 275 m; A5890, 270 m;
A5891, 368 m; A5899, 460 m; A5901, 181 m;
A5902, 171 m; A5909, 160 m; A5915, 186 m;
A5916, 183 m; A5917, 165 m; A5923, 175 m;
A5936, 396 m; A5937, 192 m; A5938, 344 m;
A5939, 400 m; A5940, 282 m; A5941, 235 m;
A5944, 270 m; A5947, 321 m; A5948, 300 m;
A5949, 275 m; A5950, 222 m; A5951, 270 m;
A5952, 230 m.

Cruise 059 — A6835, 194 m; A6837, 171 m; A6838, 206 m;
A6839, 203 m; A6840, 175 m; A6841, 161 m;
A6844, 158 m; A6845, 170 m; A6846, 176 m;
A6847, 230 m; A6848, 228 m; A6851, 174 m;
A6853, 251 m; A6855, 237 m; A6861, 196 m;
A6862, 373 m; A6864, 217 m; A6868, 172 m;
A6870, 246 m; A6879, 265 m; A6880, 168 m;
A6881, 159 m; A6882, 296 m; A6883, 266 m;
A6887, 289 m; A6890, 366 m; A6894, 276 m;
A6895, 292 m; A6896, 356 m; A6897, 491 m;
A6901, 199 m; A6902, 164 m; A6903, 142 m;
A6904, 137 m; A6905, 169 m; A6911, 213 m;
A6912, 184 m; A6913, 146 m; A6920, 191 m;
A6933, 191 m; A6934, 186 m; A6935, 185 m;
A6936, 175 m; A6937, 176 m; A6938, 174 m;
A6941, 168 m; A6942, 156 m; A6943, 177 m;
A6944, 170 m; A6949, 425 m; A6950, 475 m;
A6953, 206 m; A6954, 224 m; A6955, 395 m;
A6958, 238 m; A6959, 223 m; A6961, 209 m;
A6965, 321 m; A6967, 286 m; A6968, 245 m;
A6969, 257 m; A6970, 323 m; A6973, 216 m;
A6974, 189 m; A6977, 243 m; A6978, 250 m;
A6981, 391 m; A6982, 458 m.

Cruise 060 — A6985, 247 m; A7000, 254 m; A7021, 240 m;
A7044, 159 m; A7045, 156 m.

Cruise 069 — A8298, 160 m; A8310, 240 m; A8312, 250 m;
A8314, 258 m; A8320, 181 m; A8321, 208 m;
A8325, 280 m; A8326, 265 m; A8327, 261 m;
A8328, 288 m; A8329, 345 m; A8335, 166 m;
A8338, 146 m; A8339, 140 m; A8341, 174 m;
A8342, 200 m; A8343, 191 m; A8346, 327 m;
A8348, 425 m; A8350, 457 m; A8359, 174 m.

Cruise 075 — A8993, 181 m; A8995, 174 m; A8997, 365 m;
A8998, 235 m; A8999, 235 m; A9000, 242 m;
A9001, 251 m; A9002, 238 m; A9003, 231 m;
A9004, 248 m; A9005, 245 m; A9007, 250 m;
A9009, 251 m; A9010, 336 m; A9011, 300 m;
A9013, 238 m; A9014, 170 m; A9015, 184 m;
A9016, 174 m; A9017, 152 m; A9022, 186 m;
A9026, 245 m; A9027, 438 m; A9028, 400 m;
A9031, 300 m; A9033, 284 m; A9034, 187 m;
A9039, 235 m; A9041, 269 m; A9043, 263 m;
A9051, 191 m; A9052, 145 m; A9066, 190 m;
A9067, 183 m; A9068, 218 m; A9070, 200 m;
A9071, 170 m; A9081, 155 m; A9082, 173 m;
A9083, 190 m; A9084, 185 m; A9085, 152 m;
A9098, 179 m; A9117, 150 m; A9118, 167 m;
A9122, 185 m; A9123, 177 m; A9124, 188 m;
A9125, 181 m; A9126, 211 m; A9129, 345 m;
A9130, 264 m; A9131, 227 m; A9132, 220 m;
A9133, 248 m; A9138, 465 m; A9139, 481 m;
A9141, 470 m; A9145, 253 m; A9146, 280 m;
A9148, 340 m; A9149, 305 m; A9150, 351 m;
A9153, 440 m; A9154, 372 m.

Cruise 079 — A9766, 148 m; A9767, 203 m; A9768, 219 m;
A9768, 219 m; A9771, 152 m; A9793, 143 m;
A9794, 166 m; A9795, 182 m; A9796, 174 m;
A9797, 162 m; A9798, 166 m; A9799, 162 m;
A9800, 213 m; A9801, 194 m; A9802, 195 m;
A9803, 189 m; A9804, 191 m; A9809, 178 m;
A9810, 265 m; A9811, 356 m; A9813, 398 m;
A9815, 240 m; A9816, 315 m; A9817, 444 m;
A9818, 250 m; A9819, 224 m; A9820, 218 m;
A9821, 227 m; A9822, 207 m; A9823, 454 m;
A9824, 288 m; A9825, 442 m; A9828, 233 m;
A9829, 238 m; A9830, 234 m; A9831, 229 m;
A9832, 242 m; A9833, 173 m; A9835, 224 m.

Station latitude and depth range — 27°22,2′S, 14°16,2′E to 36°06,8′S, 19°50,7′E, 98–515 m.

Distribution — The Izak catshark or "hallelujah shark" was by far the most frequently encountered cartilaginous fish in the present survey, although it seldom occurred in large numbers or formed massive catches, as with some squaloid sharks and skates. It is a southern and East African endemic with a range from southern Namibia to Natal, Moçambique, Tanzania, Kenya, and possibly Somalia, and may repre-

sent a species complex rather than a single species. The types of *H. regani* are from west of Cape Town. Off the west coast of southern Africa, *H. regani* is confined to the survey area, and it occurred in *Africana* stations from south-west of Lüderitz along the continental shelf and upper slope to south of Cape Agulhas on the Agulhas Bank (Fig. 9c). The current survey and Spanish records (Lloris 1986, Turon *et al.* 1986) establishes its approximate north-western extent as south of Lüderitz and north of the Orange River, where it barely overlaps with the smaller *Galeus polli*. A latitude-depth summer-winter plot (see Fig. 18a) suggests a fairly even distribution off the west coast of South Africa between 100 and 500 m, considering the unevenness of sampling, and little seasonal change except for a possible slight northward extension in summer.

Scyliorhinus capensis (Smith, 1838) — yellowspotted catshark

Scyllium capense — Smith 1837: 85 (nomen nudum); Smith 1838: 73 (nomen nudum); Smith, in Müller and Henle 1838: 11 ("vom Cap." = Cape of Good Hope, South Africa); Gray 1851: 31 (listed, Cape Seas); Bleeker 1860: 57, 79 (Cape of Good Hope); Dumeril 1865: 320 (Cape of Good Hope); Günther 1870: 404 (Cape Seas, India); Gilchrist 1902: 165 (South Africa, Cape seas).

Catulus capensis — Garman 1913: 74 (southern Africa).

Scylliorhinus capensis — Thompson 1914: 137 (Cape seas, Simon's Bay, South Africa); Gilchrist 1921: 71 (Cape); Gilchrist 1922b: 45 (R.V. *Pickle* #219, 34°34,45′S, 18°25,20′E, 251 m; #221, 34°34,55′S, 18°35,00′E, 174 m; #231, 34°41,10′S, 18°27,30′E, 225 m; #238, 33°46,30′S, 17°49,33′E, 207 m; north-west of Cape Town to west of Cape Point); Von Bonde 1923: 5 (Cape, R.V. *Pickle* #221); Barnard 1925: 40, Fig. 8b (Table Bay, False Bay to Natal, 37–366 m); Von Bonde 1934: 15 (Table Bay, False Bay to Natal); Barnard 1947: 16, Pl. 3, Figs 1, 1a (South Africa, Table Bay to Natal).

Scyliorhinus (*Scyliorhinus*) *capensis* — Norman 1935: 36 (South Africa, west of Cape Town, 34°02′S, 17°41′E, 311 m).

Scyliorhinus capensis — Regan 1908b: 458 (South Africa); Fowler 1941: 35 (South Africa, Table and False bays to Natal); Bigelow and Schroeder 1948b: 203 (in key to species); Smith 1949: 54, Pl. 2 (Port Nolloth around the Cape eastwards to India, 37–458 m); Smith 1965: 54, Pl. 2 (South Africa, India); Springer 1966: 584 (South Africa); Day *et al.* 1970: 88 (False Bay, Beira–Port Nolloth, Indian Ocean, 5–25 m); Bass *et al.* 1975a: 32, Figs 19, 20c (South-Western Cape to Natal, 26–290 m in Cape waters, 420 m off Natal); Springer 1979: 132, Fig. 84 (Cape of Good Hope, False Bay); Cadenat and Blache 1981: 181 (Cape to Natal); Compagno 1984: 359, ill. (south-western Cape Province east to Natal, 26–420 m); Bass 1986: 95, Fig. 11.16, Pl. 3 (South-Western Cape to Natal, 26–460 m); Lloris 1986: 140, Fig. 51 (southern Namibia, just north of Orange River mouth, 28°10′S, 14°31′E, 434–439 m; 28°14′S, 15°02′E, 329–350 m); Turon *et al.* 1986: 71, 178, 235, 299 (southern Namibia, 16 stations from 27°01,4′S, 14°08,3′E to 29°41,6′S, 14°38,4′E, 198–494 m); Compagno 1988: 122–124 (Western Cape to Natal); Compagno *et al.* 1989: 46, ill. (Lüderitz to central Natal, 26–495 m); Compagno 1989: 606, Figs 2, 6b, 7b, 8c–d (Namibia and South Africa from vicinity of Orange River mouth to East London and Natal, 26–530 m).

Africana demersal trawl stations (n = 70):

Cruise 028 —	A2235, 466 m;	A2241, 500 m;	A2304, 354 m;
	A2364, 203 m.		
Cruise 033 —	A2747, 202 m;	A2750, 192 m;	A2768, 175 m;
	A2769, 201 m;	A2786, 364 m.	
Cruise 039 —	A3340, 230 m;	A3346, 313 m;	A3352, 245 m;
	A3359, 359 m;	A3387, 281 m;	A3395, 299 m;
	A3400, 312 m;	A3428, 255 m;	A3429, 365 m;
	A3430, 217 m.		
Cruise 046 —	A4291, 217 m;	A4296, 165 m;	A4303, 200 m;
	A4304, 240 m;	A4305, 490 m;	A4306, 390 m;
	A4307, 495 m;	A4323, 225 m;	A4367, 385 m;
	A4371, 368 m;	A4372, 360 m.	
Cruise 050 —	A5229, 450 m;	A5230, 220 m;	A5237, 155 m;
	A5255, 217 m;	A5303, 270 m;	A5305, 266 m;
	A5308, 377 m.		
Cruise 054 —	A5852, 305 m;	A5863, 174 m;	A5864, 205 m;
	A5865, 230 m;	A5866, 224 m;	A5868, 452 m;
	A5870, 410 m;	A5875, 274 m;	A5877, 257 m;
	A5880, 234 m;	A5936, 396 m;	A5945, 205 m;
	A5946, 205 m;	A5950, 222 m.	
Cruise 059 —	A6838, 206 m;	A6839, 203 m;	A6840, 175 m;
	A6948, 397 m;	A6953, 206 m;	A6970, 323 m.
Cruise 060 —	A7013, 451 m;	A7040, 486 m.	
Cruise 069 —	A8346, 327 m;	A8357, 297 m.	
Cruise 075 —	A9027, 438 m;	A9028, 400 m;	A9140, 350 m;
	A9140, 350 m;	A9141, 470 m;	A9145, 253 m.
Cruise 079 —	A9810, 265 m;	A9815, 240 m;	A9816, 315 m.

Station latitude and depth range — 27°31,6′S, 14°31,3′E to 36°06,8′S, 19°50,7′E, 155–500 m.

Distribution — The yellowspotted catshark is a southern African endemic which is most commonly encoun-

tered in Cape seas, with the extremes of its range being southern Namibia south-west of Lüderitz and Natal. It is recorded in shallow water in Table and False bays, but during the survey, *Africana* collected it on the outer shelf and uppermost slope at 155–500 m, with most records between 200 and 400 m. Records cluster in the area between the Orange River and Doring Bay, and Saldanha Bay – Cape Agulhas (Fig. 9d), with few records in between. It is a faunal associate of the smaller *H. regani* on the uppermost slope, but it is less common and found at fewer, more scattered stations. An interesting difference is its absence from the outer shelf between Saldanha Bay and the Orange River, in contrast to the numerous shelf records of *H. regani* in that area. *Africana* also encountered it off the Eastern Cape (Compagno *et al.* in prep.).

FAMILY TRIAKIDAE — HOUNDSHARKS

Galeorhinus galeus (Linnaeus, 1758) — tope, soupfin shark or vaalhaai

Squalus galeus — Linnaeus 1758: 234 ("Habitat in Oceano Europae").

Galeus canis — Gray 1851: 52 (Cape of Good Hope); Günther 1870: 379 (Cape seas); Gilchrist 1902: 163 (South Africa).

Galeorhinus canis — Thompson 1914: 140 (Cape seas, South Africa); Barnard 1925: 28, Pl. 1, Fig. 3 ("Cape Seas"); Von Bonde 1933: 40 (Cape Seas); Von Bonde 1934: 14 (South Africa, Cape seas).

Galeorhinus galeus — Fowler 1936b: 57, Fig. 14 (Eastern Atlantic from Europe to South Africa); Fowler 1941: 190 (South Africa); Barnard 1947: 10, Pl. 1, Figs 5, 5a (South Africa); Smith 1949: 44, Fig. 15 (South Africa, south and east coasts); Smith 1957a: 586, Fig. 1, Pl. 18 (South Africa, most of coast from Cape to Natal, usually in deepish water to 183 m, Algoa Bay at 110 m; no records from anywhere north of Delagoa Bay); D'Aubrey 1964: 21, Pl. 7 (Port Elizabeth to south-east and west coasts of South Africa); Smith 1965: 44, Fig. 15 (South Africa); Smith and Smith 1966: 21, ill. (Tsitsikamma Park, Eastern Cape, South Africa); Day *et al.* 1970: 88 (False Bay, Beira–Walvis Bay); Bass *et al.* 1975b: 20, Fig. 14, Pl. 1 (Western and Southern Cape, north-east to East London in the Eastern Cape, inshore to 183 m); Van der Elst 1981: 40, ill. (Namibia to Algoa Bay, to 100 m); Compagno 1984: 386, ill. (Namibia, South Africa); Bass *et al.* 1986: 78, Fig. 9.20, Pl. 2 (Angola to East London, rarely if ever off Natal, inshore to 200 m); Van der Elst and Vermeulen 1986: 20, ill. (Namibia to Algoa Bay, to 450 m); Compagno 1988: 249–252 (West Coast, east to East London); Van der Elst 1988: 43, ill. (Namibia to East London); Compagno *et al.* 1989: 56, ill. (Namibia to East London, inshore to 299 m).

Africana demersal trawl stations ($n = 92$):

Cruise 039 — A3355, 212 m; A3373, 214 m; A3380, 159 m; A3382, 244 m; A3395, 299 m; A3404, 208 m; A3405, 224 m; A3410, 158 m; A3425, 175 m.
Cruise 046 — A4288, 190 m; A4289, 170 m; A4295, 230 m; A4296, 165 m; A4298, 135 m; A4301, 151 m; A4302, 175 m; A4331, 195 m; A4332, 175 m; A4335, 270 m; A4337, 240 m; A4357, 163 m; A4381, 200 m; A4388, 160 m.
Cruise 050 — A5233, 140 m; A5234, 137 m; A5237, 155 m; A5241, 161 m; A5260, 200 m; A5282, 175 m; A5283, 175 m; A5296, 155 m; A5310, 216 m; A5312, 178 m; A5322, 209 m; A5323, 204 m; A5325, 184 m; A5334, 150 m; A5335, 144 m; A5337, 199 m; A5339, 190 m.
Cruise 054 — A5857, 190 m; A5859, 151 m; A5871, 144 m; A5889, 275 m; A5890, 270 m; A5901, 181 m; A5907, 83 m; A5909, 160 m; A5911, 155 m; A5916, 183 m; A5921, 187 m; A5923, 175 m; A5925, 164 m; A5949, 275 m.
Cruise 059 — A6835, 194 m; A6847, 230 m; A6860, 216 m; A6866, 148 m; A6868, 172 m; A6880, 168 m; A6881, 159 m; A6884, 174 m; A6900, 162 m; A6904, 137 m; A6936, 175 m; A6937, 176 m; A6938, 174 m; A6942, 156 m; A6944, 170 m.
Cruise 069 — A8298, 160 m; A8342, 200 m.
Cruise 075 — A8994, 209 m; A8995, 174 m; A8996, 163 m; A9017, 152 m; A9018, 127 m; A9032, 287 m; A9034, 187 m; A9069, 227 m; A9071, 170 m; A9100, 154 m; A9122, 185 m; A9132, 220 m.
Cruise 079 — A9766, 148 m; A9779, 134 m; A9782, 132 m; A9792, 122 m; A9793, 143 m; A9794, 166 m; A9797, 162 m; A9800, 213 m; A9818, 250 m.

Station latitude and depth range — 28°34,5′S, 15°01,6′E to 35°20,5′S, 19°08,4′E, 83–299 m.

Distribution — The soupfin shark, tope or vaalhaai is an amphitemperate, wide-ranging littoral, epibenthic, active shark, known from the Eastern North Atlantic and Mediterranean, both coasts of southern Africa, the Western South Pacific, and the Eastern Pacific. It occurs from close inshore in shallow bays, such as Saldanha and False Bay, to the uppermost slope. Off southern Africa it ranges from southern Namibia to East London and rarely if ever to Natal. Spanish researchers did not report it from Namibia, and during the present

survey *Africana* recorded it in Namibian waters just north of the Orange River but not beyond that point. Otherwise, the survey found it sporadically but regularly along the continental shelf and uppermost slope of South Africa from the Orange River to south-west of Cape Agulhas on the Agulhas Bank (Fig. 10a), with most records between 100 and 250 m and south of 28°S. Distribution is fairly regular in parts of the area where soupfin occurred, with no strong suggestion of aggregations given the irregularity of the sampling. Soupfin caught in *Africana* trawls were usually single individuals and generally adult males, with no newborn or small juveniles in the catch. A latitude-depth summer-winter plot (see Fig. 20a) indicates a northerly concentration of records in summer, but no obvious seasonal depth pattern. Soupfin are known to be highly mobile and migratory elsewhere, and show sexual segregation by area.

Mustelus mustelus (Linnaeus, 1758) — houndshark

Squalus mustelus — Linnaeus 1758: 235 ("Habitat in Europa").

Mustelus laevis — Gilchrist 1902: 163 (Cape seas, South Africa, in part, including *Triakis megalopterus*); Thompson 1914: 142 (Cape seas, South Africa, in part, including *Triakis megalopterus*); Barnard 1925: 29, in part (Table Bay, Kalk Bay, account based in part on *Triakis megalopterus*, but mention of placental reproduction probably refers to *M. mustelus*).

Mustelus manazo — Smith 1949: 45 (in part?, southern Africa); Smith 1957b: 357 (in part?, southern Africa); Smith 1965: 45 (in part?, southern Africa).

Mustelus punctulatus — Smith 1949: 45 (in part, Cape seas); Smith 1965: 45 (in part, southern Africa).

Mustelus canis — Fowler 1936b: 61 (in part, South Africa); Fowler 1941: 204 (in part, South Africa); Smith 1949: 46 (in part, southern Africa); Poll 1951: 28, Figs 10–11, Pl. 1, Figs 3–4, Pl. 11, Fig. 4, Pl. 12, Fig. 2 (Angolan records); Smith 1965: 46 (in part, southern Africa); Van der Elst 1981: 40 (in part, southern Africa).

Mustelus mustelus — Smith 1949: 46 (in part); Penrith 1978: 182 (Moçamedes, southern Angola); Alluć *et al.* 1984: 129 (northern Namibia from south-west of the Cunene River to south-west of Cape Frio, 3 stations from 17°30,0′S, 11°32,0′E to 18°18,0′S, 11°44,0′E, 70–125 m); Compagno 1984: 419, ill. (France, British Isles and Mediterranean south to South Africa); Bass *et al.* 1986: 82, Fig. 9.27 (Mediterranean and west coast of Africa south to Namibia and around to the Fish River); Lloris 1986: 143, Fig. 53 (northern Namibia near Angolan border, 17°44′S, 11°44′E, 70 m); Turon *et al.* 1986, in part?: 178, 235, 299 (central Namibia from Walvis Bay south to South Africa south-west of the Orange River mouth, 23 stations from 23°57,8′S, 13°47,1′E to 29°21,0′S, 14°49,0′E, 24–340 m, possibly including *M. palumbes* in deep-water catches?); Compagno 1988: 223, 226 (Eastern Cape, Tsitsikamma, Gamtoos River mouth and Port Elizabeth); Compagno *et al.* 1989: 58, ill. (Namibia to Natal, inshore to less than 100 m).

Africana demersal trawl stations (n = 1):

Cruise 075 — A9025, 34°35,0′S, 19°17,3′E, 38 m.

Distribution — The houndshark is confined to the Eastern Atlantic, Mediterranean, and south-western Indian Ocean, and ranges from the United Kingdom and France southwards to tropical West Africa, Angola, Namibia, and South Africa off the Western Cape, Eastern Cape and Natal. South of Namibia this shark is apparently an inshore species, confined to water shallower than 100 m, and it was not collected by *Africana* except in one inshore station off Gans Bay (Fig. 10b). In contrast, the whitespotted houndshark *Mustelus palumbes* ranges onto the upper slope and was frequently collected by *Africana* (see below). Spanish researchers list *M. mustelus* as occurring in deeper water, from 70 to 340 m, but it is unsure from their accounts whether their records are solely based on *M. mustelus* or that they also include *M. palumbes*. Off tropical West Africa *M. mustelus* is reported as extending to 350 m depth, but this apparently is not the case off the west coast of South Africa between the Orange River and Cape Agulhas, where it was not collected in trawls at 50 m or deeper. Authentic records of this shark in the area are few, but it is apparently abundant in St Helena Bay and especially Saldanha Bay, where it is sometimes caught in hundreds during fishing competitions and where it is fished commercially. It is also reported from Table Bay and caught in False Bay. Off the South-Eastern Cape it commonly occurs in *Africana* trawls shallower than 70 m, and its distribution there will be reported elsewhere.

Mustelus palumbes Smith, 1957 — whitespotted smoothhound

Mustelus palumbes — Smith 1957b: 358, Figs 1e–f (Knysna Estuary, False Bay to Delagoa Bay); Smith

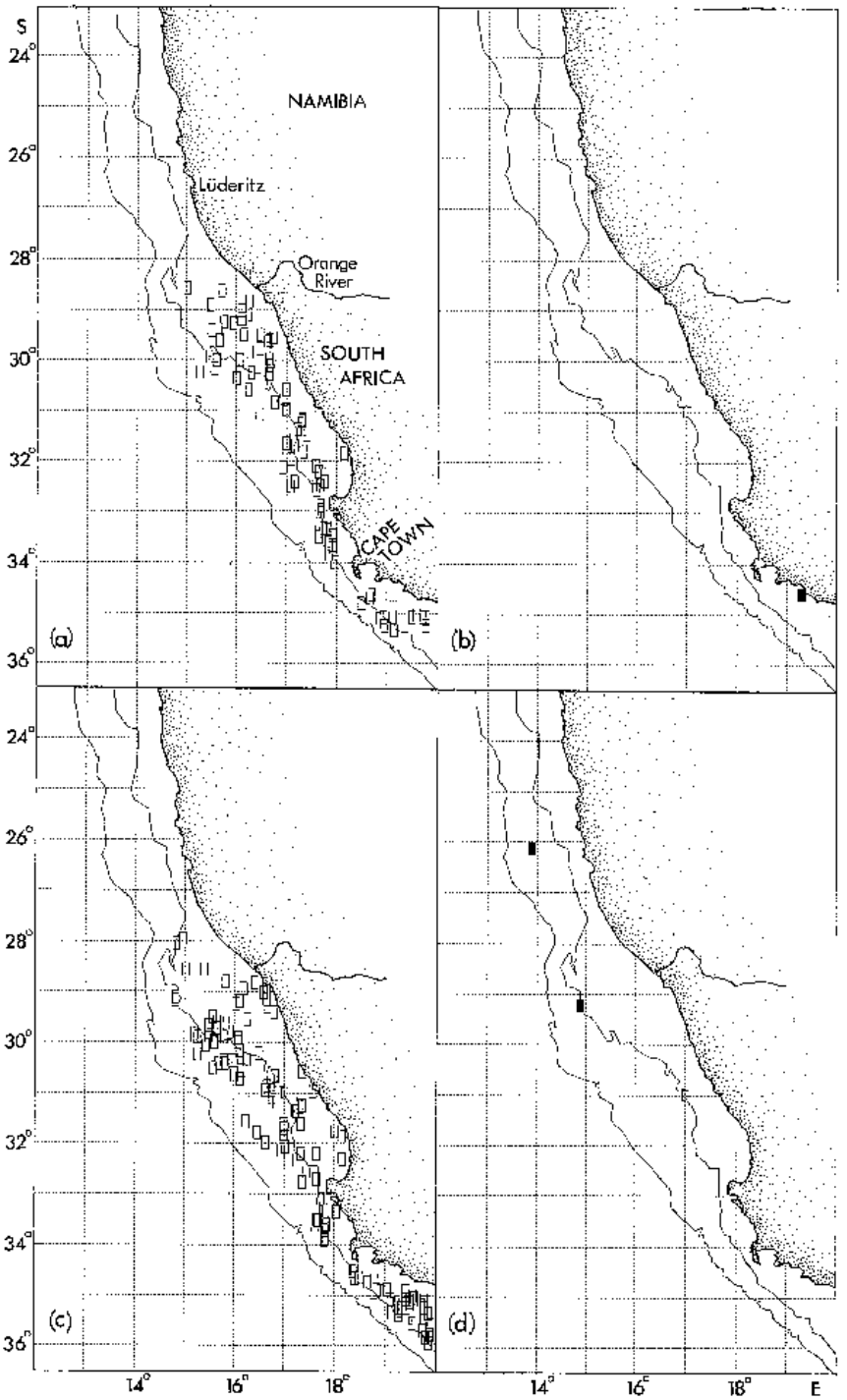

Fig. 10: *Africana* demersal trawl stations at which (a) soupfin shark (*Galeorhinus galeus*, *n* = 92), (b) houndshark (*Mustelus mustelus*, *n* = 1), (c) whitespotted houndshark (*Mustelus palumbes*, *n* = 135), (d) blue shark (*Prionace glauca*, *n* = 2) were taken, 1986–1990

1965: 565 (South Africa); Smith and Smith 1966: 22, ill. (Tsitsikamma Park, Eastern Cape, South Africa); Day *et al.* 1970: 88 (False Bay, Durban–Walvis Bay, 10–50 m); Compagno 1984: 422, ill. (Namibia, South Africa and extreme southern Moçambique); Bass *et al.* 1986: 82, Fig. 9.28, Pl. 4 (Walvis Bay to Algoa Bay); Compagno 1988: 223, 226 (Eastern Cape, Algoa Bay and Knysna Estuary); Compagno *et al.* 1989: 58, ill. (Namibia to central Natal, inshore to 443 m).

Mustelus asterias — ?Allué *et al.* 1984: 129 (north-central Namibia from the Cunene River to north-west of Walvis Bay, 6 stations from 17°30,0′S, 11°32,0′E to 22°26,0′S, 12°48,0′E, 117–502 m); Lloris 1986: 141, Fig. 52 (northern Namibia near Angolan border, 17°35′S, 11°20′E, 611 m; 17°44′S, 11°44′E, 70 m; 18°04′S, 11°39′E, 126 m); Turon *et al.* 1986: 37, 71, 235 (Namibia from the Cunene River to off the Orange River mouth, 3 stations from 17°35,7′S, 11°20,0′E to 28°38,0′S, 15°24,8′E, 181–611 m).

Mustelus canis — Thompson 1914: 141 (Cape seas, South Africa); Barnard 1925: 30 (False Bay to Algoa Bay and Natal, to 275 m); Norman 1935: 36 (South Africa, west of Cape Town, 33°53′S, 17°38′E, 310 m); Smith 1949: 46 (in part); Smith 1965: 46 (in part).

Mustelus manazo — Smith 1949: 45 (in part?); Smith 1957b: 357 (in part?); Smith 1965: 45 (in part?).

Mustelus mustelus — Fowler 1936b: 61 (in part, South Africa); Fowler 1941: 207 (in part, South Africa); Smith 1949: 46 (in part); Smith 1965: 46 (in part).

Mustelus vulgaris — ?Bleeker 1860: 57 (Cape of Good Hope); ?Gilchrist 1902: 163 (South Africa, in part); Von Bonde 1923: 4 (R.V. *Pickle* #93, 33°12,32′S, 17°25,00′E, west of Saldanha, 165 m).

Africana demersal trawl stations ($n = 135$):

Cruise 028 — A2232, 165 m; A2268, 261 m; A2299, 227 m; A2387, 199 m.
Cruise 033 — A2758, 199 m; A2766, 170 m; A2772, 154 m; A2788, 260 m; A2806, 104 m.
Cruise 039 — A3324, 239 m; A3326, 187 m; A3327, 178 m; A3328, 171 m; A3332, 189 m; A3333, 171 m; A3336, 169 m; A3337, 174 m; A3339, 200 m; A3367, 272 m; A3373, 214 m; A3380, 159 m; A3383, 271 m; A3389, 345 m; A3390, 362 m; A3397, 443 m; A3402, 262 m; A3404, 208 m; A3405, 224 m; A3420, 71 m; A3425, 175 m; A3426, 182 m; A3427, 199 m; A3430, 217 m.
Cruise 046 — A4289, 170 m; A4293, 175 m; A4297, 180 m; A4298, 135 m; A4299, 145 m; A4300, 155 m; A4302, 175 m; A4322, 230 m; A4330, 235 m; A4335, 270 m; A4336, 260 m; A4351, 215 m.
Cruise 050 — A5227, 173 m; A5231, 169 m; A5232, 133 m; A5232, 153 m; A5233, 140 m; A5234, 137 m; A5235, 186 m; A5244, 252 m; A5255, 217 m; A5259, 264 m; A5263, 162 m; A5290, 100 m; A5295, 123 m; A5297, 165 m; A5305, 266 m; A5309, 215 m; A5310, 216 m; A5320, 179 m; A5323, 204 m; A5324, 183 m; A5325, 184 m; A5326, 204 m; A5327, 188 m; A5331, 93 m; A5332, 121 m.
Cruise 054 — A5854, 170 m; A5858, 117 m; A5859, 151 m; A5860, 159 m; A5890, 270 m; A5907, 83 m; A5915, 186 m; A5916, 183 m; A5940, 282 m; A5946, 205 m.
Cruise 059 — A6837, 171 m; A6840, 175 m; A6841, 161 m; A6844, 158 m; A6845, 170 m; A6846, 176 m; A6852, 180 m; A6861, 196 m; A6866, 148 m; A6867, 77 m; A6868, 172 m; A6900, 162 m; A6901, 199 m; A6907, 77 m; A6912, 184 m; A6916, 87 m; A6927, 103 m; A6929, 105 m; A6934, 186 m; A6941, 168 m; A6943, 177 m; A6944, 170 m; A6968, 245 m; A6977, 243 m; A6978, 250 m.
Cruise 060 — A7000, 254 m; A7021, 240 m.
Cruise 069 — A8320, 181 m; A8321, 208 m; A8342, 200 m; A8421, 190 m; A8422, 199 m.
Cruise 075 — A8993, 181 m; A9012, 234 m; A9014, 170 m; A9017, 152 m; A9018, 127 m; A9020, 139 m; A9023, 158 m; A9042, 257 m; A9070, 200 m; A9123, 177 m; A9124, 188 m; A9131, 227 m; A9133, 248 m; A9144, 253 m.
Cruise 079 — A9782, 132 m; A9791, 76 m; A9799, 162 m; A9801, 194 m; A9820, 218 m; A9821, 227 m; A9828, 233 m; A9829, 238 m; A9830, 234 m; A9831, 229 m.

Station latitude and depth range — 27°57,2′S, 14°57,4′E to 35°57,0′S, 19°50,9′E, 71–443 m.

Distribution — The whitespotted houndshark is a southern African endemic of the continental shelf and upper slope, that ranges from northern or central Namibia to Natal and southern Moçambique. It overlaps the depth distribution of the larger *M. mustelus* in South Africa and sometimes occurs off open beaches and in shallow bays along with that species. It is commoner, however, on the outer shelf and uppermost slope below 70 m in the area where *M. mustelus* does not penetrate. *Africana* frequently collected it in offshore stations from south-south-west of Lüderitz to the Orange River, and southwards along the outer shelf and uppermost slope of South Africa to south-west of Cape Agulhas (Fig. 10c). There were very few stations that yielded it north of the Orange River; and none north of 27°S. Most records were between 100 and 300 m depth. A latitude-depth summer-winter plot

(see Fig. 20b) suggests the possibility that, in winter, this species is concentrated on the outer shelf and upper slope between St Helena Bay and the Orange River, but that it ranges closer inshore during the summer, while not abandoning deeper water. This seasonal variation is different from that of the St Joseph *Callorhinchus capensis*, which was frequently collected on the shelf and uppermost slope along this sector of coastline during summer and winter.

FAMILY CARCHARHINIDAE — REQUIEM SHARKS

Prionace glauca (Linnaeus, 1758) — blue shark

Squalus glaucus — Linnaeus 1758: 235 ("Habitat in Oceano Europaeo").

Carcharias (*Prionodon*) *glaucus* — Lampe 1914: 213 (Simon's Town, False Bay).

Carcharhinus glaucus — Barnard 1925: 26 (Agulhas Bank); Barnard 1947: 9 (Agulhas Bank).

Prionace glauca — Bigelow and Schroeder 1948b: 282 (west coast of South Africa); D'Aubrey 1964: 24, Pl. 10 (east and west coasts of South Africa); Day *et al.* 1970: 88 (False Bay); Bass *et al.* 1975b: 32, Fig. 20, Pl. 6 (South Africa, 35°S to Comores); Penrith 1978: 182 (common south of the Cunene River, southern Angola); Compagno 1984: 521, ill. (wide-ranging off southern Africa, world distribution); Bass *et al.* 1986b: 84, Fig. 9.32, Pl. 1 (wide-ranging, to 80–220 m offshore); Lloris 1986: 147, Fig. 54 (northern Namibia, 17°33′S, 11°31′E, 157 m); Turon *et al.* 1986: 178, 235, 299 (Namibia, from north-west of Walvis Bay to south-west of Lüderitz, 8 stations from 20°46,8′S, 12°33,5′E to 27°18,2′S, 14°09,0′E, 117–476 m); Van der Elst and Vermeulen 1986: 32, ill. (wide-ranging off southern Africa); Compagno 1988: 349–351 (wide-ranging, Eastern Cape off Algoa Bay); Compagno *et al.* 1989: 70, ill. (wide-ranging, surface to over 152 m).

Glyphis glaucus — Fowler 1936b: 54, Fig. 13 (South Africa); Fowler 1941: 178 (South Africa); Smith 1949: 42, Fig. 10 (South Africa, west coast); Smith 1965: 42, Fig. 10 (South Africa).

Eulamia glaucus — Von Bonde 1934: 14 (South Africa, Agulhas Bank).

Africana demersal trawl stations ($n = 2$):

Cruise 059 — A6953, 206 m.
Cruise 069 — A8408, 356 m.

Station latitude and depth range — 26°08,4′S, 13°53,0′E and 29°13,5′S, 14°52,4′E, 206–356 m.

Distribution — The blue shark has perhaps the widest known range of any cartilaginous fish, and occurs in the epipelagic zone in all cool temperate to tropical seas. Off coasts with narrow shelves it can approach close inshore, particularly at night, and is recorded from False Bay in the area. Blue sharks were often seen during *Africana* cruises when adrift at trawl stations or when cruising, but they were a rare and accidental catch in bottom trawls. Several were caught by rod and reel, but only two at trawl stations off Lüderitz and south-west of the Orange River mouth (Fig. 10d). The blue shark probably occurs throughout the entire area, in appropriately blue water at the edge of the continental shelf and westwards from it.

BATOIDS

ORDER RHINOBATIFORMES

FAMILY RHINOBATIDAE — GUITARFISH

Rhinobatos annulatus Smith, 1841 — little guitarfish

Rhinobatus (*Syrrhina*) *annulatus* — Smith, in Müller and Henle 1841: 116 ("Vom Kap", = Cape of Good Hope); Bleeker 1860: 58 (Cape of Good Hope); Dumeril 1865: 487, Pl. 10, Fig. 6 (Cape of Good Hope).

Rhinobatus annulatus — Garman 1913: 272 (southern and eastern Africa); Von Bonde and Swart 1923: 3, 21 (South Africa); Barnard 1925: 59, Fig. 9a (Simon's Bay to Natal); Norman 1926: 964, Fig. 17 (Cape of Good Hope, Port Natal, Bird Island, Algoa Bay, Zululand Coast, 73–91 m); Von Bonde 1934: 16 (Simon's Bay to Natal); Barnard 1947: 22, Pl. 3, Fig. 10 (False Bay to Natal); Wallace 1967a: 27, Figs 14–15 (Natal, Pondoland, Algoa Bay, near Plettenberg Bay, surf to 73 m); Day *et al.* 1970: 89 (False Bay, Beira-Saldanha Bay, 1–10 m).

Rhinobatos annulatus — Smith 1949: 64, Pl. 3 (Cape to Zanzibar); Smith 1965: 64, Pl. 3 (Cape to

Zanzibar); Smith and Smith 1966: 28, ill. (Tsitsikamma Park, Eastern Cape, South Africa); Van der Elst 1981: 55, ill. (Saldanha Bay to Moçambique, inshore to 50 m); Compagno 1986: 129, Fig. 27.2, Pl. 4 (Cape to Natal, doubtful to Madagascar; surf zone to 73 m); Van der Elst and Vermeulen 1986: 38, ill. (Western Cape to Moçambique, inshore to 50 m); Van der Elst 1988: 59, ill. (Saldanha Bay to Moçambique); Compagno *et al.* 1989: 78, ill. (Namibia to central Natal, inshore to 70 m).

Rhinobatus columnae — Gilchrist 1902: 167 (possibly Cape of Good Hope, False Bay to Port Natal); Thompson 1914: 155 (Table Bay, Kowie, Algoa Bay, Natal, South Africa).

Rhinobatos (*Syrrhina*) *columnae* — Lampe 1914: 215 (Simon's Town, False Bay).

Africana demersal trawl stations (n = 1):

Cruise 075 — A9025, 34°35,0′S, 19°17,3′E, 38 m.

Distribution — This common demersal guitarfish or "sandshark" is a coastal endemic found close inshore along most of southern Africa, but details of its distribution are very sketchy along the West Coast. It apparently occurs from the shore to less than 100 m deep and is abundant in enclosed bays such as Saldanha Bay. In the survey area, *Africana* encountered it only once, south-west of Gans Bay in shallow water (Fig. 11a). It is often collected on *Africana* hake demersal cruises on inshore stations along the south-east coast between Cape Agulhas and Port Alfred (Compagno *et al.* in prep.).

ORDER TORPEDINIFORMES

FAMILY TORPEDINIDAE — TORPEDO RAYS

Torpedo nobiliana — Bonaparte, 1835 — Atlantic electric ray

Torpedo nobiliana — Bonaparte 1835, Fasc. 12 (Italy); Fowler 1936b: 121, Fig. 50 (South Africa); Fowler 1941: 346 (South Africa); Smith 1949: 75, Fig. 92 (west coast of South Africa east to Algoa Bay, rarely above 110 m, not uncommon on west coast to 458 m); Smith 1965: 75, Fig. 92 (west coast of South Africa east to Algoa Bay); Allué *et al.* 1984: 125 (central Namibia north-west of Walvis Bay, 22°21,0′S, 12°49,0′E, 360–380 m); Compagno 1986: 112, Fig. 23.2 (Western Cape to Algoa Bay, 110–457 m); Lloris 1986: 129, Fig. 44 (Namibia north-west of Walvis Bay to off Lüderitz, 21°04′S, 13°04′E, 510–530 m; 22°21′S, 12°49′E, 360-380 m; 26°19′S, 13°19′E, 387–389 m); Turon *et al.* 1986: 69, 176, 233, 298 (central Namibia and South Africa from south-west of Walvis Bay to south-west of the Orange River mouth, 12 stations from 24°02,9′S, 13°36,5′E to 29°21,7′S, 14°46,4′E, 275–458 m); Compagno *et al.* 1989: 80, ill. (West Coast from Namibia south to Mossel Bay, probably Algoa Bay: 110–457 m).

Torpedo nobilianus — Barnard 1925: 89 (Agulhas Bank).

Narcobatus nobilianus — Norman 1935: 37 (South Africa); Barnard 1947: 30, Pl. 4, Fig. 10 (South Africa).

Torpedo hebetans — Thompson 1914: 159 (South Africa); Von Bonde and Swart 1923: 15, 21 (South Africa).

Africana demersal trawl stations (n = 15):

Cruise 028 — A2316, 262 m.
Cruise 033 — A2768, 175 m.
Cruise 039 — A3348, 456 m.
Cruise 046 — A4299, 145 m; A4319, 230 m; A4320, 232 m.
Cruise 050 — A5236, 167 m; A5251, 430 m.
Cruise 059 — A6855, 237 m; A6944, 170 m; A6947, 351 m.
Cruise 069 — A8367, 269 m; A8417, 409 m.
Cruise 075 — A9018, 127 m.
Cruise 079 — A9832, 242 m.

Station latitude and depth range — 23°09,5′S, 13°27,3′E to 35°59,0′S, 19°58,5′E, 127–456 m.

Distribution — This large electric ray occurs in temperate coastal and offshore waters of the North Atlantic and Mediterranean Sea and southern Africa from Namibia to Algoa Bay. Namibian records are relatively few, from the vicinity of Walvis Bay to the Orange River at 275–530 m, and South African records are mostly anecdotal. *Africana* collected it from a small number of demersal stations along the outer shelf and upper slope of the entire survey area from west of Walvis Bay to south of Cape Agulhas (Fig. 11b). Only one or a few individuals were caught at any one station. Its young were occasionally collected during tows of pelagic plankton nets on the edge of the continental shelf. It is suspected that the limited capture of this ray is not indicative of its abun-

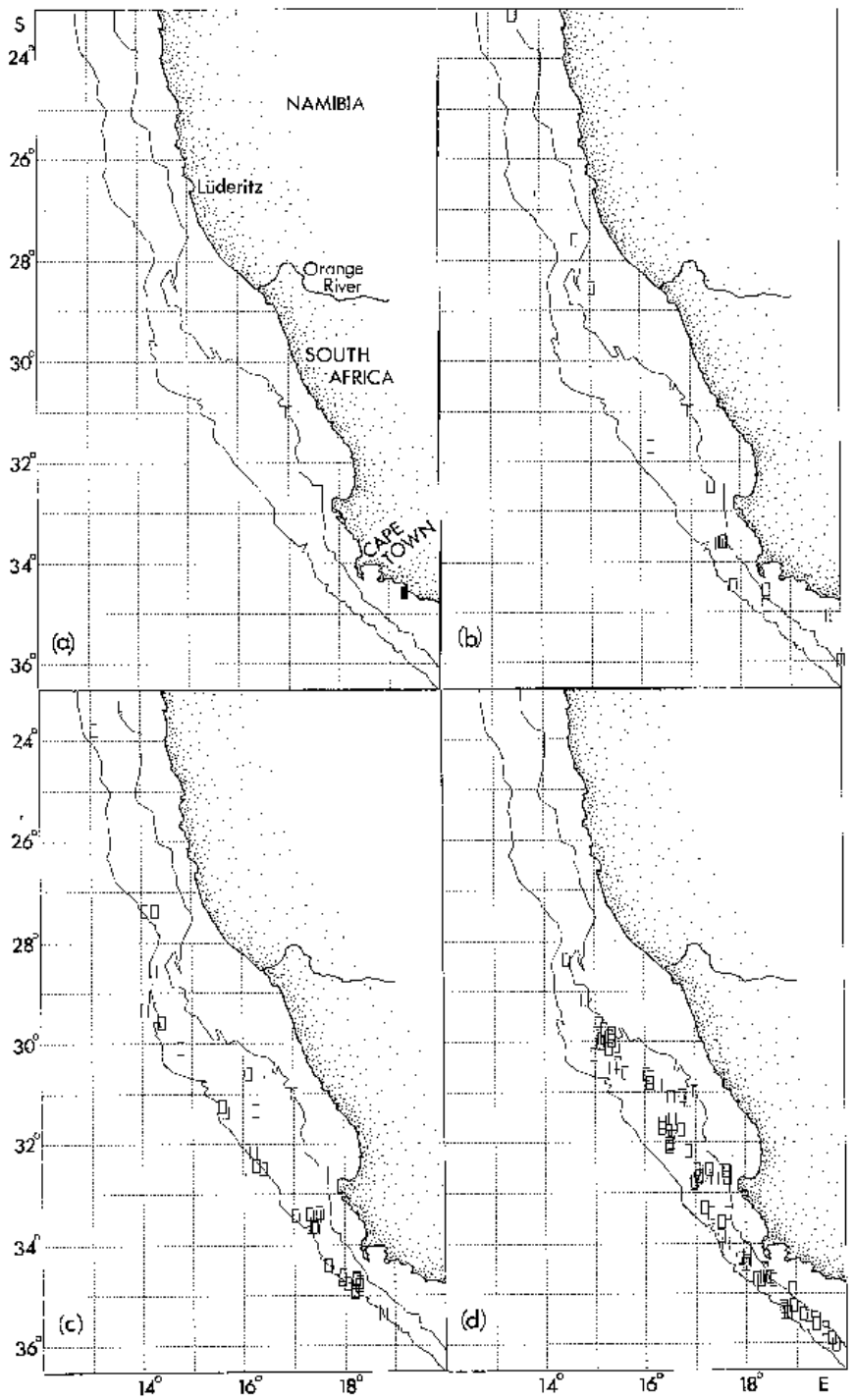

Fig. 11: *Africana* demersal trawl stations at which (a) little guitarfish (*Rhinobatos annulatus*, $n = 1$), (b) Atlantic electric ray (*Torpedo nobiliana*, $n = 15$), (c) African softnose skate (*Bathyraja smithii*, $n = 39$), (d) roughnose legskate (*Cruriraja parcomaculata*, $n = 84$) were taken, 1986–1990

dance in the area. Although it probably rests on the bottom, it may move well above it while hunting fish and other large prey.

ORDER RAJIFORMES

FAMILY RAJIDAE — SKATES

Bathyraja smithii (Müller and Henle, 1841) — African softnose skate

Raja smithii — Müller and Henle 1841: 150, Pl. 49, Fig. 1 ("Südafrika"); Gray 1851: 112 (South Africa); Bleeker 1860: 58 (Cape of Good Hope); Dumeril 1865: 553 (South Africa); Günther 1870: 467 (South Africa, Bosphorus?); Gilchrist 1902: 168 (South Africa); Thompson 1914: 159 (South Africa); Norman 1935: 37, 41 (South Africa west of Cape Town, 33°48′S, 17°29,5′E, 402–235 m); Fowler 1941: 364 (South Africa, not *R. eatoni* from Kerguelen Island = *Bathyraja eatoni*).

Raia smithi — Garman 1913: 366 (South Africa); Von Bonde and Swart 1923: 5, 21 (Cape); Barnard 1925: 66, Pl. 4, Fig. 4 (off Cape Point, 695–869 m; not Kerguelen Island, = *B. eatoni*); Smith 1949: 66 (South Africa, not Fig. 68, = *Cruriraja parcomaculata*; not Pl. 3, ? = *Raja* cf. *clavata*); Smith 1965: 66 (South Africa, not Fig. 68 or Pl. 3).

Bathyraja smithii — Hulley 1970, Figs 20a–c, 21a–b, Pl. 13 (East of Cape Point, 658–868 m); Hulley 1972a: 86–96, Figs 58–59 (geographic and depth distribution; west coast of southern Africa, deep slopes, potentially occurring off East Coast, 660–1 040 m); Hulley 1986: 116, Fig. 25.1 (Agulhas Bank and west of Cape Town, 650–1 020 m); Lloris 1986: 113, Fig. 36 (Namibia north-west of Walvis Bay, 21°33′S, 12°31′E, 622–630 m); Turon *et al.* 1986: 66, 230 (Namibia north-west of Walvis Bay and South Africa south-west of the Orange River mouth, 21°32,6′S, 12°31,4′E; 29°6,5′S, 14°36,5′E, 295–630 m); Compagno *et al.* 1989: 86, ill. (Walvis Bay to Agulhas Bank, 440–1 020 m).

Africana demersal trawl stations (n = 39):

Cruise 028 — A2367, 497 m; A2378, 467 m.
Cruise 033 — A2756, 502 m.
Cruise 039 — A3345, 453 m; A3356, 479 m; A3358, 826 m; A3467, 716 m.
Cruise 046 — A4305, 490 m; A4307, 495 m; A4310, 760 m; A4364, 440 m.
Cruise 050 — A5249, 800 m; A5280, 780 m; A5311, 704 m.
Cruise 054 — A5868, 452 m; A5895, 685 m; A5896, 719 m.
Cruise 059 — A6854, 520 m; A6950, 475 m; A6951, 864 m; A6956, 849 m.
Cruise 060 — A6987, 710 m; A6989, 680 m; A6999, 923 m; A7002, 668 m; A7011, 880 m; A7022, 498 m; A7024, 894 m; A7024, 894 m; A7025, 496 m; A7037, 903 m; A7038, 917 m; A7040, 486 m.
Cruise 066 — A7550, 900 m; A7616, 880 m.
Cruise 069 — A8374, 718 m.
Cruise 075 — A9030, 900 m; A9151, 825 m.
Cruise 079 — A9827, 796 m.

Station latitude and depth range — 23°47,0′S, 13°04,0′E to 35°22,3′S, 18°45,4′E, 440–923 m.

Distribution — The African softnose skate is a southern African deep-slope endemic of the West Coast, with a reported range from central Namibia to the Agulhas Bank and a suggestion that it may occur off the east coast of South Africa. A record from the Bosphorus is probably erroneous, and *B. eatoni* from Kerguelen Island (which is sometimes synonymized with this species) is distinct. Recorded depths of *B. smithii* are as shallow as 402–235 m, but most of the few detailed records are from 600 to 1 020 m. During this survey, *Bathyraja smithii* was recorded from numerous stations along virtually its entire recorded range, with few in Namibian waters, south-west of Walvis Bay to the Orange River, and most along the South African slope from the Orange River to south-west of Quoin Point (Fig. 11c) deeper than 450 m. Most stations had one or a few individuals, except between Saldanha Bay and Cape Point, where it occurred in numbers at a few stations of Cruise 060. All stages were recorded, from hatchlings to large adults.

Cruriraja durbanensis (Von Bonde and Swart, 1923) — smoothnose legskate

Raia durbanensis —Von Bonde and Swart 1923: 11, Pl. 22, Fig. 1 ("Natal", R.V. *Pickle* #343, 30°10,00′S, 14°33,00′E, north-west of Hondeklip Bay, Western Cape, 860 m); Barnard 1925 ("Natal", 860 m).

Cruriraja durbanensis — Bigelow and Schroeder 1948a: 550 (Natal coast); Bigelow and Schroeder 1953: 315 (Natal coast); Bigelow and Schroeder 1962: 199 (Natal coast); Smith 1964: 287 (type specimens lost, not from Natal but about 640 km north-west of Cape Town); Wallace 1967c: 7 (north-west of Cape Town); Hulley 1970: 156, Fig. 3 (types lost, north-west of Cape Town); Hulley 1972a: 86–96, Figs 58–59 (geographic and depth distribution, confined to West Coast); Hulley 1986: 116, Fig. 25.2 (original record); Compagno *et al.* 1989: 84, ill. (original record).

Raia spinacidermis — Smith 1949: 66 (in part,

Raia durbanensis in synonymy); Smith 1965: 66 (in part).

Africana demersal trawl stations: none.

Distribution — This rare skate has not been recorded by *Africana* or any other research or commercial trawler since its collection by the R.V. *Pickle* off Hondeklip Bay (not Natal, despite its name). It is suspected that it may show up with further deep-slope trawling off the west coast of South Africa, particularly at stations deeper than 1 000 m.

Cruriraja parcomaculata (Von Bonde and Swart, 1923) — roughnose legskate

Raia parcomaculata — Von Bonde and Swart 1923: 9, Pl. 21, Fig. 2 (R.V. *Pickle* #116, 29°57,30′S, 31°34,15′E, off Durban, Natal, 545 m).

Raja parcomaculata — Norman 1935: 46 (South Africa, Natal, doubtful species).

Cruriraja parcomaculata — Bigelow and Schroeder 1948a: 550 (Natal, South Africa); Bigelow and Schroeder 1953: 315 (Natal coast, South Africa); Bigelow and Schroeder 1962: 199 (Natal coast, South Africa, 545 m); Smith 1964: 288, Pls 26–27 (Algoa Bay, c. 183 m); Wallace 1967c: 11, Fig. 6 (rare, off Durban); Hulley 1970: 157, Pl. 1a, Figs 4a, b (holotype lost, off Durban; otherwise off West Coast from west-north-west of Lüderitz to Cape Columbine, 267–622 m, Algoa Bay, 193 m; probably not extending north-east of Port Alfred); Hulley 1972a: 86–96, Figs 58–59 (geographic and depth distribution; 170–550 m); Hulley 1986: 117, Fig. 25.3 (Lüderitz to Durban, 260–620 m); Turon *et al.* 1986: 174, 230, 296 (south-central Namibia and South Africa from south-west of Lüderitz to south-west of the Orange River mouth, 9 stations from 27°31,0′S, 14°25,6′E to 29°38,3′S, 14°47,0′E, 198–489 m); Compagno *et al.* 1989: 84, ill. (Lüderitz to Durban, 195–620 m); Mas-Riera and Macpherson 1989: 2, Figs 1, 2 (southernmost Namibia in vicinity of Orange River mouth and north-west coast of South Africa between 28 and 30°S, 150–500 m, slightly more northerly in summer).

Raja caudaspinosa — Norman 1935: 43 (South Africa, in part, for BMNH 1935.5.2.64, west of Cape Town, 34°08′S, 17°33′E, 402–?548 m; 33°48′S, 17°29,5′E, 402–235 m).

Raia miraletus — Barnard 1925: 68 (in part, for types of *C. parcomaculata*); Fowler 1941: 375 (South Africa, Natal in part, also including *Raia parcomaculata* Von Bonde and Swart, 1923 in synonymy).

Raia smithi — Smith 1949: 66, Fig. 68 (in part, South Africa, thought to be the young of *Bathyraja smithii*); Smith 1965: 66, Fig. 68 (in part, South Africa),

Africana demersal trawl stations (n = 84):

Cruise 028	A2299, 227 m;	A2304, 354 m;	A2305, 513 m;
	A2372, 370 m;	A2373, 284 m;	A2379, 375 m;
	A2380, 344 m.		
Cruise 033	A2750, 192 m;	A2751, 356 m;	A2754, 302 m;
	A2756, 502 m;	A2783, 301 m;	A2786, 364 m;
	A2841, 207 m.		
Cruise 039	A3325, 225 m;	A3341, 485 m;	A3344, 209 m;
	A3345, 453 m;	A3355, 212 m;	A3390, 362 m;
	A3428, 255 m;	A3429, 365 m;	A3466, 488 m.
Cruise 046	A4287, 213 m;	A4291, 217 m;	A4304, 240 m;
	A4305, 490 m;	A4309, 300 m;	A4327, 285 m;
	A4328, 300 m;	A4329, 335 m;	A4331, 195 m;
	A4362, 219 m;	A4386, 380 m.	
Cruise 050	A5245, 289 m;	A5250, 370 m;	A5255, 217 m;
	A5256, 296 m;	A5275, 250 m;	A5278, 275 m;
	A5279, 300 m;	A5285, 390 m;	A5303, 270 m;
	A5304, 270 m;	A5305, 266 m;	A5309, 215 m.
Cruise 054	A5853, 262 m;	A5854, 170 m;	A5863, 174 m;
	A5866, 224 m;	A5891, 368 m;	A5892, 380 m;
	A5945, 205 m.		
Cruise 059	A6839, 203 m;	A6847, 230 m;	A6853, 251 m;
	A6854, 520 m;	A6883, 266 m;	A6958, 238 m;
	A6959, 223 m;	A6960, 198 m;	A6970, 323 m;
	A6981, 391 m.		
Cruise 060	A7021, 240 m;	A7022, 498 m.	
Cruise 066	A7548, 473 m.		
Cruise 069	A8325, 280 m;	A8326, 265 m;	A8346, 327 m.
Cruise 075	A9011, 300 m;	A9012, 234 m;	A9013, 238 m;
	A9027, 438 m;	A9028, 400 m;	A9031, 300 m;
	A9129, 345 m;	A9130, 264 m;	A9146, 280 m.
Cruise 079	A9814, 455 m;	A9816, 315 m;	A9824, 288 m;
	A9828, 233 m;	A9829, 238 m;	A9835, 224 m.

Station latitude and depth range — 28°23,0′S, 14°25,3′E to 36°01,7′S, 19°47,5′E, 170–520 m.

Distribution — This moderately common small skate is another southern African endemic, and it ranges from south-central Namibia to Natal. Only the holotype was recorded from Natal, and the species is otherwise known from Lüderitz to Algoa Bay and possibly East London at 150–620 m. In Natal offshore waters it may be replaced by the smaller and easily distinguished *Cruriraja triangularis* Smith, 1964. The survey had a single record of *C. parcomaculata* in Namibian waters,

from just north-west of the Orange River, but the remainder were scattered along the uppermost slope and occasionally the outer shelf of South Africa from the Orange River to south-west of Cape Agulhas (Fig. 11d), with most records between 200 and 400 m. Usually very few were caught in any one trawl, but the catch ranged from hatchlings to adults.

Neoraja stehmanni (Hulley, 1972) — African dwarf skate

Breviraja stehmanni — Hulley 1972b: 253, Figs 1–5 (West of Cape Town, 292 m; 33°53,7–57,3′S, 17°25,0–26,8′E, 640 m; 33°55,6–56,1′S, 17°25,0–26,8′E, 600 m).

Neoraja (Neoraja) stehmanni — Hulley 1986: 118, Fig. 25.5 (south of Agulhas Bank to west of Cape Town, 292–1 025 m).

Neoraja stehmanni — Compagno *et al.* 1989: 88, ill. (Orange River mouth to Agulhas Bank, 292–1 025 m)

?*Raia plutonia* — Barnard 1925: 68 (in part, 824–1 025 m?)

Africana demersal trawl stations ($n = 11$):

Cruise 059 — A6956, 849 m.
Cruise 060 — A6986, 552 m; A6987, 710 m; A6989, 680 m; A7002, 668 m; A7023, 700 m; A7024, 894 m; A7025, 496 m; A7037, 903 m; A7038, 917 m; A7039, 719 m.

Station latitude and depth range — 29°35,1′S, 14°23,3′E to 34°56,5′S, 18°12,8′E, 496–917 m.

Distribution — This deep-water skate, one of the smallest southern African rajids, is a South African west coast endemic which has been recorded from west of Cape Town to south of the Agulhas Bank at 292–1 025 m. *Africana* encountered *Neoraja stehmanni* on several stations from limited areas on the deep slope, south-west of Cape Point and south-west of Saldanha Bay in its known range, but additionally northwards with a record south-west of the Orange River, a range extension. As currently known, its distribution is unusually localized compared to other offshore southern African rajids, but this may change with further deep-slope exploration. Off Cape Town and Saldanha Bay it was caught in considerable numbers (mostly adults) in limited areas below 600 m (Fig. 12a). It could have specialized habitat requirements not shared by other, more wide-ranging deep-water skates in the area, but this remains to be seen. Several other deep-water cartilaginous fish, including the skates *Bathyraja smithii*, *Raja (Rajella) leopardus*, *R. (R.) dissimilis* and *R. (R.) ravidula* were caught at some of the same stations that yielded *N. stehmanni*.

Raja (Amblyraja) radiata Donovan, 1808 — thorny skate

Raja radiata — Donovan 1808: Pl. 114 (Great Britain); Bigelow and Schroeder 1953: 255, Figs 55–56 (distribution in North Atlantic); Hulley 1970: 193, Fig. 13, Pl. 7a (west of Cape Town, 548–640 m); Hulley 1972a: 86–96, Figs 58–59 (geographic and depth distribution); Hulley 1986: 124, Fig. 25.16 (West Coast); Compagno *et al.* 1989: 88, ill. (off Cape Town).

Africana demersal trawl stations: none.

Distribution — The thorny skate is a common North Atlantic offshore species of high latitudes, with a broad range from the U.S.A. to Greenland, Spitzbergen, Iceland, and southwards to Holland and possibly the Bay of Biscay. Its known depth range is 55–604 m. It is known in southern African waters only from two specimens (South African Museum, SAM-25182, examined by the present authors) taken off Cape Town in 548–640 m. In view of its abundance and wide depth range elsewhere and its distinctiveness, it is surprising that *Africana* did not encounter this skate in the area. Possibly the species is very localized within the survey area, and perhaps *Africana* failed to sample patches of bottom and depth where this skate occurs. Limited coverage in the 500–650 m depth range was one of the deficiencies of the present survey.

Raja (Amblyraja) robertsi Hulley, 1970 — bigmouth skate

Raja robertsi — Hulley 1970: 190, Figs 12a–b (west of Cape Town, 33°51′S, 17°14′E, 1 350 m); Hulley 1972a: 86–96, Figs 58–59 (geographic and depth distribution); Hulley 1986: 125, Fig. 25.18 (west of Cape Town); Compagno *et al.* 1989: 88, ill. (off Cape Town).

Africana demersal trawl stations: none.

Distribution — This large, distinctive deep-water skate is a South African west coast endemic, collected from west of Cape Town in deeper water than sampled in the present survey. It has not been recorded since its

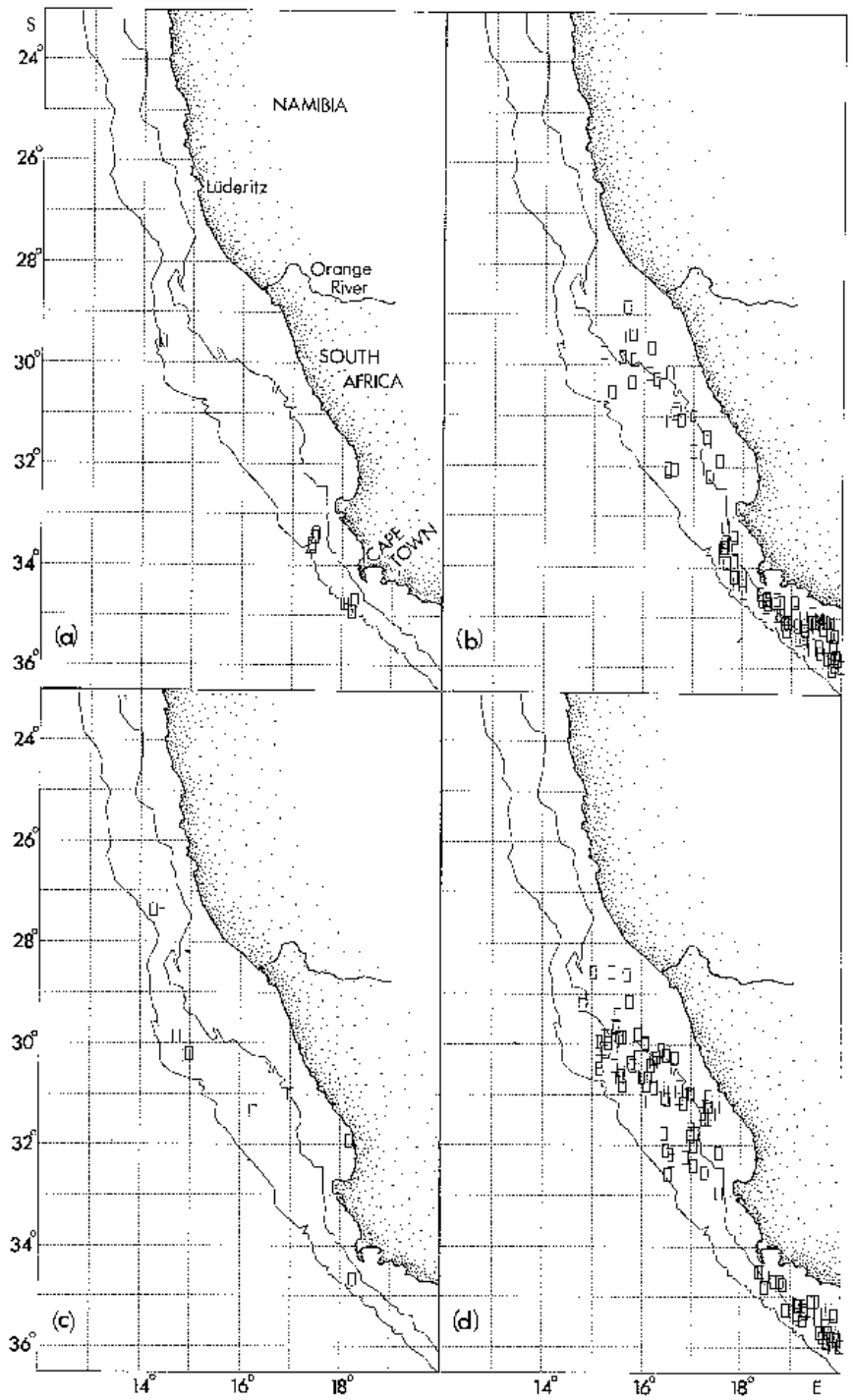

Fig. 12: *Africana* demersal trawl stations at which (a) African pygmy skate (*Neoraja stehmanni*, *n* = 11), (b) slime skate (*Raja* (*Dipturus*) *pullopunctata*, *n* = 103), (c) roughbelly skate (*Raja* (*Dipturus*) *springeri*, *n* = 8), (d) yellowspot skate (*Raja* (*Leucoraja*) *wallacei*, *n* = 123) were taken, 1986–1990

original description.

***Raja* (*Dipturus*) *doutrei* Cadenat, 1960 — javelin skate**

Raja doutrei — Cadenat 1960a: 294, Figs 1–13, 15 (Sud Fosse Kayar, Senegal, 450–500 m); Hulley 1970: 164, Figs 5a–c, Pl. 1b (WSW of Lüderitz, Namibia, 494 m); Hulley 1972a: 86–96, Figs 58–59 (geographic and depth distribution, 480–520 m; Senegal); Trunov 1972: 399, Fig. 3 (northern Namibia south to off Walvis Bay; 17°30′S, 11°20′E, 480–485 m; 17°30′S, 11°21′E, 495–500 m; 21°32′S, 12°44′E; 23°25′S, 13°02′E, 510–515 m; also north-central Namibia between 16°30′ and 25°00′S); Karrer 1973: 200, Fig. 1 (northern Namibia west of Cape Frio, 18°41′S, 11°31′E, 450–480 m); Allué *et al.* 1984: 127 (northern Namibia from the Cunene River to south-west of Rocky Point, 7 stations from 17°42,0′S, 11°20,0′E to 19°23,0′S, 11°36,0′E, 270–520 m); Hulley 1986: 122, Fig. 25.11 (Senegal to Lüderitz, Namibia, 450–600 m); Lloris 1986: 115, Fig. 37 (Namibia, west of Walvis Bay, 22°31′S, 12°47′E, 545–710 m; 22°41′S, 12°52′E, 409–420 m); Turon *et al.* 1986: 67, 174, 231, 296 (Namibia and South Africa, from Cunene River to south-west of the Orange River mouth, 28 stations from 17°32,9′S, 11°21,0′E to 29°24,0′S, 15°10,7′E, 163–615 m); Compagno *et al.* 1989: 90, ill. (Senegal south to north-central Namibia, 450–600 m); Mas-Riera and Macpherson 1989: 2, Figs 1, 2 (central Namibia south-west of Walvis Bay at approximately 23°20′–24°10′S, also south-west of Lüderitz between 27°00′ and 27°10′S, below 300 m).

Raia doutrei — Lleonart and Rucabado 1984: 41 (central Namibia north-west and west of Walvis Bay, 21°30,5′S, 12°34,1′E and 22°56,7′S, 13°04,2′E, 400–800 m).

Raja batis — ?Hulley 1966: 512 (Cape Columbine, 457 m, ? = *Raja springeri*).

Africana demersal trawl stations: none.

Distribution — This Atlantic African skate has a broad range from Senegal to Namibia, and off Namibia and South Africa it was reported from the Cunene River to just south-west of the Orange River, at depths of 163–800 m, with most records deeper than 400 m. It was not collected by *Africana* in Namibian waters or off South Africa in the survey area, although R.S. *Benguela* collected it near the Cunene River. It is close to the east coast *Raja* (*Dipturus*) *stenorhynchus* Wallace, 1967. It is possible that some of the numerous Namibian records of this skate by Spanish researchers may be based on *R.* (*D.*) *springeri*, which *Africana* collected off the Orange River.

***Raja* (*Dipturus*) *pullopunctata* Smith, 1964 — slime skate**

Raia pullopunctata — Smith 1964: 285, Pl. 25a (Algoa Bay, 183 m; uncertain if additional specimens mentioned from 29°59′S, 31°07′E, 230 m off Natal are this species or *R. campbelli*).

Raja pullopunctata — Hulley 1966: 505, Figs 4, 5 (west of Cape Town and Algoa Bay); Wallace 1967c: 13, Fig. 7 (Algoa Bay); Day *et al.* 1970: 89 (False Bay, Algoa Bay-Walvis Bay, 15–100 m); Hulley 1970: 166, Figs 6a–c, Pls 2a–b (west of Cape Town to off Port Alfred, 91–457 m); Hulley 1972a: 86–96, Figs 58–59 (geographic and depth distribution; 60–460 m); Hulley 1986: 123, Fig. 25.15, Pl. 6 (in part, Lüderitz to 23°S off Moçambique, including *R. campbelli*); Compagno *et al.* 1989: 92, ill. (Lüderitz to Port Alfred, 50–457 m); Mas-Riera and Macpherson 1989: 2, Figs 1, 2 (southernmost Namibia and South Africa in vicinity of Orange River mouth, about 28°30′–29°S, between 100 and 200 m, slightly more northerly in summer).

Raia batis — Thompson 1914: 156 (Buffels Bay); Von Bonde and Swart 1923: 3, 21 (Cape, Buffels Bay, off Cape Point lighthouse, 62 m); Barnard 1925: 70, Pl. 4, Fig. 3 (False Bay and off Cape Point, 62–183 m); Clark 1926: 53 (South Africa?); Von Bonde 1934: 16 (False Bay and off Cape Point); Smith 1949: 66, Fig. 65 (west coast around to Algoa Bay, 37–366 m); Smith 1965: 66, Fig. 65 (west coast to Algoa Bay).

Raia stabuliforis — Von Bonde and Swart 1923: 12, 21 (Mossel Bay).

Raja batis — Norman 1935: 39 (off Cape Point, 182 m); Fowler 1941: 385 (South Africa); Bigelow and Schroeder 1953: 146 (South Africa).

Africana demersal trawl stations (n = 103):

Cruise 028 —	A2336, 204 m;	A2362, 176 m.	
Cruise 033 —	A2749, 225 m;	A2750, 192 m;	A2754, 288 m;
	A2758, 199 m;	A2762, 159 m;	A2766, 170 m;
	A2768, 175 m;	A2772, 154 m;	A2773. 159 m;
	A2782, 353 m.		
Cruise 039 —	A3325, 225 m;	A3326, 187 m;	A3327, 178 m;
	A3330, 139 m;	A3332, 189 m;	A3339, 200 m;
	A3381, 213 m.		
Cruise 046 —	A4288, 190 m;	A4291, 217 m;	A4293, 175 m;
	A4294, 160 m;	A4297, 180 m;	A4298, 135 m;
	A4299, 145 m;	A4302, 175 m;	A4304, 240 m;
	A4309, 300 m;	A4312, 280 m;	A4319, 230 m;

A4321, 230 m; A4386, 380 m.
Cruise 050 — A5227, 173 m; A5228, 230 m; A5231, 169 m; A5232, 153 m; A5233, 140 m; A5234, 137 m; A5235, 186 m; A5236, 167 m; A5237, 155 m; A5259, 264 m; A5264, 217 m; A5265, 240 m; A5277, 240 m; A5281, 261 m; A5304, 270 m; A5313, 178 m; A5326, 204 m.
Cruise 054 — A5852, 305 m; A5853, 262 m; A5854, 170 m; A5855, 200 m; A5856, 222 m; A5857, 190 m; A5858, 117 m; A5859, 151 m; A5860, 159 m; A5862, 165 m; A5863, 174 m; A5866, 224 m; A5920, 180 m; A5924, 171 m; A5941, 235 m.
Cruise 059 — A6837, 171 m; A6838, 206 m; A6839, 203 m; A6844, 158 m; A6845, 170 m; A6846, 176 m; A6851, 174 m; A6868, 172 m; A6870, 246 m; A6877, 254 m; A6901, 199 m; A6911, 213 m; A6937, 176 m; A6970, 323 m; A6977, 243 m; A6978, 250 m.
Cruise 060 — A7021, 240 m; A7045, 156 m.
Cruise 069 — A8302, 250 m; A8321, 208 m.
Cruise 075 — A8996, 163 m; A9012, 234 m; A9013, 238 m; A9014, 170 m; A9015, 184 m; A9016, 174 m; A9018, 127 m; A9019, 154 m; A9020, 139 m; A9023, 158 m; A9024, 123 m; A9154, 372 m.
Cruise 079 — A9765, 144 m; A9801, 194 m; A9802, 195 m; A9820, 218 m; A9824, 288 m; A9829, 238 m.

Station latitude and depth range — 28°51,0′S, 15°39,0′E to 36°01,7′S, 19°47,5′E, 117–380 m.

Distribution — The slime skate is an endemic southern African batoid with a range from Lüderitz and possibly Walvis Bay, Namibia, at least to Algoa Bay, South Africa, in depths of 15–457 m. West Coast literature records of *R. pullopunctata* off South Africa are sketchy. Records from Natal may partly or entirely be based on a smaller and similar relative, *Raja (Dipturus) campbelli* Wallace, 1967. Off southern Namibia, the species may extend farther north in summer than in winter. The present survey did not obtain any Namibian records of *R. pullopunctata*, but it was taken in considerable numbers in South African waters from the outer shelf and upper slope south-west of the Orange River mouth to south of Cape Agulhas (Fig. 12b). Most records clustered between Saldanha Bay and Cape Agulhas, but there was a sparser group of records from off Cape Columbine to the Orange River, and most records were from between 100 and 350 m deep. All stages from hatchlings to adults were collected, including gravid females.

Raja (Dipturus) springeri Wallace, 1967 — roughbelly skate

Raja springeri — Wallace 1967c: 18, Figs 9–10 (c. 48 km ESE of Durban, 549 m; *Anton Bruun* #398B, 22°25′S, 35°54′E, east of Barra da Falsa, Moçambique, 741 m; also 403–421 m ESE of Durban); Hulley 1972a: 86–96, Figs 58–59 (geographic and depth distribution; east coast of southern Africa from Durban to Barra Falsa, 400–740 m); Hulley 1986: 125, Fig. 25.20 (23°S off Moçambique, ESE of Durban in 400–740 m; off Kenya); Ochumba 1988: 29 (Kenya); Compagno *et al.* 1989: 92, ill. (Lüderitz to central Moçambique, also Madagascar and Kenya, 88–740 m).

?Raja batis — Hulley 1966: 512 (off Cape Columbine, 458 m).

Africana demersal trawl stations ($n = 8$):

Cruise 039 — A3469, 440 m.
Cruise 046 — A4364, 440 m.
Cruise 050 — A5289, 88 m.
Cruise 054 — A5935, 454 m.
Cruise 059 — A6949, 425 m; A6950, 475 m.
Cruise 060 — A7040, 486 m.
Cruise 075 — A9139, 481 m.

Station latitude and depth range — 27°22,2′S, 14°16,2′E to 34°40,5′S, 18°14,7′E, 88–486 m.

Distribution — This rare giant deep-water skate was formerly considered to be an east coast African endemic, with a range from Natal, Moçambique, Madagascar and Kenya in 400–740 m of water, but collecting by *Africana* has extended its range to the Eastern Cape and to the west coast of southern Africa. This survey recorded it from south-west of Cape Point to off Port Nolloth in South African waters and into Namibian waters, with two records south-west of Lüderitz (Fig. 12c). Most records are on the upper slope between 400 and 500 m, but *Africana* once collected a small juvenile at 88 m off Lambert's Bay. Most of the records are of one large juvenile per station, but once an adult male and a small juvenile were collected simultaneously. It may be more common off the Eastern Cape.

Raja (Leucoraja) wallacei Hulley, 1970 — yellowspot skate

Raja wallacei — Hulley, 1970: 210, Figs 19a–b, Pl. 12b (south-west of Cape Town, 34°10′S, 17°45′E, 292 m); Hulley 1972a: 86–96, Figs 58–59 (geographic and depth distribution; 65–430 m); Hulley 1986: 127, Fig. 25.23, Pl. 6 (Cape to Limpopo River mouth, Moçambique, 70–450 m); Compagno *et al.* 1989: 94, ill. (Lüderitz to southern Moçambique, 95–432 m); Mas-Riera and Macpherson 1989: 3, Figs 9, 10 (southern Namibia and north-west South Africa in vicinity

of Orange River mouth, about 28°10′–30°S, 100–500 m).

Raia barnardi — Smith 1949: 67, Pl. 3 (in part, Port Nolloth to Algoa Bay, South Africa, down to 366 m); Smith 1965: 67, Pl. 3 (in part).

Raja barnardi — Wallace 1967c: 39, Figs 20–21 (west and east coasts of southern Africa; off Chalumna River, Eastern Cape, in 73 m; SE of Durban Bluff, Natal, in 293–421 m; off Limpopo River mouth, southern Moçambique, 447 m).

Raia caudaspinosa — Smith 1949: 67, Fig. 72 (in part, Cape to Natal); Smith 1965: 67, Fig. 72 (in part, Cape to Natal).

Africana demersal trawl stations ($n = 123$):

Cruise 028 — A2333, 182 m; A2336, 204 m; A2373, 284 m.
Cruise 033 — A2764, 160 m; A2766, 170 m; A2767, 213 m; A2768, 175 m; A2769, 201 m; A2784, 291 m; A2842, 200 m.
Cruise 039 — A3325, 225 m; A3327, 178 m; A3329, 157 m; A3337, 174 m; A3339, 200 m; A3360, 379 m; A3381, 213 m; A3386, 240 m; A3395, 299 m; A3428, 255 m.
Cruise 046 — A4290, 170 m; A4291, 217 m; A4293, 175 m; A4294, 160 m; A4294, 160 m; A4295, 230 m; A4296, 165 m; A4302, 175 m; A4304, 240 m; A4362, 219 m; A4363, 432 m; A4369, 330 m; A4381, 200 m; A4382, 233 m; A4383, 372 m.
Cruise 050 — A5227, 173 m; A5228, 230 m; A5232, 153 m; A5238, 160 m; A5242, 157 m; A5254, 265 m; A5256, 296 m; A5259, 264 m; A5299, 173 m; A5309, 215 m; A5322, 209 m; A5325, 184 m; A5327, 188 m; A5337, 199 m; A5338, 160 m; A5339, 190 m.
Cruise 054 — A5861, 165 m; A5863, 174 m; A5865, 230 m; A5886, 460 m; A5893, 358 m; A5920, 180 m; A5921, 187 m; A5937, 192 m; A5938, 344 m; A5940, 282 m; A5945, 205 m; A5946, 205 m.
Cruise 059 — A6837, 171 m; A6839, 203 m; A6845, 170 m; A6846, 176 m; A6847, 230 m; A6851, 174 m; A6852, 180 m; A6853, 251 m; A6887, 289 m; A6912, 184 m; A6913, 146 m; A6934, 186 m; A6935, 185 m; A6942, 156 m; A6943, 177 m; A6944, 170 m; A6954, 224 m; A6959, 223 m; A6960, 198 m; A6961, 209 m; A6968, 245 m; A6978, 250 m.
Cruise 060 — A6985, 247 m; A7021, 240 m.
Cruise 069 — A8326, 265 m; A8341, 174 m; A8342, 200 m; A8343, 191 m.
Cruise 075 — A9014, 170 m; A9015, 184 m; A9016, 174 m; A9017, 152 m; A9019, 154 m; A9042, 257 m; A9043, 263 m; A9051, 191 m; A9069, 227 m; A9084, 185 m; A9122, 185 m; A9124, 188 m; A9130, 264 m; A9131, 227 m; A9133, 248 m; A9140, 350 m; A9141, 470 m; A9145, 253 m; A9146, 280 m; A9150, 351 m; A9154, 372 m.
Cruise 079 — A9768, 219 m; A9795, 182 m; A9803, 189 m; A9815, 240 m; A9816, 315 m; A9820, 218 m; A9822, 207 m; A9824, 288 m; A9828, 233 m; A9829, 238 m; A9830, 234 m.

Station latitude and depth range — 28°34,0′S, 15°23,7′E to 36°00,0′S, 19°50,0′E, 146–470 m.

Distribution — This common, distinctive skate is an endemic of southern Africa, with a reported range from southern Namibia to southern Moçambique at 70–500 m. There are few detailed West Coast records, and it barely extends into Namibian waters in the vicinity of the Orange River. The present survey recorded it from southernmost Namibia at the Orange River mouth southwards along the outer shelf and upper slope to south of Cape Agulhas (Fig. 12d), with most records between 150 and 300 m. *Raja wallacei* shows a distinctly bimodal geographic distribution off the west coast of South Africa, with all the records concentrated in an area between the Orange River and Cape Columbine, and a second area between Cape Point and Cape Agulhas with no records in between. It is very common off the Eastern Cape (Compagno *et al.* in prep.).

Raja (*Malacoraja*) *spinacidermis* Barnard, 1923 — roughskin skate

Raia spinacidermis — Barnard 1923: 440 (exact locality uncertain); Barnard 1925: 73, Pl. 4, Fig. 6 (off Cape Point in deep water); Fowler 1941: 392 (South Africa); Smith 1949: 66 (in part, South Africa, not *Raia durbanensis*, in synonymy); Smith 1965: 66 (in part, South Africa).

Raja spinacidermis — Norman 1935: 46 (South Africa); Hulley 1970, 173, Pls 4a–b (west of Cape Town, 33°49′S, 17°13′E, 1 000 m; 33°51′S, 17°41′E, 1 350 m); Hulley 1972a: 86–96, Figs 58–59 (geographic and depth distribution; 1 000–1 350 m); Trunov 1972: 400 (north-central Namibia between 16°30′ and 25°00′S); Hulley and Stehmann 1977: 227, Figs 1–5 (west of Cape Town, 33°43′S, 17°21′E, 914 m); Stehmann and Bürkel 1984: 182 (Western North Atlantic and Iceland-Faeroes Ridge, South Africa); Hulley 1986: 125, Fig. 25.19 (North Atlantic; west coast of South Africa below 900 m); Compagno *et al.* 1989: 96, ill. (southern Namibia to Cape Town, 864–1 350 m).

Raja mollis — Bigelow and Schroeder 1950: 388, Pl. 2 (southern Nova Scotia, 1 569 m); Bigelow and Schroeder 1953: 237, Fig. 51 (southern Nova Scotia);

Bigelow and Schroeder 1954: 63 (Georges Bank and southern Nova Scotia, 760–895 m); Templeman 1965: 268, Figs 10–13 (south-west Grand Bank to Baffin Island, 450–745 m); Krefft and Lübben 1966: 389, Figs 1–2 (west of Iceland-Faeroes Ridge, 680 m).

?*Raia plutonia* — Barnard 1925: 68 (in part, off Cape Point and south of Agulhas Bank, 824–1 025 m?, also including holotype of *Raia albalinea* Von Bonde and Swart, 1923 = *R. caudaspinosa*).

Africana demersal trawl stations ($n = 8$):

Cruise 050 — A5249, 800 m.
Cruise 059 — A6892, 903 m; A6951, 864 m; A6956, 849 m.
Cruise 060 — A6988, 900 m; A6999, 923 m; A7024, 894 m.
Cruise 066 — A7550, 900 m.

Station latitude and depth range — 29°20,7′S, 14°03,3′E to 34°56,5′S, 18°12,8′E, 800–923 m.

Distribution — This rare deep-water skate has an amphitemperate distribution on the North Atlantic slope from Georges Bank to the Iceland-Faeroes Ridge in 450–1 569 m, and off north-central Namibia and Cape Town, South Africa, at 1 000–1 350 m. This survey collected it in small numbers from the deep slope of South Africa from off Port Nolloth, south-west of Lambert's Bay, north-west of Cape Town, and south-west of Cape Point (Fig. 13a) at 800 m and deeper. Catches ranged from small juveniles to adults.

Raja (*Raja*) cf. *clavata* Linnaeus, 1758 — biscuit skate

Raja clavata — Linnaeus 1758, 1: 232 ("Habitat in Europa"); Gilchrist 1922a: 7 (South Africa); Fowler 1936b: 110 (South Africa, Walvis Bay to Natal, to 293 m); Fowler 1941: 360 (South Africa, Natal, ?Mauritius); Hulley 1966: 508, Fig. 8 (Namibia to Natal and off southern Madagascar and Mauritius); Wallace 1967c: 35, Fig. 4, 18–19 (west and east coast of southern Africa; off Lambert's Bay, Western Cape, 293 and 458 m; Algoa Bay in 55–128 m, and off Chalumna River in 92 m, Eastern Cape); Hulley, 1970: 183, Figs 10a–c, Pl. 6a (Cape Columbine to Algoa Bay, 55–548 m); Hulley 1972a: 86–96, Figs 58–59 (geographic and depth distribution; Eastern North Atlantic and Mediterranean south to about 20°N; northern limit of about 23°S in southern Africa from Namibia to Cape Point, then north-east to Barra Falsa, Moçambique, southern Madagascar and Mauritius; 50–1 040 m); Hulley 1986: 120, Fig. 25.7, Pl. 6 (Walvis Bay to Durban, 50–1 020 m; also Black Sea, Mediterranean, Eastern North Atlantic, southern Madagascar and Mauritius); Lloris 1986: 117, Fig. 38 (Namibia south-west of Walvis Bay, 23°31′S, 12°58′E, 761–768 m); Turon *et al.* 1986: 36, 67, 137, 175, 231, 296 (Namibia, 29 stations from 17°32,9′S, 11°21,0′E to 29°22,5′S, 14°34,9′E, 24–823 m); Mas-Riera and Macpherson 1989: 2, Figs 3, 4 (southern Namibia and South Africa from 25°50′–30°S, between 100 and 200 m, more northerly in summer).

Raia clavata — Barnard 1925: 64, Pl. 4, Fig. 2 (in part?, Walvis Bay, Table Bay to Natal); Von Bonde 1933: 39 (Cape seas); Von Bonde 1934: 16 (Walvis Bay to Natal); Barnard 1947: 26, Pl. 4, Fig. 1 (South Africa); Day *et al.* 1970: 89 (False Bay, Beira-Walvis Bay, 15–100 m); Lleonart and Rucabado 1984: 42 (central Namibia west of Walvis Bay, 22°53,0′S, 12°58,1′E, 470–650 m).

Raja bonae-speiensis — Fowler 1910: 468 (replacement name for *Raja capensis* Müller and Henle, 1841).

Raia capensis — Müller and Henle 1841: 151 ("Vom Cap"; junior homonym of *Raja capensis* Gmelin, 1789 = *Narke capensis*); Gray 1851: 112 ("Cape"); Bleeker 1860: 58 (Cape of Good Hope); Dumeril 1865: 540, Pl. 12, Figs 11–12 (Cape of Good Hope); Günther 1870: 455, ftn. * (Cape of Good Hope); Gilchrist 1902: 168 (Cape of Good Hope); Thompson 1914: 157 (Cape seas, South Africa); Gilchrist 1921: 34 (Western Cape).

Raia capensis — ?Sauvage 1891: 510 (Madagascar); Von Bonde and Swart 1923: 4, 21 (Cape seas, R.V. *Pickle* #59, 32°27,30′S, 17°22,00′E, 267 m; #351, 32°36,00′S, 17°05,00′E, 293 m; between Lambert's Bay and Cape Columbine, Western Cape).

Raia maculata — ?Barnard 1925: 71 (Cape seas); ?Von Bonde 1933: 32 (Cape seas).

Raja maculata — ?Bleeker 1860: 58 (Cape of Good Hope); ?Gilchrist 1902: 168 (South Africa); ?Thompson 1914: 157 (Cape seas, South Africa).

Raia oculata — ?Von Bonde and Swart 1923: 4, 21 (Cape seas).

Raia ocellifera — Garman 1913: 365 (South Africa, in part, *R. capensis* and *R. rhizacanthus* in synonymy).

Raia quadrimaculata — ?Von Bonde and Swart 1923: 5, 21 (Natal, *Pickle* #97, 29°52,00′S, 31°18,00′E, off Durban, 375 m); ?Von Bonde 1934: 16 (west coast of South Africa).

Raia rhizacanthus — Regan 1906: 3, Pl. 3 (Natal, 73 m); Regan 1908a: 242 (Bird Island, Algoa Bay);

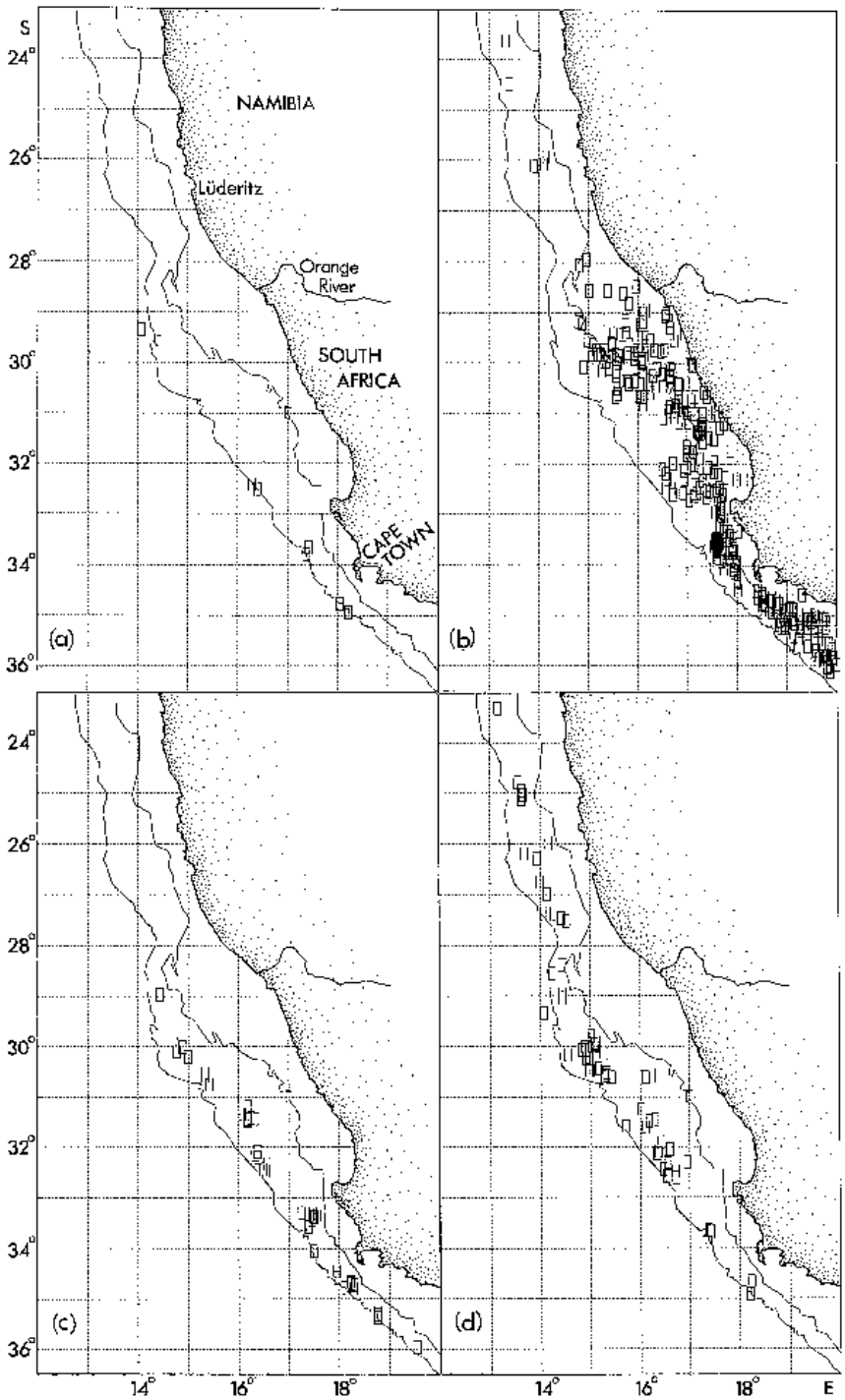

Fig. 13: *Africana* demersal trawl stations at which (a) roughskin skate (*Raja* (*Malacoraja*) *spinacidermis*, $n = 8$), (b) biscuit skate (*Raja* (*Raja*) cf. *clavata*, $n = 401$), (c) Munchkin skate (*Raja* (*Rajella*) *caudaspinosa*, $n = 40$), (d) bigthorn skate (*Raja* (*Rajella*) *confundens*, $n = 68$) were taken, 1986–1990

Gilchrist and Thompson 1916: 288 (Natal, Bird Island); Von Bonde and Swart 1923: 5, 21 (Cape and Natal); Smith 1949: 66 (southern Africa, Walvis Bay to Madagascar, to 366 m); Smith 1965: 66 (southern Africa).

Raja rhizacanthus — Thompson 1914: 158 (Natal, Bird Islands); Norman 1935: 40 (South Africa, Walvis Bay to Natal, Madagascar; specimens from Kalk Bay, False Bay, Agulhas Bank, Cape St Blaize and Bird Island, "Natal" [? = Algoa Bay]); Smith and Smith 1966: 29, ill. (Tsitsikamma Park, Eastern Cape, South Africa); Hulley 1966: 499 (= *Raja clavata*).

?*Raja smithi* — Smith 1949: 66, Pl. 3 (in part?); Smith 1965: 66, Pl. 3 (in part?).

Raja straeleni — Poll 1951: 118, Fig. 54 (Angola, including type locality, also Namibia off Rocky Point, 19°52′S, 12°20′E, 220 m); Krefft 1968a: Pl. 5a (Angola, Spanish Guinea, 210–660 m); Hulley 1970: 187, Figs 11a–c, Pl. 6b (Angola and north-central Namibia, 10°28′ to 22°03′S, 200–700 m); Stehmann 1971: 187, Figs 8–13 (north-west Africa, Angola and Namibia from south-west of the Cunene River to north-west of Walvis Bay, 18°30′S, 11°27′E to 22°03′S, 13°12′E, 200–400 m); Hulley 1972a: 86–96, Figs 58–59 (geographic and depth distribution; commonest between 20°N and 15°S); Trunov 1972: 400 (north-central Namibia between 16°30′S and 25°00′S); Allué *et al.* 1984: 127 (north-central Namibia from the Cunene River to off Walvis Bay, 18 stations from 17°30,0′S, 11°32,0′E to 22°23,0′S, 13°05,0′E, 117–405 m); Hulley 1986: 126, Fig. 25.22 (Namibia; Eastern Atlantic between 20°N and 22°S, 80–690 m); Lloris 1986: 121, Fig. 40 (Namibia, north-west to west of Walvis Bay, 21°04′S, 13°04′E, 510–530 m; 22°57′S, 13°04′E, 400–500 m); Turon *et al.* 1986: 67, 137, 175, 231, 296 (Namibia and South Africa from the Cunene River mouth to south-west of the Orange River mouth, 53 stations from 17°46,0′S, 11°30,0′E to 29°16,1′S, 14°50,4′E, 88–417 m); Compagno *et al.* 1989: 94, ill. (Namibia to Algoa Bay; perhaps Natal, inshore to 353 m); Mas-Riera and Macpherson 1989: 2, Figs 3, 4 (south-central Namibia from south-west of Walvis Bay to south-west of Lüderitz, between 23°40′ and 27°10′S, between 150 and 350 m, more northerly in summer).

Raia straeleni — Lleonart and Rucabado 1984: 41 (central Namibia north-west and west of Walvis Bay, 4 stations from 21°03,9′S, 12°58,9′E to 22°56,7′S, 13°04,2′E, 180–800 m).

Africana demersal trawl stations ($n = 401$):

Cruise 028 — A2214, 187 m; A2220, 175 m; A2223, 213 m; A2232, 165 m; A2239, 199 m; A2240, 202 m; A2247, 234 m; A2299, 227 m; A2316, 242 m; A2325, 186 m; A2333, 182 m; A2335, 194 m; A2362, 176 m; A2364, 203 m; A2387, 199 m; A2388, 175 m.

Cruise 033 — A2745, 198 m; A2747, 202 m; A2749, 225 m; A2749, 225 m; A2750, 192 m; A2750, 192 m; A2751, 356 m; A2752, 238 m; A2752, 238 m; A2753, 308 m; A2758, 199 m; A2758, 199 m; A2759, 235 m; A2760, 186 m; A2762, 159 m; A2763, 161 m; A2764, 160 m; A2765, 163 m; A2766, 170 m; A2767, 213 m; A2768, 175 m; A2769, 201 m; A2770, 200 m; A2772, 154 m; A2772, 154 m; A2773, 159 m; A2774, 138 m; A2774, 138 m; A2775, 138 m; A2775, 144 m; A2776, 194 m; A2788, 260 m; A2800, 134 m; A2809, 123 m; A2817, 161 m; A2818, 148 m; A2826, 154 m; A2834, 119 m; A2840, 215 m; A2841, 207 m; A2842, 200 m.

Cruise 039 — A3324, 239 m; A3325, 225 m; A3327, 178 m; A3328, 171 m; A3329, 157 m; A3334, 148 m; A3428, 255 m; A3428, 255 m; A3439, 308 m; A3448, 353 m; A3450, 293 m; A3452, 263 m.

Cruise 046 — A4287, 213 m; A4288, 190 m; A4289, 170 m; A4290, 170 m; A4291, 217 m; A4292, 235 m; A4293, 175 m; A4294, 160 m; A4295, 230 m; A4296, 165 m; A4297, 180 m; A4297, 180 m; A4298, 135 m; A4299, 145 m; A4300, 155 m; A4301, 151 m; A4302, 175 m; A4304, 240 m; A4312, 280 m; A4313, 195 m; A4314, 210 m; A4316, 239 m; A4317, 230 m; A4318, 230 m; A4319, 230 m; A4320, 232 m; A4321, 230 m; A4322, 230 m; A4323, 225 m; A4324, 230 m; A4325, 230 m; A4325, 230 m; A4327, 285 m; A4328, 300 m; A4330, 235 m; A4335, 270 m; A4336, 260 m; A4345, 115 m; A4349, 159 m; A4351, 215 m; A4352, 216 m; A4357, 163 m; A4358, 186 m; A4362, 219 m; A4369, 330 m; A4381, 200 m; A4382, 233 m; A4385, 335 m; A4390, 186 m.

Cruise 050 — A5227, 173 m; A5228, 230 m; A5229, 450 m; A5230, 220 m; A5232, 133 m; A5233, 140 m; A5234, 137 m; A5235, 186 m; A5236, 167 m; A5237, 155 m; A5238, 160 m; A5239, 252 m; A5241, 161 m; A5242, 157 m; A5243, 186 m; A5256, 296 m; A5257, 277 m; A5259, 264 m; A5260, 200 m; A5261, 166 m; A5262, 226 m; A5263, 162 m; A5264, 217 m; A5265, 240 m; A5270, 223 m; A5271, 241 m; A5272, 237 m; A5277, 240 m; A5278, 275 m; A5281, 61 m; A5282, 175 m; A5283, 175 m; A5284, 214 m; A5289, 88 m; A5290, 100 m; A5293, 100 m; A5295, 123 m; A5296, 155 m; A5297, 165 m; A5297, 165 m; A5298, 170 m; A5299, 173 m;

A5299, 173 m; A5303, 270 m; A5305, 266 m;
A5309, 215 m; A5310, 216 m; A5314, 168 m;
A5317, 102 m; A5317, 102 m; A5320, 179 m;
A5321, 200 m; A5321, 200 m; A5323, 204 m;
A5324, 183 m; A5324, 183 m; A5325, 184 m;
A5326, 204 m; A5327, 188 m; A5328, 170 m;
A5331, 93 m; A5332, 121 m; A5336, 217 m;
A5337, 199 m; A5339, 190 m.

Cruise 054 — A5851, 181 m; A5852, 305 m; A5853, 262 m;
A5854, 170 m; A5855, 200 m; A5856, 222 m;
A5857, 190 m; A5859, 151 m; A5860, 159 m;
A5861, 165 m; A5862, 165 m; A5863, 174 m;
A5864, 205 m; A5866, 224 m; A5871, 144 m;
A5872, 173 m; A5873, 285 m; A5874, 240 m;
A5875, 274 m; A5876, 245 m; A5877, 257 m;
A5878, 257 m; A5879, 270 m; A5880, 234 m;
A5885, 390 m; A5887, 386 m; A5889, 275 m;
A5890, 270 m; A5893, 358 m; A5906, 99 m;
A5915, 186 m; A5916, 183 m; A5917, 165 m;
A5920, 180 m; A5921, 187 m; A5923, 175 m;
A5924, 171 m; A5925, 164 m; A5926, 185 m;
A5937, 192 m; A5940, 282 m; A5941, 235 m;
A5945, 205 m; A5946, 205 m; A5947, 321 m;
A5949, 275 m; A5950, 222 m; A5952, 230 m.

Cruise 059 — A6835, 194 m; A6836, 244 m; A6837, 171 m;
A6838, 206 m; A6839, 203 m; A6840, 175 m;
A6841, 161 m; A6844, 158 m; A6845, 170 m;
A6846, 176 m; A6847, 230 m; A6848, 228 m;
A6851, 174 m; A6852, 180 m; A6853, 251 m;
A6855, 237 m; A6860, 216 m; A6861, 196 m;
A6864, 217 m; A6866, 148 m; A6867, 77 m;
A6868, 172 m; A6870, 246 m; A6871, 261 m;
A6872, 252 m; A6873, 256 m; A6874, 264 m;
A6875, 256 m; A6876, 244 m; A6877, 254 m;
A6878, 256 m; A6880, 168 m; A6881, 159 m;
A6884, 174 m; A6900, 162 m; A6902, 164 m;
A6905, 169 m; A6906, 107 m; A6907, 77 m;
A6911, 213 m; A6912, 184 m; A6914, 77 m;
A6915, 131 m; A6916, 87 m; A6922, 78 m;
A6927, 103 m; A6929, 105 m; A6933, 191 m;
A6934, 186 m; A6935, 185 m; A6936, 175 m;
A6937, 176 m; A6938, 174 m; A6941, 168 m;
A6942, 156 m; A6943, 177 m; A6944, 170 m;
A6953, 206 m; A6958, 238 m; A6959, 223 m;
A6960, 198 m; A6961, 209 m; A6968, 245 m;
A6969, 257 m; A6974, 189 m; A6975, 190 m;
A6976, 203 m; A6977, 243 m; A6978, 250 m.

Cruise 060 — A6985, 247 m; A7021, 240 m; A7045, 156 m.

Cruise 069 — A8298, 160 m; A8301, 255 m; A8302, 250 m;
A8305, 275 m; A8306, 244 m; A8308, 248 m;
A8312, 250 m; A8314, 258 m; A8316, 245 m;
A8318, 249 m; A8320, 181 m; A8321, 208 m;
A8325, 280 m; A8326, 265 m; A8327, 261 m;
A8328, 288 m; A8338, 146 m; A8340, 133 m;
A8341, 174 m; A8342, 200 m; A8343, 191 m;
A8357, 297 m; A8372, 295 m; A8421, 190 m;
A8422, 199 m.

Cruise 075 — A8993, 181 m; A8994, 209 m; A8995, 174 m;
A8998, 235 m; A8999, 235 m; A9000, 242 m;
A9002, 238 m; A9003, 231 m; A9004, 248 m;
A9005, 245 m; A9007, 250 m; A9012, 234 m;
A9013, 238 m; A9014, 170 m; A9015, 184 m;
A9016, 174 m; A9017, 152 m; A9018, 127 m;
A9019, 154 m; A9020, 139 m; A9022, 186 m;
A9023, 158 m; A9024, 123 m; A9025, 38 m;
A9026, 245 m; A9034, 187 m; A9042, 257 m;
A9043, 263 m; A9066, 190 m; A9068, 218 m;
A9069, 227 m; A9070, 200 m; A9082, 173 m;
A9083, 190 m; A9084, 185 m; A9122, 185 m;
A9124, 188 m; A9125, 181 m; A9129, 345 m;
A9131, 227 m; A9132, 220 m; A9133, 248 m;
A9138, 465 m; A9145, 253 m; A9148, 340 m;
A9150, 351 m; A9154, 372 m.

Cruise 079 — A9767, 203 m; A9768, 219 m; A9772, 152 m;
A9782, 132 m; A9795, 182 m; A9797, 162 m;
A9798, 166 m; A9799, 162 m; A9800, 213 m;
A9801, 194 m; A9802, 195 m; A9803, 189 m;
A9804, 191 m; A9810, 265 m; A9818, 250 m;
A9819, 224 m; A9820, 218 m; A9821, 227 m;
A9824, 288 m; A9828, 233 m; A9829, 238 m;
A9830, 234 m; A9831, 229 m; A9832, 242 m;
A9833, 173 m; A9834, 135 m; A9836, 149 m.

Station latitude and depth range — 23°36,7′S, 13°20,3′E to 36°06,8′S, 19°50,7′E, 28–465 m.

Distribution — This is the commonest skate in southern African waters, but ironically the most problematical for ichthyologists because of variation in spination and coloration. All records of *straeleni-clavata* skates are listed here together, pending a resolution of the question of whether two species are sympatric in the area or only one.

Members of the group, termed biscuit skates because of their brown, mottled pattern, range from Namibia to Algoa Bay and possibly Natal off southern Africa. They were the most frequently recorded cartilaginous fish other than the Izak catshark *Holohalaelurus regani*. In the survey area, *Africana* caught them at a few stations south-west of Walvis Bay, north-west of Lüderitz and north-west of the Orange River mouth off Namibia, but most of the records were from the South African shelf and the uppermost slope from the Orange River to south of Cape Agulhas. Concentrations of the species-group appeared between the Orange River and Doring Bay, between Saldanha Bay and Cape Point, and south of Cape Point to south of Cape Agulhas (Fig. 13b). Most of the records were from 100 to 300 m of water depth. The latitude-depth summer-winter plot (see Fig. 18b) includes more

records between 50 and 150 m for summer than winter, and more in winter for 300–450 m, suggesting general movement shorewards in summer and offshore in winter.

Classification — The biscuit skate of the west coast of South Africa has commonly been identified as the European thornback skate *Raja clavata* Linnaeus, 1758, or as certain other European species. It has also been considered a separate species *R. rhizacanthus* Regan, 1906, or *R. capensis* Müller and Henle, 1841 (junior homonym, replaced by *R. bonae-speiensis* Fowler, 1910). In contrast, *R. straeleni* was proposed by Poll (1951) for similar skates in more northern waters off Angola and northern Namibia, and its southern limit was considered as about 22°S off central Namibia, south of which it was replaced by southern African *R. clavata* (Hulley 1986). The range of *R. straeleni* was extended northwards to north-west Africa (Stehmann 1971), where it is replaced by true European *R. clavata*, and southwards along the Namibian coast to South African waters just south of the Orange River (Turon *et al.* 1986). The range of southern African *R. clavata* was extended in turn to off the Cunene River, northern Namibia (Turon *et al.* op. cit.).

Examination of many hundreds of skates of this group collected by *Africana* from the west and south-east coasts of South Africa and Namibia suggests skates with the external clasper morphology and coloration attributed to *R. straeleni* by Hulley (1970, 1986) and Stehmann (1971) were wide-ranging off South Africa, and there was a problem in distinguishing southern African *R. clavata* from *R. straeleni* because of morphological variation. Most of the skates were more or less similar to *R. straeleni* in colour pattern, with bold dark spots and bars and with a pectoral ocellus varying from bold to obsolete, and the adult males examined had an enlarged clasper shield as in *R. straeleni* rather than *R. clavata*. Individuals with *R. clavata*-like coloration of numerous irregular blotches did occur, but intergraded with the *R. straeleni*-like individuals with small discrete dark spots. Stehmann (op. cit.) was convinced that *R. straeleni* from southern and north-west Africa were distinct from European *R. clavata*. The problem is whether the true *R. clavata* occurs off southern Africa in addition to the *R. straeleni*-like form or if all the biscuit skates of southern Africa are a single species. If so, one of the earlier South African taxa (*R. rhizacanthus* or *R. capensis* = *R. bonae-speiensis*) may be a senior synonym of *R. straeleni* and may be applicable to the South African *straeleni*-like biscuit skate. Pending a revision of this complex of skates off southern Africa (*straeleni-clavata* or, as it was termed in frustration aboard *Africana*, "stravata"), the name *Raja* cf. *clavata* is used here as a species name for the southern African biscuit skate as a temporary expedient. Compagno *et al.* (1989) used *R. straeleni* as an alternative name.

Raja (*Raja*) *miraletus* Linnaeus, 1758 — twineye skate

Raja miraletus — Linnaeus 1758: 231 ("Habitat in mari Mediterraneo"); Thompson 1914: 158 (South Africa); Fowler 1936b: 114 (Agulhas Bank and Natal in 66 m); Fowler 1941: 375 (South Africa, Natal in part, also including *Raia parcomaculata* in synonymy); Poll 1951: 107, Fig. 53, Pl. 8, Figs 1–2, 4, Pl. 13, Fig. 1 (Angolan records); Wallace 1967c: 31, Figs 16–17 (Algoa Bay in 55–106 m and off Chalumna River, 73–92 m, Eastern Cape; between Durban and Richards Bay, Natal, 13–75 m); Hulley 1969: 137, Figs 1, 2c (Mediterranean, North and West Africa); Hulley 1970: 179, Figs 9a–c, Pl. 7b (Cape Agulhas to Natal, 48–78 m; Sierra Leone; Angola and northern Namibia, 100–440 m); Hulley 1972a: 86–96, Figs 58–59 (geographic and depth distribution; Mediterranean south to Morocco, Cape Bojador, Rio de Oro, Cape Blanc to Cape Verde, Senegal, Cape Lopez in Gabon, Baie dos Tigres in Angola, northern Namibia at 18°30′S, 11°27′E; gap in distribution along west coast of South Africa and south-central Namibia but present from False Bay north-eastwards to Richards Bay, Natal; commonest between 50 and 150 m, range 10–420 m); Trunov 1972: 400 (north-central Namibia between 16°30′ and 25°00′S); Penrith 1978: 182 (Porto Alexandre, southern Angola); Allué *et al.* 1984: 127 (northern Namibia from the Cunene River to south-west of Rocky Point, 6 stations from 17°30,0′S, 11°32,0′E to 19°10,0′S, 12°16,0′E, 70–126 m); Ochumba 1984: 46 (Kenya); Hulley 1986: 123, Fig. 25.14, Pl. 6 (False Bay to Durban, 20–440 m; also Mediterranean south to Angola); Lloris 1986: 119, Fig. 39 (northern Namibia near Angolan border, 17°44′S, 11°44′E, 70 m); Turon *et al.* 1986: 67, 175, 231 (Namibia and South Africa, 5 stations from 22°11,1′S, 12°46,4′E to 29°22,5′S, 14°34,9′E, 168–421 m); Ochumba 1988: 29 (Kenya, 200–800 m); Compagno *et al.* 1989: 96, ill. (Namibia, False Bay to Durban, 17–106 m).

Raia miraletus — Von Bonde and Swart 1923: 5, 21 (Cape); Barnard 1925, 68 (in part, Agulhas Bank and Natal, not types of *Cruriraja parcomaculata*); Clark 1926: 9 (Cape Colony, Mossel Bay).

Raia ocellifera — Regan 1906: 2, Pl. 2 (Algoa Bay and Natal, 73 m); Regan 1908a: 242 (Bird Island,

Algoa Bay); Garman 1913: 365 (South Africa, in part); Gilchrist and Thompson 1916: 270, 286 (Natal, Bird Island); Von Bonde and Swart 1923: 5, 21 (Algoa Bay, Cape and Natal); Barnard 1925, 67 (False Bay to Natal, 9–73 m); Fowler 1925: 193 (Natal); Von Bonde 1933: 51 (Eastern Cape); Barnard 1947: 26, Pl. 4, Fig. 2 (False Bay to Natal); Smith 1949: 66, Pl. 3 (Cape to Natal, Delagoa Bay, to 183 m); Smith 1964: 285 (16–19 km west of Cape Barracouta, Natal, 74 m); Smith 1965: 66, Pl. 3 (Cape to Natal, Delagoa Bay); Day *et al.* 1970: 89 (False Bay east to Delagoa Bay, 5–100 m).

Raja ocellifera — Thompson 1914: 158 (Algoa Bay, Natal, South Africa); Norman 1935: 42 (South Africa, False Bay, Agulhas Bank, Cape St Blaize, Algoa Bay and Natal); Fowler 1941: 375 (South African references, False Bay, Agulhas Bank, Algoa Bay, Bird Island, Natal); Hulley 1969: 137, Figs 1, 2b, 3 (False Bay and Agulhas Bank to Natal = *R. miraletus*); Ochumba 1984: 46 (Kenya).

Africana demersal trawl stations: none.

Distribution — This distinctive little skate is endemic to the Eastern Atlantic, Mediterranean and western Indian Ocean, where it may form distinct subpopulations (McEachran *et al.* 1989). In southern Africa it occurs from Angola to southern Namibia in the vicinity of the Orange River, with an apparent gap in distribution along the Western Cape coast to False Bay, where it reappears and ranges north-east to Natal, Moçambique and Kenya. Turon *et al.* (1986) reported it from two stations south-south-west of the Orange River in South African waters in 168–337 m, but most records in the northern part of the survey area are from Lüderitz northwards to Walvis Bay, at 70–421 m. The present survey missed the species in Namibian and South-Western Cape waters, which may partly be related to the virtual lack of inshore stations in water shallower than 200 m off Namibia, as well as little inshore sampling between False Bay and Cape Agulhas. A large number of trawl stations by *Africana* between 50 and 200 m between the Orange River and St Helena Bay did not yield it, although St Joseph (*Callorhinchus capensis*) and biscuit skates (*Raja* cf. *clavata*) were regularly caught there. This suggests that the gap in distribution between north-western and south-eastern populations of *R. miraletus* reported by previous authors is real, although there might be occasional vagrants in the area, such as those reported by Turon *et al.* (1986) off the Orange River. The species is a common catch in *Africana* hauls off the South-Eastern Cape from Cape Agulhas to Port Alfred, and its detailed distribution will be discussed by Compagno *et al.* (in prep).

Raja (*Rajella*) *caudaspinosa* Von Bonde and Swart, 1923 — Munchkin skate

Raia caudaspinosa — Von Bonde and Swart 1923: 8, Pl. 21, Fig. 1 ("Natal", R.V. *Pickle* #336, 32°03,00′S, 16°12,00′E, west of Lambert's Bay, Western Cape, 512 m); Smith 1949, 67, not Fig. 72, = *Raja wallacei* (in part, Cape to Natal); Smith 1965, 67 (in part, not Fig. 72, Cape to Natal).

Raia plutonia — Barnard 1925: 68 (in part, for types of *Raia albalinea*).

Raja caudaspinosa — Norman 1935: 37, 43 (South Africa, range from Cape Town to Natal); Fowler 1941: 376 (South Africa, Natal); Hulley 1970: 170, Figs 7a–c, Pl. 3a–b (Port Nolloth to west of Cape Town, 292–914 m; Natal, 512 m); Hulley 1972a: 86–96, Figs 58–59 (geographic and depth distribution, possibly confined to West Coast; 310–510 m); Hulley 1986: 120, Fig. 25.7 (Lüderitz to Cape Point, 310–520 m); Compagno *et al.* 1989: 96, ill. (Lüderitz to Cape Agulhas, 310–718 m).

Raia albalinea — Von Bonde and Swart 1923: 6, 21, Pl. 20, Fig. 1 ("Natal", R.V. *Pickle* #336, 32°03,00′S, 16°12,00′E, west of Lambert's Bay, Western Cape, 512 m; #519, 31°27,00′S, 15°35,00′E, north-west of Lambert's Bay, 1 098 m).

Africana demersal trawl stations ($n = 40$):

Cruise 028	A2367, 497 m;	A2382, 426 m.	
Cruise 033	A2771, 517 m.		
Cruise 039	A3347, 333 m;	A3351, 430 m;	A3356, 479 m;
	A3357, 515 m;	A3398, 455 m;	A3399, 415 m.
Cruise 046	A4305, 490 m;	A4307, 495 m;	A4365, 455 m;
	A4367, 385 m;	A4368, 480 m;	A4373, 461 m;
	A4387, 469 m.		
Cruise 050	A5248, 457 m;	A5301, 420 m;	A5308, 377 m.
Cruise 054	A5868, 452 m;	A5900, 480 m;	A5935, 454 m;
	A5939, 400 m.		
Cruise 059	A6897, 491 m.		
Cruise 060	A6986, 552 m;	A6987, 710 m;	A6989, 680 m;
	A6990, 480 m;	A7013, 451 m;	A7022, 498 m;
	A7023, 700 m;	A7025, 496 m.	
Cruise 066	A7548, 473 m;	A7552, 401 m;	A7580, 485 m;
	A7581, 390 m;	A7654, 450 m.	
Cruise 069	A8348, 425 m.		
Cruise 075	A9028, 400 m.		
Cruise 079	A9823, 454 m.		

Station latitude and depth range — 28°58,0′S, 14°25,7′E

to 35°58,0′S, 19°32,0′E, 333–710 m.

Distribution — This southern African endemic is the smallest member of the subgenus *Rajella* in the area. There is an early Natal record, but the species is otherwise known from the upper slopes off southern Namibia and South Africa from Lüderitz to Cape Point, in water 310–520 m deep. *Africana* did not collect *R. caudaspinosa* in Namibian waters, but the species has a scattering of records from west of the Orange River along the South African slope to south of Quoin Point (Fig. 13c). All stages were collected, from hatchlings, with the distinctive "*R. albalinea*" colour pattern, to adults, but with few to a station. It was a less common species than *R. confundens* and *R. leopardus* off South Africa, and it apparently has a more limited range than these two species and *R. dissimilis*.

Raja (*Rajella*) *confundens* Hulley, 1970 — bigthorn skate

Raja confundens — Hulley 1970: 203, Figs 17a–c, Pls 11a–b (Western Cape off Cape Columbine, 620 m, and off Cape Point, 660 m); Hulley 1972a: 86–96, Figs 58–59 (geographic and depth distribution; tropical West Africa at 2°09′N, 9°27′E, 260–650 m; west coast of southern Africa at 200-660 m); Hulley 1986: 121, Fig. 25.9 (West Coast from 19°S, northern Namibia to east of Cape Point, 170–660 m); Lloris 1986: 123, Fig. 41 (northern Namibia, 20°37′S, 12°05′E, 527 m); Turon *et al.* 1986: 68, 176, 232, 297 (Namibia and South Africa, from Cunene River mouth to south-west of Orange River mouth, 135 stations from 17°35,7′S, 11°20,0′E to 29°47,0′S, 14°37,5′E, 102–809 m); Compagno *et al.* 1989: 98, ill. (Namibia to Algoa Bay, 170–913 m); Mas-Riera and Macpherson 1989: 2, Figs 5, 6, 13, 14, Tab. 1 (south-central Namibia and north-west South Africa from Walvis Bay to the vicinity of the Orange River, 23–30°S, 250–500+ m, dropping to 350+ m in summer north to 27°S).

Raja confudens — Trunov 1972: 400 (north-central Namibia between 16°30′ and 25°00′S).

Raja barnardi — Krefft 1968a: 61, Pls 3c, 4 (Spanish Guinea, northern Namibia at 20°04′S, 11°56′E, 537 m; also holotype of *Raja barnardi* Norman, 1935, from off Cape Town, 34°00′S, 17°58′E, 210–173 m.

Africana demersal trawl stations (n = 68):

Cruise 028 — A2372, 370 m; A2378, 467 m.
Cruise 033 — A2780, 496 m; A2782, 353 m; A2785, 442 m.
Cruise 039 — A3360, 379 m; A3362, 398 m; A3398, 455 m; A3400, 312 m; A3428, 255 m; A3429, 365 m; A3442, 420 m; A3447, 431 m; A3457, 407 m; A3466, 488 m; A3467, 716 m.
Cruise 046 — A4367, 385 m; A4368, 480 m; A4371, 368 m; A4372, 360 m; A4373, 461 m; A4387, 469 m.
Cruise 050 — A5300, 484 m; A5307, 454 m; A5308, 377 m.
Cruise 054 — A5885, 390 m; A5886, 460 m; A5887, 386 m; A5899, 460 m; A5935, 454 m.
Cruise 059 — A6897, 491 m; A6948, 397 m; A6949, 425 m; A6950, 475 m; A6951, 864 m; A6963, 484 m; A6964, 817 m; A6982, 458 m.
Cruise 060 — A6988, 900 m; A6999, 923 m; A7011, 880 m; A7022, 498 m; A7037, 903 m; A7038, 917 m.
Cruise 066 — A7581, 390 m; A7616, 880 m; A7623, 381 m; A7625, 855 m; A7628, 450 m; A7652, 394 m; A7655, 865 m.
Cruise 069 — A8328, 288 m; A8370, 407 m; A8379, 490 m; A8391, 462 m; A8392, 434 m; A8407, 263 m; A8410, 370 m; A8417, 409 m.
Cruise 075 — A9138, 465 m; A9139, 481 m; A9141, 470 m; A9142, 730 m.
Cruise 079 — A9813, 398 m; A9814, 455 m; A9816, 315 m; A9817, 444 m; A9818, 250 m.

Station latitude and depth range — 23°19,1′S, 13°09,9′E to 34°55,6′S, 18°11,7′E, 250–923 m.

Distribution — This distinctive, common deep-water skate is an endemic of tropical West Africa and the west coast of southern Africa, occurring from Spanish Guinea to South Africa. Off Namibia it has been recorded regularly along the entire coast from the Cunene River to the Orange River in 102–809 m of water. It ranges southwards to east of Cape Point, but there are few detailed South African records. *Africana* collected it from many stations along the upper slope of Namibia and South Africa, from south-west of Walvis Bay to south-west of Cape Point (Fig. 13d), with most records between 350 and 500 m, but a few much deeper. There were concentrations of records between Port Nolloth and Lambert's Bay, and off Doring Bay.

Raja (*Rajella*) *dissimilis* Hulley, 1970 — ghost skate

Raja dissimilis — Hulley 1970: 199, Fig. 15a–c, Pls 10a–b (Western Cape west of Cape Town, 33°47′S, 17°14′E, 1 000 m); Hulley 1972a: 86–96, Figs 58–59 (original records, geographic and depth distribution; 600–1 000 m); Hulley 1986: 121, Fig. 25.10 (west of Cape Town); Compagno *et al.* 1989: 98, ill. (Orange River mouth to Cape Town, 719–1 016 m).

Raja (*Rajella*) cf. *leopardus* — Turon *et al.* 1986: 137, 233 (southern Namibia between Lüderitz and the

Orange River mouth, 27°18,2′S, 14°09,0′E, 28°47,6′S, 14°22,9′E, 470–805 m).

Africana demersal trawl stations ($n = 22$):

Cruise 046 — A4361, 850 m.
Cruise 050 — A5248, 457 m; A5249, 800 m; A5280, 780 m; A5301, 420 m; A5307, 454 m.
Cruise 054 — A5886, 460 m; A5894, 425 m.
Cruise 059 — A6892, 903 m; A6956, 849 m; A6971, 1 000 m.
Cruise 060 — A7024, 894 m; A7038, 917 m; A7039, 719 m.
Cruise 066 — A7550, 900 m; A7616, 880 m.
Cruise 069 — A8374, 718 m; A8413, 900 m; A8414, 1 005 m.
Cruise 075 — A9142, 730 m.
Cruise 079 — A9812, 861 m; A9827, 796 m.

Station latitude and depth range — 23°47,0′S, 13°04,0′E to 34°56,5′S, 18°12,8′E, 420–1 005 m.

Distribution — This rare skate was first described from deep water off Cape Town, but there were no additional records that could be confirmed until the present survey, in which *Africana* collected it along the deep slope from south-west of Walvis Bay and off Lüderitz in Namibian waters, and from the Orange River to south-west of Cape Point (Fig. 14a) off South Africa. There were a few shallow stations, between 400–500 m, of young *R. dissimilis*, but most records are from deeper than 700 m.

Raja (*Rajella*) *leopardus* Von Bonde and Swart, 1923 — leopard skate

Raia leopardus — Von Bonde and Swart 1923: 7, 21, Pl. 20, Fig. 2 ("Natal"; R.V. *Pickle* #336, 32°03,00′S, 16°12,00′E, west of Lambert's Bay, Western Cape, 512 m; ?#444, 29°25,00′S, 31°45,00′E, off Durban, 73 m; Barnard 1925: 74 (Natal coast, 73–512 m); Smith 1949, 67, Fig. 73 (Walvis Bay to Natal, down to 549 m); Smith 1965, 67, Fig. 73 (Walvis Bay to Natal).

Raia quadrimaculata — ?Von Bonde and Swart 1923: 5 (Natal); Barnard 1925: 70, Pl. 4, Fig. 5 (West Coast, Cape Peninsula, Saldanha Bay, 183–458 m); ?Von Bonde 1934: 16 (west coast of South Africa).

Raia lintea — Barnard 1925: 72 (west coast off Cape Peninsula, 366–549 m).

Raia naevus — Barnard 1925: 72 (in part?, off Cape Peninsula and Saldanha Bay, 183–366 m).

Raja leopardus — Norman 1935: 37, 44 (South Africa, west of Cape Town, 34°08′S, 17°33′E, 402–?548 m; also off Dassen Island, Saldanha Bay, Table Bay, Cape Peninsula, Cape Point, and Natal); Fowler 1941: 390 (South Africa, Natal); Hulley 1970: 206, Figs 18a–c, Pls 12a–b (west-north-west of Lüderitz, Namibia, to Western Cape east of Cape Point, 300–660 m); Hulley 1972a: 86–96, Figs 58–59 (geographic and depth distribution; 300–680 m); Hulley 1986: 122, Fig. 25.13 (west coast of southern Africa, from 18°S, northern Namibia, to 35°S, east of Cape Point, 300–690 m); Lloris 1986: 123, Fig. 41 (Namibia west of Walvis Bay, 22°31′S, 12°47′E, 545–710 m; 22°32′S, 13°48′E, 124 m); Turon *et al.* 1986: 69, 233 (Namibia, 3 stations from 24°07,9′S, 13°13,8′E to 27°37,5′S, 14°35,0′E, 393–611 m); Compagno *et al.* 1989: 98, ill. (northern Namibia to Algoa Bay, 300–923 m); Mas-Riera and Macpherson 1989: 3, Figs 7, 8 (south-central Namibia, scattered localities from Walvis Bay to north-western South Africa from 23–30°S, deeper than 400 m).

?*Raja barnardi* — Norman 1935: 37, 43, Fig. 14 (South Africa, west of Cape Town, 34°00′S, 17°58′E, 210–173 m); Fowler 1941: 371 (South Africa).

Africana demersal trawl stations ($n = 111$):

Cruise 028 — A2305, 513 m; A2318, 388 m; A2319, 438 m; A2378, 467 m.
Cruise 033 — A2756, 502 m; A2757, 350 m; A2778, 495 m; A2779, 445 m; A2780, 496 m; A2781, 401 m; A2782, 353 m; A2783, 301 m; A2785, 442 m; A2786, 364 m.
Cruise 039 — A3345, 453 m; A3348, 456 m; A3357, 515 m; A3358, 826 m; A3361, 500 m; A3362, 398 m; A3363, 338 m; A3389, 345 m; A3397, 443 m; A3398, 455 m; A3400, 312 m; A3467, 716 m; A3469, 440 m.
Cruise 046 — A4305, 490 m; A4306, 390 m; A4307, 495 m; A4308, 300 m; A4310, 760 m; A4359, 417 m; A4360, 495 m; A4361, 850 m; A4364, 440 m; A4367, 385 m; A4368, 480 m; A4369, 330 m; A4370, 295 m; A4371, 368 m; A4383, 372 m; A4384, 374 m; A4387, 469 m.
Cruise 050 — A5229, 450 m; A5248, 457 m; A5249, 800 m; A5250, 370 m; A5251, 430 m; A5280, 780 m; A5300, 484 m; A5301, 420 m; A5306, 509 m; A5307, 454 m; A5308, 377 m.
Cruise 054 — A5885, 390 m; A5886, 460 m; A5887, 386 m; A5893, 358 m; A5895, 685 m; A5896, 719 m; A5898, 448 m; A5900, 480 m; A5934, 405 m; A5935, 454 m; A5939, 400 m.
Cruise 059 — A6888, 457 m; A6889, 460 m; A6894, 276 m; A6895, 292 m; A6896, 356 m; A6897, 491 m; A6948, 397 m; A6949, 425 m; A6950, 475 m; A6951, 864 m; A6956, 849 m; A6964, 817 m; A6965, 321 m; A6971, 1 000 m; A6982, 458 m;

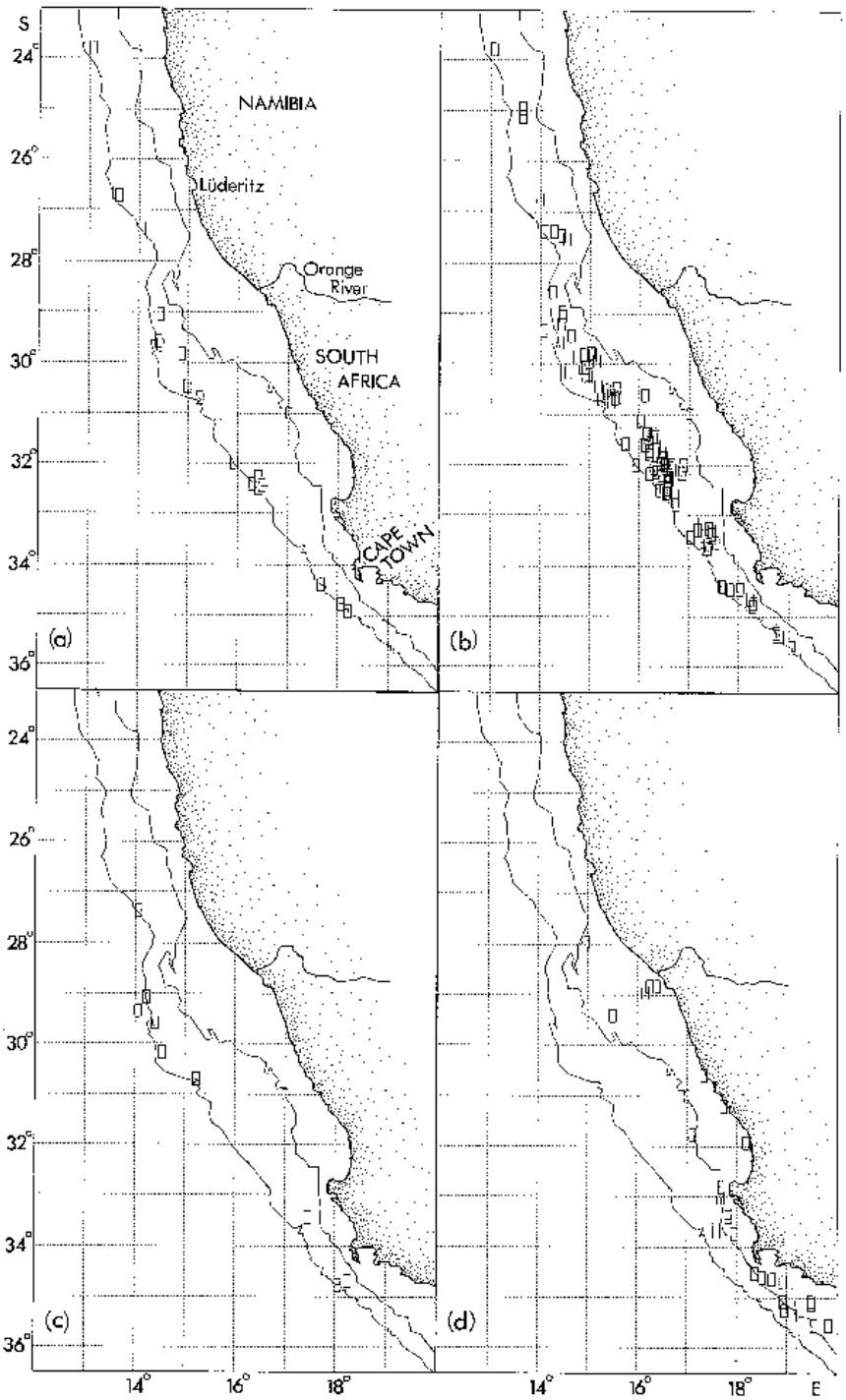

Fig. 14: *Africana* demersal trawl stations at which (a) ghost skate (*Raja* (*Rajella*) *dissimilis*, *n* = 22), (b) leopard skate (*Raja* (*Rajella*) *leopardus*, *n* = 401), (c) smoothback skate (*Raja* (*Rajella*) *ravidula*, *n* = 9), (d) spearnose skate (*Raja* (*Rostroraja*) *alba*, *n* = 30) were taken, 1986–1990

A6983, 461 m.
Cruise 060 — A6986, 552 m; A6987, 710 m; A6989, 680 m; A6990, 480 m; A6999, 923 m; A7011, 880 m; A7022, 498 m; A7040, 486 m.
Cruise 066 — A7548, 473 m; A7581, 390 m; A7616, 880 m; A7625, 855 m; A7655, 865 m.
Cruise 069 — A8348, 425 m; A8351, 426 m; A8374, 718 m; A8391, 462 m; A8392, 434 m; A8417, 409 m.
Cruise 075 — A9027, 438 m; A9036, 462 m; A9129, 345 m; A9138, 465 m; A9139, 481 m; A9150, 351 m; A9154, 372 m.
Cruise 079 — A9813, 398 m; A9814, 455 m; A9816, 315 m.

Station latitude and depth range — 23°47,0′S, 13°04,0′E to 35°35,7′S, 19°04,0′E, 276–1 000 m.

Distribution — This southern African endemic skate is the commonest upper slope skate in the area, along with *R. confundens*. It is recorded from northern Namibia to east of Cape Point, South Africa, on the west coast, and off Algoa Bay and possibly from off Natal at 300–690 m. This survey recorded it from a scattering of stations from south-west of Walvis Bay to off the Orange River in Namibia, but most records were from South African waters between the Orange River and south-west of Quoin Point (Fig. 14b). There were concentrations of records between Port Nolloth and Doring Bay, and between Doring Bay and Cape Town. The majority of records were between 300 and 500 m, but there were a scattering of deep-slope records from 650 to 1 000 m which included large adult females.

The distribution of this skate is complementary with *R. confundens* in the area, with the former commoner in South African waters and the latter commoner off Namibia, although both extend throughout the area.

Raja (*Rajella*) *ravidula* Hulley, 1970 — smoothback skate

Raja ravidula — Hulley 1970: 196, Fig. 14, Pls 9a–b (Western Cape west of Cape Town, 33°49′S, 17°13′E and 33°47′S, 17°14′E, 1 000 m); Hulley 1972a: 86–96, Figs 58–59 (geographic and depth distribution); Hulley 1986: 124, Fig. 25.17 (west of Cape Town; also eastern tropical Atlantic, according to Stehmann *in litt.*); Compagno *et al.* 1989: 100, ill. (Lüderitz to Cape Town, 496–1 016 m).

Africana demersal trawl stations ($n = 9$):

Cruise 050 — A5311, 704 m.
Cruise 059 — A6951, 864 m; A6956, 849 m; A6971, 1 000 m.
Cruise 060 — A6989, 680 m; A7025, 496 m.
Cruise 066 — A7550, 900 m; A7616, 880 m; A7625, 855 m.

Station latitude and depth range — 27°22,3′S, 14°03,7′E to 34°47,1′S, 18°03,3′E, 496–1 000 m.

Distribution — This rare skate was described from specimens caught off the west coast of South Africa, on the deep slope off Cape Town, but it may also occur off tropical West Africa. *Africana* collected it south-west of Lüderitz on one station, but the rest of the few records are on the deep slope from south-west of the Orange River to off Lambert's Bay, from between Saldanha Bay and Cape Town, and south of Cape Point (Fig. 14c), with most specimens being caught deeper than 700 m.

Raja (*Rostroraja*) *alba* Lacépède, 1803 — spearnose skate

Raja alba — Lacépède 1803: 663, Pl. 20, Fig. 1 (no locality, probably European seas); Norman 1935: 37, 40 (South Africa, from Kalk Bay, Simonstown, Agulhas Bank, Cape St Blaize, and off Bird Island, Natal, ? = Algoa Bay, Eastern Cape; also from English Channel to Mediterranean; northern and north-western Africa); Fowler 1941: 365 (Namibia and South Africa, Walvis Bay to Natal); Hulley 1966: 497, Fig. 8 (map, Namibia to Natal); Wallace 1967c: 27, Figs 13–15 (Algoa Bay, 55–128 m and off Chalumna River, 66–92 m, Eastern Cape; north-east of Durban, 119–320 m, off Tugela River, 31 m, and off Amatikulu Bluff, 132–141 m, Natal; off Barra da Falsa, Moçambique, 329–364 m); Hulley 1969: 137 (South Africa); Hulley 1970: 176, Figs 8a–c, Pls 5a–b (False Bay to Port Alfred, 110–183 m); Hulley 1972a: 86–96, Figs 58–59 (geographic and depth distribution; eastern north Atlantic and Mediterranean south to about 20°N; northern limit of about 23°S in southern Africa from Namibia to Cape Point, then north-east to Barra Falsa, Moçambique; 60–370 m; off Madagascar); Trunov 1972: 400 (north-central Namibia between 16°30′S and 25°00′S); Stehmann 1976: 170 (north-east of Madagascar, 70–80 m); Ochumba 1984: 46 (Kenya); Hulley 1986: 119, Fig. 25.6 (Namibia to Barra Falsa, Moçambique, 50–360 m); Van der Elst and Vermeulen 1986: 40, ill. (central Namibia to southern Moçambique, to 450 m); Ochumba 1988: 29 (Kenya); Van der Elst 1988: 59, ill. (Namibia to Moçambique, inshore to 450 m); Compagno *et al.* 1989: 94, ill. (Namibia to central Moçambique, inshore to 366 m).

Raia alba — Von Bonde and Swart 1923: 5, 21 (Cape and Natal); Smith 1949: 66, Fig. 67 (west coast of southern Africa around to Natal, to 183 m); Smith 1964: 285 (16–19 km west of Cape Barracouta, Natal); Smith 1965: 66, Fig. 67 (southern Africa).

Raja marginata — Lacépède 1803: 663, Pl. 20, Fig. 2

(Dieppe, Liverpool, Brighton); Thompson 1914: 158 (Bird Island).

Raia marginata — Regan 1908a: 232 (Bird Island, Algoa Bay); Gilchrist and Thompson 1916: 270, 285 (Natal); Barnard 1925: 65, Pl. 4, Fig. 1 (Walvis Bay, Table Bay, False Bay to Algoa Bay, Natal); Clark 1926: 47, Pls 28–30, 31a (South Africa); Von Bonde 1933: 41 (Cape Agulhas–Cape Infanta); Von Bonde 1934: 16 (Walvis Bay to Natal); Barnard 1947: 26, Pl. 3, Fig. 11 (Walvis Bay to Natal); Day *et al.* 1970: 89 (False Bay, Durban–Walvis Bay).

Africana demersal trawl stations ($n = 30$):

Cruise 039 —	A3334, 148 m;	A3364, 143 m.	
Cruise 046 —	A4294, 160 m;	A4300, 155 m;	A4302, 175 m;
	A4390, 186 m.		
Cruise 050 —	A5231, 169 m;	A5232, 133 m;	A5237, 155 m;
	A5289, 88 m;	A5290, 100 m;	A5295, 123 m.
Cruise 054 —	A5857, 190 m;	A5859, 151 m.	
Cruise 059 —	A6840, 175 m;	A6845, 170 m;	A6847, 230 m;
	A6851, 174 m;	A6866, 148 m;	A6871, 261 m;
	A6880, 168 m;	A6914, 77 m.	
Cruise 060 —	A7021, 240 m.		
Cruise 069 —	A8306, 244 m;	A8421, 190 m.	
Cruise 075 —	A8996, 163 m;	A9024, 123 m;	A9122, 185 m.
Cruise 079 —	A9768, 219 m;	A9791, 76 m;	A9792, 122 m.

Station latitude and depth range — 27°57,2′S, 14°57,4′E to 35°33,8′S, 19°34,7′E, 76–261 m.

Distribution — The giant, spearnose, bottlenose or white skate is an endemic of the Eastern Atlantic, the Mediterranean and the south-western Indian Ocean. It ranges from the United Kingdom and the Mediterranean south to off Mauritania and Senegal, with a gap in its known distribution south to central Namibia, where it ranges to Cape Agulhas, the Eastern Cape, Natal, Moçambique, Madagascar and Kenya in 60–370 m of water. *Africana* collected it from a few stations on the inner and outer shelf and uppermost slope of Namibia from between Lüderitz and the Orange River mouth, but most records were off South Africa from the Orange River to south-west of Cape Agulhas (Fig. 14d). Records were most frequent between Cape Columbine and Cape Agulhas. The catch consisted of large adults or subadults, the former up to 96 kg and 2,2 m long, but no small juveniles occurred at any of the stations, although a few egg cases were collected. It is suspected that, in the area, young occur more consistently inshore than large juveniles and adults, but that the latter have a larger bathymetric range and range from the uppermost slope to shallow bays such as Saldanha Bay and False Bay. Hatchlings and juveniles have been caught by beach-seine netters working off the beaches of False Bay (pers. obs.).

ORDER MYLIOBATIFORMES

FAMILY MYLIOBATIDAE — EAGLE RAYS

Myliobatis aquila (Linnaeus, 1758) — bullray

Raja aquila — Linnaeus 1758: 232 ("Habitat in Mari Mediterraneo").

Myliobatis aquila — Bleeker 1860: 59 (Cape of Good Hope); Dumeril 1865: 634 (Cape of Good Hope); Gilchrist 1902: 169 (Cape of Good Hope); Thompson 1914: 165 (Algoa Bay, Bird Island, South Africa); Gilchrist and Thompson 1916: 280 (Natal, Cape coast); Von Bonde and Swart 1923: 17, 22 (South Africa); Barnard 1925: 82, Pl. 4, Fig. 7 (Walvis Bay, Table Bay to Algoa Bay; Madagascar records may not be this species); Von Bonde 1934: 17 (Walvis Bay and Table Bay to Algoa Bay); Smith 1935: 169 (east coast of southern Africa); Barnard 1947: 28, Pl. 4, Fig. 6 (Walvis Bay to Algoa Bay); Smith 1949: 69 (doubtful in southern African waters); Smith 1965: 69 (doubtful in southern Africa); Wallace 1967b: 17, Fig. 8 (Durban, Nature's Valley, inshore); Day *et al.* 1970: 89 (False Bay, Durban–Walvis Bay, 5–15 m); Penrith 1978: 182 (Moçamedes, southern Angola, to at least Walvis Bay, also Cape Agulhas to Natal); Van der Elst 1981: 50, ill. (Namibia to northern Natal, coastal); Allué *et al.* 1984: 125 (northern Namibia west of Cape Frio, 18°04,0′S, 11°39,0′E, 126 m); Compagno 1986: 133, Fig. 28.2, Pl. 5 (Mediterranean and East Atlantic around the Cape to Natal); Lloris 1986: 131, Fig. 45 (northern Namibia to Walvis Bay, 20°02′S, 12°28′E, 179 m; 20°37′S, 12°05′E, 527 m; 22°41′S, 12°52′E, 409–420 m); Turon *et al.* 1986: 36, 69 (north-central Namibia between Palgrave Point and Walvis Bay, 3 stations from 20°02,5′S, 12°27,4′E to 22°32,6′S, 13°47,9′E, 124–527 m); Van der Elst and Vermeulen 1986: 45, ill. (central Namibia to Natal, inshore); Ochumba 1988: 32 (Kenya off Msambweni, Vanga, Malindi, 25–280 m); Van der Elst 1988: 59, ill. (southern Africa); Compagno *et al.* 1989: 112, ill. (Namibia to Natal).

Holorhinus aquila — Fowler 1941: 459 (Walvis Bay and Table Bay).

Myliobatis cervus — Smith 1935: 169, Fig. 1 (Cape Agulhas, Knysna Estuary, Bushmans River, Port Alfred, Great Fish Point); Smith 1949: 68, Fig. 75, Pl. 3

(South Africa, Agulhas to Natal, shallow water); Smith 1965: 68, Fig. 75, Pl. 3 (South Africa); Smith and Smith 1966: 30, ill. (Tsitsikamma Park, Eastern Cape, South Africa); Ochumba 1984: 46 (Kenya).

Holorhinus cervus — Fowler 1941: 460 (South Africa).

Africana demersal trawl stations ($n = 1$):

Cruise 075 — A9025, 34°35,0′S, 19°17,3′E, 38 m.

Distribution — The bullray is a common inshore and offshore ray of the Eastern Atlantic, Mediterranean Sea, and south-western Indian Ocean. It ranges from the North Sea and Mediterranean to Angola, Namibia, South Africa and Kenya. It has been collected on the outer shelf and upper slope from north-central Namibia at 124–527 m and at 25–280 m off Kenya. During the present survey it was collected inshore only once, off Gans Bay, South Africa (Fig. 15a). It is common in shallow water in False Bay and Saldanha Bay, but its absence from numerous *Africana* demersal trawl stations between 100 and 200 m off the west coast of South Africa suggests that it may stay close inshore (shallower than 50 m) in the area. Unfortunately there are few details of its distribution off the Western Cape. It is commonly collected inshore by *Africana* during demersal cruises off the Eastern Cape (Compagno *et al.* in prep.).

SUBCLASS HOLOCEPHALII — CHIMAERAS

ORDER CHIMAERIFORMES — CHIMAERAS

FAMILY CALLORHINCHIDAE — ELEPHANTFISHES

Callorhinchus capensis Dumeril, 1865 — St Joseph

Chimaera callorynchus — Linnaeus 1758: 236 (in part: "Habitat in Mari Aethiopico.").

Callorhynchus capensis — Dumeril 1865: 695, Pl. 13, Figs 5, 5a (Cape of Good Hope); Garman 1904: 271, Pl. 6, Figs 5–6 (tooth plates); Garman 1911: 99 (Cape of Good Hope); Barnard 1925: 96, Pl. 5, Fig. 6 (west coast from Walvis Bay to Agulhas Bank, shallow water to 92 m); Fowler 1941: 507 (South Africa, to 91 m); Barnard 1947: 31, Pl. 5, Fig. 2 (Walvis Bay to Agulhas Bank); Smith 1949: 77, Fig. 95 (South Africa, rarer off Natal, 9–183 m); Poll 1951: 151, Fig. 67, Pl. 13, Fig. 5 (Namibia west of Walvis Bay, 22°54′S, 14°30′E, 20–24 m); Smith 1965: 77, Fig. 95 (South Africa); Smith and Smith 1966: 35, ill. (Tsitsikamma Park, Eastern Cape, South Africa); Van der Elst 1981: 33, ill. (Walvis Bay to Durban, inshore to 200 m); Lleonart and Rucabado 1984: 44 (central Namibia north-west of Walvis Bay, 20°31,7′S, 12°02,0′E and 21°03,9′S, 12°58,9′E, 180–600 m).

Callorhinchus capensis — Allué *et al.* 1984: 130 (northern Namibia from south-west of the Cunene River to south-west of Cape Frio, 4 stations from 17°44,0′S, 11°44,0′E to 18°37,0′S, 11°55,0′E, 70–126 m); Compagno 1986: 147, Fig. 34.1 (Namibia to Natal, inshore to 200 m); Lloris 1986: 153, Fig. 59 (northern Namibia to west of Walvis Bay, 18°04′S, 11°39′E, 126 m; 21°04′S, 13°04′E, 510–530 m; 22°57′S, 13°04′E, 400–500 m); Turon *et al.* 1986: 179, 236, 300 (central Namibia and South Africa from off Walvis Bay to south-west of the Orange River mouth, 60 stations from 23°30,8′S, 13°48,4′E to 29°32,2′S, 14°57,1′E, 24–295 m); Van der Elst and Vermeulen 1986: 4, ill. (Namibia to Natal, to 200 m); Compagno *et al.* 1989: 120, ill. (Namibia to Natal, inshore to 374 m); Van der Elst 1988: 33, ill. (southern Africa).

Callorhynchus antarcticus — Bleeker 1860: 57, 78 (Cape of Good Hope); Gilchrist 1902: 162 (Cape of Good Hope); Thompson 1914: 167 (Cape of Good Hope, South Africa); Gilchrist and Thompson 1916: 290 (Natal, Cape, Bird Island, considered conspecific with Australian, New Zealand and South American *Callorhinchus*); Von Bonde 1923: 5 (R.V. *Pickle* #224, 34°19,00′S, 18°32,00′E, off Cape Town, South Africa, 68 m); Schnakenbeck 1931: 44 (Namibia, off Walvis Bay, 156–256 m).

Africana demersal trawl stations ($n = 334$):

Cruise 028 — A2290, 84 m; A2353, 76 m; A2354, 83 m.
Cruise 039 — A3324, 239 m; A3325, 225 m; A3326, 187 m; A3327, 178 m; A3328, 171 m; A3329, 157 m; A3330, 139 m; A3331, 249 m; A3332, 189 m; A3333, 171 m; A3334, 148 m; A3336, 169 m; A3337, 174 m; A3338, 200 m; A3339, 200 m; A3343, 172 m; A3344, 209 m; A3352, 245 m; A3355, 212 m; A3365, 134 m; A3366, 247 m; A3368, 212 m; A3370, 235 m; A3371, 238 m; A3372, 231 m; A3373, 214 m; A3375, 130 m; A3376, 106 m; A3377, 89 m; A3378, 101 m; A3379, 86 m; A3381, 213 m; A3382, 244 m; A3383, 271 m; A3384, 181 m; A3385, 165 m; A3386, 240 m; A3387, 281 m; A3389, 345 m; A3391, 91 m; A3392, 154 m; A3395, 299 m; A3402, 262 m; A3403, 236 m; A3405, 224 m;

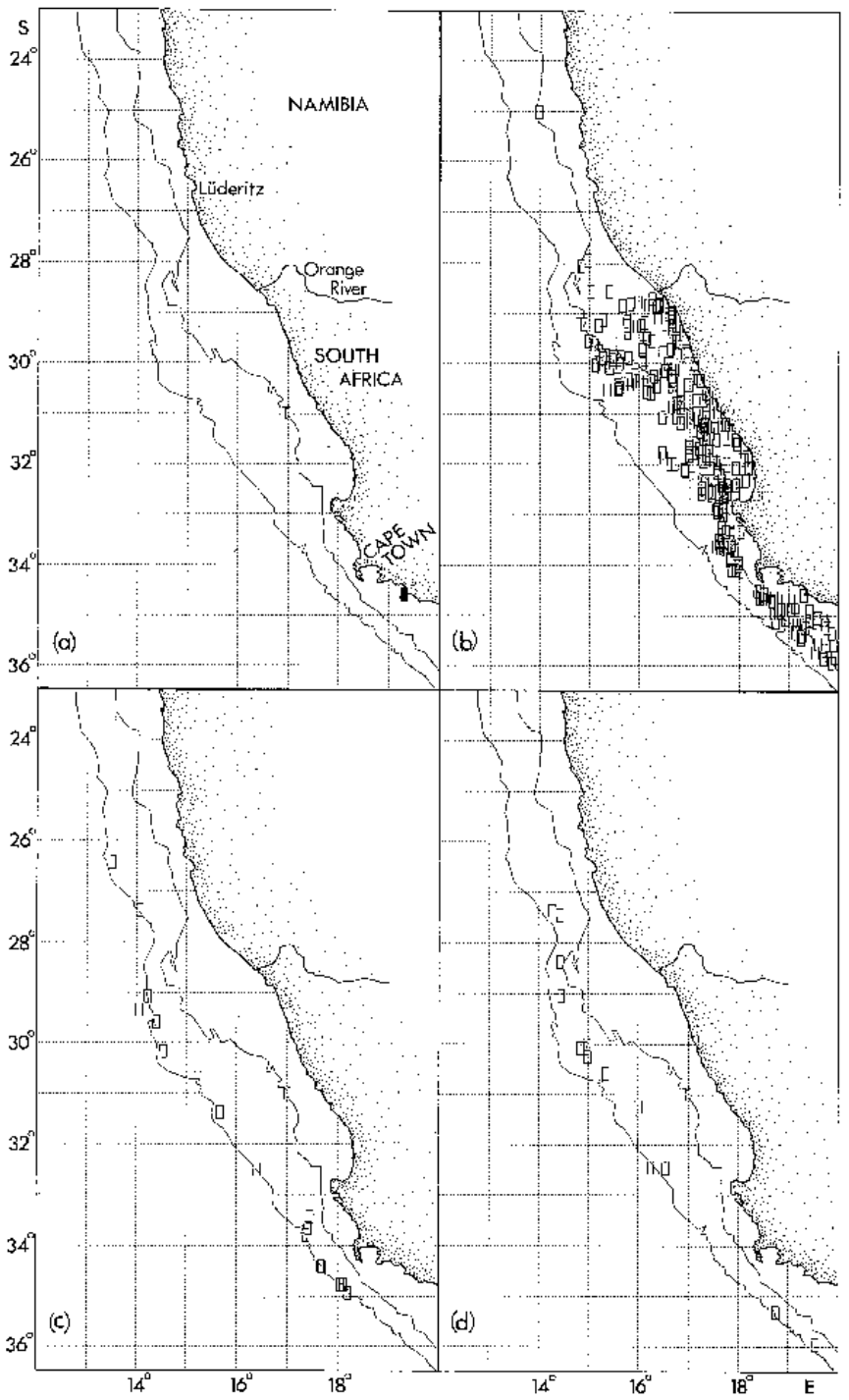

Fig. 15: *Africana* demersal trawl stations at which (a) bullray (*Myliobatis aquila*, $n = 1$), (b) St Joseph (*Callorhinchus capensis*, $n = 334$), (c) Cape chimaera (*Chimaera* sp. $n = 19$), (d) brown chimaera (*Hydrolagus* sp., $n = 16$) were taken, 1986–1990

A3408, 189 m; A3411, 148 m; A3413, 179 m; A3418, 124 m; A3420, 71 m; A3421, 72 m; A3423, 119 m; A3427, 199 m; A3429, 365 m; A3430, 217 m.

Cruise 046 — A4287, 213 m; A4289, 170 m; A4290, 170 m; A4293, 175 m; A4296, 165 m; A4297, 180 m; A4298, 135 m; A4299, 145 m; A4300, 155 m; A4301, 151 m; A4302, 175 m; A4303, 200 m; A4313, 195 m; A4314, 210 m; A4320, 232 m; A4321, 230 m; A4322, 230 m; A4323, 225 m; A4330, 235 m; A4331, 195 m; A4332, 175 m; A4333, 110 m; A4335, 270 m; A4338, 155 m; A4339, 135 m; A4341, 95 m; A4342, 100 m; A4346, 124 m; A4350, 185 m; A4351, 215 m; A4352, 216 m; A4357, 163 m; A4358, 186 m; A4376, 55 m; A4377, 71 m; A4378, 90 m; A4381, 200 m; A4383, 372 m; A4384, 374 m; A4385, 335 m; A4388, 160 m; A4389, 176 m.

Cruise 050 — A5230, 220 m; A5232, 153 m; A5233, 140 m; A5234, 137 m; A5235, 186 m; A5236, 167 m; A5237, 155 m; A5241, 161 m; A5242, 157 m; A5261, 166 m; A5263, 162 m; A5283, 175 m; A5288, 98 m; A5289, 88 m; A5290, 100 m; A5292, 127 m; A5293, 100 m; A5294, 62 m; A5297, 165 m; A5298, 170 m; A5299, 173 m; A5303, 270 m; A5304, 270 m; A5305, 266 m; A5313, 178 m; A5314, 168 m; A5315, 131 m; A5316, 80 m; A5318, 172 m; A5322, 209 m; A5323, 204 m; A5324, 183 m; A5325, 184 m; A5326, 204 m; A5327, 188 m; A5328, 170 m; A5329, 112 m; A5330, 56 m; A5331, 93 m; A5332, 121 m; A5333, 120 m; A5339, 190 m.

Cruise 054 — A5851, 181 m; A5855, 200 m; A5857, 190 m; A5858, 117 m; A5859, 151 m; A5872, 173 m; A5874, 240 m; A5888, 247 m; A5890, 270 m; A5902, 171 m; A5903, 150 m; A5904, 140 m; A5906, 99 m; A5907, 83 m; A5909, 160 m; A5910, 115 m; A5911, 155 m; A5915, 186 m; A5916, 183 m; A5917, 165 m; A5920, 180 m; A5925, 164 m; A5929, 80 m; A5930, 107 m; A5940, 282 m; A5950, 222 m; A5951, 270 m; A5952, 230 m.

Cruise 059 — A6835, 194 m; A6837, 171 m; A6840, 175 m; A6841, 161 m; A6844, 158 m; A6845, 170 m; A6848, 228 m; A6851, 174 m; A6852, 180 m; A6853, 251 m; A6861, 196 m; A6864, 217 m; A6866, 148 m; A6867, 77 m; A6868, 172 m; A6880, 168 m; A6881, 159 m; A6882, 296 m; A6884, 174 m; A6900, 162 m; A6902, 164 m; A6903, 142 m; A6904, 137 m; A6906, 107 m; A6907, 77 m; A6908, 95 m; A6911, 213 m; A6912, 184 m; A6913, 146 m; A6914, 77 m; A6915, 131 m; A6916, 87 m; A6921, 177 m; A6922, 78 m; A6925, 104 m; A6926, 82 m; A6927, 103 m; A6928, 90 m; A6929, 105 m; A6931, 127 m; A6935, 185 m; A6936, 175 m; A6937, 176 m; A6938, 174 m; A6941, 168 m; A6943, 177 m; A6944, 170 m; A6953, 206 m; A6954, 224 m; A6958, 238 m; A6959, 223 m; A6960, 198 m; A6961, 209 m; A6967, 286 m; A6968, 245 m; A6969, 257 m; A6970, 323 m; A6973, 216 m; A6974, 189 m; A6976, 203 m; A6977, 243 m; A6978, 250 m.

Cruise 060 — A6985, 247 m; A6991, 298 m; A7021, 240 m; A7044, 159 m.

Cruise 069 — A8298, 160 m; A8306, 244 m; A8320, 181 m; A8321, 208 m; A8327, 261 m; A8331, 37 m; A8333, 144 m; A8334, 168 m; A8335, 166 m; A8338, 146 m; A8339, 140 m; A8340, 133 m; A8341, 174 m; A8342, 200 m; A8343, 191 m; A8357, 297 m; A8394, 185 m; A8421, 190 m; A8422, 199 m.

Cruise 075 — A8993, 181 m; A8994, 202 m; A8995, 174 m; A8996, 163 m; A9000, 242 m; A9002, 238 m; A9003, 231 m; A9012, 234 m; A9014, 170 m; A9017, 152 m; A9018, 127 m; A9019, 154 m; A9020, 139 m; A9023, 158 m; A9024, 123 m; A9025, 38 m; A9033, 284 m; A9034, 187 m; A9035, 168 m; A9039, 235 m; A9042, 257 m; A9043, 263 m; A9051, 191 m; A9053, 121 m; A9055, 98 m; A9055, 101 m; A9066, 190 m; A9068, 218 m; A9069, 227 m; A9070, 200 m; A9082, 173 m; A9083, 190 m; A9084, 185 m; A9086, 94 m; A9100, 154 m; A9113, 50 m; A9114, 33 m; A9115, 125 m; A9116, 113 m; A9118, 167 m; A9132, 220 m; A9133, 248 m; A9144, 253 m.

Cruise 079 — A9760, 100 m; A9765, 144 m; A9766, 148 m; A9768, 219 m; A9772, 152 m; A9773, 92 m; A9774, 81 m; A9775, 99 m; A9779, 134 m; A9782, 132 m; A9791, 76 m; A9792, 122 m; A9793, 143 m; A9794, 166 m; A9796, 174 m; A9797, 162 m; A9799, 162 m; A9800, 213 m; A9801, 194 m; A9803, 189 m; A9804, 191 m; A9810, 265 m; A9815, 240 m; A9818, 250 m; A9819, 224 m; A9820, 218 m; A9821, 227 m; A9822, 207 m; A9828, 233 m; A9829, 238 m; A9830, 234 m; A9831, 229 m; A9832, 242 m; A9833, 173 m; A9834, 135 m; A9836, 149 m.

Station latitude and depth range — 25°01,7′S, 14°57,4′E to 35°57,0′S, 19°50,9′E, 33–374 m.

Distribution — The St Joseph or elephantfish is by far the commonest chimaeroid taken in *Africana* trawls and was the third most frequent cartilaginous fish recorded, after *Holohalaeturus regani* and *Raja* cf. *clavata*. It is the only chimaeroid in southern African waters that occurs on the continental shelf. It ranges from close inshore along the open coast and in shallow bays to the shelf edge and upper slope down to 600 m. The St Joseph is a southern African endemic and ranges from northern Namibia to Natal, but it is commonest off southern Namibia and the Cape coast

of South Africa. In the survey area *Africana* had few records of St Joseph in Namibian waters, with almost all of these from the vicinity of the Orange River mouth, except for a single record from between Walvis Bay and Lüderitz. Off the Western Cape, St Joseph were frequently caught along most of the shelf and upper slope from the Orange River to the southern Agulhas Bank south of Cape Agulhas (Fig. 15b). *Africana* took St Joseph mostly between 50 and 250 m deep (Table I). The scatter of records by latitude and depth is fairly uniform in the area south of 28°S (Table II), except that the deepest records are between 29 and 33°S. The latitude-depth summer-winter plot (see Fig. 18c) revealed little to indicate any gross seasonal differences in latitudinal and bathymetric distribution.

Spanish researchers collected *Callorhinchus capensis* down to 530–600 m (Lleonart and Rucabado 1984, Lloris 1986), but it is also known from close inshore. Specimens have been caught from skiboats in shallow water inside Saldanha Bay, and the species is fished commercially with beach seines in the Western Cape. Catches on *Africana* varied considerably, from single fish to large numbers, and most were of adults or subadults, although small juveniles were occasionally encountered.

Nomenclature — Older references often refer to this species as *Callorhynchus antarcticus*. Following Dumeril (1865) and Garman (1904, 1911), the southern African *Callorhinchus* was generally recognized as a separate endemic species, *C. capensis*, by local ichthyologists, whereas the type species *C. callorhynchus* (Linnaeus, 1758) was restricted to members of this genus from temperate South America. However, Linnaeus (1758) noted that his *Chimaera callorhynchus* occurred in "Mari Aethiopico" or African seas, and mentioned nothing about South America as a locality for the species. According to Wheeler (1979), Linnaeus derived his *Chimaera callorhynchus* from L. Gronovius' non-binomial description of his genus "Callorynchus" from southern Africa, as well as A. M. Frezier's account of a fish termed the "Pejegallo" from Chile. Both pre-Linnaean accounts were mentioned by Linnaeus (op. cit.) and were based on members of the genus *Callorhinchus*, but, as noted by Wheeler (op. cit.), the southern African and South American species "are currently considered to be distinct". It seems likely that Dumeril and Garman erred in restricting Linnaeus' *C. callorhynchus* to the South American pejegallo rather than the southern African St Joseph, despite Linnaeus' statement on its locality, but Dumeril's action as first revisor in proposing *C. capensis* will have to stand in the interest of nomenclatural stability.

FAMILY CHIMAERIDAE — SHORTNOSE CHIMAERAS

Chimaera sp. — Cape chimaera

Not *Chimaera monstrosa* — Linnaeus 1758: 236 ("Habitat in mari Atlantico").

Chimaera monstrosa — Dumeril 1865: 688 (western seas, Iceland, Mediterranean, Cape of Good Hope); Gilchrist 1902: 162 (Cape of Good Hope); Thompson 1914: 166 (Cape of Good Hope, South Africa); Gilchrist 1922b: 51 (south-east of Cape Point, 824 m); Barnard 1925: 94 (off Cape Point and Saldanha Bay, 824–915 m); Fowler 1936b: 143 (South Africa off Cape Point and Saldanha Bay); Fowler 1941: 489 (South Africa, including *C. vaillanti* as a synonym from Cape of Good Hope); Barnard 1947: 30, probably not Pl. 5, Fig. 3 = *C. monstrosa* from European seas (west coast of South Africa); Smith 1949: 76 (Cape seas, South Africa, 92–1 098 m); Smith 1965: 76 (Cape seas); Stehmann and Bürkel 1984: 213 (South Africa, records questionable); Compagno 1986: 144, not Fig. 32.1, which is European *C. monstrosa* (off Cape Province); Van der Elst and Vermeulen 1986: 4 (in part?, Namibia to Natal, including *Hydrolagus* sp.?).

?*Chimaera vaillanti* — Dean 1906: 7 (Cape of Good Hope, "Dean, MS. [type in Jardin des Plantes, No. 2557]" = Museum National d'Histoire Naturelle, Paris, 0,75 m specimen), *nomen nudum*, apparently not described by Dean in a subsequent work.

Chimaera sp. — Compagno *et al.* 1989: 120, ill. (West Coast, Lüderitz to Cape Point, 680–1 016 m).

Africana demersal trawl stations ($n = 19$):

Cruise 046 — A4310, 760 m.
Cruise 050 — A5249, 800 m; A5280, 780 m; A5311, 704 m.
Cruise 054 — A5896, 719 m.
Cruise 059 — A6951, 864 m; A6956, 849 m; A6971, 1 000 m.
Cruise 060 — A6988, 900 m; A6989, 680 m; A6999, 923 m; A7023, 700 m; A7024, 894 m; A7026, 717 m; A7037, 903 m.
Cruise 066 — A7550, 900 m; A7616, 880 m; A7625, 855 m.
Cruise 069 — A8411, 830 m.

Station latitude and depth range — 26°05,6′S, 13°30,8′E to 34°56,5′S, 18°12,8′E, 680–1 000 m.

Distribution — The distribution of the Cape chimaera was sketchily known until this survey, being previously reported from off Cape Point and Saldanha Bay in 824–915 m. *Africana* collected it regularly in small numbers in the area from 19 stations from west and south-west of Lüderitz southwards to the Orange River mouth, the border of Namibia, and southwards again along the deep slope of South Africa to Cape Town and south-south-west of Cape Point (Fig. 15c). Most specimens were collected from a depth greater than 700 m (Table I).

Classification — This is an undescribed species of endemic deep-water chimaerid, previously confused with *Chimaera monstrosa* (Linnaeus, 1758) from Iceland and Norway to the Mediterranean Sea, Madeira and the Azores. It is clearly separable from that species, as shown by a comparison of the series collected by *Africana* with a specimen of *C. monstrosa* from the Bay of Biscay. Dean (1906) named but did not describe *C. vaillanti* from the Cape of Good Hope, and indicated a type specimen in the "Jardin des Plantes". Barnard (1925) noted that he queried Dr Pellegrin of the Museum National d'Histoire Naturelle, Paris, on the type of *Chimaera vaillanti* Dean (MNHN 2557) from the Cape of Good Hope. Pellegrin replied (Barnard op. cit.) that MNHN 2557 had a slightly less sinuous lateral line than in typical *C. monstrosa*, but that in other respects it agreed so well that he saw no reason for separating it from *C. monstrosa*. The present authors have not examined MNHN 2557 as of writing this account, and cannot say if it is the same as the Cape chimaera recognized here and in Compagno *et al.* (1989). The problem is currently under study.

Hydrolagus sp. — brown chimaera

?*Chimaera africana* — Gilchrist 1922b: 51, Pl. 8 (R.V. *Pickle* #156, 30°08,00′S, 31°22,40′E, off Durban, Natal, 593 m); Barnard 1925: 95 (Natal, 593 m); Norman 1935: 47 (west coast of South Africa); Fowler 1941: 499 (South Africa, Natal); Smith 1949: 76, Fig. 94 (Natal, down to 549 m); Smith 1965: 76, Fig. 94 (Natal); Smith 1968: 3, Pl. 1a (off Durban, Natal, c. 421 m).

Hydrolagus africanus — Karrer 1975: 201 (Namibia, west of Lüderitz, 26°14′S, 13°51′E, 600 m; 26°16′S, 13°47′E, 395–425 m); Lloris 1986: 148, Fig. 56 (Namibia, north-west of Walvis Bay, 22°31′S, 12°47′E, 545–710 m); Turon *et al.* 1986: 71, 137, 178, 236, 300 (central Namibia and South Africa from Walvis Bay to south-west of the Orange River mouth, 26 stations from 22°50,5′S, 12°52,6′E to 29°46,6′S, 14°37,0′E, 410–915 m).

Hydrolagus africana (in part) — Compagno *et al.* 1989: 120 (central Namibia to Cape Agulhas).

Hydrolagus mirabilis — ?Lleonart and Rucabado 1984: 43 (central Namibia north-west of Walvis Bay, 22°31,3′S, 12°46,6′E, 545–717 m; error for *H. mirabilis*).

Africana demersal trawl stations ($n = 16$):

Cruise 033 — A2771, 517 m.
Cruise 039 — A3466, 488 m.
Cruise 046 — A4361, 850 m; A4368, 480 m.
Cruise 050 — A5307, 454 m.
Cruise 054 — A5899, 460 m.
Cruise 059 — A6949, 425 m; A6950, 475 m; A6963, 484 m.
Cruise 066 — A7548, 473 m; A7580, 485 m.
Cruise 075 — A9138, 465 m; A9151, 825 m.
Cruise 079 — A9814, 455 m; A9817, 444 m; A9826, 470 m.

Station latitude and depth range — 27°22,2′S, 14°16,2′E to 35°58,0′S, 19°320′E, 425–850 m.

Distribution — A *Hydrolagus* from the west coast of southern Africa, classified as *H. africanus* or possibly the European *H. mirabilis* (Collett, 1904), has been reported from northern Namibia to Walvis Bay, and into the present area to south-south-west of the Orange River mouth in 395–915 m of water. *Africana* regularly caught *Hydrolagus* along the uppermost slope of the area from south-west of Lüderitz to the Orange River mouth and southwards along the South African slope to south-west of Cape Agulhas (Fig. 15d). *Africana* also recorded *Hydrolagus* specimens during South-East Coast demersal cruises between Cape Agulhas and Port Alfred. An interesting feature of the distribution of this species is that it was never taken at the same stations as the larger *Chimaera* sp., although it has virtually the same geographic range in the area and has some depth overlap with the latter species. It is here termed the brown chimaera, in distinction to the blackish *Chimaera* sp.

Classification — Off southern Africa, the genus *Hydrolagus* is known from the endemic *Hydrolagus africanus* (Gilchrist, 1922), collected off Durban, Natal, but sub-

sequently recorded from off Moçambique and Kenya (Compagno 1986). Whether or not the West Coast *Hydrolagus* is the same as *H. africanus* is under study.

FAMILY RHINOCHIMAERIDAE — LONG-NOSE CHIMAERAS

Harriotta raleighana Goode and Bean, 1895 — narrownose chimaera

Harriotta raleighana — Goode and Bean 1895: 472, Pl. 19, Figs 1–2 (western North Atlantic, 1 294–1 978 m); Bigelow and Schroeder 1953: 551, Figs 124–126 (western North Atlantic, off Virginia and Nova Scotia, 732–1 429 m); Bigelow and Schroeder 1954: 72, Figs 6d–f, 7 (western North Atlantic off the north-eastern U.S.A. and Nova Scotia, 530–1 143 m); Smith 1965: 78, Fig. 96 (West Africa; wide-ranging, not recorded off South Africa); Karrer 1972: 217, Fig. 5 (North Atlantic and Eastern Pacific); Shcherbachev 1978: 7 (South Africa west of Doring Bay, 31°30′S, 15°29′E, 1 100 m); Compagno 1986: 146, Fig. 33.1 (Western Cape, 1 100 m); Compagno *et al.* 1989: 122, ill. (Lüderitz south to Doring Bay, 850–1 100 m); Compagno *et al.* 1990: 202, 220–221, Figs 1a–b (South Africa, including A4361 from west of Doring Bay, 850 m).

Africana demersal trawl stations ($n = 6$):

Cruise 046 — A4361, 850 m.
Cruise 059 — A6951, 864 m.
Cruise 066 — A7616, 880 m; A7625, 855 m; A7655, 865 m.
Cruise 069 — A8413, 900 m.

Station latitude and depth range — 26°43,6′S, 13°36,0′E to 31°59,8′S, 15°56,2′E, 850–900 m.

Distribution — The narrownose chimaera has a wide range and disjunct distribution on the deep slopes of the North Atlantic from Chesapeake Bay to the Canary Islands, the west coast of southern Africa, and the Western and Eastern Pacific. Shcherbachev (1978) reported the first record of this species in southern African waters, from west of Doring Bay, South Africa, in 1 100 m. *Africana* collected it from several deep stations west and south-west of Lüderitz in Namibia (the first records there) southwards to south-west of the Orange River and along the South African slope to north-west of Cape Columbine (Fig. 16a). It is likely that it has a more extensive range off southern Africa than is known at present.

Neoharriotta pinnata (Schnakenbeck, 1931) — sickle-fin chimaera

Harriotta pinnata — Schnakenbeck 1931: 40, Figs 6–8 (Namibia, off Walvis Bay in deep water); Barnard 1937: 46 (Walvis Bay); Fowler 1941: 505 (Walvis Bay); Barnard 1947: 31, Pl. 5, Fig. 1 (Walvis Bay); Poll 1951: 145, Figs 63–65, Pl. 13, Fig. 4 (Angolan records; also Namibia off Rocky Point, 19°52′S, 12°20′E, 220 m).

Harriotta raleighana — Smith 1949: 78 (in part, *H. pinnata* included in synonymy, Walvis Bay); Rodriguez-Roda 1961: 89, Figs 1–2 (off Cabo Blanco, Spanish Sahara–Mauritania, 330 m).

Neoharriotta pinnata — Bigelow and Schroeder 1950: 406 (Walvis Bay, Namibia, also Gulf of Guinea); Barnard 1952: 66 (southern Africa, no localities); Bigelow and Schroeder 1953: 550 (equatorial West Africa and Walvis Bay, Namibia); Smith 1965: 78, Fig. 97 (west coast of Africa); Bullis and Carpenter 1966: 443, Fig. 5b (Liberia, Angola, Walvis Bay, Namibia); Krefft 1968a: 72 (West Africa, Gold Coast and Spanish Guinea, 530–850 m); Penrith 1969: 66 (Namibia); Karrer 1972: 217, Fig. 5 (range from vicinity of Senegal south to Namibia, including northern Namibia at 18°51′S, 11°36′E, 320–330 m); Lleonart and Rucabado 1984: 43 (central Namibia north-west of Walvis Bay, 3 stations from 20°31,7′S, 12°02,0′E to 22°31,3′S, 12°46,6′E, 220–717 m); Allué *et al.* 1984: 130 (north-central Namibia from Cape Frio to north-west of Walvis Bay, 10 stations from 18°01,0′S, 11°25,0′E to 21°33,0′S, 12°39,0′E, 310–406 m); Compagno 1986: 146, Fig. 33.2 (Gulf of Guinea to Walvis Bay, 200–470 m); Lloris 1986: 149, Fig. 57 (northern Namibia to west of Walvis Bay, 18°38′S, 11°22′E, 512–531 m; 20°29′S, 12°04′E, 406 m; 21°10′S, 12°35′E, 392–399 m; 21°30′S, 12°34′E, 510 m; 22°57′S, 13°04′E, 400–500 m); Turon *et al.* 1986: 37, 72, 236, 300 (north-central Namibia from the Cunene River to between Walvis Bay and Lüderitz, 16 stations from 17°32,9′S, 11°21,0′E to 25°51,5′S, 13°40,5′E, 337–626 m); Compagno *et al.* 1989: 120, ill. (West Coast from Walvis Bay north to the Angolan border and northwards to the Gulf of Guinea); ?Manilo and Movchan 1989: 136, Fig. 1 (Arabian Sea, 300–550 m, possibly not conspecific with *N. pinnata*?, also specimens from West Africa, 400 m).

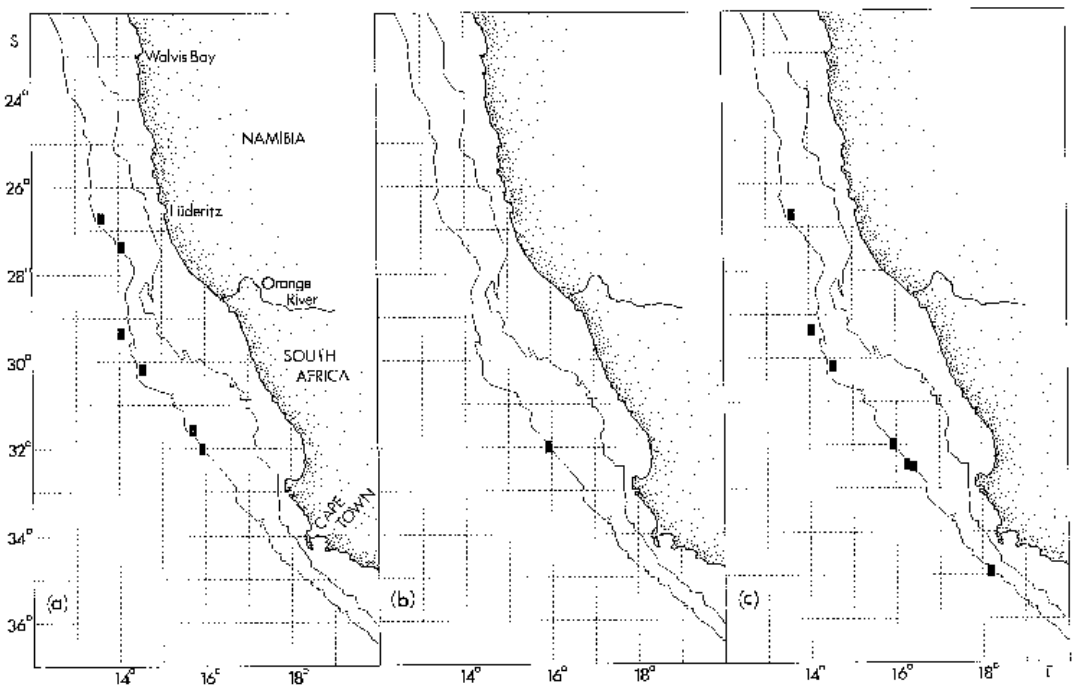

Fig. 16: *Africana* demersal trawl stations at which (a) narrow-nose chimaera (*Harriotta raleighana*, *n* = 6), (b) paddlenose chimaera (*Rhinochimaera africana*, *n* = 1), (c) spearnose chimaera (*Rhinochimaera atlantica*, *n* = 7) were taken, 1986–1990

Africana demersal trawl stations: none.

Distribution — The sicklefin chimaera is an Eastern Atlantic endemic species of the uppermost continental slope, with a range from Cabo Blanco at the Spanish Sahara and Mauritanian border to south-central Namibia at depths of 220–850 m. In Namibian waters, it is common from the Cunene River to Walvis Bay and enters the present area to north-west of Lüderitz. However, it was not collected by F.R.S. *Africana* in Namibian waters or off South Africa. Spanish catches and this survey suggest that the species may not normally occur south of Lüderitz or in South African waters. However, as with *Oxynotus shubnikovi* and *Etmopterus pusillus*, deep-water sharks that are relatively common in north-central Namibia but are not known from South African waters except by isolated records off the Cape Peninsula, this species could eventually be taken as a vagrant off the Western Cape. Manilo and Movchan (1989) recorded the species from the Arabian Sea, but morphometric differences suggest that the *Neoharriotta* from the Arabian Sea may not be *N. pinnata*.

Rhinochimaera africana Compagno, Stehmann and Ebert, 1990 — paddlenose chimaera

Rhinochimaera africana — Compagno *et al.* 1990: 206, Figs 2–5 (summary of records off South Africa and in Moçambique Channel between Madagascar and Europa Island, in 549–1 450 m).

Rhinochimaera atlantica — Penrith 1969: 66 (in part, off Cape Columbine, c. 549 m); Shcherbachev 1978: 8 (in part, South Africa: off Atlantic side of Agulhas Bank, no depth and precise locality; off Kosi Bay, KwaZulu, 945–1 100 m); Compagno 1986: 146 (in part, Natal).

Rhinochimaera pacifica — Shcherbachev *et al.* 1982: 28 (in part, records of Shcherbachev 1978 from Agulhas Bank and Kosi Bay).

Rhinochimaera sp. — Compagno *et al.* 1989: 122, ill. (off Doring Bay, 850 m; Moçambique Channel).

Africana demersal trawl station (n = 1):

Cruise 046: A4361, 31°59,8′S, 15°56,2′E, 850 m.

Distribution — The bizarre paddlenose chimaera was discovered when a specimen was collected by F.R.S. *Africana* in the same trawl station off Doring Bay (Fig. 16b) as a similar-sized, similar-sexed specimen each of *Rhinochimaera atlantica* and *Harriotta raleighana*. Previously, it had been collected by Penrith (1969) and by Shcherbachev (1978) and Shcherbachev *et al.* (1982) in South African waters, but it had been confused with *R. atlantica* and *R. pacifica*. As currently known, *R. africana* is a southern African endemic. In the area it is currently known from off Doring Bay and Cape Columbine at 549–850 m, but it also occurs off the Atlantic side of the Agulhas Bank (locality uncertain) and off KwaZulu and in the Moçambique Channel at depths of 945–1 450 m. It may have been trawled in Namibian waters off the Cunene River by Spanish researchers (e.g. Lloris 1986), but this is uncertain at present.

Rhinochimaera atlantica Holt and Byrne, 1909 — spearnose chimaera

Rhinochimaera atlantica — Holt and Byrne 1909: 279 (50°51′N, 11°31′W, Irish Atlantic Slope, 1 226–1 409 m); Bigelow and Schroeder 1954: 72, Figs 5, 6a–c, 7 (western North Atlantic off the north-eastern U.S.A. and Nova Scotia, 530–997 m); Penrith 1969: 66 (in part?, including *R. africana*); Karrer 1972: 217, Fig. 5 (distribution, southern African record after Penrith); Shcherbachev 1978: 8 (in part, South-Eastern Cape, South Africa, south of Plettenberg Bay at 35°02,8′S, 24°04′E, 960 m); Lleonart and Rucabado 1984: 43 (central Namibia north-west of Walvis Bay, 22°31,3′S, 12°46,6′E, 545–717 m); Lloris 1986: 151, Fig. 58 (in part, off Walvis Bay, 22°31′S, 12°47′E, 545–710 m?; Turon *et al.* 1986: 72, 138 (Namibia from the Cunene River to off the Orange River mouth, 6 stations from 17°41,2′S, 11°17,4′E to 28°19,0′S, 14°18,6′E, 609–823 m, possibly including *R. africana*?); Compagno 1986: 146, Fig. 33.3 (in part, Lüderitz); Compagno *et al.* 1989: 122, ill. (in part, not Natal records, = *R. africana*); Compagno *et al.* 1990: 205–206, 219, Fig. 6, 10 (summary of *Africana* catches and other records from Namibia and South Africa, range from northern Namibia to Plettenberg Bay, South Africa, including map, 659–960 m).

Harriotta atlantica — Garman 1911: 96 (Irish Atlantic slope, erroneous assignment to *Harriotta*).

Rhinochimaera pacifica — Shcherbachev *et al.* 1982: 28 (in part, record of Shcherbachev 1978 from Plettenberg Bay).

Africana demersal trawl stations (n = 7):

Cruise 046 — A4361, 850 m.
Cruise 050 — A5249, 800 m.
Cruise 059 — A6951, 864 m.
Cruise 060 — A7037, 903 m.
Cruise 066 — A7625, 888 m.
Cruise 069 — A8413, 900 m.
Cruise 075 — A9151, 825 m.

Station latitude and depth range — 26°43,6′S, 13°36,0′E to 34°55,6′S, 18°11,7′E, 825–903 m.

Distribution — The spearnose chimaera has a disjunct distribution in the North Atlantic and off southern Africa. Compagno *et al.* (1990) summarized its distribution in southern African waters, which as currently known is from northern Namibia south to Cape Point, Western Cape, and off Plettenberg Bay on the South-East Coast, in 659–960 m of water. In its survey area, *Africana* collected it from off Lüderitz, off the Orange River, north-west of Cape Columbine and south-west of Cape Point (Fig. 16c). Spanish researchers have reported *R. atlantica* from several stations from the Cunene River to the Orange River off Namibia (Lleonart and Rucabado 1984, Lloris 1986, Turon *et al.* 1986).

DISTRIBUTION PATTERNS

During the course of the surveys reported herein, it soon became apparent that the distribution of demersal cartilaginous fish off the west coast of southern Africa was neither uniform nor random. A governing factor of the distribution of chondrichthyan species was their rough zonation or stratification by depth and by latitude. No demersal species occurred at all depths sampled and, although several species, including the St Joseph *Callorhinchus capensis* and the biscuit skate (*Raja* cf. *clavata*) were encountered along most bands of latitude sampled, many species were limited or patchy in latitudinal distribution. A possible exception is the sixgill cowshark *Hexanchus griseus*, a wide-ranging, giant apical predator that potentially can occur throughout the area at depths from close inshore to over 1 000 m and near the bottom as well as far

above it, but which was seldom encountered by *Africana*. Zonation was suggested by data in literature sources on local cartilaginous fish, but the distribution of West Coast chondrichthyans had never been treated in detail, except for Hulley's (1972) work on skates (Rajidae) of southern Africa. Zonation was readily apparent during *Africana* hake biomass trawls, where repeated stations at different depth ranges yielded different groups of demersal chondrichthyan species, and stations in Namibian waters at similar depths yielded different mixes of species from those off the Western Cape. Depth and latitudinal zonation is more of a spectrum or continuum graded by depth and areal variation within individual species than a set of discrete, sharply defined zones each containing groups of different species. However, enough species are similar in their basic distribution patterns by depth to fit into definable groups or zones, despite overlap.

In addition, it was noticed that, for some species with sufficient records, there was evidence of seasonal movement from the differences in cumulative summer and winter cruise records. These were both by latitude and by depth, and they might indicate migration or localized responses by the species to seasonal changes in temperature, prey abundance, salinity, oxygen concentration or other environmental factors. Also, some species showed discrete clusters of records in parts of their range, with few or no records in between, apparently independent of the sampling pattern of the *Africana* during the survey.

The present account concentrates on the distribution pattern of demersal cartilaginous fish off the west coast of southern Africa, and it is not a zoogeographic analysis of southern African cartilaginous fish. This subject will be addressed elsewhere, in the context of the world distribution of cartilaginous fish (Compagno in prep.), after a complementary work on the distribution of cartilaginous fish on the South-East Coast is completed (Compagno *et al.* in prep.). However, a few interesting instances of sympatry and allopatry that came to light during the survey should be discussed here.

Zonation by depth

Zonation patterns by depth were analysed by compiling the bathymetric distributions of 64 species of cartilaginous fish in the survey area, including all *Africana* records except for those of three pelagic sharks (*Alopias vulpinus*, *Isurus oxyrinchus* and *Prionace glauca*) that are accidental catches of the bottom trawl. These were included in a spreadsheet listing records by 50-m increments from 0–49 m to 1 050+ m (Table III). Additional bathymetric records from the literature were included as qualitative records for the depth increments, and these were summarized for each species as minimum and maximum depth increments. Using the database sorting capability of the spreadsheet program, the depth records of the species were sorted in ascending order by the minimum depth as the primary key, and the maximum depth as the secondary key. This produced a depth spectrum pattern for the species (Table III), in which depth zones with component species could be roughly delimited.

INSHORE SPECIES

These are demersal species confined to the continental shelf, from close inshore to the mid-shelf, typically found shallower than 100 m. Due to the paucity of inshore stations on the West Coast in the 0–49 m depth range (see Fig. 2a), few inshore demersal or epibenthic species were collected. These include *Halaelurus natalensis*, *Mustelus mustelus* and *Rhinobatos annulatus*. There are numerous additional species of inshore elasmobranchs that were not caught during the survey but which definitely occur in the area (Compagno *et al.* 1989).

Hexanchidae: sevengill cowshark *Notorynchus cepedianus* (Péron, 1807).

Scyliorhinidae: puffadder shyshark *Haploblepharus edwardsii* (Voigt, in Cuvier 1832); dark shyshark *Haploblepharus pictus* (Müller and Henle, 1838); pyjama shark *Poroderma africanum* (Gmelin, 1789); leopard catshark *Poroderma pantherinum* (Smith, in Müller and Henle, 1838).

Triakidae: spotted gully shark *Triakis megalopterus* (Smith, 1849).

Rhinobatidae: bluntnose guitarfish *Rhinobatos blochii* Müller and Henle, 1841.

Narkidae: onefinned electric ray *Narke capensis* (Bloch and Schneider, 1801). Marginal in the area, in False Bay (Barnard 1925, 1947, Day *et al.* 1970).

Torpedinidae: ?blackspotted electric ray *Torpedo fuscomaculata* Peters, 1855. False Bay records of the European *Torpedo marmorata* Risso, 1810 may be based on this species (Barnard 1925, 1947, Day *et al.* 1970).

Dasyatidae: shorttail stingray *Dasyatis brevicaudatus* (Hutton, 1875); blue stingray *Dasyatis marmorata*

Table III: Distribution of West coast demersal cartilaginous fish by depth, with species sorted in ascending order by their minimum and maximum depth occurrence (50-m depth increments). The list does not include three littoral oceanic sharks (*Alopias vulpinus*, *Isurus oxyrinchus* and *Prionace glauca*) rarely caught by *Africana*, but it includes several species not collected by *Africana*

Species	Number per 50-m depth increment									
	0–49	50–99	100–149	150–199	200–249	250–299	300–349	350–399	400–459	450–499
Halaelurus natalensis	1									
Rhinobatos annulatus	*									
Mustelus mustelus	1	*								
Galeorhinus galeus	*	1	13	52	19	7				
Raja (Rostroraja) alba	*	3	7	15	4	1				
Raja (Raja) miraletus	*	*	*	*			*		*	
Mustelus palumbes	*	7	15	63	31	16	1	1	1	
Squalus megalops	*	1	12	110	71	26	7	2		1
Myliobatis aquila	1		*	*					*	
Callorhinchus capensis	3	36	58	126	80	25	3	3	*	
Hexanchus griseus	*			2	*	*	2	1	*	*
Raja (Raja) cf. *clavata*	1	8	34	158	127	55	9	7	*	2
Pliotrema warreni		*	1							
Echinorhinus brucus		*				*				
Raja (Dipturus) pullopunctata		*	10	48	29	10	3	3		*
Raja (Dipturus) springeri		1							3	4
Holohalaelurus regani		1	18	167	143	74	36	36	23	24
Squalus acanthias		2	9	19	22	29	12	12	2	*
Raja (Leucoraja) wallacei			1	53	39	18	3	6	1	2
Torpedo nobiliana			2	3	4	2		1	2	1
Oxynotus shubnikovi			*	*		*				
Raja (Rajella) leopardus			*			3	9	21	19	33
Scyliorhinus capensis				6	23	10	6	13	3	8
Squalus cf. *mitsukurii*				27	47	31	13	20	12	18
Cruriraja parconaculata				5	23	18	13	13	2	7
Galeus polli			*	*	4	5	7	7	3	
Raja (Dipturus) doutrei				*		*	*	*	*	*
Centrophorus granulosus					*	*	*	1	3	1
Neoharriotta pinnata					*		*	*	*	*
Raja (Rajella) confundens					*	4	2	17	9	24
Bathyraja smithii					*	*			1	11
Hexanchias perlo						*	*	*	*	
Neoraja stehmanni						*				1
Chlamydoselachus anguineus							*	*	1	
Raja (Rajella) caudaspinosa							1	3	8	22
Deania profundorum								1	4	4
Centrophorus squamosus								*	2	*
Hydrolagus sp.								*	2	11
Deania calcea								*	*	3
Etmopterus cf. *brachyurus*								*	1	13
Etmopterus cf. *granulosus*								*		
Etmopterus pusillus									5	3
Scymnodon squamulosus									*	*
Etmopterus compagnoi									*	5
Centroscymnus crepidater									*	1
Raja (Rajella) dissimilis									2	3
Euprotomicroides zantedeschia										*
Deania quadrispinosum										1
Aspinurus saldanha										1
Raja (Rajella) ravidula										1
Centroscyllium fabricii										1
Mitsukurina owstoni										
Raja (Amblyraja) radiata										
Rhinochimaera africana										
Centroscymnus coelolepis										
Somniosus microcephalus										
Aspristurus sp.										
Chimaera sp.										
Aspristurus microps										
Rhinochimaera atlantica										
Raja (Malcoraja) spinacidermis										
Cruriraja durbanensis										
Harriotta raleighana										
Raja (Amblyraja) robertsi										

* Literature records

Table III (*continued*)

Number per 50-m depth increment												Minimum depth (m)	Maximum depth (m)
500–549	550–599	600–649	650–699	700–749	750–799	800–849	850–899	900–949	950–999	1 000–1 049	1 050–1 450		
												0	0
												0	0
												0	50
												0	250
												0	250
												0	400
												0	400
												0	450
*												0	500
*	*	*										0	600
*		*										0	600
*	*	*	*	*	*	*						0	800
												50	100
												50	250
												50	450
												50	450
3												50	500
1												50	500
*												100	500
*												100	500
		*	*									100	650
5	1	*	2	4	2	4	6	1		1		100	1 000
1												150	500
3	2											150	550
3		*										150	650
*	*	*	*									150	650
*	*	*	*	*	*	*						150	800
*												200	500
*	*	*	*	*								200	700
*		*	*	2		1	5	4				200	900
2		*	3	5	3	3	6	5		*		200	1 000
												250	400
	1		2	3		1	1	2		*		250	1 000
												300	400
2	1		1	2				*			*	300	1 050
	*	*		1								350	700
*	*	*	*	*	*	1						350	800
1	*	*	*	*	*	1	1	*	*			350	850
*	*	*	2	8	1	3	3					350	850
3	2	*	2	8	3	3	5	1				350	900
			2	5	4	3	3	8	*		*	350	1 450
*	*	*	1	1								400	700
*	*	*	*	1				1				400	900
1	1		2	6	2		1	4				400	900
*	1	*	*	3	3	1	2	2				400	900
*	*	*		3	2	2	4	4		2		400	1 000
		*										450	600
		*										450	650
2			1	2	1							450	750
			1	1		1	3	1		1		450	1 000
*	*	*	1	8	5	5	6	9		2		450	1 000
*												500	500
*		*										500	600
*							1					500	850
*	*	*	3	4	4		5	7		2		500	1 000
			*									650	650
			2	5	2	3	3	1		1		650	1 000
			1	4	2	3	1	4		1		650	1 000
				1	5	2	4	6		1		700	1 400
						2	3	2				800	900
						3	2	4		*	*	800	1 350
							*					850	850
							5	1			*	850	1 100
											*	1 350	1 350

(Steindachner, 1892).

Gymnuridae: diamond ray *Gymnura natalensis* (Gilchrist and Thompson, 1911).

Myliobatidae: duckbill ray *Pteromylaeus bovinus* (Geoffroy St. Hilaire, 1817).

Additional inshore trawl stations would be desirable in the area, because the inshore demersal species are apparently under-represented in the present survey.

INSHORE OVERLAP SPECIES

These are cartilaginous fish that occur close inshore and enter shallow bays, but which also range onto the outer shelf and the upper slope to varying depths. Ranked by increasing maximum depth, they include *Raja alba*, *Galeorhinus galeus*, *Mustelus palumbes*, *Raja miraletus* (Namibia), *Squalus megalops*, *Myliobatis aquila* (Namibia), *Callorhinchus capensis* and *Raja* cf. *clavata*. Off the west coast of South Africa, *M. aquila* apparently is an inshore species and *R. miraletus* may be so also. *Echinorhinus brucus* is occasionally caught from shore, but it is generally found in deep water as a shelf overlap species.

SHELF OVERLAP SPECIES

These fish occur on the outer shelf deeper than 50 m and generally range onto the uppermost slope. Ranked by increasing minimum and maximum depth, the cartilaginous fish include *Pliotrema warreni* (marginal in the area, but with a shelf overlap distribution off the Eastern Cape), *Echinorhinus brucus*, *Raja springeri* (most records on the upper slope), *Raja pullopunctata*, *Squalus acanthias*, *Holohalaelurus regani*, *Raja wallacei*, *Torpedo nobiliana*, *Oxynotus schubnikovi*, *Raja leopardus* (this mostly on the slope below 200 m), *Scyliorhinus capensis*, *Squalus* cf. *mitsukurii* (most below 200 m), *Galeus polli*, *Cruriraja parcomaculata* and *Raja doutrei*.

UPPER SLOPE SPECIES

The distribution of cartilaginous fish on the continental slope off the west coast of southern Africa in depths of 200–1 000 m has a broad intergradation of species, with increasingly great minimal depths. Some species also have greater depth ranges than others. Slope distributions are also more poorly known than shelf distributions, and the present spectrum will undoubtedly be modified as information on them continues to accumulate. The three slope components are somewhat arbitrary, but some of the species within them show relatively limited distributions on the upper, intermediate and deep slopes, whereas some species range from the upper to the deep slope. The upper slope species are those with an upper limit just below the shelf edge, within depths of 200–300 m, and include *Centrophorus granulosus*, *Neoharriotta pinnata*, *Raja confundens*, *Bathyraja smithii*, *Heptranchias perlo*, *Neoraja stehmanni*, *Chlamydoselachus anguineus* and *Raja caudaspinosa*. Sharks and chimaeras in this group have a maximum range of 400–700 m of water depth, but the skates range deeper, down to 900 m or more.

INTERMEDIATE SLOPE SPECIES

This group includes a variety of species that occur in 350–500 m of water as part of a broad transitional zone of slope inhabitants, many of which reach depths >700 m. They include *Deania profundorum*, *Centrophorus squamosus*, *Hydrolagus* sp., *Deania calcea*, *Etmopterus* cf. *brachyurus*, *E. pusillus*, *Scymnodon squamulosus*, *Etmopterus compagnoi*, *Centroscymnus crepidater*, *Deania quadrispinosum*, *Apristurus saldanha*, *Centroscyllium fabricii* and *Centroscymnus coelolepis*. A few records of deeper-dwelling species, such as *Raja dissimilis* (young), *Etmopterus* cf. *granulosus*, *Raja ravidula* and *Rhinochimaera africana*, are known from the intermediate slope, but other records of these species are mostly from depths >600 m.

DEEP-SLOPE SPECIES

There is a step or gap at 500–600 m of water depth between transitional and deep-slope species, which probably reflects a current paucity of knowledge of the species in this depth range. The deep-slope species, with records at 600–1 000 m, include *Apristurus* spp., *Chimaera* sp., *Apristurus microps*, *Rhinochimaera atlantica*, *Raja spinacidermis* and *Harriotta raleighana*.

Exploration by *Africana* in water depths of 1 000–2 000 m may well reveal additional species with a distribution starting deeper than 1 000 m. *Raja robertsi* is one possibility, but deep-dwelling species of *Hydrolagus* and *Apristurus* and possibly even *Harriotta haeckeli* Karrer, 1973 may be expected, along with several intermediate and deep-slope species, including *Centroscymnus coelolepis*, *Etmopterus* cf. *granulosus*, several skates, *Harriotta raleighana* and *Rhinochimaera africana*.

EURYBATHIC SPECIES

These are cartilaginous fish with a wide bathymetric

range, from close inshore to the deep slope. The sixgill cowshark *Hexanchus griseus* is one example encountered by the survey.

Zonation by latitude

A spreadsheet was compiled for latitudinal records of 64 species of demersal cartilaginous fish in the survey area (Table IV), including literature records but excluding large littoral and oceanic species. An ascending sort of the species by minimum and maximum latitude suggests four broad faunal groups of species by latitude, with some overlap.

ATLANTIC-NAMIBIAN AND BICOASTAL SPECIES

Atlantic-Namibian species occur in the Eastern Atlantic south to Namibia, but drop out between Walvis Bay and the Orange River. These species are absent or very rare from the west coast of South Africa and apparently are absent from the east coast of southern Africa: *Neoharriotta pinnata*, *Galeus polli*, *Oxynotus schubnikovi* and *Raja doutrei*. Bicoastal species occur in the Eastern Atlantic south to Namibia, are absent or very rare off the Western Cape, and reappear along the east coast of southern Africa from off the Eastern Cape to Natal: *Heptranchias perlo*, *Childoselachus anguineus*, *Deania quadrispinosum*, *Etmopterus pusillus* and *Scymnodon squamulosus*. *Raja miraletus* is a largely bicoastal species that drops out in southern Namibia, but reappears in False Bay after a gap southwards from the Orange River to Cape Point.

WESTERN CAPE SPECIES

Several species have complementary distributions to Namibian and bicoastal species on the Western Cape coast of South Africa, but they drop out at various latitudes between Cape Columbine and Lüderitz and do not extend into central Namibia. They include *Raja springeri*, *R. ravidula*, *Squalus* cf. *mitsukurii*, *Cruriraja parcomaculata*, *Scyliorhinus capensis*, *Holohalaelurus regani*, *Raja caudaspinosa*, *Galeorhinus galeus*, *Raja pullopunctata*, *Raja wallacei*, *Neoraja stehmanni*, *Raja spinacidermis*, *Apristurus microps*, *Etmopterus* cf. *granulosus*, *Apristurus saldanha* and *Etmopterus compagnoi*. Some of them are confined as currently known to the Western Cape, but others also range off the Eastern Cape and beyond.

EAST COAST SPECIES

A few species of offshore demersal elasmobranchs are marginal to the area, but have an extensive range on the east coast of southern Africa. *Pliotrema warreni* is one such species and *Narke capensis* may be another.

WIDE-RANGING SPECIES

Many offshore demersal species range from Namibia to Cape Columbine and in many instances to Cape Agulhas and the Eastern Cape. They include *Hexanchus griseus*, *Raja confundens*, *Rhinochimaera atlantica*, *Deania calcea*, *Raja alba*, *Centroscymnus crepidater*, *Raja leopardus*, *Centroscyllium fabricii*, *Centroscymnus coelolepis*, *Callorhinchus capensis*, *Bathyraja smithii*, *Hydrolagus* sp., *Torpedo nobiliana*, *Mustelus palumbes*, *Etmopterus* cf. *brachyurus*, *Raja* cf. *clavata*, *Squalus megalops* and *Raja dissimilis*. *Squalus acanthias* is recorded from Namibia as well as the Western Cape and may be wider-ranging than suggested by the present survey.

Littoral and oceanic species

There are numerous littoral and epipelagic species of sharks and rays in the area but which were not collected by *Africana* at trawl stations nor were they widely reported from other trawl-based surveys. Some of them have occasionally been captured by bottom trawls elsewhere and could be caught from *Africana* during future trawl surveys. However, these active-swimming and mostly large sharks and rays are at most incidental catches in bottom trawls and are more readily caught by longline, gillnet, handline, rod and reel, or harpoon. Accidental catches of active-swimming or oceanic cartilaginous fish may include the few trawl records of *Alopias vulpinus*, *Isurus oxyrinchus* and *Prionace glauca* during the survey, and possibly the bottom trawl record of *Euprotomicroides zantedeschia*. A list of cartilaginous fish in the area with a low probability of being trawled by *Africana* are listed below.

Family Rhincodontidae: whale shark *Rhincodon typus* Smith, 1828.

Family Odontaspididae: spotted raggedtooth shark *Carcharias taurus* Rafinesque, 1810.

Family Pseudocarchariidae: crocodile shark *Pseudocarcharias kamoharai* (Matsubara, 1936).

Family Cetorhinidae: basking shark *Cetorhinus maximus* (Gunnerus, 1765).

Table IV: Distribution of West coast demersal cartilaginous fish by latitude, with species sorted in ascending order by their minimum and maximum latitudinal occurrence (increments are latitudinal degree bands). The list does not include three littoral oceanic sharks (*Alopias vulpinus, Isurus oxyrinchus* and *Prionace glauca*) rarely caught by *Africana*, but it includes several species not collected by *Africana*

Species	Number of species records per degree band of latitude															Minimum latitude (°S)	Maximum latitude (°S)
	<23	23	24	25	26	27	28	29	30	31	32	33	34	34	36		
Hexatrachias perlo	*															22	22
Neoharriotta pinnata	*	*	*	*												22	25
Deania quadrispinosum	*					1										22	27
Chlamydoselachus anguineus	*					1										22	27
Scymnodon squamulosus	*	1			1	*										22	27
Galeus polli	*	2	5	6	8	3	*									22	28
Raja (Raja) miraletus	*				*			*								22	29
Raja (Dipturus) doutrei	*	*	*			*	*	*								22	29
Deania profundorum	*		2	2	2	1	1		2							22	30
Centrophorus granulosus	*	*		2	1	1			1							22	30
Centrophorus squamosus	*	*	*	1	*	1	*				1					22	32
Hexanchus griseus	*	2	1		*	*	*	1			1	*				22	33
Raja (Rajella) confundens	*	1	2	3	3	5	3	6	22	6	11	3	3			22	34
Myliobatis aquila	*												1			22	34
Mustelus mustelus	*			*	*		*	*					1			22	34
Oxynotus bruhkovi	*		*										*			22	34
Rhinochimaera atlantica	*				1			1	1	1	2	*	1			22	34
Etmopterus pusillus	*	2	2	1	2	2	*						1			22	34
Deania calcea	*	1	1			1		3	2	2		4	6			22	34
Raja (Rostroraja) alba	*			*		1	3	1	1	3	1	6	5	9		22	35
Centroscymnus crepidater	*	1	1	*	1	*		3		1		3	1	2		22	35
Raja (Rajella) leopardus	*	1	1	1	1	4	2	10	17	23	25	13	8	5		22	35
Centroscyllium fabricii	*	*	1		3	*	1	4	3	4	3	5	11	2		22	35
Centroscymnus coelolepis	*		*		2		*	4	2	3	3	8	5	2		22	35
Callorhinchus capensis	*	*	*	1	*	1	21	53	56	56	47	37	26	36		22	35
Bathyraja smithii	*	1				2	1	3	2	3	3	8	15	1		22	35
Hydrolagus sp.	*	*		*	*	21	1	1	5	3	2			2		22	35
Torpedo nobiliana	*	1	*		1	1	1	*		1	1	3	3	3		22	35
Mustelus palumbes	*					1	7	21	22	19	10	13	11	31		22	35
Etmopterus cf. *brachyurus*	*	1	1	*	2	1	2	5	3	4	3	10	6	3		22	35
Raja (Raja) cf. *clavata*	*	1	1	1	2	1	9	57	56	34	40	90	45	60	4	22	36
Squalus megalops	*	2	*	1		1	3	42	42	12	7	14	29	72	3	22	36
Squalus acanthias		1				*	3	11	23	32	33	5	1			23	34
Raja (Rajella) dissimilis		1			2	1		4	2	2	5		5			23	34
Harriotta raleighana					1	1		1	1		2					26	31
Chimaera sp.					1	1		3	2	1	1	3	7			26	34
Apristurus sp.					2			3	3	2	1	3	5	1		26	35
Echinorhinus brucus						*						*				27	33
Raja (Dipturus) springeri						2		1	2	2			1			27	34
Raja (Rajella) ravidula						1		3	2			1	2			27	34
Squalus cf. *mitsukurii*						1	1	40	48	26	23	12	7	15		27	35
Cruriraja parcomaculata						*	1	10	12	11	15	5	17	12	1	27	36
Scyliorhinus capensis						1	1	10	14	3	4	5	11	19	2	27	36
Holohalaelurus regani						2	9	72	85	85	77	80	43	68	3	27	36
Raja (Rajella) candaspinosa							1	1	6	7	6	7	8	4		28	35
Galeorhinus galeus							4	20	11	14	13	14	5	11		28	35
Raja (Dipturus) pullopunctata							1	6	8	6	4	13	22	42	1	28	35
Raja (Leucoraja) wallacei							3	18	32	19	11		8	31	1	28	36
Neoraja stehmanni								1				4	6			29	34
Raja (Malacoraja) spinacidermis								2			2	2	2			29	34
Cruriraja durbanensiss									*							30	30
Apristurus microps									2	3	2	3	7	2		30	35
Rhinochimaera africana										1	*					31	31
Etmopterus cf. *granulosus*										1	3	8	11	2		31	35
Somniosus microcephalus											*					32	32
Eupromicroides zantedeschia												*				33	33
Mitsukurina owstoni												*				33	33
Raja (Amblyraja) radiata												*				33	33
Raja (Amblyraja) robertsi												*				33	33
Rhinobatos annulatus													1			33	34
Apristurus saldanha												1	4	2		33	35
Etmopterus compagnoi												8	12	2		33	35
Halaelurus natalensis													1			34	34
Pliotrema warreni														1		35	35

* Literature records

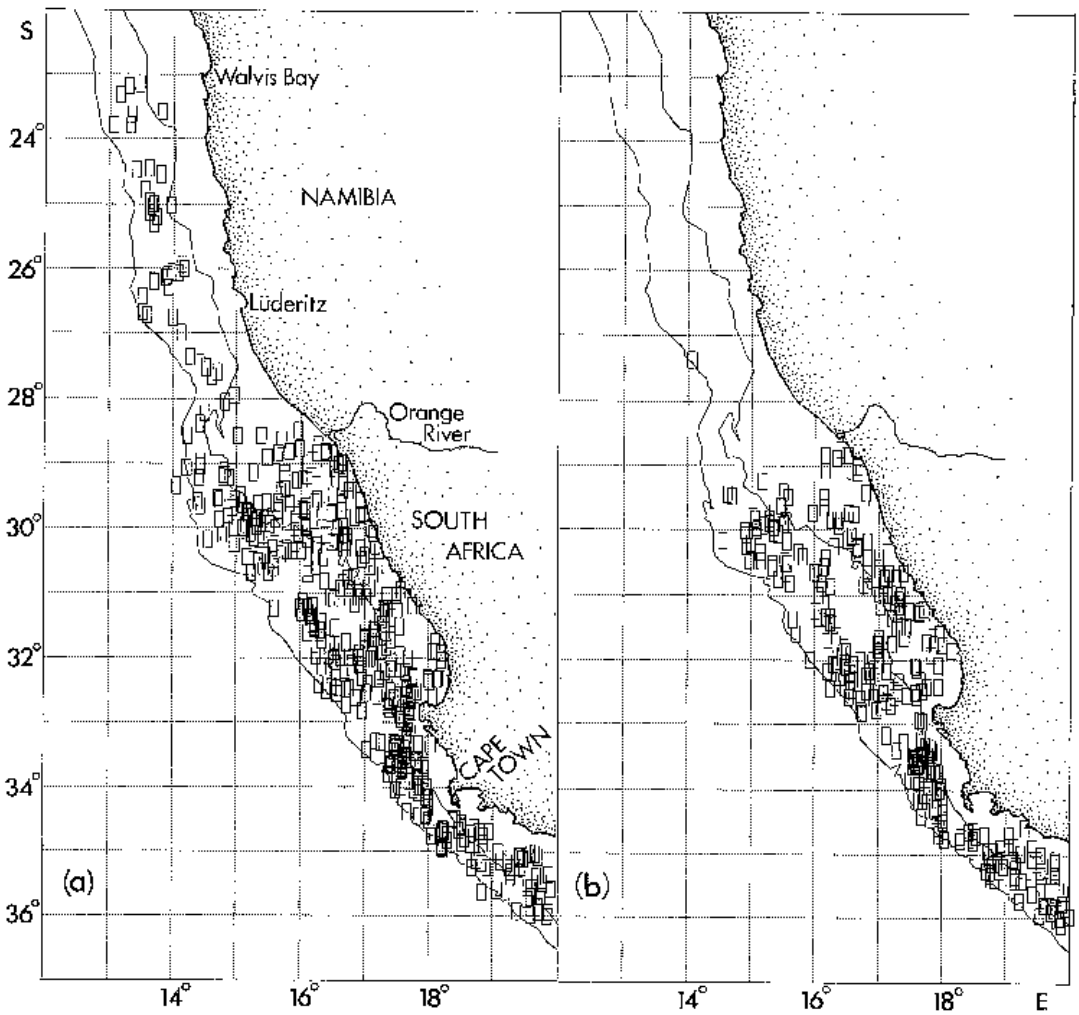

Fig. 17: Records of the 869 F.R.S. *Africana* demersal trawl stations which collected cartilaginous fish in (a) summer and (b) winter

Family Lamnidae: white shark *Carcharodon carcharias* (Linnaeus, 1758).

Family Carcharhinidae: bronze whaler *Carcharhinus brachyurus* (Günther, 1870); oceanic whitetip shark *Carcharhinus longimanus* (Poey, 1861); dusky shark *Carcharhinus obscurus* (Lesueur, 1818).

Family Sphyrnidae: smooth hammerhead *Sphyrna zygaena* (Linnaeus, 1758).

Family Dasyatidae: pelagic stingray *Pteroplatytrygon violacea* (Bonaparte, 1834).

Family Mobulidae: manta *Manta birostris* (Walbaum, 1792).

In addition, two species of oceanic squaloids, *Isistius brasiliensis* (Quoy and Gaimard, 1824) and *Heteroscymnoides marleyi* Fowler, 1934 were recorded by Krefft (1980) from about 1 700 km west of Cape

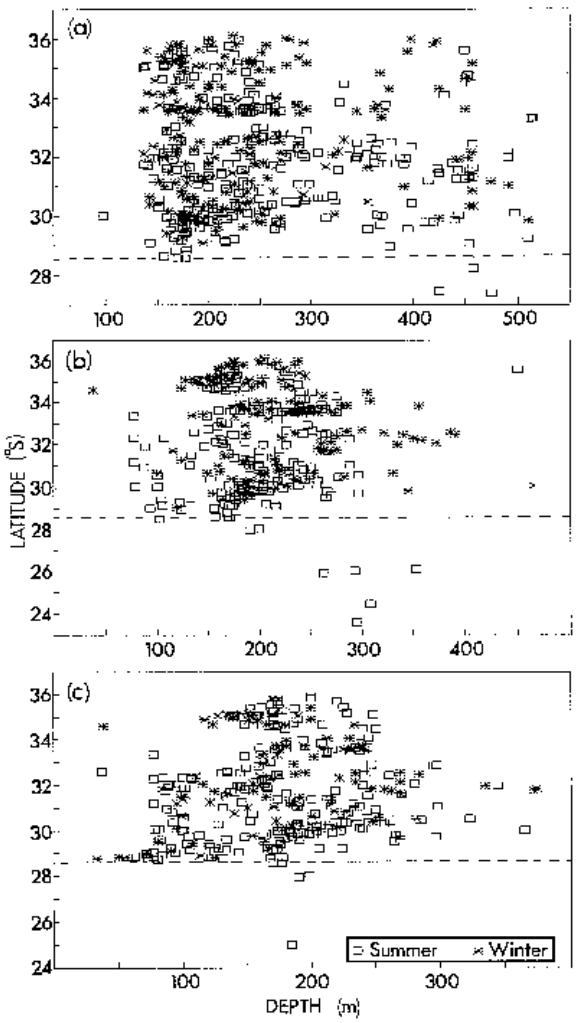

Fig. 18: Latitude-depth summer-winter plots of survey records of the three most frequently caught cartilaginous fish — (a) *Holohalaelurus regani*, (b) *Raja* cf. *clavata*, (c) *Callorhinchus capensis*

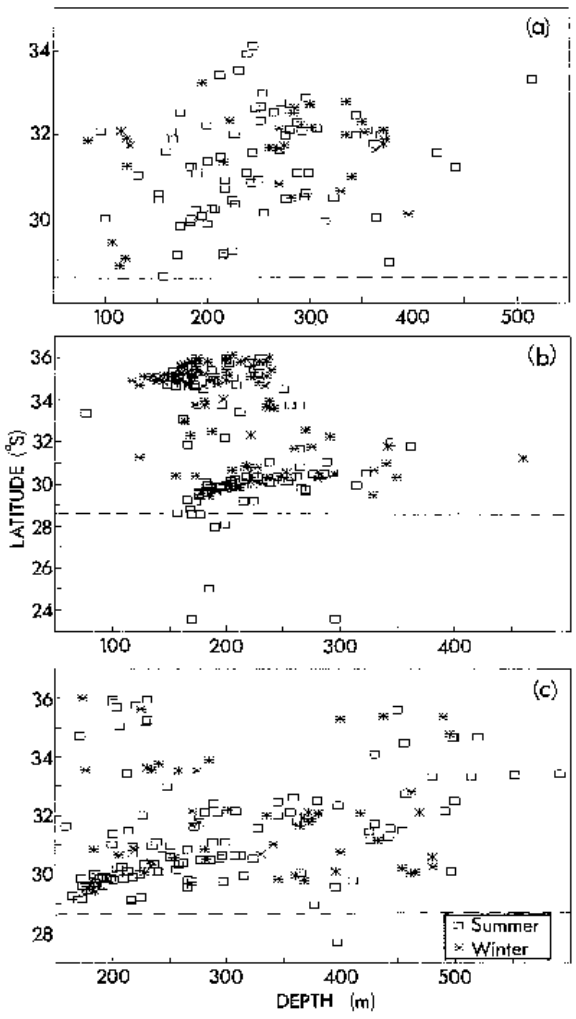

Fig. 19: Latitude-depth summer-winter plots of survey records of three species of spiny dogfish — (a) *Squalus acanthias*, (b) *Squalus megalops*, (c) *Squalus* cf. *mitsukurii*

Town, and Jahn and Haedrich (1987) recorded *I. brasiliensis* off the Agulhas Bank south-east of Cape Agulhas. Neither species has been collected in the area to date.

Summer-winter patterns

The survey included more summer stations than winter (Fig. 17), in part because of limited coverage of winter cruise 066, but also because two cruises (059 and 060) took place in summer 1988 and because almost all Namibian trawling took place during summer. The following discussion of summer-winter distribution patterns is confined to South African data.

Depth-latitude summer-winter plots (Figs 18–20) were made by separating summer and winter records and plotting them against depth and latitude for species with numerous records. Some species, including *Holohalaelurus regani* (Fig. 18a), *Callorhinchus capensis* (Fig. 18c) and *Squalus acanthias* (Fig. 19a) show little to indicate regular movements in the sam-

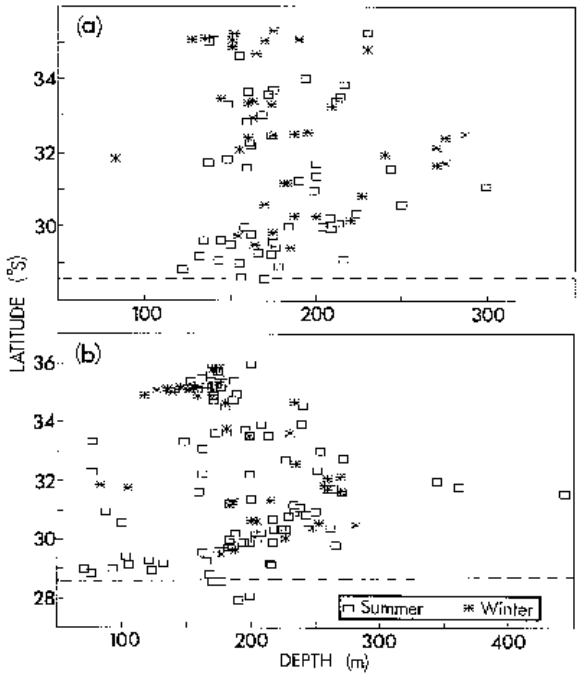

Fig. 20: Latitude-depth summer-winter plots of survey records of two species of houndshark — (a) *Galeorhinus galeus*, (b) *Mustelus palumbes*

ple area. Records of *Raja* cf. *clavata* (Fig. 18b) suggest a shift from deeper to shallower water in summer and vice versa in winter. Records of *Galeorhinus galeus* (Fig. 20a) and *Mustelus palumbes* (Fig. 20b) tend to be slightly farther north in summer than in winter, but with a broad overlap, while *M. palumbes* also seems to range more inshore in summer.

Aggregations by latitude and depth

Some species have a fairly regular, if uneven, distribution pattern, as shown by depth-latitude plots of *Holohalaelurus regani* (Fig. 18a), *Raja* cf. *clavata* (Fig. 18b), *Callorhinchus capensis* (Fig. 18c), *Squalus acanthias* (Fig. 19a) and *Galeorhinus galeus* (Fig. 20a), despite summer-winter shifts in *Galeorhinus* and *Raja*. Others, including *Squalus megalops* (Fig. 19b) and to a lesser extent *Squalus* cf. *mitsukurii* (Fig. 19c) and *Mustelus palumbes* (Fig. 20b), have records concentrated in certain depth-latitude blocks. *Squalus megalops* shows a strongly bimodal pattern, with most records in a southerly cluster at 34–36°S and 100–250 m and a northerly cluster at 29–31°S and 150–300 m. Most records of *S.* cf. *mitsukurii* are concentrated between 29 and 32°S in 150–450 m of water. The difference in the distributions of *S. acanthias* and *S. megalops* is striking and may be attributable to possible differences in habitat selection, social structure, feeding habits or other behavioural characteristics. It will be worthwhile in future work to attempt to find correlations between the distribution of demersal chondrichthyans and the physiographic data and distribution of potential prey species taken on *Africana* cruises. In addition, finer details of the distribution of cartilaginous fish may be arrived at through analysis of the biomass of the commoner species collected during the survey.

Sympatry and allopatry

Many species of West Coast demersal elasmobranchs are sympatric and occur as faunal associates at similar latitudes and depths on similar substrata (Tables III, IV). Examples of narrow depth and latitudinal sympatry are the regular occurrence of *Holohalaelurus regani* and the less abundant *Scyliorhinus capensis* in the same trawl stations (Fig. 21a). *Galeus polli*, in contrast, is geographically allopatric to *H. regani* and *S. capensis* over most of its range, and is found together with these species only between Lüderitz and the Orange River mouth in southern Namibia. A possible instance of narrow bathymetric allopatry within broad geographic sympatry is illustrated by two species of chimaerids, *Hydrolagus* sp. and *Chimaera* sp. These have similar latitudinal ranges (Figs 15c–d, 21b) and overlap in depth, yet they were never taken at the same trawl stations. A depth-latitude plot suggests that *Hydrolagus* is usually found in shallower water than *Chimaera*, which may be useful for avoiding competition between two similar species. In contrast, *Centroscymnus coelolepis* and *C. crepidater* occurred together at many deep-slope stations, but unpublished data indicate that they have very different food habits and are not trophic competitors.

Diversity indices

If the numbers of station records (species per station) at increments of depth (50 m) and latitude (degree bands) are divided by the number of stations at each increment, a relative measure of species diversity can be arrived at for each increment of depth (Table I) and latitude (Table II). The diversity index is the average number of species at each station at a given depth increment or latitude band. If the values of these diversity indices are plotted against their increments,

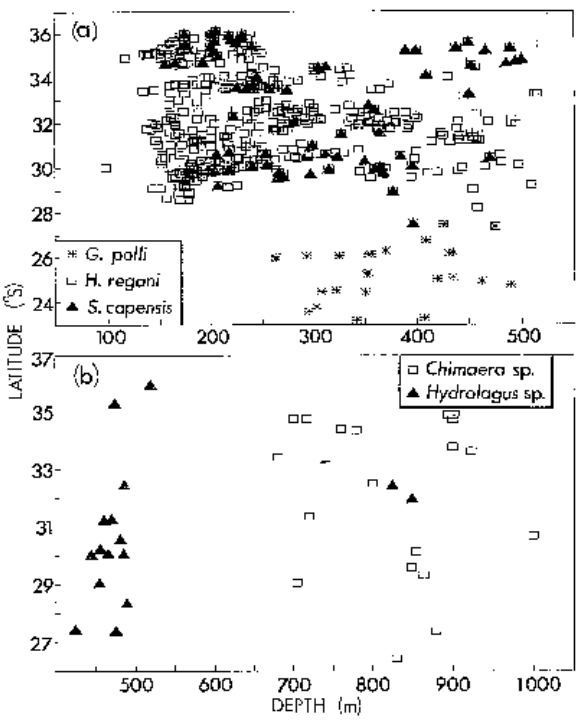

Fig. 21: Latitude-depth plots of scyliorhinid sharks and chimaeroids, showing allopatry and sympatry — (a) three species of the family Scyliorhinidae (*Galeus polli* is an Atlantic-Namibian species that replaces *Holohalaelurus regani* and *Scyliorhinus capensis* in similar depths on soft bottom between the Orange River and Lüderitz; the latter two species are broadly sympatric, but barely overlap with *G. polli*); (b) two deep-water members of the family Chimaeridae with a wide range in the survey area that could be considered as broadly sympatric but which were not collected at the same stations (*Chimaera* sp. occurs mostly deeper than *Hydrolagus* sp.)

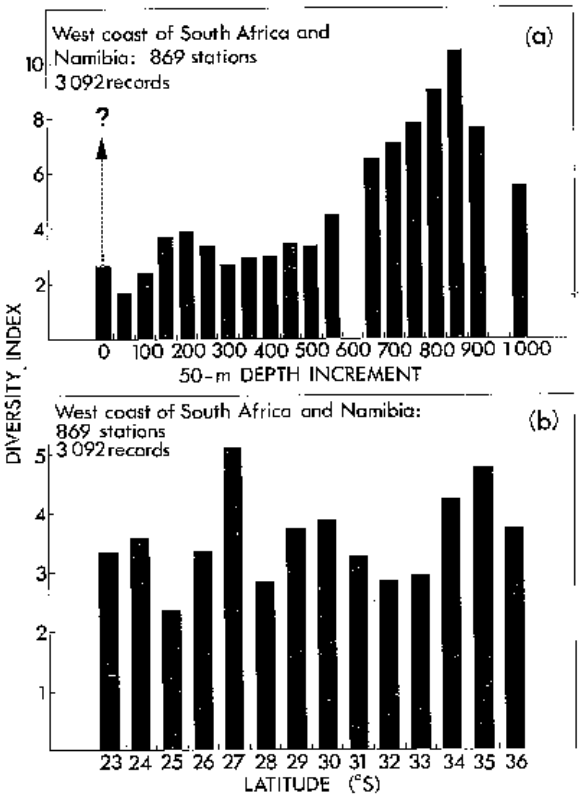

Fig. 22: Histograms of diversity index (number of species records/number of stations) as a function of depth and latitude — (a) diversity index along 50-m depth increments, (b) diversity index over one-degree latitude bands

histograms for depth (Fig. 22a) and latitude (Fig. 22b) can be generated to compare the species diversity at different depths and latitudes.

DEPTH (Fig. 22a)

The 0–49 m (inshore) increment was inadequately sampled during the *Africana* survey, and the diversity index of this increment is probably too low and a function of the few stations in this depth range on the West Coast. Inshore stations are frequently made on *Africana* cruises to the South-East Coast, and the diversity index for the inshore increment there should reflect this (Compagno *et al.* in prep.). Many inshore species found on both East and West coasts regularly occur at *Africana* East Coast stations but rarely or never in the West Coast trawls. In offshore increments, diversity indices are much lower for cartilaginous fish between 50 and 500 m depth, the range in which Cape hake *Merluccius capensis* and *M. paradoxus* predominate in biomass, than in 650–850 m depth, where hake diminish in biomass and finally drop out. There may be an inverse correlation between the distribution of hake and the diversity of demersal cartilaginous fish.

A potential problem in assessing the phenomenon of low average diversity of chondrichthyans in the hake zone off South Africa is the demersal trawl fishery, which unselectively catches demersal cartilaginous fish along with hake and other teleosts, and indeed has done so for many years. Hake produce large numbers of small eggs and are inherently more resistant to fisheries exploitation than cartilaginous

fish, which uniformly produce few young or large eggs. It is possible that the lower diversity index of cartilaginous fish in the hake zone is related to the activity of the hake fishery, and to differential over-exploitation of cartilaginous fish within the hake zone. Cartilaginous fish are a largely discarded by-catch of the hake fishery, and any diminution of their catch would not affect the fishing effort by the trawling fleet.

LATITUDE (Fig. 22b)

Compared to depth, latitude diversity is more uniform, but Namibian indices may not be directly comparable to South African indices because there were far fewer Namibian stations and most of these were in water deeper than 200 m. However, diversity was highest in the 27°S block, south-west of Lüderitz, an area of transition between Namibian-bicoastal and Western Cape species. Off the South African coast, diversity was lower between the Orange River and Cape Town than between Cape Town and Cape Agulhas.

ACKNOWLEDGEMENTS

We thank Drs L. Botha, A. I. L. Payne, C. J. Augustyn, A. Badenhorst and R. Melville Smith, and Messrs A. A. Robertson, B. Rose, G. W. Brill and P. F. Sims, and Mrs S. du Plessis of the Sea Fisheries Research Institute, Cape Town; Capt. D. Krige and the officers and crew of F.R.S. *Africana*; Dr M. Stehmann and Ms G. Schulze of the Institut für Seefischerei, Hamburg; Prof. M. Bruton, Drs P. C. Heemstra and M. E. Anderson, and Messrs B. Ranchod and E. Matama of the J. L. B. Smith Institute of Ichthyology; Drs G. J. B. Ross and M. J. Smale of the Port Elizabeth Museum; Dr Y. N. Shcherbachev of the Shirshov Institute of Oceanology, Moscow; Ms R. Alexander, Ms A. Macras, Ms K. Lilley and Messrs A. Bertolini, P. White, M. Boon and S. Matama of the Shark Research Centre; Dr P. A. Hulley, Ms M. A. Compagno Roeleveld, Mrs M. van der Merwe, Ms E. Hoensen, Ms J. Blascoe, and Messrs S. Kannemeyer, C. Goliath and M. Bougaardt of the South African Museum; Dr E. Macpherson of the Instituto de Ciencias del Mar, Barcelona; and the captain, officers and crew of the F.V. *Chicha Touza* for much support on matters related to this paper. LJVC's research was supported by partial and comprehensive research grants and SANCOR grants from the South African Foundation for Research Development (FRD) at the South African Museum and the J. L. B. Smith Institute of Ichthyology, and by funds from the South African Fisheries Development Corporation and the J. L. B. Smith Institute of Ichthyology. DAE's and PMC's research was supported by a FRD predoctoral bursary, by Rhodes University and by the Shark Research Centre.

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APPENDIX

Africana West Coast stations that collected cartilaginous fish

Station	Cruise	Number	Block	Date	Depth (m)	Latitude (°S)		Longitude (°E)	
						Deg.	Min	Deg.	Min.
A2214	028	001	2504	850107	187	33	54,0	17	55,0
A2217	028	002	3335	850108	267	34	03,0	17	46,0
A2218	028	003	3338	850108	220	34	00,0	17	52,0
A2220	028	005	2534	850108	175	34	38,0	18	30,0
A2223	028	006	2751	850109	213	36	01,0	19	50,0
A2226	028	009	2650	850109	174	35	34,0	19	36,0
A2231	028	010	2633	850110	162	35	24,0	19	40,0
A2232	028	011	2608	850110	165	35	15,0	19	25,0
A2233	028	012	2751	850110	165	35	00,0	19	05,0
A2234	028	013	2211	850110	204	35	38,0	18	50,0
A2235	028	014	5143	850110	466	35	16,0	18	40,0
A2239	028	015	3559	850111	199	34	54,0	18	39,0
A2240	028	016	3360	850111	202	34	48,0	18	33,0
A2241	028	017	5138	850111	500	34	50,0	18	17,0
A2247	028	019	3321	850112	234	33	33,0	17	37,0
A2254	028	023	3307	850113	274	32	47,0	17	23,0
A2255	028	024	3295	850113	254	32	40,0	17	24,0
A2264	028	028	4101	850114	364	32	13,0	16	33,0
A2266	028	030	3246	850114	294	31	59,0	16	49,0
A2268	028	032	3238	850114	261	31	43,0	17	00,0
A2273	028	033	5077	850115	491	31	58,0	16	14,0
A2274	028	034	4080	850115	393	31	55,0	16	55,0
A2276	028	036	4060	850115	424	31	36,0	16	18,0
A2280	028	038	3229	850116	232	31	32,0	17	10,0
A2290	028	045	1072	850117	84	32	20,0	18	08,0
A2299	028	049	3305	850118	227	32	42,0	17	38,0
A2304	028	051	4137	850119	354	32	50,0	16	58,0
A2305	028	052	5113	850119	513	33	17,0	17	11,0
A2316	028	060	EXP	850120	242	33	38,0	17	35,0
A2316	028	062	EXP	850120	262	33	39,0	17	34,0
A2318	028	064	4087	850121	388	31	58,0	16	26,0
A2319	028	065	5074	850121	438	31	47,0	16	13,0
A2325	028	067	2326	850122	186	31	19,0	17	19,0
A2332	028	071	2183	850122	178	29	53,0	16	17,0
A2333	028	072	2196	850123	182	29	58,0	16	05,0
A2335	028	074	2222	850123	194	30	05,0	15	58,0
A2336	028	075	3063	850123	204	30	16,0	16	15,0
A2341	028	077	2253	850124	151	30	18,0	16	56,0
A2342	028	078	1032	850124	98	30	01,0	17	06,0
A2353	028	085	1013	850125	76	29	04,0	16	40,0
A2354	028	086	1008	850125	83	28	55,0	16	31,0
A2362	028	089	2083	850126	176	29	26,0	15	41,0
A2363	028	090	3019	850126	200	29	57,0	15	31,0
A2364	028	091	3011	850126	203	29	53,0	15	18,0
A2367	028	092	5014	850127	497	30	06,0	14	46,0
A2371	028	094	3042	850128	250	30	11,0	15	21,0
A2372	028	095	4010	850128	370	30	00,0	15	05,0
A2373	028	096	3082	850128	284	30	26,0	15	27,0
A2374	028	097	4025	850128	307	30	36,0	15	25,0
A2378	028	098	5067	850129	467	30	37,0	16	07,0
A2379	028	099	4072	850129	375	31	46,0	16	43,0
A2380	028	100	4081	850129	344	31	54,0	16	32,0
A2381	028	101	4093	850129	363	32	01,0	16	31,0
A2382	028	102	5084	850129	426	32	12,0	16	24,0
A2387	028	105	2485	850130	199	33	31,0	17	41,0
A2388	028	106	2490	850130	175	33	37,0	17	55,0
A2745	033	001	2512	850701	198	34	01,0	17	58,8
A2746	033	002	2605	850702	182	35	14,0	19	09,0
A2747	033	003	3373	850702	202	35	11,0	18	57,4
A2748	033	004	3369	850702	236	35	09,0	18	47,4
A2749	033	005	3359	850702	225	34	47,0	18	29,5
A2750	033	006	2542	850702	192	34	44,0	18	32,0
A2751	033	007	4165	850703	356	33	51,0	17	30,8
A2752	033	008	3335	850703	238	33	56,0	17	47,7
A2753	033	009	4171	850703	308	34	05,0	17	44,1
A2754	033	010	3343	850703	302	34	17,0	17	55,4
A2755	033	011	3348	850703	302	34	17,0	17	55,4
A2756	033	012	5117	850704	502	33	23,0	17	18,5
A2757	033	013	4162	850704	350	33	32,0	17	31,9
A2758	033	014	2845	850704	199	33	31,0	17	40,7
A2759	033	015	3325	850704	235	33	41,0	17	38,2
A2760	033	016	2495	850704	186	33	42,0	17	50,0
A2761	033	017	2496	850704	165	33	44,0	17	57,0
A2762	033	018	2622	850705	159	35	14,0	19	37,7
A2763	033	019	2632	850705	161	35	16,0	19	32,0
A2764	033	020	2659	850705	160	35	36,0	19	53,0
A2765	033	021	2664	850705	163	35	40,0	19	53,5
A2766	033	022	2668	850705	170	35	46,0	19	52,7
A2767	033	023	3402	850705	213	35	48,0	19	37,5
A2768	033	024	2675	850706	175	35	59,0	19	58,5
A2769	033	025	3406	850706	201	36	00,0	19	50,0
A2770	033	026	3403	850706	200	35	53,0	19	44,2
A2771	033	027	5150	850707	517	35	58,0	19	32,0
A2772	033	028	2584	850707	154	35	04,0	19	24,2
A2773	033	029	2573	850707	159	34	59,0	19	13,4
A2774	033	030	2555	850707	138	34	59,0	19	13,4
A2775	033	031	2564	850707	138	34	59,0	19	13,4
A2776	033	032	2479	850708	194	33	28,0	17	42,3
A2777	033	033	2474	850708	195	33	14,0	17	40,9
A2778	033	034	5115	850708	495	33	16,0	17	24,9
A2779	033	035	5109	850708	445	33	10,0	17	08,5
A2780	033	036	5090	850709	496	32	26,0	16	29,1
A2781	033	037	5085	850709	401	32	12,0	16	26,6
A2782	033	038	4094	850709	353	32	03,0	16	36,4
A2783	033	039	4015	850709	301	32	10,0	16	51,6
A2784	033	040	3265	850709	291	32	15,0	16	53,0
A2785	033	041	5060	850710	442	31	27,0	16	18,0
A2786	033	042	4061	850710	364	31	38,0	16	20,5
A2787	033	043	4073	850710	342	31	48,0	16	28,0
A2788	033	044	3238	850710	260	31	42,0	17	01,2
A2789	033	045	3282	850711	277	32	28,0	17	15,4
A2800	033	046	2451	850713	134	33	25,0	17	51,6
A2802	033	048	2422	850714	154	32	08,0	17	36,6
A2805	033	051	2391	850714	121	31	55,1	17	50,0
A2806	033	052	2383	850714	104	31	46,0	18	00,0
A2809	033	055	2330	850715	123	31	17,0	17	39,5
A2815	033	061	2311	850717	148	31	02,0	17	23,4
A2816	033	062	2304	850717	170	31	00,0	17	13,7
A2817	033	063	2286	850717	161	30	44,0	17	06,2
A2818	033	064	2281	850717	148	30	40,0	17	10,0
A2824	033	067	2815	850718	169	29	51,0	16	21,4
A2825	033	068	2200	850718	178	29	56,0	16	23,3
A2826	033	069	2152	850718	154	29	44,0	16	32,8
A2834	033	073	2022	850719	119	29	04,0	16	34,4
A2839	033	075	3023	850720	231	30	03,0	15	20,0
A2840	033	076	3017	850720	215	29	58,0	15	20,9
A2841	033	077	3011	850720	207	29	54,0	15	17,3
A2842	033	078	3013	850720	200	29	52,0	15	32,9
A2843	033	079	3019	850720	202	29	55,0	15	30,7
A3324	039	001	3332	860108	239	33	54,0	17	48,7
A3325	039	002	3384	860109	225	35	28,0	19	14,0
A3326	039	003	2628	860109	187	35	24,0	19	16,6
A3327	039	004	2618	860109	178	35	18,8	19	17,1
A3328	039	005	2607	860109	171	35	15,0	19	19,9
A3329	039	006	2585	860109	157	35	05,0	19	24,8
A3330	039	007	2600	860109	139	35	05,0	19	40,5
A3331	039	008	3368	860110	249	35	08,0	18	44,0
A3332	039	009	2568	860110	189	34	56,9	18	47,8
A3333	039	010	2562	860110	171	34	53,0	18	50,6
A3334	039	011	2547	860110	148	34	42,0	18	56,1
A3336	039	013	2659	860111	169	35	35,0	19	53,2
A3337	039	014	2662	860111	174	35	42,3	19	44,4
A3338	039	015	3403	860111	200	35	51,2	19	41,4
A3339	039	016	3406	860111	200	35	57,0	19	50,9
A3340	039	017	3406	860111	230	35	57,0	19	42,2
A3341	039	018	5150	860111	485	35	59,0	19	34,2
A3342	039	501		860111	764	35	56,2	19	22,0
A3343	039	019	2534	860112	172	34	36,0	18	30,8
A3344	039	020	3358	860112	209	34	40,4	18	28,0

Station	Cruise	Number	Block	Date	Depth (m)	Latitude (°S)		Longitude (°E)	
						Deg.	Min	Deg.	Min.
A3345	039	021	5137	860112	453	34	44,4	18	18,0
A3346	039	022	4179	860112	313	34	31,0	18	09,8
A3347	039	023	4175	860112	333	34	27,0	17	57,1
A3348	039	024	5128	860112	456	34	28,0	17	50,3
A3349	039	025	3326	860113	203	33	41,0	17	43,1
A3350	039	026	4164	860113	328	33	49,8	17	31,6
A3351	039	027	5122	860113	430	34	04,1	17	29,8
A3352	039	028	3340	860113	245	34	06,0	17	50,9
A3355	039	031	3319	860114	212	33	24,3	17	38,6
A3356	039	032	5118	860114	479	33	22,0	17	30,1
A3357	039	033	5114	860114	515	33	18,0	17	15,4
A3358	039	E02		860114	826	33	25,8	17	02,1
A3359	039	034	4126	860115	359	32	37,0	16	52,0
A3360	039	035	4116	860115	379	32	29,3	16	42,8
A3361	039	036	5091	860115	500	32	28,0	16	33,8
A3362	039	037	4106	860115	398	32	19,0	16	33,9
A3363	039	038	4108	860115	338	32	15,0	16	41,0
A3364	039	039	2465	860116	143	32	49,0	17	42,2
A3365	039	040	2462	860116	134	32	39,1	17	42,8
A3366	039	041	3286	860116	247	32	36,9	17	28,3
A3367	039	042	3307	860116	272	32	45,0	17	21,5
A3368	039	E03		860116	212	33	30,1	17	39,2
A3369	039	E04		860117	233	33	35,0	17	37,2
A3370	039	E05		860117	235	33	40,0	17	37,8
A3371	039	E06		860117	238	33	32,7	17	35,8
A3372	039	E07		860117	231	33	31,0	17	37,1
A3373	039	E08		860117	214	33	31,0	17	38,8
A3374	039	E09		860117	241	33	31,5	17	37,8
A3375	039	043	2461	860118	130	32	34,0	17	47,2
A3376	039	044	2445	860118	106	32	20,0	18	00,0
A3377	039	045	1067	860118	89	32	02,0	18	12,0
A3378	039	046	2394	860118	101	31	54,0	18	04,0
A3379	039	047	1061	860118	86	31	45,0	18	06,3
A3380	039	048	2344	860119	159	31	36,0	17	19,8
A3381	039	049	3223	860119	213	31	29,0	17	16,6
A3382	039	050	3229	860119	244	31	34,1	17	08,6
A3383	039	051	3232	860119	271	31	37,0	17	00,1
A3384	039	052	2362	860119	181	31	41,0	17	12,0
A3385	039	053	2396	860119	165	31	56,0	17	17,2
A3386	039	054	3253	860120	240	32	01,0	17	03,1
A3387	039	055	3255	860120	281	32	06,5	16	54,6
A3388	039	056	4100	860120	308	32	08,4	16	47,4
A3389	039	057	4089	860120	345	31	59,0	16	37,5
A3390	039	058	4073	860120	362	31	47,0	16	27,4
A3391	039	059	1043	860121	91	30	48,0	17	29,5
A3392	039	060	2286	860121	154	30	43,4	17	08,6
A3395	039	063	3177	860122	299	31	05,0	16	28,3
A3397	039	064	5063	860123	443	31	33,0	16	13,4
A3398	039	065	5059	860123	455	31	29,0	16	11,1
A3399	039	066	5046	860123	415	31	12,0	16	11,8
A3400	039	067	4025	860124	312	30	37,0	15	25,3
A3401	039	068	3098	860124	296	30	31,8	15	31,8
A3402	039	069	3071	860124	262	30	24,0	15	40,9
A3403	039	070	3057	860124	236	30	19,0	15	46,3
A3404	039	071	3049	860124	208	30	14,0	15	15,5
A3405	039	072	3075	860124	224	30	21,0	16	00,8
A3408	039	073	2250	860125	189	30	19,0	16	41,8
A3409	039	074	2243	860125	180	30	13,4	16	42,9
A3410	039	075	2203	860125	158	29	58,6	16	39,6
A3411	039	076	2153	860125	148	29	43,0	16	38,3
A3412	039	077	2128	860125	165	29	36,0	16	13,6
A3413	039	078	2146	860125	179	29	40,0	16	04,7
A3418	039	081	2022	860126	124	29	05,8	16	30,9
A3420	039	082	1010	860126	71	28	59,0	16	38,1
A3421	039	083	1004	860126	72	28	49,0	16	23,4
A3423	039	084	2004	860126	119	28	50,0	16	15,3
A3425	039	085	2121	860127	175	29	36,0	15	39,3
A3426	039	086	2141	860127	182	29	43,0	15	38,4
A3427	039	087	2176	860127	199	29	52,9	15	28,8
A3428	039	088	3032	860127	255	30	09,0	15	16,0
A3429	039	089	4010	860127	365	30	02,0	15	06,5
A3430	039	090	3011	860127	217	29	54,0	15	15,7
A3439	039	E17		860129	308	24	28,6	13	24,6
A3442	039	E20		860130	420	25	02,4	13	39,6
A3443	039	E21		860130	352	25	11,8	13	41,7
A3446	039	E24		860130	353	25	19,0	13	41,1
A3447	039	E25		860131	431	26	11,0	13	41,4
A3448	039	E26		860131	353	26	06,5	13	54,5
A3449	039	E27		860131	325	26	03,0	13	59,0
A3450	039	E28		860131	293	26	04,0	14	05,5
A3452	039	E30		860131	263	25	56,0	14	07,9
A3457	039	E35		860202	407	27	00,0	14	07,3
A3465	039	E43		860203	458	28	13,0	14	30,2
A3466	039	E44		860203	488	28	23,0	14	25,3
A3467	039	E45		860203	716	28	34,1	14	13,6
A3468	039	091	5001	860204	411	29	47,0	14	52,4
A3469	039	092	5002	860204	440	29	52,0	14	44,2
A4287	046	001	3342	860701	213	34	06,2	18	00,6
A4288	046	002	2590	860702	190	35	06,0	18	51,8
A4289	046	003	2581	860702	170	35	04,0	19	06,3
A4290	046	004	2606	860702	170	35	10,2	19	09,5
A4291	046	005	3404	860703	217	35	55,0	19	42,4
A4292	046	006	3400	860703	235	35	47,5	19	35,0
A4293	046	007	2667	860703	175	35	49,9	19	47,5
A4294	046	008	2562	860703	160	35	33,3	19	49,6
A4295	046	009	3359	860704	230	34	48,7	18	29,3
A4296	046	010	2544	860704	165	34	42,3	18	40,5
A4297	046	011	2534	860704	180	34	38,2	18	29,7
A4298	046	012	2601	860705	135	35	07,4	19	45,4
A4299	046	013	2612	860705	145	35	10,3	19	44,0
A4300	046	014	2597	860705	155	35	08,6	19	28,4
A4301	046	015	2565	860705	151	34	52,8	19	07,4
A4302	046	016	2629	860706	175	35	20,5	19	08,4
A4303	046	017	3384	860706	200	35	25,3	19	14,0
A4304	046	018	3383	860706	240	35	25,3	19	08,0
A4305	046	019	5144	860706	490	35	22,3	18	45,4
A4306	046	020	4190	860706	390	35	15,3	18	41,9
A4307	046	021	5138	860707	495	34	48,0	18	16,4
A4308	046	022	4176	860707	300	34	27,5	18	01,5
A4309	046	023	3347	860707	300	34	18,6	17	53,4
A4310	046	E01		860707	760	34	25,6	17	41,2
A4312	046	025	3330	860708	280	33	51,7	17	36,2
A4313	046	026	2495	860708	195	33	44,6	17	50,1
A4314	046	027	3324	860708	210	33	39,5	17	43,2
A4315	046	028	4161	860708	357	33	29,0	17	33,6
A4316	046	E02		860708	239	33	30,0	17	37,3
A4317	046	E03		860708	230	33	37,0	17	38,0
A4318	046	E04		860708	230	33	37,4	17	38,0
A4319	046	E05		860709	230	33	37,0	17	39,0
A4320	046	E06		860709	232	33	36,8	17	37,5
A4321	046	E07		860709	230	33	36,8	17	37,8
A4322	046	E08		860709	230	33	36,8	17	37,8
A4323	046	E09		860709	225	33	36,3	17	38,0
A4324	046	E10		860709	230	33	37,0	17	37,9
A4325	046	E11		860709	230	33	37,0	17	38,0
A4326	046	029	3300	860710	300	32	42,0	17	12,0
A4327	046	030	3292	860710	285	32	38,2	17	09,0
A4328	046	031	4130	860710	300	32	43,2	17	03,4
A4329	046	032	4131	860710	335	32	46,6	16	59,0
A4330	046	033	3290	860711	235	32	33,5	17	27,0
A4331	046	034	2459	860711	195	32	33,7	17	36,5
A4332	046	035	2455	860711	175	32	29,2	17	41,8
A4333	046	036	2452	860711	110	32	25,0	17	56,8
A4335	046	038	3256	860712	270	32	08,8	16	56,0
A4336	046	039	3253	860712	260	32	04,0	17	01,0
A4337	046	040	3249	860712	240	31	57,2	17	05,8
A4338	046	041	2362	860712	155	31	45,0	17	14,0
A4339	046	042	2355	860712	135	31	39,0	17	25,0
A4341	046	043	1051	860713	95	31	13,0	17	43,2
A4342	046	044	1055	860713	100	31	23,2	17	51,5
A4345	046	047	2381	860713	115	31	44,5	17	52,3
A4346	046	048	2368	860713	124	31	44,2	17	45,4
A4349	046	049	2310	860714	159	31	00,8	17	19,3
A4350	046	050	2315	860714	185	31	07,2	17	15,0
A4351	046	051	3214	860714	215	31	21,0	17	13,0
A4352	046	052	3198	860714	216	31	10,2	17	02,0
A4357	046	055	2469	860716	163	32	57,5	17	42,0

Station	Cruise	Number	Block	Date	Depth (m)	Latitude (°S)		Longitude (°E)	
						Deg.	Min	Deg.	Min.
A4358	046	056	2468	860716	186	32	55,8	17	39,1
A4359	046	057	5079	860717	417	32	03,1	16	18,3
A4360	046	058	5077	860717	495	31	56,5	16	13,5
A4361	046	E12		860717	850	31	59,8	15	56,2
A4362	046	059	3139	860718	219	30	48,8	16	06,6
A4363	046	060	5039	860718	432	31	09,0	16	08,6
A4364	046	061	5055	860718	440	31	20,0	16	15,0
A4365	046	062	5059	860718	455	31	27,5	16	11,9
A4367	046	063	4022	860719	385	30	31,7	15	19,5
A4368	046	064	5028	860719	480	30	35,2	15	19,5
A4369	046	065	4028	860719	330	30	40,0	15	33,0
A4370	046	066	3083	860719	295	30	29,1	15	31,5
A4371	046	067	4004	860720	368	29	47,3	15	01,2
A4372	046	068	4007	860720	360	29	58,0	15	05,0
A4373	046	069	5012	860720	461	30	00,5	14	53,6
A4376	046	072	1008	860721	55	28	50,0	16	30,0
A4377	046	073	1013	860721	71	29	00,7	16	40,1
A4378	046	074	1014	860721	90	29	06,3	16	40,6
A4380	046	076	2229	860722	180	30	05,9	16	35,0
A4381	046	077	3063	860722	200	30	15,7	16	18,3
A4382	046	078	3091	860722	233	30	25,4	16	11,2
A4383	046	079	4073	860723	372	31	46,0	16	28,1
A4384	046	080	4081	860723	374	31	52,4	16	30,2
A4385	046	081	4095	860723	335	32	00,0	16	42,5
A4386	046	082	4092	860723	380	32	02,5	16	29,0
A4387	046	083	5082	860723	469	32	05,8	16	22,6
A4388	046	084	2481	860724	160	33	21,2	17	50,5
A4389	046	085	2486	860724	176	33	32,2	17	48,9
A4390	046	086	2496	860724	186	33	44,3	17	57,8
A5227	050	003	2618	870108	173	35	15,8	19	15,6
A5228	050	004	3357	870108	230	35	15,6	18	54,9
A5229	050	005	5145	870108	450	35	35,7	19	04,0
A5230	050	006	3395	870108	220	35	44,5	19	31,8
A5231	050	007	2641	870109	169	35	32,8	19	31,7
A5232	050	008	2626	870109	153	35	22,0	19	51,0
A5233	050	009	2587	870109	140	35	05,4	19	41,9
A5234	050	010	2577	870109	137	35	01,8	19	34,1
A5235	050	011	2549	870110	186	34	43,9	18	39,7
A5236	050	012	2526	870110	167	34	34,5	18	31,1
A5237	050	013	2537	870110	155	34	38,3	18	43,0
A5238	050	014	2552	870110	160	34	45,3	18	50,6
A5239	050	015	3295	870111	252	32	39,6	17	24,0
A5240	050	016	2460	870111	173	32	31,2	17	49,0
A5241	050	017	2434	870111	161	32	16,4	17	45,6
A5242	050	018	2421	870111	157	32	09,2	17	33,6
A5243	050	019	2429	870111	186	32	10,1	17	24,6
A5244	050	020	3275	870112	252	32	19,7	17	14,3
A5245	050	021	3285	870112	289	32	32,0	17	02,1
A5248	050	024	5090	870112	457	32	25,6	16	29,2
A5249	050	E05		870112	800	32	30,5	16	24,3
A5250	050	025	4088	870113	370	31	59,8	16	30,7
A5251	050	026	5071	870113	430	31	42,6	16	12,9
A5252	050	027	5064	870113	424	31	34,3	16	19,1
A5253	050	028	5043	870113	450	31	14,3	15	59,2
A5254	050	029	5127	870114	265	30	49,7	16	23,4
A5255	050	030	3127	870114	217	30	42,6	16	07,0
A5256	050	031	4026	870114	296	30	37,2	15	35,1
A5257	050	032	3083	870114	277	30	29,2	15	35,0
A5258	050	033	3056	870114	236	30	20,5	15	43,8
A5259	050	034	3232	870115	264	31	41,8	17	00,0
A5260	050	035	3239	870115	200	31	42,0	17	10,0
A5261	050	036	2396	870115	166	31	53,8	17	15,1
A5262	050	037	3253	870115	226	32	00,0	17	05,9
A5263	050	038	2471	870116	162	33	04,5	17	44,0
A5264	050	039	3317	870116	217	33	12,0	17	40,0
A5265	050	E06		870116	240	33	30,0	17	40,0
A5266	050	E07		870117	271	33	33,0	17	35,0
A5269	050	E10		870117	243	33	32,3	17	35,0
A5270	050	E11		870117	223	33	33,7	17	37,2
A5271	050	E12		870117	241	33	28,7	17	36,9
A5272	050	E13		870117	237	33	29,2	17	36,7
A5274	050	E15		870118	252	33	34,6	17	36,4
A5275	050	040	4168	870118	250	34	00,6	17	35,4

Station	Cruise	Number	Block	Date	Depth (m)	Latitude (°S)		Longitude (°E)	
						Deg.	Min	Deg.	Min.
A5277	050	042	3345	870118	240	34	10,7	18	00,0
A5278	050	043	3352	870118	275	34	18,7	18	00,1
A5279	050	044	7175	870118	300	34	24,8	17	58,8
A5280	050	E16		870118	780	34	23,8	17	40,1
A5281	050	045	3331	870119	261	33	55,1	17	42,7
A5282	050	046	2496	870119	175	33	43,0	17	55,6
A5283	050	047	2406	870119	175	33	43,0	17	55,6
A5284	050	048	3321	870119	214	33	35,0	17	40,0
A5285	050	049	4162	870119	390	33	34,4	17	31,3
A5286	050	050	5118	870119	591	33	24,9	17	28,8
A5288	050	052	1063	870120	98	31	54,2	18	06,9
A5289	050	053	1066	870120	88	31	55,1	18	11,1
A5290	050	054	1040	870120	100	30	35,0	17	21,2
A5291	050	055	2266	870121	152	30	28,4	16	58,3
A5292	050	056	2255	870121	127	30	16,4	17	09,9
A5293	050	057	1031	870121	100	30	01,3	17	06,2
A5294	050	058	1005	870122	62	28	51,2	16	24,6
A5295	050	059	2001	870122	123	28	57,1	16	10,7
A5296	050	060	2017	870122	155	29	00,6	16	06,4
A5297	050	061	2052	870122	165	29	14,7	16	02,3
A5298	050	062	2023	870122	170	29	08,6	15	15,6
A5299	050	063	2023	870122	173	29	09,6	15	44,8
A5300	050	064	5012	870123	484	30	05,4	14	49,8
A5301	050	065	5001	870123	420	29	49,1	14	51,7
A5302	050	066	4001	870123	368	29	40,9	14	55,5
A5303	050	067	3002	870123	270	29	37,8	15	05,2
A5304	050	068	3007	870123	270	29	45,0	15	10,8
A5305	050	069	3010	870123	266	29	49,3	15	11,3
A5306	050	E17		870124	509	29	13,2	14	23,8
A5307	050	E18		870124	454	29	03,6	14	26,0
A5308	050	E19		870124	377	28	58,0	14	25,7
A5309	050	E20		870124	215	29	10,5	14	48,0
A5310	050	E21		870124	216	29	07,0	14	48,3
A5311	050	E22		870124	704	29	04,2	14	12,8
A5312	050	E23		870125	178	28	54,0	15	28,9
A5313	050	E24		870125	178	28	51,0	15	39,0
A5314	050	E25		870125	168	28	48,7	15	48,7
A5315	050	E26		870125	131	28	47,2	15	58,6
A5316	050	E27		870125	80	28	42,3	16	15,8
A5317	050	E28		870125	102	28	29,4	15	57,9
A5318	050	070	2167	870126	172	29	50,0	16	51,1
A5319	050	071	2146	870126	185	29	42,2	16	01,6
A5320	050	072	2123	870126	179	29	37,3	15	49,8
A5321	050	073	3009	870126	200	29	48,7	15	47,3
A5322	050	074	3018	870126	209	29	55,8	15	27,4
A5323	050	075	3027	870126	204	30	00,1	15	35,2
A5324	050	076	2197	870127	183	29	55,1	16	04,8
A5325	050	077	2210	870127	184	29	59,7	16	04,1
A5326	050	078	2236	870127	204	30	10,0	16	06,1
A5327	050	079	2241	870127	188	30	13,0	16	30,4
A5328	050	080	2232	870127	170	30	07,8	16	44,0
A5329	050	081	2175	870127	112	29	47,3	16	55,8
A5330	050	082	1008	870128	56	28	50,1	16	30,2
A5331	050	083	1012	870128	93	29	00,8	16	36,0
A5332	050	084	2059	870128	121	29	17,3	16	39,5
A5333	050	085	2096	870128	120	29	24,8	16	45,2
A5334	050	086	2112	870128	150	29	30,0	16	30,0
A5335	050	087	2133	870128	144	29	37,5	16	38,4
A5336	050	088	3175	870129	217	30	55,0	16	54,4
A5337	050	089	2302	870129	199	30	58,7	16	59,3
A5338	050	090	2311	870129	160	31	02,5	17	20,6
A5339	050	091	2326	870129	190	31	15,2	17	19,9
A5851	054	001	2512	870616	181	33	57,0	18	00,0
A5852	054	002	4176	870617	305	34	30,4	18	01,1
A5853	054	003	3349	870617	262	34	21,1	18	00,8
A5854	054	004	2570	870618	170	34	54,1	18	55,5
A5855	054	005	3364	870618	200	34	56,6	18	42,4
A5856	054	006	3368	870618	222	35	04,5	18	44,3
A5857	054	007	2591	870618	190	35	05,0	18	55,7
A5858	054	008	2576	870619	117	34	54,2	19	25,0
A5859	054	009	2598	870619	151	35	05,1	19	28,9
A5860	054	010	2609	870619	159	35	10,0	19	28,4
A5861	054	011	2632	870619	165	35	19,2	19	33,2

Station	Cruise	Number	Block	Date	Depth (m)	Latitude (°S)		Longitude (°E)	
						Deg.	Min	Deg.	Min.
A5862	054	012	2652	870619	165	35	20,0	19	45,4
A5863	054	013	2677	870620	174	35	59,4	20	00,6
A5864	054	014	3405	870620	205	36	06,8	19	50,7
A5865	054	015	3399	870620	230	35	48,2	19	35,0
A5866	054	016	3391	870620	224	35	37,2	19	23,7
A5867	054	E01		870620	763	35	44,4	19	12,2
A5868	054	017	5129	870621	452	34	35,8	17	58,0
A5869	054	018	4173	870621	326	34	23,4	17	54,8
A5870	054	019	5123	870621	410	34	09,8	17	38,2
A5871	054	020	2487	870622	144	33	29,0	17	55,6
A5872	054	021	2499	870622	173	33	44,8	17	54,2
A5873	054	022	3330	870622	285	33	52,7	17	38,3
A5874	054	023	3326	870622	240	33	44,9	17	44,2
A5875	054	E02		870622	274	33	30,7	17	34,6
A5876	054	E03		870622	245	33	36,0	17	35,6
A5877	054	E04		870622	257	33	31,5	17	35,6
A5878	054	E05		870622	257	33	30,0	17	35,5
A5879	054	E06		870623	270	33	33,5	17	34,6
A5880	054	E07		870623	234	33	32,1	17	36,5
A5885	054	024	4115	870624	390	32	29,0	16	35,2
A5886	054	025	5093	870624	460	32	33,8	16	32,4
A5887	054	026	4125	870624	386	32	35,8	16	43,4
A5888	054	027	3244	870625	247	31	52,2	17	01,2
A5889	054	028	3237	870625	275	31	44,7	16	59,6
A5890	054	029	3233	870625	270	31	39,8	17	00,6
A5891	054	030	4087	870626	368	31	54,2	16	30,3
A5892	054	031	4096	870626	380	32	05,0	16	28,4
A5893	054	032	4102	870626	358	32	11,4	16	35,3
A5894	054	033	3085	870626	425	32	15,1	16	24,9
A5895	054	E12		870626	685	32	10,3	16	12,5
A5896	054	E13		870627	719	31	22,5	15	40,2
A5898	054	034	5050	870627	448	31	20,0	16	11,4
A5899	054	035	5044	870627	460	31	15,0	16	01,0
A5900	054	036	5052	870627	480	31	21,5	16	04,6
A5901	054	037	2317	870628	181	31	10,1	17	19,9
A5902	054	038	2311	870628	171	31	04,1	17	20,5
A5903	054	039	2305	870628	150	30	59,8	17	20,8
A5904	054	040	2288	870628	140	30	43,9	17	16,6
A5906	054	041	1040	870628	99	30	39,6	17	24,4
A5907	054	042	1064	870629	83	31	51,3	18	09,4
A5909	054	043	2450	870630	160	32	25,0	17	46,1
A5910	054	044	2415	870630	115	32	04,6	17	57,0
A5911	054	045	2422	870630	155	32	05,5	17	35,5
A5915	054	046	2326	870701	186	31	17,0	17	19,6
A5916	054	047	2321	870701	183	31	11,7	17	19,4
A5917	054	048	2338	870701	165	31	29,5	17	26,3
A5920	054	050	2241	870702	180	30	08,7	16	30,8
A5921	054	051	2250	870702	187	30	16,4	16	39,3
A5923	054	053	2166	870703	175	29	50,4	16	16,0
A5924	054	054	2127	870703	171	29	39,6	16	08,5
A5925	054	055	2088	870703	164	29	30,1	16	08,5
A5926	054	056	2145	870703	185	29	44,7	15	58,3
A5929	054	057	1024	870704	80	29	29,8	16	55,4
A5930	054	058	2096	870704	107	29	25,9	16	47,8
A5932	054	E16		870705	329	29	29,1	14	41,3
A5934	054	E18		870705	405	29	27,1	14	36,9
A5935	054	059	5016	870706	454	30	12,5	14	59,0
A5936	054	060	4009	870706	396	30	06,4	15	05,1
A5937	054	061	2119	870706	192	29	38,5	15	28,5
A5938	054	062	4029	870707	344	30	49,3	15	36,0
A5939	954	063	5029	870707	400	30	45,0	15	25,0
A5940	054	064	3083	870707	282	30	30,5	15	34,5
A5941	054	065	3056	870707	235	30	20,0	15	45,0
A5943	054	066	4034	870708	341	31	01,0	16	04,0
A5944	054	067	3139	870708	270	30	50,6	16	08,1
A5945	054	068	3116	870708	205	30	40,3	16	02,2
A5946	054	069	3115	870708	205	30	38,4	16	00,0
A5947	054	070	4123	870709	321	32	35,0	16	55,6
A5948	054	071	3279	870709	300	32	30,0	17	00,0
A5949	054	072	3275	870709	275	32	25,0	17	10,0
A5950	054	073	3271	870709	222	32	20,0	17	20,0
A5951	054	074	3294	870709	270	32	34,6	17	15,5
A5952	054	075	3338	870710	230	34	05,6	17	55,9

Station	Cruise	Number	Block	Date	Depth (m)	Latitude (°S)		Longitude (°E)	
						Deg.	Min	Deg.	Min.
A6835	059	001	2512	880202	194	34	00,8	17	59,4
A6836	059	002	3344	880202	244	34	09,9	17	57,5
A6837	059	003	2663	880203	171	34	41,9	18	47,2
A6838	059	004	2403	880203	206	35	01,9	19	38,8
A6839	059	005	3396	880203	203	35	42,6	19	34,2
A6840	059	006	2649	880203	175	35	33,8	19	34,7
A6841	059	007	2644	880203	161	35	28,8	19	45,7
A6844	059	008	2596	880204	158	35	05,6	19	24,4
A6845	059	009	2606	880204	170	35	10,7	19	13,4
A6846	059	010	2593	880204	176	35	09,3	19	07,2
A6847	059	011	3376	880204	230	35	15,7	18	57,0
A6848	059	012	3371	880204	228	35	11,7	18	49,4
A6851	059	013	2534	880205	174	34	36,6	18	30,5
A6852	059	014	2521	880205	180	34	30,0	18	25,0
A6853	059	015	3356	880205	251	34	30,4	18	22,2
A6854	059	016	5136	880205	520	34	41,2	18	12,8
A6855	059	017	3361	880205	237	34	51,5	18	31,0
A6860	059	020	3333	880206	216	33	51,7	17	50,9
A6861	059	021	2494	880206	196	33	43,5	17	48,7
A6862	059	022	4164	880206	373	33	44,8	17	30,1
A6864	059	023	3321	880207	217	33	34,5	17	39,1
A6866	059	025	2481	880207	148	33	19,8	17	50,1
A6867	059	026	1115	880207	77	33	19,9	18	01,9
A6868	059	027	2490	880207	172	33	35,4	17	50,8
A6870	059	E01		880207	246	33	42,0	17	36,1
A6871	059	E02		880208	261	33	42,0	17	37,0
A6872	059	E03		880208	252	33	42,7	17	36,1
A6873	059	E04		880208	256	33	42,9	17	35,6
A6874	059	E05		880208	264	33	42,6	17	35,2
A6875	059	E06		880208	256	33	42,3	17	36,4
A6876	059	E07		880208	244	33	41,4	17	36,7
A6877	059	E08		880208	254	33	42,7	17	36,2
A6878	059	E09		880208	256	33	43,7	17	37,1
A6879	059	E10		880209	265	33	42,9	17	34,9
A6880	059	028	2471	880209	168	33	01,0	17	41,4
A6881	059	029	2467	880209	159	32	52,2	17	41,3
A6882	059	030	3311	880209	296	32	52,2	17	34,3
A6883	059	031	3302	880209	266	32	43,3	17	23,0
A6884	059	032	2454	880209	174	32	29,2	17	40,0
A6887	059	033	3273	880210	289	32	23,8	17	03,8
A6888	059	034	5096	880210	457	32	43,7	16	43,1
A6889	059	035	5092	880210	460	32	33,0	16	34,5
A6890	059	036	4116	880210	366	32	26,6	16	41,7
A6892	059	E11		880210	903	32	25,0	16	17,6
A6894	059	037	3246	880211	276	31	58,9	16	54,2
A6895	059	038	3250	880211	292	32	05,1	16	47,3
A6896	059	039	4097	880211	356	32	05,6	16	33,6
A6897	059	040	5082	880211	491	32	08,6	16	19,9
A6900	059	041	2432	880212	162	32	12,6	17	38,4
A6901	059	042	3264	880212	199	32	12,4	17	20,3
A6902	059	043	2409	880212	164	32	03,9	17	26,3
A6903	059	044	2401	880212	142	31	59,7	17	40,5
A6904	059	045	2365	880212	137	31	44,1	17	25,0
A6905	059	046	2344	880212	169	31	34,3	17	19,6
A6906	059	047	2445	880213	107	32	18,7	18	00,1
A6907	059	048	1072	880213	77	32	18,5	18	09,5
A6908	059	049	1067	880213	95	32	03,8	18	11,0
A6911	059	050	3215	880214	213	31	24,5	17	16,1
A6912	059	051	2322	880214	184	31	14,6	17	22,1
A6913	059	052	2329	880214	146	31	15,4	17	31,4
A6914	059	053	1051	880214	77	31	12,1	17	44,9
A6915	059	054	2313	880214	131	31	02,5	17	30,6
A6916	059	055	1046	880214	87	30	57,3	17	34,6
A6920	059	057	2249	880215	191	30	19,4	16	39,8
A6921	059	058	2231	880215	177	30	08,1	16	40,0
A6922	059	059	1032	880215	78	30	03,4	17	07,2
A6925	059	060	2175	880216	104	29	45,5	16	58,4
A6926	059	061	1024	880216	82	29	34,6	16	56,4
A6927	059	062	2077	880216	103	29	24,5	16	47,8
A6928	059	063	1016	880216	90	29	14,7	16	44,5
A6929	059	064	2033	880216	105	29	09,0	16	39,0
A6931	059	065	2044	880216	127	29	13,6	16	33,7
A6933	059	066	2179	880217	191	29	54,6	15	55,7
A6934	059	067	2162	880217	186	29	47,1	15	54,2

Station	Cruise	Number	Block	Date	Depth (m)	Latitude (°S)		Longitude (°E)	
						Deg.	Min	Deg.	Min.
A6935	059	068	2146	880217	185	29	43,3	16	03,1
A6936	059	069	2103	880217	175	29	33,4	16	44,3
A6937	059	070	2065	880217	176	29	24,3	15	45,4
A6938	059	071	2034	880217	174	29	14,1	15	44,6
A6941	059	B12		880218	168	28	48,5	15	48,6
A6942	059	B13		880218	156	28	37,8	15	41,8
A6943	059	B14		880218	177	28	34,0	15	23,7
A6944	059	B15		880218	170	28	34,5	15	01,6
A6947	059	E16		880219	351	27	36,3	14	41,4
A6948	059	E17		880219	397	27	31,6	14	31,3
A6949	059	E18		880219	425	27	27,4	14	25,0
A6950	059	E19		880219	475	27	22,2	14	16,2
A6951	059	E20		880219	864	29	20,7	14	03,3
A6953	059	E21		880220	206	29	13,5	14	52,4
A6954	059	E22		880220	224	29	12,9	14	47,0
A6955	059	E23		880220	395	29	34,0	14	45,0
A6956	059	E24		880220	849	29	35,1	14	23,3
A6958	059	072	3024	880221	238	30	05,8	15	24,4
A6959	059	073	3016	880221	223	29	59,0	15	18,4
A6960	059	074	2157	880221	198	29	51,0	15	18,8
A6961	059	075	3007	880221	209	29	49,4	15	15,0
A6963	059	077	5015	880221	484	30	05,1	14	50,3
A6964	059	E25		880221	817	30	10,2	14	33,5
A6965	059	078	4026	880222	321	30	40,6	15	30,2
A6967	059	079	3084	880222	286	30	28,8	15	35,2
A6968	059	080	3072	880222	245	30	21,5	15	46,2
A6969	059	081	3054	880222	257	30	19,4	15	34,1
A6970	059	082	4023	880222	323	30	31,2	15	20,5
A6971	059	E26		880222	1 000	30	41,6	15	13,0
A6973	059	083	3183	880223	216	31	04,9	16	56,1
A6974	059	084	2308	880223	189	31	04,3	17	01,8
A6975	059	085	2297	880223	190	30	55,5	17	05,4
A6976	059	086	3135	880223	203	30	45,0	16	50,0
A6977	059	087	3160	880223	243	30	51,2	16	39,7
A6978	059	088	3171	880223	250	30	56,5	16	37,3
A6981	059	089	4066	880224	391	31	44,0	16	20,0
A6982	059	090	5067	880224	458	31	36,3	16	07,3
A6983	059	091	5053	880224	461	31	23,0	16	09,0
A6985	060	01-01B		880304	247	32	56,9	17	34,4
A6986	060	01-02B		880304	552	33	22,9	17	29,1
A6987	060	01-03B		880305	710	33	34,6	17	23,6
A6988	060	01-04B		880305	900	33	48,4	17	22,2
A6989	060	02-03B		880305	680	33	26,2	17	27,5
A6990	060	02-02B		880305	480	33	18,6	17	28,4
A6991	060	03-01M		880305	298	32	53,9	17	33,1
A6992	060	03-02M		880306	461	33	19,8	17	28,8
A6999	060	01-04B		880308	923	33	40,0	17	25,8
A7000	060	06-01B		880308	254	32	59,4	17	37,4
A7002	060	06-03B		880308	668	33	37,5	17	24,5
A7011	060	05-04B		880309	880	33	38,9	17	23,0
A7012	060	05-03B		880310	700	33	36,9	17	24,1
A7013	060	05-02B		880310	451	33	20,0	17	32,8
A7021	060	11-01B		880312	240	34	31,1	18	22,4
A7022	060	11-02B		880312	498	34	40,0	18	13,5
A7023	060	11-03B		880312	700	34	47,2	18	06,1
A7024	060	11-04B		880312	894	34	56,5	18	12,8
A7025	060	12-02B		880312	496	34	41,3	18	14,6
A7026	060	12-03B		880312	717	34	47,3	18	03,6
A7027	060	12-04B		880313	901	34	58,6	18	13,0
A7029	060	13-03M		880313	699	34	47,1	18	03,9
A7035	060	15-02B		880314	499	34	39,5	18	13,0
A7036	060	15-03B		880314	710	34	46,2	18	02,9
A7037	060	15-04B		880314	903	34	55,6	18	11,7
A7038	060	16-04B		880314	917	34	54,9	18	12,1
A7039	060	16-03B		880314	719	34	45,3	18	03,9
A7040	060	16-02B		880314	486	34	40,5	18	14,7
A7044	060	S-01B		880315	159	35	06,8	19	25,6
A7045	060	S-02B		880315	156	35	07,2	19	28,2
A7048	060	S-05M		880315	157	35	04,6	19	25,1
A7049	060	S 06M		880316	158	35	04,4	19	24,2
A7050	060	S-07M		880316	157	35	05,2	19	25,0
A7051	060	S-08M		880316	157	35	04,8	19	24,8

Station	Cruise	Number	Block	Date	Depth (m)	Latitude (°S)		Longitude (°E)	
						Deg.	Min	Deg.	Min.
A7548	066	013	5144	880805	473	35	20,0	18	45,0
A7550	066	DT1		880805	900	34	47,1	18	03,3
A7552	066	014	5137	880806	401	34	43,7	18	17,7
A7580	066	027	5089	880810	485	32	27,7	16	33,0
A7581	066	028	4106	880810	390	32	19,4	16	34,4
A7616	066	DT2		880816	880	27	22,3	14	03,7
A7623	066	053	4007	880818	381	29	59,8	15	04,6
A7625	066	DT3		880818	855	30	10,0	14	33,1
A7628	066	057	5028	880818	450	30	36,6	15	18,3
A7652	066	073	4080	880823	394	31	55,0	16	25,0
A7654	066	075	5054	880823	450	31	25,5	16	14,9
A7655	066	DT4		880823	865	31	35,0	15	42,9
A7663	066	080	5098	880825	495	32	50,0	16	45,0
A8298	069	001	2496	880105	160	33	40,1	17	55,2
A8301	069	E01		880106	255	33	40,7	17	35,0
A8302	069	E02		880106	250	33	39,8	17	36,0
A8305	069	E03		880106	275	33	32,8	17	35,0
A8306	069	E04		880106	244	33	39,2	17	36,5
A8308	069	E05		880106	248	33	39,2	17	35,6
A8310	069	E06		880106	240	33	36,1	17	36,9
A8314	069	E08		890107	258	33	39,8	17	35,8
A8316	069	E09		890107	245	33	40,0	17	36,3
A8318	069	002	3323	890107	249	33	38,1	17	35,6
A8320	069	003	2489	890107	181	33	37,4	17	48,6
A8321	069	004	3333	890107	208	33	52,6	17	50,1
A8325	069	005	3293	890108	280	32	35,3	17	12,2
A8326	069	006	3288	890108	265	32	32,2	17	16,4
A8327	069	007	3282	890108	261	32	28,0	17	16,3
A8328	069	008	3266	890108	288	32	17,2	16	58,1
A8329	069	009	4117	890108	345	32	27,9	16	46,2
A8331	069	010	1093	890109	37	32	35,6	18	04,3
A8333	069	011	2460	890109	144	32	33,1	17	44,1
A8334	069	012	2448	890109	168	32	23,9	17	38,9
A8335	069	013	2442	890109	166	32	18,4	17	45,7
A8338	069	014	2399	890110	146	31	57,4	17	33,6
A8339	069	015	2364	890110	140	31	42,6	17	24,2
A8340	069	016	2347	890110	133	31	31,0	17	33,0
A8341	069	017	2332	890110	174	31	23,1	17	25,5
A8342	069	018	3215	890110	200	31	22,4	17	14,8
A8343	069	019	2321	890110	191	31	14,1	17	17,6
A8346	069	020	4058	890111	327	31	32,8	16	32,5
A8348	069	021	5064	890111	425	31	26,4	16	19,8
A8350	069	022	5049	890111	457	31	17,8	16	08,3
A8351	069	023	5039	890111	426	31	08,9	16	02,5
A8357	069	024	3004	890112	297	29	44,5	15	09,1
A8359	069	025	2118	890112	174	29	37,0	15	20,6
A8365	069	E15		890114	169	23	35,3	13	49,0
A8369	069	E16		890115	342	23	11,0	13	17,1
A8362	069	M02		890115	269	23	09,5	13	27,3
A8370	069	E17		890115	407	23	19,1	13	09,9
A8372	069	E19		890115	295	23	36,7	13	20,3
A8373	069	E20		890115	303	23	47,9	13	20,0
A8374	069	DT1		890115	718	23	47,0	13	04,0
A8378	069	E24		890116	350	24	27,8	13	36,9
A8379	069	E25		890117	490	24	47,0	13	33,2
A8382	069	E28		890117	322	24	32,8	13	48,1
A8391	069	E29		890118	462	24	57,1	13	37,7
A8392	069	E30		890118	434	25	07,2	13	38,1
A8394	069	E32		890118	185	25	01,7	13	58,0
A8394	069	E32+(NS)		890118	345	25	00,8	13	41,7
A8407	069	E36		890120	263	25	59,9	14	10,9
A8408	069	E37		890120	356	26	08,4	13	53,0
A8409	069	E38		890120	435	26	12,2	13	42,1
A8410	069	E39		890120	370	26	17,2	13	55,1
A8411	069	DT2		890120	830	26	25,6	13	30,8
A8413	069	DT4		890121	900	26	43,6	13	36,0
A8414	069	DT5		890121	1 005	26	40,6	13	31,8
A8417	069	E42		890122	409	26	45,5	13	59,5
A8420	069	E45		890123	397	27	40,3	14	36,8
A8421	069	E46		890124	190	27	57,2	14	57,4
A8422	069	E47		890124	199	28	03,7	14	49,2

Station	Cruise	Number	Block	Date	Depth (m)	Latitude (°S)		Longitude (°E)	
						Deg.	Min	Deg.	Min.
A8993	075	001	2499	890714	181	33	45,0	17	50,0
A8994	075	002	3318	890714	202	33	15,0	17	40,0
A8995	075	003	2480	890715	174	33	19,9	17	45,0
A8996	075	004	2484	890715	163	33	25,0	17	50,0
A8997	075	005	4162	890715	365	33	30,8	17	33,0
A8998	075	E01		890715	235	33	34,7	17	36,7
A8999	075	E02		890716	235	33	35,5	17	36,5
A9000	075	E03		890716	242	33	35,4	17	36,6
A9001	075	E04		890716	251	33	35,2	17	35,6
A9002	075	E05		890716	238	33	37,4	17	33,2
A9003	075	E06		890716	231	33	35,2	17	35,0
A9004	075	E07		890716	248	33	35,0	17	35,0
A9005	075	E08		890716	245	33	36,5	17	35,0
A9007	075	E09		890716	250	33	35,0	17	35,0
A9009	075	E10		890717	251	33	35,0	17	37,0
A9010	075	006	4171	890717	336	34	09,5	17	42,5
A9011	075	007	3348	890717	300	34	18,0	17	55,0
A9012	075	008	3358	890717	234	34	40,0	18	25,0
A9013	075	009	3405	890719	238	36	01,7	19	47,5
A9014	075	010	2669	890719	170	35	50,2	19	55,2
A9015	075	011	3401	890719	184	35	49,0	19	43,0
A9016	075	012	2651	890719	174	35	34,3	19	40,4
A9017	075	013	2612	890720	152	35	15,0	19	45,2
A9018	075	014	2588	890720	127	35	05,0	19	45,0
A9019	075	015	2597	890720	154	35	05,0	19	29,0
A9020	075	016	2577	890720	139	35	00,0	19	33,0
A9022	075	017	2569	890721	186	34	57,1	18	49,0
A9023	075	018	2564	890721	158	34	52,8	19	02,3
A9024	075	019	2548	890721	123	34	41,4	19	03,6
A9025	075	020	1159	890722	38	34	35,0	19	17,3
A9026	075	021	3376	890722	245	35	16,0	18	54,6
A9027	075	022	3144	890722	438	35	24,0	18	50,0
A9028	075	023	4190	890722	400	35	16,2	18	44,9
A9030	075	DT1		890722	900	34	41,8	17	57,8
A9031	075	025	3291	890723	300	32	40,0	17	04,5
A9032	075	026	3280	890723	287	32	30,2	17	05,0
A9033	075	027	3289	890723	284	32	30,0	17	20,0
A9034	075	028	2459	890723	187	32	30,0	17	35,0
A9035	075	029	2440	890723	168	32	18,2	17	40,0
A9036	075	030	5098	890724	462	32	47,5	16	44,8
A9039	075	032	3258	890805	235	32	10,0	17	08,3
A9041	075	034	3247	890805	269	32	00,0	16	55,0
A9042	075	035	3241	890805	257	31	49,8	16	59,9
A9043	075	036	3237	890805	263	31	45,8	17	00,2
A9051	075	037	2337	890806	191	31	29,7	17	20,9
A9052	075	038	2324	890806	145	31	15,0	17	30,0
A9053	075	039	2331	890806	121	31	15,1	17	39,5
A9055	075	041	2361	890806	101	31	35,0	17	58,5
A9066	075	042	2303	890807	190	30	59,7	17	09,2
A9067	075	043	2291	890807	183	30	50,0	17	04,5
A9068	075	044	3162	890807	218	30	52,5	16	50,0
A9069	075	045	3147	890807	227	30	50,1	16	46,5
A9070	075	046	2277	890807	200	30	39,8	16	50,2
A9071	075	047	2273	890807	170	30	35,0	17	00,0
A9081	075	048	2260	890808	155	30	25,0	17	00,0
A9082	075	049	2264	890808	173	30	25,0	16	50,0
A9083	075	050	2249	890808	190	30	20,0	16	40,0
A9084	075	051	2243	890808	185	30	15,0	16	40,5
A9085	075	052	2233	890808	152	30	09,9	16	50,0
A9086	075	053	1032	890808	94	30	01,8	17	08,2
A9098	075	054	2215	890809	179	30	05,0	16	35,0
A9100	075	056	2153	890809	154	29	45,0	16	36,7
A9113	075	057	1006	890810	50	28	49,9	16	32,1
A9114	075	058	1001	890810	33	28	45,0	16	24,4
A9115	075	059	2003	890810	125	28	50,0	16	09,2
A9116	075	060	2006	890810	113	28	53,1	16	20,4
A9117	075	061	2027	890810	150	29	04,7	16	10,0
A9118	075	062	2051	890810	167	29	14,7	15	09,9
A9122	075	063	2080	890811	185	29	25,0	15	29,8
A9123	075	064	2102	890811	177	29	30,5	15	35,0
A9124	075	065	2139	890811	188	29	39,8	15	29,1
A9125	075	066	2158	890811	181	29	44,7	15	20,4
A9126	075	067	3011	890811	211	29	50,0	15	16,5
A9129	075	068	4005	890812	345	29	50,0	15	03,1
A9130	075	069	3015	890812	264	29	55,5	15	10,7
A9131	075	070	3025	890812	227	30	03,8	15	25,0
A9132	075	071	3044	890812	220	30	09,6	15	34,2
A9133	075	072	3072	890812	248	30	24,5	15	49,2
A9138	075	073	5015	890813	465	30	05,0	14	54,1
A9139	075	074	5021	890813	481	30	15,0	14	55,0
A9140	075	075	4015	890813	350	30	20,0	15	07,7
A9141	075	076	5026	890813	470	30	28,3	15	08,1
A9142	075	DT2		890813	730	30	29,0	14	58,5
A9144	075	078	3105	890814	253	30	33,9	16	08,9
A9145	075	079	3127	890814	253	30	40,0	16	08,1
A9146	075	080	3156	890814	280	30	51,8	16	15,4
A9148	075	081	4117	890815	340	32	28,9	16	49,3
A9149	075	082	4109	890815	305	32	15,0	16	49,0
A9150	075	083	4111	890815	351	32	17,6	16	36,4
A9151	075	DT3		890815	825	32	26,6	16	15,4
A9153	075	084	5082	890816	440	32	05,7	16	19,8
A9154	075	085	4097	890816	372	32	06,0	16	30,0
A9759	079	035	1093	900116	120	32	36,6	18	03,6
A9760	079	036	2445	900116	100	32	21,4	18	00,6
A9766	079	039	2375	900117	148	31	50,1	17	21,0
A9767	079	040	3249	900117	203	32	00,9	17	08,9
A9768	079	041	3239	900117	219	31	45,4	17	07,2
A9771	079	043	2274	900118	152	30	35,9	17	05,3
A9772	079	044	2260	900118	152	30	25,1	16	59,7
A9773	079	045	1035	900118	92	30	20,0	17	14,8
A9774	079	046	1032	900118	81	30	04,9	17	07,9
A9775	079	047	1031	900118	99	30	00,0	17	06,2
A9779	079	048	2114	900119	134	29	36,3	16	40,3
A9782	079	051	2031	900119	132	29	11,0	16	06,5
A9791	079	052	1004	900120	76	28	50,3	16	24,9
A9792	079	053	2001	900120	122	28	50,0	16	15,0
A9793	079	054	2018	900120	143	29	05,0	16	14,5
A9794	079	055	2037	900120	166	29	15,8	15	56,7
A9795	079	056	2213	900121	182	30	06,3	16	24,7
A9796	079	057	2202	900121	174	30	00,0	16	33,8
A9797	079	058	2151	900121	162	29	46,5	16	28,8
A9798	079	059	2149	900121	166	29	44,6	16	19,8
A9799	079	060	2109	900121	162	29	33,0	16	15,0
A9800	079	061	3028	900122	213	30	05,8	16	41,6
A9801	079	062	2178	900122	194	29	54,0	15	46,2
A9802	079	063	3009	900122	195	29	50,0	15	33,0
A9803	079	064	2159	900122	189	29	51,4	15	36,6
A9804	079	065	2100	900122	191	29	35,9	15	28,6
A9809	079	E11		900123	178	29	29,0	15	04,0
A9810	079	E12		900123	265	29	32,8	14	58,5
A9811	079	E13		900123	356	29	32,1	14	42,3
A9812	079	DT1		900123	861	29	38,8	14	25,4
A9813	079	066	4015	900124	398	30	26,1	15	09,8
A9814	079	067	5019	900124	455	30	15,0	14	58,0
A9815	079	068	3022	900124	240	30	05,0	15	13,0
A9816	079	069	4006	900124	315	29	57,0	15	07,9
A9817	079	070	5010	900124	444	30	01,3	14	57,7
A9818	079	071	3106	900125	250	30	35,7	16	14,5
A9819	079	072	3079	900125	224	30	27,1	16	21,2
A9820	079	073	3062	900125	218	30	20,0	16	14,5
A9821	079	074	3059	900125	227	30	21,3	15	56,3
A9822	079	075	3048	900125	207	30	14,3	15	54,3
A9823	079	076	5050	900126	454	31	21,2	16	10,2
A9824	079	077	3177	900126	288	31	05,2	16	30,6
A9825	079	078	5039	900126	442	31	14,0	16	06,2
A9826	079	079	5047	900126	470	31	17,6	16	01,9
A9827	079	DT2		900126	796	31	14,6	15	35,5
A9828	079	080	3189	900127	233	31	11,0	16	50,6
A9829	079	081	3180	900127	238	31	05,0	16	45,2
A9830	079	082	3162	900127	234	30	56,7	16	45,6
A9831	079	083	3134	900127	229	30	46,9	16	44,3
A9832	079	084	3283	900128	242	32	31,2	17	25,0
A9833	079	085	2454	900128	173	32	31,1	17	36,5
A9834	079	086	2461	900128	135	32	36,2	17	42,9
A9835	079	087	3298	900128	224	32	34,9	17	38,7
A9836	079	088	2465	900128	149	32	45,8	17	41,4

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