

CHAPTER 4 TRAWL SURVEY: CATCH DISTRIBUTION, COMPOSITION AND SWEEP AREA BIOMASS ESTIMATES OF DEMERSAL FISH

The composition of the fish fauna on the shelf and slope changes with depth. The analyses were therefore performed for the inner shelf, down to 55 m depth, and the outer shelf from 55 m to 150 m. In addition, the slope area (150 m to 500 m) was analysed separately. The locations of the trawl stations are shown in Fig. 1, pooled length distributions (weighted by the catch) of main species are shown in Annex I and II and records of the catches are presented in Annex III.

In the swept-area biomass estimates only the shelf area down to 200 m has been included, divided into depth zone 0-50 m and 50-200 m.

4.1 CONGO

The results of swept-area trawl stations are summarized in Tables 1 to 3. Only 14 hauls were made in this area, partly due to the many oil rigs and pipelines hindering trawling on the shelf.

Table 1 shows the catch rates (kg/hour) by broad groups of species. "Demersal" comprises the families Sciaenidae, Ariidae, Haemulidae (=Pomadasiidae), Serranidae, Sparidae and Lutjanidae, while "Pelagic" includes Engraulididae, Clupeidae, Carangidae, Scombridae, Sphyraenidae and Trichiuridae. The catch rates of pelagic species dominate both on the inner and outer shelf, and this is the opposite of what was found in both surveys in 1989. The total catch rates of demersal groups are slightly lower than in 1989, especially on the inner shelf, while the catch rates of pelagic species are much higher now in all areas. Both groups have the highest catch rates on the outer shelf. If all demersal species are included, the catch rates are higher than in 1989 (see below).

No lobster was caught on the inner shelf in 1994, while it was common in 1989. The catch rates of shrimps are highest on the slope, and like in 1989 the high rates are mainly due to a few large catches of *Nematocarcinus africanus* (African spider shrimp). *Parapenaeus longirostris* (deep water rose shrimp) was found on most of the stations on the slope with catch rates up to

60 kg/hour, an increase compared to 1989. Mean length was 1-2 cm larger than in 1989 (Annex I).

Sharks were caught on a few stations, mainly on the slope, with catch rates somewhat lower than in survey I 1989. Cephalopods were caught in all areas, but in highest rates on the outer shelf and the slope, and the most common species were *Illex coindetti* and *Sepia* spp. The rates were half of those found in survey I 1989, but higher than the rates from survey II 1989.

Table 1. CONGO. Catch rates (kg/hour) by main groups in swept area bottom trawl hauls for the shelf and the slope.

INNER SHELF 0-55 m

ST.NO.	DEP.	Demersal	Pelagic	Sharks	Shrimps	Lobster	Other
39	21	68.0	320.6		0.4		21.9
40	17	47.5	74.2		5.6		35.4
MEAN		57.8	197.4		3.0		28.7

OUTER SHELF 55-150 m

ST.NO.	DEP.	Demersal	Pelagic	Sharks	Shrimps	Cephalopod	Other
24	94	342.2	504.3	10.7	0.6	1.2	117.2
30	71	6.3	1467.1			2.2	153.2
31	108	189.1	414.1	11.9	13.1	23.1	140.5
38	82	49.7	4.1		0.1	6.7	22.8
MEAN		146.8	597.4	5.7	3.4	8.3	108.4

SLOPE 150-500 m

ST.NO.	DEP.	Demersal	Pelagic	Sharks	Shrimps	Cephalopod	Other
25	178	86.1	35.6		59.4	16.4	316.2
26	304		2.7	4.4	24.5		124.9
27	478			37.8	131.6	4.8	105.5
28	403			129.0	505.5		86.7
29	249	3.4	54.7		52.1	2.8	273.4
32	199	48.0	45.4		41.2	6.6	101.1
36	320		14.9		85.1	16.2	445.1
37	174	31.0	18.1	1.9	3.4	16.8	208.9
MEAN		21.1	21.4	21.6	112.9	8.0	207.7

Catch rates of pelagic fish in bottom trawl hauls (Table 2) are presented to give some indication of the forms present. The dominating species in all areas was *Trichiurus lepturus* (hairtail), and it was much more abundant than in both surveys in 1989. Among the carangids, adult *Trachurus trecae* (Cunene horse mackerel) was the most common, found on both the inner and outer shelf, while *Selene dorsalis* (lookdown) and *Chloroscombrus chrysurus* (Atlantic bumper) were mainly found on the inner shelf. Like in 1989 clupeids were most common on the inner shelf, where *Ilisha africana* (West African ilisha) had the highest catch rates, but also *Sardinella maderensis* (flat sardinella) occurred in the bottom hauls. In the pelagic hauls, however, both *S. maderensis*

and *S. aurita* (round sardinella) were much more abundant. Barracudas were much less abundant than in 1989, found on only one station on the inner shelf, and scombrids did not occur in any of the bottom trawl hauls. Mean lengths of *T. trecae* and *S. maderensis* were larger than in 1989, while that of *C. chrysurus* was similar.

Table 2. CONGO. Catch rates (kg/hour) of main pelagic families in swept area bottom trawl hauls for the shelf and the slope.

INNER SHELF 0-55 m

ST.NO.	DEP.	Clupeids	Carangids	Barracudas	Scombrids	Hairtails	Other
39	21	48.4	46.0	5.4		220.8	90.3
40	17	16.7	15.3			42.1	88.5
MEAN		32.6	30.7	2.7		131.5	89.4

OUTER SHELF 55-150 m

ST.NO.	DEP.	Clupeids	Carangids	Barracudas	Scombrids	Hairtails	Other
24	94		318.1			186.2	471.9
30	71	4.3	709.0			753.8	161.7
31	106	2.2				411.9	377.6
38	82		4.1				79.2
MEAN		1.6	257.8			338.0	272.6

SLOPE 150-500 m

ST.NO.	DEP.	Clupeids	Carangids	Barracudas	Scombrids	Hairtails	Other
25	178					35.6	478.1
26	304					2.7	153.8
27	478						279.7
28	403						721.2
29	249		0.7			54.0	331.6
32	199	5.5				39.8	196.9
36	320					14.9	546.4
37	174		0.1			18.0	262.0
MEAN		0.7	0.1			20.6	371.2

Table 3 shows the catch rates of demersal families. The croakers were the most common, with the highest catch rates on the outer shelf, and *Pentheroscion mbizi* (blackmouth croaker) and *Umbrina canariensis* (Canary drum) were the most abundant species. *Pteroscion peli* (boe drum) was only found on the inner shelf. On average the catch rates of croakers were comparable to those found in survey I 1989, but the *Pseudolithus* species were less abundant now. Mean lengths were similar to those obtained in 1989.

Table 3. CONGO. Catch rates (kg/hour) of main demersal families in swept area bottom trawl hauls for the shelf and the slope.

INNER SHELF 0-55 m

ST.NO.	DEP.	Sparids	Grunts	Croakers	Groupers	Hakes	Other
39	21	2.9	39.2	25.9			342.8
40	17		26.4	21.1			115.2
MEAN		1.4	32.8	23.5			229.0

OUTER SHELF 55-150 m

ST.NO.	DEP.	Sparids	Grunts	Croakers	Groupers	Hakes	Other
24	94	125.0		202.1	15.1		634.0
30	71	6.3					1622.5
31	108	35.7		153.3			602.7
38	82	49.7					33.6
MEAN		54.2		88.9	3.8		723.2

SLOPE 150-500 m

ST.NO.	DEP.	Sparids	Grunts	Croakers	Groupers	Hakes	Other
25	178	22.5		63.6			427.6
26	304					99.0	57.5
27	478					72.0	207.7
28	403						721.2
29	249			3.4		24.1	358.9
32	199			48.0			194.3
36	320					156.0	405.4
37	174	21.3		9.7			249.1
MEAN		5.5		15.6		43.9	327.7

Grunts were only found on the inner shelf, and they were much less abundant than in 1989. Like in 1989, *Brachydeuterus auritus* (bigeye grunt) was the dominating species found in this family. Sparids occurred in all areas, with very low rates on the inner shelf and the slope and somewhat higher rates on the outer shelf. The catch rates were a little higher than those found in both surveys in 1989. *Dentex angolensis* (Angola dentex) was the most abundant species, followed by *Pagellus bellottii* (red pandora). The same species were also most abundant in 1989 and the mean lengths were about the same.

Like in 1989 groupers were not abundant, only *Epinephelus aeneus* (white grouper) was found on one station on the outer shelf. However, these species cannot be properly evaluated by the swept area method because they mostly occur on rocky bottoms inaccessible to bottom trawl. *Merluccius polli* (Benguela hake) was found on most stations deeper than 200 m. *Brotula barbata* (Bearded brotula) occurred on both the outer shelf and the slope, but the catch rates were somewhat lower than those obtained in survey I 1989.

Table 4 presents the swept area estimates of mean densities based on 14 random bottom trawl hauls. Most pelagic species are not included in the calculations. Like in 1989 bigeye grunt was the species with the highest density in the 0-50 m zone. In the 50-200 m zone *Synagrops microlepis* (thinlip splitfin) had the highest density, followed by *P. mbizi*, *D. angolensis* and *U. canariensis*. *B. auritus*, followed by *P. mbizi* and *D. angolensis* dominated this zone in 1989. In the deepest zone (200-500 m) *N. africanus* came out with the highest densities, followed by *M. polli*. The same was found in 1989.

Table 4. CONGO. Swept area estimates of demersal species in tonnes/nm² by depth ranges.

SPECIES NAME	SAMPLE DISTRIB. BY CATCH CLASSES Lower limits, Kg/nm					% inci- dence	Mean dens. t/nm ²	Mean densities by bottom depth strata t/nm ²			
	>0	10	30	100	300			1000	- 50m	50-200m	200-500m
<i>Nematocarcinus africanus</i>			1	1		7	1.42			3.99	
<i>Pterothrissus belloci</i>	3	1	2			43	0.86		0.83	1.25	
<i>Merluccius polli</i>	1	2	1			29	0.81			2.28	
<i>Synagrops microlepis</i>	5	4				64	0.79		1.46	0.17	
<i>Pentheroscion mbizi</i>	3	1	1			36	0.57		1.13	0.02	
<i>Dentex angolensis</i>	4	1	1			43	0.50		1.01		
<i>Ectreposebastes ius</i>	1		1			14	0.43		0.01	1.19	
<i>Parapenaeus longirostris</i>	7	2				57	0.41	0.10	0.38	0.58	
<i>Umbrina canariensis</i>		3				21	0.41		0.81		
<i>Deania profundorum</i>		1	1			14	0.38			1.08	
<i>Chlorophthalmus atlanticus</i>	2	2				29	0.31		0.43	0.27	
Shrimps, small, non comm.	3	1				21	0.26	0.01	0.20	0.45	
<i>Brotula barbata</i>	5	1				43	0.20		0.37	0.04	
<i>Zenopsis conchifer</i>	4	1				36	0.17		0.23	0.15	
<i>Brachydeuterus auritus</i>	1	1				7	0.17	1.19			
<i>Raja miraletus</i>	5	1				43	0.16	0.08	0.30		
<i>Cynoponticus ferox</i>	4					29	0.16		0.31		
<i>Pseudolithus brachygnathus</i>	2	1				21	0.15	0.27	0.22		
<i>Illex coindetii</i>	8					57	0.11		0.10	0.16	
<i>Pagellus bellottii</i>	2	1				21	0.11	0.05	0.20		
<i>Pteroscion peli</i>	2					7	0.08	0.54			
<i>Sepiella ornata</i>	3					21	0.08	0.42			
<i>Octopus vulgaris</i>	1					7	0.06		0.12		
<i>Scorpaena angolensis</i>	2					14	0.06			0.17	
<i>Argyrosomus hololepidotus</i>	1					7	0.06		0.13		
<i>Octopus sp.</i>	2					14	0.05		0.10		
<i>Laemonema laureysi</i>	3					21	0.05			0.14	
<i>Chaunax pictus</i>	4					29	0.05			0.13	
<i>Branchiostegus semifasciatus</i>	2					14	0.05		0.11		
<i>Aristeus varidens</i>	2					14	0.04			0.10	
<i>Nematopalaemon hastatus</i>	1					7	0.02			0.05	
<i>Parapenaeopsis atlantica</i>	1					7					
<i>Plesiopenaeus edwardsianus</i>	1					7				0.01	
Other fish							0.73	0.60	0.77	0.72	
Sum all species							9.69	3.26	9.22	12.95	
Sum Hakes							0.81			2.28	
Sum Groupers							0.03		0.07		
Sum Grunts							0.17	1.19			
Sum Croakers							1.28	0.86	2.29	0.02	
Sum Seabreams							0.62	0.05	1.24		
Sum Sharks							0.45		0.12	1.11	
Sum Rays							0.18	0.08	0.34		
Sum Squids							0.31	0.52	0.36	0.16	
Sum											
Sum commercial shrimps							1.89	0.10	0.38	4.73	

Number of stations included in analysis, total and by depth strata

14 2 7 5

The mean density for all demersal species was 9.7 tonnes/nm², while in survey II 1989 the corresponding figure was only 5.5 tonnes/nm². In 1985, however, the estimated mean density was 11.1 tonnes/nm², which is close to what was found in the present survey.

At the bottom of Table 4 summed densities of the most important species by main groups are presented. The group "commercial shrimps" came out with the highest density, and much higher than in 1989. This was mainly caused by a few large catches of *N. africanus*, which is of uncertain commercial value. *P. longirostris* had the second highest density in this group, several times higher than in the previous investigations. Among the fish groups, croakers had the highest mean density, followed by hakes, seabreams, sharks, squids and rays. All this groups had higher densities than in 1989, while grunts came out much lower and grouper at the same level as in 1989.

In Table 5 the densities of some important species and groups are multiplied by the area of the two shallowest depth zones (0-50 and 50-200 m). Some results from survey II 1989 are also given.

	0-50 m	50-200 m	Total	1989-total
Seabreams	40	2 200	2 240	1 490
Croakers	650	4 050	4 700	1 970
Groupers	-	120	120	120
Sum dem. val.	690	6 370	7 060	3 580
All demersal	2 400	16 300	18 700	12 500
Bigeye grunt	890	-	890	3 800
Horse mackerel	100	7 800	7 900	
Hairtail	3 550	11 650	15 200	

The summed biomass of seabreams, croakers and grunts was about the same as found in survey II 1989, but bigeye grunt contributed much more (50%) in 1989. The total biomass of all demersal species was almost 50% higher in 1994, mainly due to higher catch rates of *S. microlepis*, *Pterothrissus belloci* and other demersal species of non commercial value.

4.2 GABON

The results of the swept-area trawl stations are shown in Tables 6 to 8. Table 6 gives the catch rates (kg/hour) by main species groups, for the inner shelf, the outer shelf and the slope. The demersal fish species dominate in the inner and outer shelf over all other groups. This is different from what was found for the demersal species in Congo during this survey. On the inner and outer

shelves as well as on the slope the catch rates for demersal species were much higher than those for pelagic species. This is consistent with the results from survey I 1989, but different from what was found during survey II 1989, where the catch rates for pelagic species dominated on the outer shelf. The total catch rate for demersal fish in all areas was about 50 % higher than during survey I 1989 and about double the size of the catch rates from survey II 1989.

The catch rate of pelagic species was highest on the inner shelf, lower on the outer shelf and even less on the slope. During this survey in Congo and during both surveys in 1989 pelagic species were caught mainly on the outer shelf. A small amount of sharks was caught in all three areas, but mainly on the outer shelf and the slope. No shrimp was found on the inner and outer shelf. However, on the slope the main catch rate was very high, due to two big catches, one of *Nematocarcinus africanus* (141 kg/hour) and one of *Parapenaeopsis atlantica* (101 kg/hour). Also in the 1989-surveys shrimp was mainly found on the slope. The mean length of *Parapenaeus longirostris* in Gabon was 1-2 cm lower than in Congo during this survey.

Table 6. GABON. Catch rates (kg/hour) by main groups in swept area bottom trawl hauls for the shelf and the slope.

INNER SHELF 0-55 m

ST.NO.	DEP.	Demersal	Pelagic	Sharks	Shrimps	Lobster	Other
43	48	466.3	88.7				116.7
50	36	10.2		9.6			30.9
51	31	1579.0	535.3				6.5
64	46	45.0	1.2				39.0
68	27	419.0	422.2				44.9
69	25	245.8	101.8				18.8
73	46	169.3		0.7		3.0	46.3
74	25		10.7				3.4
75	51	71.2					26.7
80	28	10.1	387.3			0.7	11.2
81	52	3.7					19.9
90	43	50.5	16.7				44.2
91	33	40.0	139.4				9.6
MEAN		239.2	131.0	0.8		0.3	32.2

OUTER SHELF 55-150 m

ST.NO.	DEP.	Demersal	Pelagic	Sharks	Shrimps	Cephalopod	Other
42	91	119.0	311.8			7.9	17.8
45	58	724.5	565.2				68.4
52	74	109.8	52.8	5.6		2.0	5.5
59	63	77.8	15.6			12.3	13.8
60	98	99.0	49.1	10.0		11.6	10.5
62	117	844.1	1.6				51.1
63	58	5.2	1.6			20.9	8.9
65	136	400.9				6.6	235.9
67	71	1673.3	100.8			62.4	21.0
72	89	191.2	0.7			2.3	226.9
76	84	34.1	1.1	14.5		7.4	51.9
82	78	20.1				7.7	13.3
84	148	66.2		15.2		1.2	106.8
88	98	201.2	24.5			19.3	56.2
89	69	102.6	8.1			20.6	14.4
MEAN		311.3	75.5	3.0		12.2	60.2

Table 6. Cont.

SLOPE 150-500 m

ST.NO.	DEP.	Demersal	Pelagic	Sharks	Shrimps	Cephalopod	Other
41	205	47.6	72.0		12.9	6.6	257.3
46	277	94.1		2.9	1.9		229.4
53	238	20.7	11.8		1.6	31.7	381.4
54	333		20.5	2.5	5.4	8.0	291.9
55	151	364.8	11.6			2.5	405.6
61	175	60.2				17.0	193.8
65	258	51.8	19.6		6.4	37.0	544.9
70	327				1.0	8.3	243.4
71	174	106.7	8.9			73.3	57.3
77	160	117.9		5.6			186.5
78	404		21.0	2.7	141.7	1.8	65.5
85	181	32.9	19.2	8.7		374.6	54.4
87	399	4.7		7.9	101.1	7.1	130.4
MEAN		69.3	14.2	2.3	20.9	43.7	234.0

The highest catch rates for cephalopods were obtained on the slope. The dominating species was *Illex coindetti*, which was caught once with a rate of 374 kg/hour. The mean length of *Illex coindetti* was about 18 cm, a higher value than the one found in survey I 1989 (12.7 cm).

Table 7 summarises the catch rates for the main pelagic fish families in the area. Carangids dominated on the inner and outer shelves, while their catch rates were negligible above the slope.

Table 7. GABON. Catch rates (kg/hour) of main pelagic families in swept area bottom trawl hauls for the shelf and the slope.

INNER SHELF 0-55 m

ST.NO.	DEP.	Clupeids	Carangids	Barracudas	Scombrids	Hairtails	Other
43	48		86.3	2.42			583.0
50	36						50.8
51	31	0.7	478.4	18.00		38.16	1585.4
64	46		1.1		0.08		84.0
68	27		418.1	4.09			463.9
69	25	0.6	100.2	0.92	0.04		264.6
73	46						219.5
74	25		10.7				3.4
75	51						98.0
80	28		387.3				22.0
81	52						23.6
90	43		16.7				94.7
91	33		139.4				49.6
MEAN		0.1	126.0	1.96	0.01	2.94	272.5

OUTER SHELF 55-150 m

ST.NO.	DEP.	Clupeids	Carangids	Barracudas	Scombrids	Hairtails	Other
42	91		257.1		3.7	51.0	144.8
45	58	5.2	548.1	11.7			793.1
52	74		52.8				122.9
59	63	0.7	9.9		1.4	3.6	103.9
60	98		30.8		0.3	18.0	131.1
62	117		1.4		0.1		895.2
63	58		0.2		1.4		35.1
66	136						643.3
67	71	5.3	71.7		4.2	19.6	1756.7
72	89	0.7					420.4
76	84					1.1	107.9
82	78						41.1
84	148						189.1
88	98		24.5				276.7
89	69		5.7	2.4			137.6
MEAN		0.8	66.8	0.9	0.7	6.2	386.6

Table 7. cont.

SLOPE 150-500 m

ST.NO.	DEP.	Clupeids	Carangids	Barracudas	Scombrids	Hairtails	Other
41	205					72.0	324.3
46	277						328.3
53	238					11.8	435.4
54	333		0.1			20.4	307.9
55	151					11.6	772.9
61	175						271.0
65	258					19.6	640.1
70	327						252.7
71	174					8.9	237.3
77	160						310.0
78	404					21.0	211.7
85	181					19.2	470.7
87	399						251.3
MEAN			0.0			14.2	370.3

Off southern Gabon, *Trachurus trecae* followed by *Chloroscombrus chrysurus* were the main representatives of this family, while in the north only *Decapterus rhonchus* was found.

The mean length distribution of *Trachurus trecae* was substantially smaller in Gabon (17.6 cm) than in Congo (36 cm), while *Chloroscombrus chrysurus* was slightly bigger in Gabon.

Catch rates of *Trichiurus lepturus* were very low as compared to Congo, where *T. lepturus* was the dominating species on the shelf and on the slope.

Clupeids, scombrids, and barracudas were caught with a very low catch rate on the inner and outer shelf and not at all at the slope. During survey II 1989 the catch rates for these families were also very low on the inner shelf, but clupeids and scombrids were taken in high amounts on the outer shelf.

The results for the main demersal fish families, sparids, grunts, croakers, groupers and hakes, are shown in Table 8. Sparids were caught at almost all trawl stations, and their mean catch rates dominated those of the other families on the outer shelf and on the slope. For the two surveys in 1989 no separated data are given for the catch rates on the slope. During these surveys sparids had the highest catch rates on the inner as well as on the outer shelves.

Table 8. GABON. Catch rates (kg/hour) of main demersal families in swept area bottom trawl hauls for the shelf and the slope.

INNER SHELF 0-55 m

ST.NO.	DEP.	Sparids	Grunts	Croakers	Groupers	Hakes	Other
43	48	37.3	429.0				205.4
50	36	10.2					40.6
51	31	4.0	1571.4	3.6			541.8
64	46	40.6	4.4				40.2
68	27	419.0					467.1
69	25	245.8					120.6
73	46	169.3					50.1
74	25						14.1
75	51	71.2					26.7
80	28	10.1					399.2
81	52	3.7					19.9
90	43	50.5					60.9
91	33	40.0					149.0
MEAN		84.7	154.2	0.3			164.3

OUTER SHELF 55-150 m

ST.NO.	DEP.	Sparids	Grunts	Croakers	Groupers	Hakes	Other
42	91	119.0					337.5
45	58	183.2	540.0		1.3		633.6
52	74	109.8					66.0
59	63	77.4	0.4				41.8
60	98	99.0					81.2
62	117	169.7		674.4			52.7
63	58	3.7		1.5			31.5
66	136	400.9					242.4
67	71	719.9	953.4				184.2
72	89	61.2	130.0				229.9
76	84	34.1					74.9
82	78	20.1					21.0
84	148	66.2					123.2
88	98	201.2					100.0
89	69	102.2	0.3				43.1
MEAN		157.8	108.3	45.1	0.1		150.9

SLOPE 150-500 m

ST.NO.	DEP.	Sparids	Grunts	Croakers	Groupers	Hakes	Other
41	205	47.6				1.4	347.3
46	277	94.0	0.1			30.5	203.7
53	238	20.7					426.5
54	333					150.4	178.0
55	151	116.6		248.2			419.7
61	175	60.2					210.7
65	258	51.8				43.4	564.5
70	327					13.0	239.6
71	174	82.8		4.3	19.7		139.5
77	160	117.9					192.1
78	404					23.4	209.3
85	181	32.9					457.1
87	399		2.2		2.5	37.5	209.1
MEAN		48.0	0.2	19.4	1.7	23.1	292.1

Dentex angolensis had the same mean length as in Congo this survey, but it was about 5 cm higher than during survey II 1989. *Pagellus bellottii* was 5 cm smaller than in Congo.

On the inner shelf, grunts had the highest mean catch rates, mainly due to one big haul of 1 571 kg/hour of *Bachydeuterus auritus*. This species was the only representative of the family

Haemulidae (= Pomadasyidae) during the whole survey. It was also caught with high catch rates on three other stations on the outer shelf. The mean catch rate on the outer shelf was second behind the sparids. During both surveys in 1989 the mean length for *B. auritus* found in Congo was about 10-11 cm, while now in Gabon the mean length was 16 cm.

Croakers were only found once in a small amount on the inner shelf, and groupers and hakes were not taken here at all. The main croaker species found on the outer shelf and on the slope was *Umbrina canariensis*, of which two big hauls, one in each area, were taken.

The most common Serranidae taken during this survey was *Anthias anthias*. However, for consistency with former reports only groupers are included in the swept area analysis shown in Table 8. Only three single specimens were caught (*Epinephelus aeneus*, *E. haifensis*, *E. goreensis*) on the outer shelf and the slope. The catch rate for groupers is therefore very low compared with the catch rate during former surveys.

The mean catch rate of hakes was second behind the sparids. No separate data were available from former surveys. The mean length was about 26 cm, which is the same as in Congo.

Table 9 presents the swept-area estimates of mean densities based on 41 random bottom trawl hauls. Most pelagic species are not included in the calculations. Like in the Congo area *B. auritus* had the highest density in the 0-50 m zone, followed by *P. bellottii*. The latter had the highest density in this zone in 1989. The two same species also came first in the 50-200 m zone, followed by *U. canariensis* and *D. congoensis*. In 1989 *P. bellottii* also dominated this zone. In the deeper waters *Chlorophthalmus atlanticus* was the most important, followed by *M. polli*, *Synagrops microlepis* and *D. angolensis*. In 1989 *M. polli* and *Chlorophthalmus agassizi* (probably a misidentification) dominated the deepest zone. Among the shrimps, *N. africanus* and *P. atlantica* had the highest densities, but as mentioned above, they only occurred in one station, each in the deepest zone. *P. longirostris* was found in some more stations, but in low densities, the highest catch rate was only 12 kg/hour.

The mean density of all demersal species was 11.6 tonnes/nm². This is a little higher than what was found in the Congo area. In survey II 1989 the mean density for Gabon was only 4.7 tonnes/nm², but all demersal species of non commercial value may not have been included. The mean density found in 1985 was at about the same level as what found during the present investigation.

Table 9. GABON. Swept-area estimates of demersal species in tonnes/nm² by depth range.

SPECIES NAME	SAMPLE DISTRIB. BY CATCH CLASSES					% inci- dence	Mean dens. t/nm ²	Mean densities by bottom depth strata t/nm ²				
	Lower limits, Kg/nm							- 50m	50-200m	200-500m	500-800m	
	>0	10	30	100	300	1000						
<i>Brachydeuterus auritus</i>	5		1	2	2		24	2.98	6.08	2.52	0.01	
<i>Pagellus bellottii</i>	9	10	3	2			59	1.86	3.08	1.93		
<i>Chlorophthalmus atlanticus</i>	2		5	1			20	0.93			4.76	
<i>Umbrina canariensis</i>	2		1	1			10	0.75		1.40		
<i>Dentex congoensis</i>	5	6	2				32	0.56		1.04		
<i>Dentex angolensis</i>	5	5	3				32	0.54		0.69	0.88	
<i>Illex coindetii</i>	21	1		1			56	0.41	0.02	0.70	0.15	
<i>Synagrops microlepis</i>	4	1	2				17	0.39		0.33	1.09	
<i>Spicara alta</i>	8	2	2				29	0.29		0.55		
<i>Merluccius polli</i>	3	3	1				17	0.25			1.29	
<i>Zenopsis conchifer</i>	8	2	1				27	0.24		0.35	0.26	
<i>Boops boops</i>	16	1	1				44	0.23		0.42		
<i>Sepia officinalis hierredda</i>	6	2					20	0.14	0.39	0.07		
<i>Sparus pagrus africanus</i>	2		1				7	0.13		0.24		
<i>Dasyatis centroura</i>			1				2	0.13		0.24		
<i>Anthias anthias</i>	5		1				15	0.13		0.24		
<i>Neaotocarcinus africanus</i>			1					0.11			0.58	
<i>Aulopus cadenati</i>	9	1					24	0.11		0.09	0.33	
<i>Antigonia capros</i>	7	1					20	0.10		0.18		
<i>Sepia sp.</i>	12						29	0.08	0.06	0.12	0.03	
<i>Parapenaeopsis atlantica</i>			1				2	0.08			0.40	
<i>Priacanthus arenatus</i>	13	1					34	0.07	0.04	0.12		
<i>Zeus faber</i>	8						20	0.06		0.11		
<i>Raja miraletus</i>	15						37	0.06	0.08	0.08		
<i>Pseudupeneus prayensis</i>	12	1					32	0.06	0.15	0.04		
<i>Lepidotrigla carolae</i>	16						39	0.05		0.09		
<i>Saurida brasiliensis</i>	16						39	0.05		0.09		
<i>Sepia bertheloti</i>	2	1					7	0.05		0.09		
<i>Fistularia petimba</i>	14						34	0.05	0.13	0.02		
<i>Parapenaeus longirostris</i>	6						15	0.02			0.09	
<i>Plesionika martia</i>	4						10	0.01			0.04	
HIPPOLYTIDAE	1						2				0.01	
Other fish								0.67	0.52	0.52	1.44	
Sum all species								11.59	10.55	12.27	11.36	
Sum Hakes								0.25			1.29	
Sum Groupers								0.02			0.01	
Sum Grunts								2.98	6.08	2.52	0.01	
Sum Croakers								0.75	0.01	1.41		
Sum Seabreams								3.43	3.27	4.41	0.88	
Sum Sharks								0.06	0.03	0.09	0.06	
Sum Rays								0.21	0.09	0.35	0.01	
Sum Squids								0.76	0.55	1.01	0.40	
Sum												
Sum commercial shrimps								0.22			1.12	

Number of stations included in analysis, total and by depth strata

41

11

22

8

At the bottom of Table 9 mean densities of main groups of commercial value are presented. Seabreams had the highest density, followed by grunts. The same was found during survey II in 1989, but the densities were much lower then. Also croakers, hakes, sharks, squids and rays were

found in higher densities now, while groupers and snappers gave a higher value in 1989 (the latter was not found in bottom trawl hauls in 1994). Like in the Congo area a few catches of shrimp (*N. africanus* and *P. atlantica*) resulted in a relatively high mean density of shrimps compared to 1989. But like then the density of more important shrimp species was low.

In Table 10 the densities of some important species and groups are multiplied by the area of the two shallowest depth zones (0-50 and 50-200 m). Some results from survey II 1989 are also given.

The summed biomass of valuable groups was more than 50% higher than in 1989, mainly because of a larger biomass of sea-

breams. The total biomass of all demersal species was more than the double of what was found in 1989, mainly due to higher catch rates of *B. auritus*, as well as *C. atlanticus*, *Illex coindetii* and *S. microlepis*.

	0-50 m	50-200 m	Total	1989-total
Seabreams	13 700	12 700	26 400	17 000
Croakers	50	4 050	4 100	350
Groupers	-	100	100	600
Snappers	-	-	-	800
Grunts*	-	-	-	600
Sum dem. val.	13 750	16 850	30 600	19 350
All demersal	44 100	35 500	79 600	34 100
Bigeye grunt	25 400	7 300	32 700	2 900
Horse mackerel	4 300	4 000	8 300	
Hairtail	500	600	1 100	

* Not including bigeye grunt.