

3.4.3 CPUA of nectobenthos and its dominant species

Carangidae and pelagic fish species (see Appendix Table 3.2 and 3.3) were excluded from CPUA analysis.

(1) Distribution of CPUA

Figure 3.9 shows CPUA values obtained at each trawl stations by survey season.

1) *Amrigue* survey area

In all seasons, relatively high values of CPUA tended to concentrate in the vicinity of Cape Blanc to Levrier Bay and in the depth of Banc d'Arguin.

2) *Al-Awam* survey area

In all three areas, high CPUA values were observed particularly in coastal area and in offshore area in water depths over 200 m.

(2) CPUA by stratum

Table 3.18 presents mean CPUA values obtained at each stratum, as well as their standard deviations and variation intervals. CPUA values listed below were rounded off and the unit (kg/m^2) is not mentioned.

1) *Amrigue* survey area

The CPUA values obtained throughout the survey showed significant variation, between 0 and 10,582. The mean CPUA for the entire area of each survey was between 1,133 and 2,353. After a steady decline until the Phase 2 cold season, it increased until the following warm season, when it peaked.

a) Banc d'Arguin

The mean CPUA of each survey was between 891 and 2,407. It was high in the warm season and low in the cold season.

b) Other area

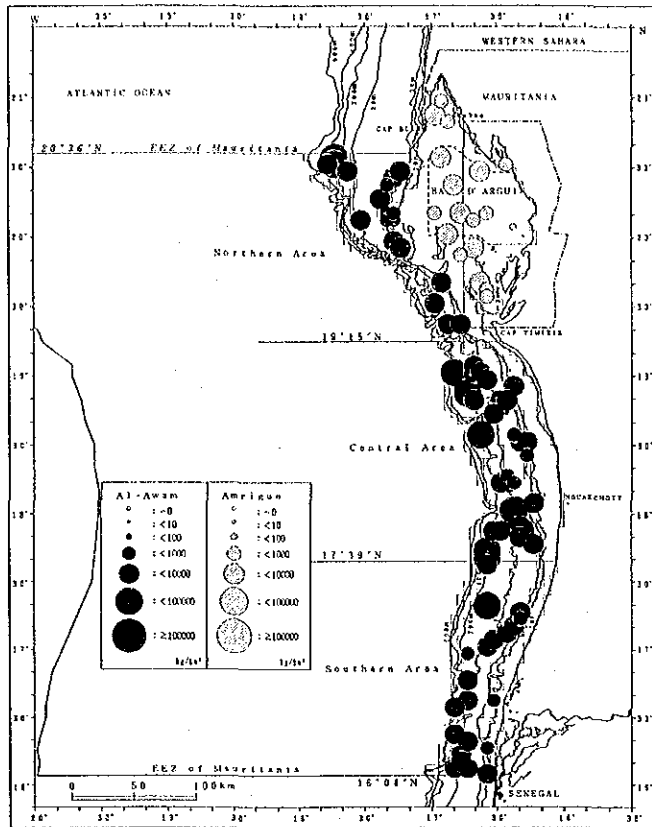
The mean CPUA of each survey was between 488 and 2,957. In Phase 1, it was high in the cold season and low in the following warm season -- then in Phase 2, it was the other way round.

2) *Al-Awam* survey area

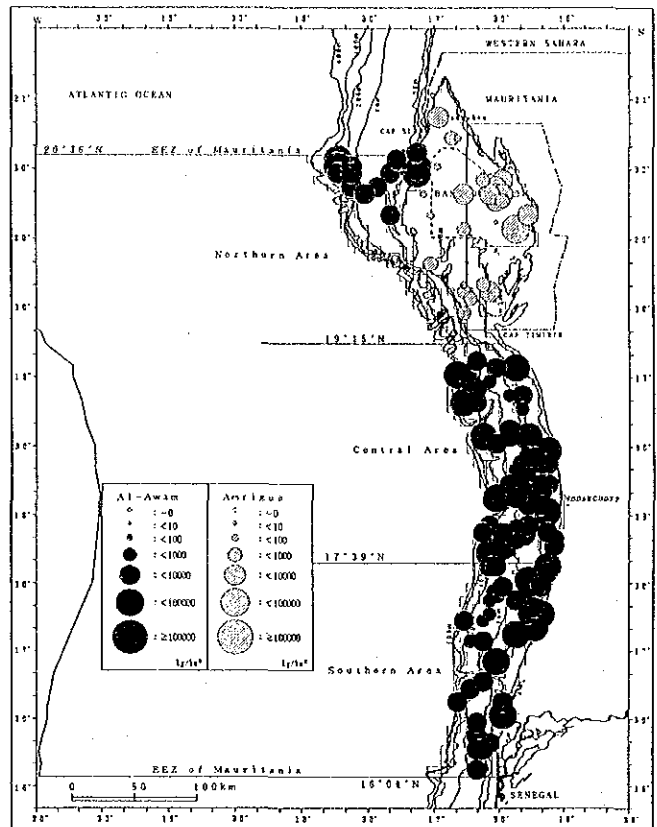
The CPUA values obtained throughout the survey presented a very significant variation, between 90 and 120,489. The overall mean CPUA was between 5,294 and 8,745 (the 3-20 m stratum of the Northern area was not surveyed in Phase 1, likewise the 200-400 m stratum in the Phase 2 cold season) and it increased as the survey went by. In the cold season, the mean CPUA by stratum in the entire area was the highest at the 3-20 m stratum (not calculated in Phase 1 ; about 20,000 in Phase 2), while in the warm season, it peaked at the 200-400 m stratum (about 20,000 in both Phases).

In each season, the mean CPUA by subarea was the highest in the Northern area (except in the Phase 1 cold season) and decreased from north to south in Phase 2. The mean CPUA by stratum in each area peaked at the 3-20 m or at the 200-400 m strata. The mean CPUA at the 3-20 m stratum in the Northern area in both seasons of Phase 2 was particularly high, 35,00 and 38,000 respectively.

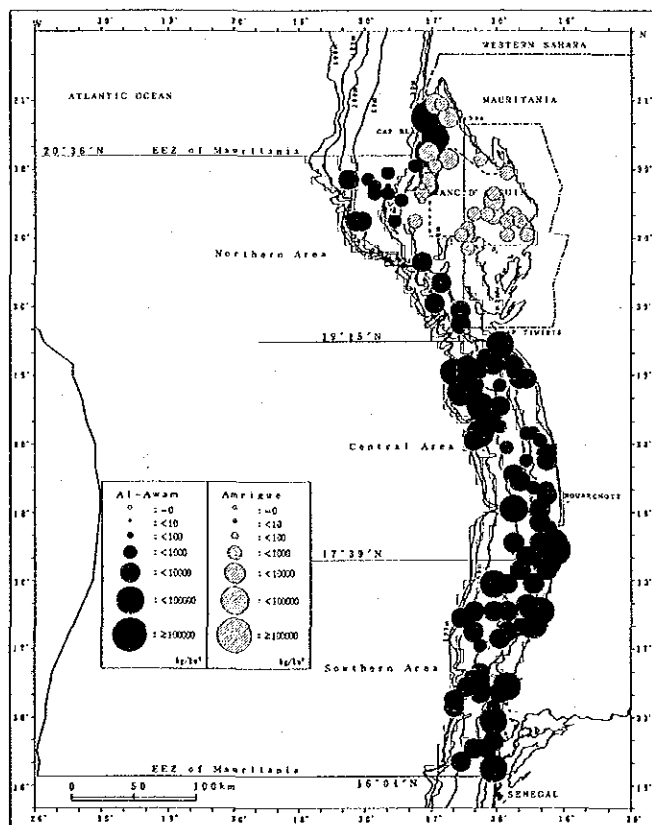
(A) Phase 1 cold season



(B) Phase 1 warm season



(C) Phase 2 cold season



(D) Phase 2 warm season

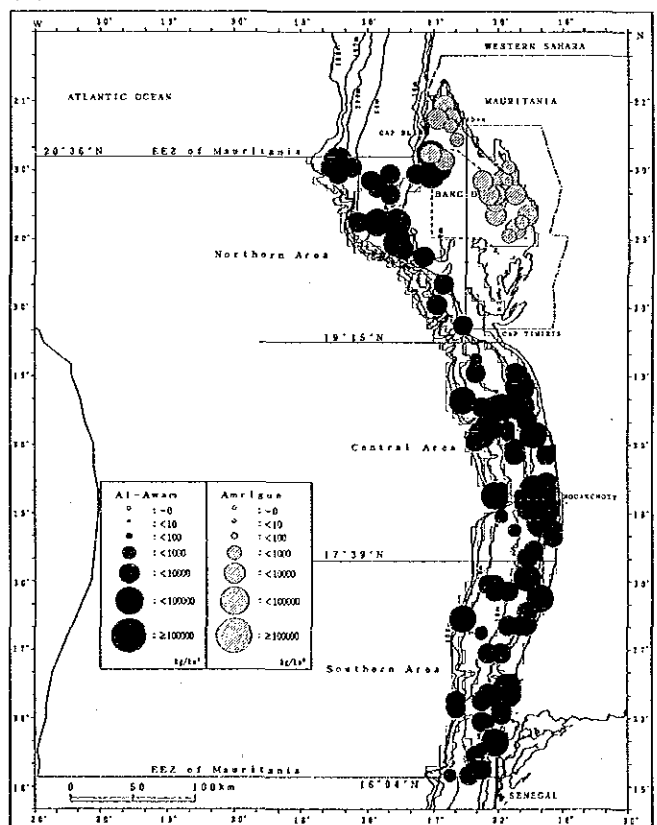


Figure 3.9 CPUA distribution of nectobenthos.

Table 3.18 CPUA of nectobenthos by stratum.

(A) *Amrigue* survey area

Phase	Season	Subarea	Stratum	CPUA (kg/km ²)			
				No.	Mean	S. D.	Range
1	Cold	Banc d'Arguin	3-20m	9	891.4	1,089.0	22.0 - 3,608.0
		Other	"	9	2,957.2	3,938.4	114.0 - 9,773.5
		All area		18	1,924.3	2,997.8	22.0 - 9,773.5
	Warm	Banc d'Arguin	3-20m	16	1,970.2	2,620.3	0.0 - 10,581.8
		Other	"	12	488.0	623.4	22.9 - 1,897.7
		All area		28	1,335.0	2,128.5	0.0 - 10,581.8
2	Cold	Banc d'Arguin	3-20m	15	1,197.4	2,005.4	154.6 - 8,045.9
		Other	"	15	1,069.5	2,125.3	22.5 - 8,351.8
		All area		30	1,133.4	2,031.3	22.5 - 8,351.8
	Warm	Banc d'Arguin	3-20m	15	2,407.4	1,271.9	317.2 - 4,228.7
		Other	"	7	2,235.7	2,136.3	548.9 - 6,505.6
		All area		22	2,352.8	1,545.7	317.2 - 6,505.6

Remark. (B) *Al-Awam* survey area is shown on next page.

(3) Dominant species in terms of CPUA by stratum

Table 3.19 (A: *Amrigue* survey area, B: *Al-Awam* survey area) shows the mean CPUA by stratum obtained in each season, as well as the top five ranked species in terms of CPUA values. The mean CPUA of target species not included in the top five are also indicated.

1) *Amrigue* survey area

Of all species captured during the survey, 17 species were chosen as occupying the top five positions – 15 fishes, 1 cephalopod and 1 crustacean. Out of these 17 species, target species were 2 species: the common cuttlefish *Sepia officinalis* and the southern pink shrimp *Penaeus notialis*.

The CPUA variation for eight species out of 17 species mentioned above are presented below. Eight species were chosen in condition, that exceeded 100 of the mean CPUA in the entire survey area in any season. However, among the chosen eight species, the southern pink shrimp was not shown here but in 3.4.5, (3).

a) Spiny butterfly ray *Gymnura altavela*

The mean CPUA in the entire survey area by season was between 90 and 218, high in Phase 2. The mean CPUA by stratum was high in other area in Phase 1 and in the Banc d'Arguin in Phase 2.

b) Smoothmouth sea catfish *Arius heudelotii*

The mean CPUA in the entire survey area by season was between 29 and 286, high in Phase 2, showing 250 or more.

c) Senegal seabream *Diplodus bellottii*

The mean CPUA in the entire survey area by season was between 106 and 914. The highest and lowest values were seen in the Phase 1 cold season and in the Phase 2 cold season respectively. The mean CPUA by stratum was high in other area except the Phase 1 warm season.

Table 3.18 continued.

(B) Al-Awam survey area

Subarea	Stratum	Phase 1								Phase 2							
		Cold season				Warm season				Cold season				Warm season			
		No.	Mean	S. D.	Range	No.	Mean	S. D.	Range	No.	Mean	S. D.	Range	No.	Mean	S. D.	Range
North	3-20m	-	-	-	-	-	-	-	-	7	37,675.2	44,171.8	5,629.0 ~ 107,675.3	4	35,103.4	24,467.8	9,566.2 ~ 64,428.4
	20-30m	5	649.8	692.4	206.4 ~ 1,874.3	4	12,692.2	11,167.7	2,570.8 ~ 25,436.7	4	1,260.4	1,798.8	141.0 ~ 3,932.6	3	7,659.5	3,645.7	4,743.4 ~ 11,747.0
	30-80m	8	2,243.9	1,796.0	866.7 ~ 6,288.3	6	2,769.1	823.3	1,564.2 ~ 3,823.7	8	1,014.1	1,212.6	90.4 ~ 3,312.9	8	9,333.9	8,827.0	1,979.4 ~ 29,277.2
	80-200m	3	4,237.3	2,160.6	1,744.4 ~ 5,570.7	3	3,226.4	2,946.7	1,153.8 ~ 6,600.0	3	2,282.8	1,285.5	1,478.8 ~ 3,765.4	3	4,132.8	2,536.5	2,143.6 ~ 6,989.1
	200-400m	3	17,265.2	16,266.5	1,365.7 ~ 33,875.4	3	18,463.4	7,536.0	9,801.6 ~ 23,516.6	-	-	-	-	3	25,272.5	35,050.6	3,386.9 ~ 65,699.4
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Central	3-600m	19	4,510.9	8,051.6	206.4 ~ 33,875.4	16	8,278.3	8,779.9	1,155.8 ~ 25,436.7	22	12,396.8	29,307.2	90.4 ~ 107,675.3	21	15,538.1	19,414.7	1,979.4 ~ 65,699.4
	3-20m	-	-	-	-	15	6,137.7	5,311.3	574.4 ~ 17,303.5	16	13,611.5	31,233.9	381.5 ~ 120,488.5	15	7,446.0	7,193.9	1,211.0 ~ 26,555.3
	20-30m	4	3,038.2	2,611.9	848.5 ~ 6,800.1	4	6,796.6	3,812.8	2,624.9 ~ 10,917.1	4	1,169.2	1,034.2	319.8 ~ 2,674.8	4	4,409.3	4,726.5	1,605.5 ~ 11,461.1
	30-80m	12	3,229.5	4,152.3	704.0 ~ 15,725.1	12	4,981.4	4,336.8	547.0 ~ 12,228.8	11	1,125.5	591.1	314.1 ~ 1,970.1	10	4,602.6	4,916.5	509.7 ~ 16,611.1
	80-200m	10	8,929.8	11,378.6	1,118.1 ~ 39,829.1	11	3,550.5	4,547.5	644.8 ~ 16,823.2	10	5,997.7	3,617.9	2,112.4 ~ 12,038.2	7	5,502.1	10,121.6	363.6 ~ 27,734.4
	200-400m	4	15,605.6	2,915.9	12,569.0 ~ 19,584.4	6	26,930.5	13,889.8	7,801.9 ~ 46,943.4	4	9,313.1	3,171.0	4,758.1 ~ 12,121.0	4	19,861.7	10,362.6	5,976.1 ~ 29,616.8
400-600m	-	-	-	-	1	3,419.0	0.0	3,419.0 ~ 3,419.0	-	-	-	-	-	-	-	-	
South	3-600m	30	6,754.2	8,233.5	704.0 ~ 39,829.1	49	7,818.1	9,543.0	547.0 ~ 46,943.4	45	7,379.4	19,085.9	314.1 ~ 120,488.5	40	7,332.9	8,330.1	363.6 ~ 29,616.8
	3-20m	-	-	-	-	8	19,347.3	19,504.2	1,366.0 ~ 50,806.5	9	17,526.9	10,994.3	5,589.9 ~ 37,357.9	9	10,439.9	11,729.7	507.1 ~ 36,543.6
	20-30m	3	3,727.8	5,251.3	489.3 ~ 9,786.7	3	4,761.1	2,009.3	3,353.9 ~ 7,062.1	4	2,684.8	3,735.0	679.1 ~ 8,285.1	4	3,563.1	2,375.4	677.6 ~ 6,277.2
	30-80m	9	3,333.1	2,615.8	344.7 ~ 8,434.8	10	6,422.0	5,998.1	1,511.3 ~ 18,890.3	11	2,741.1	1,217.9	1,680.2 ~ 5,370.5	11	3,813.7	3,183.1	872.6 ~ 10,755.9
	80-200m	7	4,514.4	3,175.8	787.2 ~ 10,164.2	9	2,307.9	2,620.6	109.7 ~ 8,708.9	9	3,423.9	4,005.4	989.2 ~ 13,784.8	6	1,956.4	1,726.8	749.4 ~ 5,317.2
	200-400m	2	4,715.4	4,804.4	1,318.1 ~ 8,112.6	3	8,980.1	632.8	8,387.1 ~ 9,646.4	3	4,653.9	1,357.6	3,341.5 ~ 6,052.5	3	13,497.9	9,270.1	7,581.7 ~ 24,181.5
400-600m	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
All area	3-600m	21	3,914.9	3,165.7	344.7 ~ 10,164.2	33	8,514.9	11,756.2	109.7 ~ 50,806.5	36	6,761.4	8,546.7	679.1 ~ 37,357.9	33	6,133.2	7,757.3	507.1 ~ 36,543.6
	3-20m	-	-	-	-	23	10,732.3	13,430.3	574.4 ~ 50,806.5	32	19,976.6	31,213.2	381.5 ~ 120,488.5	28	12,360.1	15,014.3	507.1 ~ 64,428.4
	20-30m	12	2,215.4	3,005.5	206.4 ~ 9,786.7	11	8,385.3	7,413.1	2,570.8 ~ 25,436.7	12	1,704.8	2,346.1	141.0 ~ 8,285.1	11	4,988.0	3,760.4	677.6 ~ 11,747.0
	30-80m	29	2,989.8	3,123.5	344.7 ~ 15,725.1	28	5,021.9	4,651.3	547.0 ~ 18,890.3	30	1,688.2	1,285.6	90.4 ~ 5,370.5	29	5,608.6	6,038.2	509.7 ~ 29,277.2
	80-200m	20	6,680.5	8,386.9	787.2 ~ 39,829.1	23	3,022.0	3,611.2	109.7 ~ 16,823.2	22	4,438.2	3,760.5	989.2 ~ 13,784.8	16	3,915.7	6,749.1	363.6 ~ 27,734.4
	200-400m	9	13,738.7	9,949.1	1,318.1 ~ 33,875.4	12	20,326.1	12,367.3	7,801.9 ~ 46,943.4	7	7,316.3	3,441.5	3,341.5 ~ 12,121.0	10	19,575.8	18,736.8	3,386.9 ~ 65,699.4
400-600m	-	-	-	-	1	3,419.0	0.0	3,419.0 ~ 3,419.0	-	-	-	-	-	-	-	-	
3-600m	70	5,293.5	7,069.9	206.4 ~ 39,829.1	98	8,127.9	10,133.3	109.7 ~ 50,806.5	103	8,341.8	19,099.8	90.4 ~ 120,488.5	94	8,744.8	12,023.5	363.6 ~ 65,699.4	

Remarks: -: no trawl, *: number of trawl stations.

d) Lesser African threadfin *Galeoides decadactylus*

The mean CPUA in the entire survey area by season was between 24 and 633. The mean CPUA in the Banc d'Arguin in the warm seasons of Phase 1 and Phase 2 was particularly high, near 850 respectively.

e) African sicklefish *Drepane africana*

This species was not caught in the Phase 2 warm season or in other area in each season. The mean CPUA in the entire survey area by season was between 1 and 102, less than 4 except for the Phase 1 warm season.

f) Planehead filefish *Stephanolepis hispidus*

The mean CPUA in the entire survey area by season was between 34 and 124, less than 60 except for the highest value in the Phase 1 cold season. The mean CPUA by stratum tended to be high in other area.

g) Prickly puffer *Ephippion guttifer*

This species was not caught in other area except in the Phase 1 cold season. The mean CPUA in the entire survey area by season was between 9 and 103, high in the Phase 1 cold season and the Phase 2 warm season.

All ten target species not ranked as the top five had a mean CPUA lower than 40. Among them, the blue-spotted sea bream *Pagrus caeruleostictus* and the Senegalese sole *Solea senegalensis* occurred in the Banc d'Arguin throughout the survey, while the Canary dentex *Dentex canariensis* and the West African goatfish *Pseudupeneus prayensis* occurred in other area throughout the survey. The meagre *Argyrosomus regius* occurred in the entire area only in the warm season. The common octopus *Octopus vulgaris* appeared in Phase 2. The CPUA value of 39 observed in other area in the warm season was the highest among those target species.

2) Al-Awam survey area

The top five ranked species overall in the four survey seasons were occupied by 64 species: 62 fishes (of which 7 target species) and 2 cephalopods.

CPUA variation for those species are presented below, restricted to the GRS in each area that appeared in all seasons.

Also, among these 64 species, the top five ranked species in terms of the mean CPUA in the entire survey area by season were 13 species in all seasons. Out of 13 species, four target species (*Merluccius senegalensis*, *Pagrus caeruleostictus*, *Pagellus bellottii* and *Octopus vulgaris*) are described at 2), 7) and 10) of (1) and 3) of (2) in 3.4.5 respectively. Consequently here, the horizontal, vertical and seasonal feature of CPUA for 9 species are presented below.

a) Deepbody boarfish *Antigonia capros*

This species was caught in large quantities only at the 200-400m stratum of the Northern area in the Phase 2 warm season and the CPUA at this stratum indicated 14,415. This species occurred at the 80-200m stratum in the Central and Southern areas throughout the survey (see Appendix Table 3.3, 6/14), but was not caught as much as it was selected as a CPUA high-order species.

b) Blackbelly rosefish *Helicolenus dactylopterus dactylopterus*

The mean CPUA in the entire survey area by season was the highest value of 1,097 in the Phase 1 warm season, and about 500 or less in the other seasons. The mean CPUA at the 200-400m stratum in the Northern and Central areas was especially high, sometimes around 10,000.

c) Offshore rockfish *Pontinus kuhli*

The mean CPUA in the entire survey area by season ranged 66 - 651 and decreased in chronological order. The mean CPUA by stratum was the highest value of 9,954 at the 200-400m stratum of the Northern area in the Phase 1 cold season throughout the survey. Except for this case, it was high at the 80-200m and 200-400m strata in the Central and Southern areas.

d) Thinlip splitfin *Synagrops microlepis*

The mean CPUA in the entire survey area by season was between 68 and 427, high in the warm season. The mean CPUA by stratum was high at the 80-200m stratum or at the 200-400m stratum, especially in the Central or Southern area.

e) Bastard grunt *Pomadasys incisus*

Except in the Phase 1 cold season, in which this species was not selected as a top ranked species of CPUA, the mean CPUA in the entire survey area by season ranged 475 - 770 and was increasing serially. The mean CPUA by stratum was high at two strata shallower than 30m of water depth, remarking in the Northern area.

f) Rubberlip grunt *Plectorhinchus mediterraneus*

The mean CPUA in the entire survey area by season was less than 400, except 1,755 in the Phase 2 cold season. The mean CPUA by stratum was high at the 3-20m stratum, especially in the Phase 2 cold season showed 4,500 - 9,500.

g) Large-eye dentex *Dentex macrophthalmus*

Except in the Phase 2 warm season, in which this species was not selected as a top ranked species of CPUA, the mean CPUA in the entire survey area in other three seasons was 574, 65 and 160, respectively. The mean CPUA by stratum in each season was high at the 80-200m stratum, particularly in the Central area.

h) Senegal seabream *Diplodus bellottii*

Except in Phase 1, in which the data at 3-20m stratum was incompleting, the mean CPUA of the entire survey area in the Phase 2 cold and warm seasons was 1,121 and 816, respectively. The mean CPUA by stratum was overwhelmingly high at the 3-20m stratum in the Northern area and it was about 16,000.

i) Lesser African threadfin *Galeoides decadactylus*

Except in the Phase 1 cold season, in which this species was not selected as a top ranked species of CPUA, the mean CPUA in the entire survey area ranged 201 to 409 and was increasing serially. The mean CPUA by stratum in each season was high at the 3-20m stratum, especially in the Central and Southern areas ranged 1,000 to 2,000.

Table 3.19 Mean CUPA of nectobenthos and five top-ranking species.

(A) Amrigue survey area

Top 5 ranked species	Phase 1						Phase 2					
	Cold season			Warm seson			Cold season			Warm seson		
	Banc d'Arguin	Other	Total	Banc d'Arguin	Other	Total	Banc d'Arguin	Other	Total	Banc d'Arguin	Other	Total
<i>Rhinobatos rhinobatos</i>		10	5		* 35	15	13	* 73	43			
<i>Gymnura altavela</i>	22	* 162	* 92	79	* 106	* 90	* 437		* 218	* 204	66	* 160
<i>Arius heudelotii</i>	* 73	1	37	48	3	29	* 78	* 441	* 259	* 295	* 266	* 286
<i>Halobatrachus didactylus</i>		61	31		1	+		47	24	+	* 112	36
<i>Serranus scriba</i>		89	45	7	* 49	25		19	10		44	14
<i>Pomadasys incisus</i>	* 76	26	51	29	3	18	13	4	8	59	58	59
<i>Plectorhinchus mediterraneus</i>	3	* 178	* 90	+	+	+		4	2	3	19	8
<i>Diplodus bellottii</i>	* 244	* 1584	* 914	* 363	10	* 212	27	* 186	* 106	* 171	* 930	* 413
<i>Galeoides decadactylus</i>	22	26	24	* 854	1	* 489	* 133	6	* 69	* 864	* 138	* 633
<i>Sciaena umbra</i>		* 97	48									
<i>Drepane africana</i>	2		1	* 178		* 102				5		4
<i>Psettodes belcheri</i>	23	14	18	* 85	* 53	* 71	* 126	45	* 86	116	23	86
<i>Cynoglossus senegalensis</i>				* 94	16	60	60	47	53	5		3
<i>Stephanolepis hispidus</i>	* 50	* 197	* 124	13	* 61	34	53	* 49	51	6	* 185	63
<i>Ephippion guttifer</i>	* 132	74	* 103	15		9	* 63		31	120		82
<u><i>Sepia officinalis</i></u>	38	92	65				40	* 48	44	44	30	39
<u><i>Penaeus notialis</i></u>	2	10	6	64	8	40	21	4	12	* 195	71	* 156
<u><i>Mustelus mustelus</i></u>	28	6	17									
<u><i>Epinephelus aeneus</i></u>		4	2	1		+	1		+	1		+
<u><i>Pagrus caeruleostictus</i></u>	9		4	2	19	9	3	+	2	12		8
<u><i>Dentex canariensis</i></u>	12	11	12	5	7	6	1	3	2		13	4
<u><i>Pagellus bellottii</i></u>	6		3	2	1	1				3	+	2
<u><i>Argyrosomus regius</i></u>				+	2	1				4	9	5
<u><i>Pseudupeneus prayensis</i></u>	3	4	3	9	16	12		5	3	+	4	1
<u><i>Solea senegalensis</i></u>	2	8	5	33	20	28	17		8	32	14	26
<u><i>Loligo vulgaris</i></u>		13	7		+	+					3	1
<u><i>Octopus vulgaris</i></u>								8	4	3	39	15
Total	37 spp.	45 spp.	55 spp.	44 spp.	44 spp.	60 spp.	29 spp.	40 spp.	49 spp.	46 spp.	38 spp.	56 spp.
	891	2957	1924	1970	488	1335	1197	1070	1133	2407	2236	2353

Remarks. Underline: target species, *: top five CPUAs in each category, +: CUPA less than 1.

Mean CUPA of each areas are simply sum of CUPA divided by number of stations.

Table 3.19 continued.

(B) Al-Awam survey area. I: Phase 1 cold season

Top 5 ranked species	North					Central					South					Total
	Stratum				Total	Stratum				Total	Stratum				Total	
	20-30m	30-80m	80-200m	200-400m		20-30m	30-80m	80-200m	200-400m		20-30m	30-80m	80-200m	200-400m		
<i>Raja miraletus</i>	15	4	20		9	4	38	10		15	* 692	20	4		109	41
<i>Raja straeleni</i>			55	* 379	68		16	206		75			38	5	13	55
<i>Pterothrissus belloci</i>			186		38			308	33	107		79	* 552	21	220	122
<i>Chlorophthalmus agassizi</i>			+	201	32			* 673	* 1770	* 460			97	* 381	69	227
<i>Brotula barbata</i>			12		2		2	152	246	84		* 312	* 568	229	* 345	140
<i>Caelorhynchus caelorhynchus caelorhynchus</i>				* 758	120				195	26				141	13	48
<u><i>Merluccius senegalensis</i></u>		* 261	* 574	* 1202	* 390		61	* 668	* 2760	* 615		145	* 401	* 1094	* 300	* 460
<i>Hoplostethus cadonati</i>														* 289	27	8
<u><i>Zeus faber</i></u>		19	225		44	+	* 194	418		217	29	89	241		123	142
<i>Capros aper</i>		1	10	* 3469	* 550			112	2	37		+	6		2	166
<i>Helicolenus dactylopterus dactylopterus</i>			+		2			20	* 6750	* 907		+	+	* 953	91	* 416
<i>Pontinus kuhlii</i>			24	* 9954	* 1575			* 680	* 664	315		3	* 603	* 957	294	* 651
<i>Synagrops microlepis</i>	2		* 564		90		+	375	* 822	235		* 399	345	100	* 296	214
<u><i>Epinephelus aeneus</i></u>	16				4	115	64			41	* 87				12	22
<i>Brachydeuterus auritus</i>			+		+			1		+	* 1862		1		266	80
<i>Plectorhynchus mediterraneus</i>		17	27		12	* 825	61	63		155		6	3		2	70
<i>Dentex macrophthalmus</i>	3	3	* 526		85	8	* 606	* 2655	23	* 1132		1	136	* 476	17	219
<i>Dentex maroccanus</i>		13	64		15		* 388	134		200		* 847	33		* 374	202
<i>Diplodus bellottii</i>	6	* 292			124											34
<u><i>Pagellus bellottii</i></u>	* 87	* 650			* 296	* 506	* 290	38		196	* 111	57			40	177
<u><i>Pseudupeneus pravensis</i></u>	4	13			6	* 497	73			96	6	37			17	48
<i>Uranoscopus sp.</i>	* 34	36			24	1	23	1		9		34	24		23	17
<i>Gobiidae</i>	3	* 236	40		106		8	2		4	10	20	5		12	34
<u><i>Acanthurus monroviae</i></u>						* 219		28		38						16
<u><i>Trichiurus lepturus</i></u>			* 243		38		3	17	20	9	* 300	* 304	67	23	198	74
<i>Syacium micrurum</i>	* 88	3			24	10	1			2	76	4			13	11
<i>Loligo vulgaris</i>	* 100	176			101	73	1	3		11	9	4			3	33
<i>Ocotopus vulgaris</i>	* 186	* 205	* 487	18	* 215	* 284	* 643	* 612	2	* 499	68	* 456	383	1	* 333	* 372
<u><i>Mustelus mustelus</i></u>		25			10											3
<u><i>Mugil capurrii</i></u>								13		4						2
<u><i>Pagrus caeruleostictus</i></u>						51	33			20	59				8	11
<i>Dentex angolensis</i>			235		37		44	65		39	3	54	21		31	36
<i>Dentex canariensis</i>	7	10			6	128	133	57		89	25	4			5	41
<u><i>Argyrosomus regius</i></u>											4				1	+
<i>Sepia officinalis</i>	8	4			4						52	4			9	4
<i>Penaeus notialis</i>		+			+	+	+			+	2	2			1	+
<u><i>Parapenaeus longirostris</i></u>			1	3	1			8	83	14		8	16	134	21	13
<u><i>Palinurus mauritanicus</i></u>					5											+
Total	34 spp.	58 spp.	48 spp.	47 spp.	119 spp.	43 spp.	69 spp.	76 spp.	44 spp.	124 spp.	4+ spp.	69 spp.	72 spp.	34 spp.	125 spp.	179 spp.
	650	2244	4237	17265	4511	3038	3230	8930	15606	6754	3728	3333	4514	4715	3915	5294

Remarks. Underline: target species, *, top five CPUs in each category, +: CPUA less than 1.

Mean CPUA of each areas are simply sum of CPUA divided by number of stations.

Table 3.19 continued.

(B) Al-Awam survey area. III: Phase 2 cold season

Top 5 ranked species	North					Central					South					Total
	Stratum				Total	Stratum				Total	Stratum				Total	
	3-20m	20-30m	30-80m	80-200m		3-20m	20-30m	30-80m	80-200m		200-400m	3-20m	20-30m	30-80m		
<u>Mustelus mustelus</u>	* 813		28		* 269	4				1	3				1	58
<i>Raja miraletus</i>	16	4	2		6	37	46			17	68	* 283	74	12	74	35
<i>Pteromylicus boninus</i>							* 378			34						15
<i>Pterothrissus belloti</i>				95	13			202	3	45	13		82	* 191	34	79
<i>Chlorophthalmus agassizii</i>				28	4			* 1343	* 297	* 325		2	* 937	* 184	250	230
<i>Malacocephalus occidentalis</i>								47	* 226	31			5	143	13	18
<u>Merluccius polli</u>			1	72	10			24	* 490	* 1462	245		142	161	* 255	105
<u>Merluccius senegalensis</u>		2	* 304	* 1098	* 261			4	24	186	23		7	27	132	20
<i>Halobatrachus didactylus</i>	258	59	3		94	112	* 48					26	8	13	1	11
<i>Hoplostethus cadonati</i>										10	1				* 1602	134
<u>Zeus faber</u>			7	* 120	19			* 61	131		44	6	2	78	171	68
<i>Halimolentus dactylopterus dactylopterus</i>									9	* 5672	* 506			18	* 734	66
<i>Pontinus kuhli</i>					18	3			* 478	* 355	138		6	* 428	26	111
<i>Synagrops microlepis</i>					3					18	85		47	* 286	15	87
<i>Epigonus telescopus</i>										13	1				* 186	15
<i>Pomadasys incisus</i>	* 5615	* 404			* 1860						126	* 1370	16	33		* 354
<i>Pomadasys subelini</i>											290	118				30
<i>Brachydeuternus auratus</i>	6		* 99		38	89	* 200				50	* 1990	* 1220	3		* 634
<i>Plectorhynchus mediterraneus</i>	* 9414	36			* 3002	* 4503	44	25	25		* 1617	* 4562	96	49	2	* 1167
<u>Pagrus caeruleostictus</u>	275	20			91	* 1013	9	57	1		* 375	* 1100	100	9		* 289
<i>Boops boops</i>		* 121	1		22		12	3	5		3		24	1		3
<i>Dentex macrophthalmus</i>				* 183	26			20	* 1199	62	277			* 187	153	4
<i>Dentex macrocephalus</i>			1	31	4			15	156		38			* 154	100	72
<i>Diplodus sargus cadonati</i>	* 726		2		232							228				57
<i>Diplodus bellotti</i>	* 16357	13			* 5207	55					19	9				2
<u>Pagellus bellottii</u>	323	* 162	* 85		163	371	* 197	* 252	147		244	5	* 150	* 756	1	249
<i>Spondylusoma cantharus</i>	179	* 64	57		89	21	10				8	12		2		3
<i>Galeoides decadactylus</i>	264				84	* 1281	1				* 456	* 1535	1			* 384
<i>Pseudotolithus senegalensis</i>	82				26	481					171	952	* 220	1		263
<u>Pseudupeneus praevalis</u>	39	60	7		26	* 771	39	24	2		284	154	69	37		57
<i>Gobidae</i>			* 122	* 125	62			* 74	3		19		11	118	10	40
<i>Trichurus lepturus</i>	8	3	1	1	4	91		5	43	16	44	329	* 230	* 199	45	34
<i>Microchirus buseanoti</i>			24	98	22		9	* 69	84	1	36			57	30	25
<u>Loligo vulgaris</u>	77	* 111	64		68	83	* 50	3	1		35	28	17	8		11
<i>Octopus vulgaris</i>	25	21	* 103	* 112	65	68	20	* 276	221	3	143			* 202	* 192	113
<u>Muqil capurri</u>												20		5		6
<u>Muqil cephalus</u>												11	10			3
<u>Epinephelus aeneus</u>	2	16			4	23					8	31				8
<i>Dentex angolensis</i>														3		1
<i>Dentex canariensis</i>	476	31	12		161	21	1	15	5		12	24	51	6		14
<i>Argyrosomus regius</i>	142				45	114					41	64		4		17
<i>Solea senegalensis</i>	9	3			3	14	3				5					3
<u>Sepia officinalis</u>	171	16			57	96	2				34	99	25			25
<i>Penaeus notialis</i>	5				2	20					7	8	8			3
<i>Parapenaeus longirostris</i>				8	1				19	9	5			4	40	155
<i>Palinurus mauritanicus</i>															22	2
<i>Panulirus regius</i>																
Total	34 spp	36 spp	43 spp	45 spp	107 spp	92 spp	42 spp	62 spp	74 spp	54 spp	176 spp	72 spp	42 spp	81 spp	71 spp	53 spp
	37675	1260	1014	2283	12897	13612	1169	1126	5998	9313	7379	17527	2683	2741	3424	4654

Remarks: Underline: target species; *: top five CPUs in each category; +: C/P/A less than 1.
Mean C/P/A of each areas are simply sum of C/P/A divided by number of stations.

Table 3.19 continued.

(B) Al-Awam survey area, IV: Phase 2 warm season

Top 5 ranked species	North					Total	Central					Total	South					Total	
	Stratum						Stratum						Stratum						
	3-20m	20-30m	30-80m	80-200m	200-400m		3-20m	20-30m	30-80m	80-200m	200-400m		3-20m	20-30m	30-80m	80-200m	200-400m		
<i>Leptocnaris smitti</i>	111	* 762	152			188	530	244	* 107		175	82		24		31	127		
<i>Mustelus mustelus</i>	* 2468	* 4006	* 991	17		* 1422								97		32	329		
<i>Raja miraleus</i>	1	29	41			20		104			26	23	* 316	3		112	55		
<i>Gymnura altavela</i>	223		264			143	148	295			85	164	* 306			82	97		
<i>Rhinopiera marginata</i>							278	306			135	* 1467				* 400	198		
<i>Pterothrissus bellotti</i>				* 1400		200			107	254	44			* 145	295	55	82		
<i>Arenus heudelotii</i>	83	* 252	51			71	65	* 401	50		77	175	* 388	41		108	87		
<i>Chlorophthalmus agassizii</i>				17	150	24			* 119	* 2781	299			48	* 3523	329	248		
<i>Malacocephalus occidentalis</i>					* 848	121				73	7			1	13	1	51		
<i>Caelorhynchus caelorhynchus caelorhynchus</i>					* 1419	203					322	32			114	10	63		
<i>Merluccius polli</i>				2	145	21			* 370	* 4541	* 519			* 155	* 6317	* 602	437		
<i>Merluccius senegalensis</i>				* 292	* 1094	198			68	332	35			44	16	9	62		
<i>Zenopsis conchifer</i>				2	341	49			3	* 1230	123			2	* 1124	103	99		
<i>Antigonia capros</i>					* 14415	* 2059											* 460		
<i>Helicolenus dactylopterus dactylopterus</i>				17	* 5148	738			17	* 7437	* 747			45	* 831	84	* 512		
<i>Pontinus kuhli</i>				36	14	7			* 140	353	60			* 507	200	110	66		
<i>Synagrops microlepis</i>				* 752	99	122			* 1197	* 1232	333			* 481	* 639	146	220		
<i>Eucinostomus melanopterus</i>							32	53			17	113	* 358	23		82	36		
<i>Pomadasys incisus</i>	* 4310	11	* 2986			* 1960	* 1559	* 482	* 118		* 662	174	300	179		144	* 770		
<i>Pomadasys jubelini</i>							* 507	23	2		195	* 2290	246	14		* 659	313		
<i>Brachydeuterus auritus</i>	3		23			9	266	* 382	* 209		190	381	* 326	* 858	1	* 430	254		
<i>Plectorhynchus mediterraneus</i>	187	130	293			166	* 562	1	34		219	185	3			51	148		
<i>Pagrus caeruleostictus</i>	* 6952	35	31			* 1341	* 406	11	61		168	344	131	7		112	411		
<i>Baops baops</i>	+		4			1	5		* 1433		360		+	15	1	5	155		
<i>Dentex maroccanus</i>				+	9	1			15	12	6			116	* 139	64	25		
<i>Diplodus bellottii</i>	* 16625	54	* 719			* 2448	285	4			107	4				1	* 816		
<i>Pagellus bellottii</i>	119	* 958	* 2133			972	36	* 478	* 1909		* 539	7	46	* 964		329	* 562		
<i>Galeoides decadactylus</i>	80		12			20	* 1274	199	24		504	* 1850	269	16		* 542	409		
<i>Pseudotolithus senegalensis</i>								131	5		14	* 491	46	2		140	55		
<i>Umbra canariensis</i>			50	3		19		4	1	7	2	7		* 265	1	91	37		
<i>Pseudupeneus novaeis</i>	5	76	75	1		40	287	* 422	62		165	87	* 538	76		114	120		
<i>Drepane africana</i>							151	5			57	* 445	7			122	67		
<i>Trichurus lepturus</i>	4	16	12	* 286		49	9	171	11	* 2904	369	* 568	239	127	107	17	113		
<i>Stromateus fiatola</i>	* 1077	66	6			217	34	34	5		17	130	30			39	70		
<i>Psettodes belcheri</i>	214	* 147				62	1										14		
<i>Lolium vulgare</i>	15	24	* 363	40		150			63	18	19			72	7	25	51		
<i>Octopus vulgaris</i>	13	90	308	* 633	17	225	53	205	105	94	83		21	* 229	61	90	117		
<i>Muul cephalus</i>			6			2											1		
<i>Zeus faber</i>			32	130		31			17	44	4	12		3	16	4	14		
<i>Epinophelus aeneus</i>	35	57	68			41	11				4	20	2	1		6	13		
<i>Dentex angolensis</i>									3		1								
<i>Dentex canariensis</i>	187	78	20			54	24		11		12	1		7		5	18		
<i>Aciurosumus rexius</i>	14		32			15	70	14	11		30	9	2	5		4	18		
<i>Notea senegalensis</i>		3	2			1													
<i>Senia officinalis</i>	46	136	19			35	36	80	34		50	32	24	6		14	25		
<i>Penaeus notialis</i>		+	1					1	5		1	2	1	1		1	1		
<i>Parapenaeus longirostris</i>				16	26	6				4	47			12	41	7	6		
<i>Palinurus mauritanicus</i>					21	3											1		
<i>Panulirus regius</i>	15					3						5				1	1		
Total	55 spp.	45 spp.	66 spp.	42 spp.	35 spp.	128 spp.	67 spp.	49 spp.	63 spp.	53 spp.	42 spp.	148 spp.	58 spp.	47 spp.	77 spp.	52 spp.	27 spp.	146 spp.	187 spp.
	35108	7660	9334	4133	25272	15538	7446	4409	4603	5502	19862	7333	10440	3563	3814	1956	13498	6133	8745

Remarks: Underline: target species, *: top five CPUs in each category, +: CPUA less than 1.
Mean CPUA of each areas are simply sum of CPUA divided by number of stations.

3.4.4 Estimated stock size of nectobenthos and its dominant species

Table 3.20 (A:*Amrigue*, B:*Al-Awam*) shows the estimated stock size of the nectobenthos by stratum in each survey season, as well as the top five species. It also indicates the estimated stock size of the target species even when not included among the top five. Of course, the stock size of the nectobenthos didn't contain the species of Carangidae and plagic fishes.

(1) Estimated stock size

1) *Amrigue* survey area

The total stock size of the entire survey area was between 12,000 and 24,631 tonnes. While in Phase 1, the percentage of the stock size in the Banc d'Arguin to the total stock size showed much variation according to the season (19% in the cold season against 76% in the warm season), it was relatively stable in Phase 2 (about 50% for both seasons).

The mean rate of CPUA of the the *Amrigue* and the *Al-Awam* over total catches, obtained through the comparative experiment of fishing efficiency, was 0.0250 (see Table 3.11). Total stock size estimated through this relative fishing efficiency rate was between 500,000 and 1 million tonnes, an amount well above the stock size of the area surveyed by the *Al-Awam*. If this estimate is any close to the real stock size, it gives an idea of the significance of the role it plays in the aggregation of the nectobenthos in the Northern coastal area.

2) *Al-Awam* survey area

As a reminder, the extent of the area not surveyed by the *Al-Awam* was: in Phase 1, the coastal area in the cold season and the Northern coastal area in the warm season; in Phase 2, the 200-400m stratum of the Northern area in the cold season. Also, the 400-600m stratum was surveyed by but a single trawl in the Central area in the Phase 1 warm season.

a) Total stock size of the entire survey area

Considering the coastal area not surveyed, below are the total stock size of the area by separate Phases.

In Phase 1, the total stock size in the cold and warm seasons was 117,748 and 151,068 tonnes respectively (not including the stock size at 3-20m and 400-600m strata for to compare between both seasons in same point of view), that in the warm season was about 30,000 tonnes larger than that in the cold season. As for the geographical distribution, the ration of the stock size in different areas to the total stock size of the entire area were 24 and 30% for the Northern area (respectively in the cold and warm seasons, as below), 50 and 46% for the Central area and 26 and 24% for the Southern area. As for the vertical distribution, the percentages of stock size per stratum were 5 and 17% for the 20-30m stratum, 21 and 26% for the 30-80m stratum, 37 and 14% for the 80-200m stratum and 37 and 43% for the 200-400m stratum.

In the same way, in Phase 2, the total stock size in the warm season was about 50,000 tonnes larger than that in the cold season: 352,567 tonnes in the cold season (survey not conducted at the 200-400m stratum in the Northern area) and 402,594 tonnes in the warm season. As for the geographical distribution, the Northern area accounted for 65 and 68% (in the cold and warm seasons respectively) of the total stock size, the Central area both 20% and the Southern area 14 and 12%. The fact that the ratio corresponding to the Northern area was much higher than that recorded for Phase 1 is essentially explained by the high amount of stock size at

the 3-20m stratum (about 230,000 tonnes in the cold season and about 270,000 tonnes in the warm season, almost half of the total in both seasons). Vertically, the stock size at each stratum was from the shallowest (20-30m stratum) to the deepest (200-400m stratum), 81 and 61%, 1 and 4%, both 13%, 8 and 6%, and 5 and 16% in the cold and warm seasons respectively.

As for the seasonal and temporal variation in the stock size through the four strata where it was estimated (20-30, 30-80, 80-200 and 200-400m), the following results were obtained:

- 20-30m stratum

The stock size at this stratum in each season was 6,376, 25,885, 4,764 and 16,433 tonnes serially. It increased over the warm season and decreased over the cold season. Comparing the stock size in the same season between Phase 1 and Phase 2, that in Phase 2 was smaller than that in Phase 1 in both seasons.

- 30-80m stratum

The stock size at this stratum in each season was 24,629, 39,348, 13,432 and 50,568 tonnes serially. It increased over the warm season and decreased over the cold season.

- 80-200m stratum

The stock size at this stratum in each season was 43,227, 20,507, 29,573 and 25,884 tonnes serially. The seasonal change of the stock size was different from it at abovementioned strata. It decreased over the warm season and increased over the cold season.

- 200-400m stratum

The stock size at this stratum in each season was 43,516, 65,329, 18,156 and 65,922 tonnes serially. The seasonal change of the stock size was nearly the same as that at the 30-80m stratum, but more emphasized.

b) Stock size by area

b-1) Northern area

Supposing the stock size of the coastal area in Phase 1 was in the same order (about 200,000 tonnes) as that in Phase 2, the total stock size of the last two years were about 250,000–300,000 tonnes and roughly stable. At all strata deeper than 30 m water depth, it was observed indeed that the most recent stocks were more significant.

b-2) Central area

Supposing the stock size of the coastal area in the Phase 1 cold season was in the same order (about 30,000 tonnes) as that in the Phase 2 cold season, the total stock size in each season was about 70,000 to 90,000 tonnes and generally stable. The stock size at the three strata except 80-200m stratum was low in the cold season and high in the warm season, but the opposite occurred at the 80-200m stratum.

b-3) Southern area

Supposing the stock size of the coastal area in the Phase 1 cold season was in the same order (about 20,000 tonnes) as that in the Phase 2 cold season, the total stock size in each season was about 50,000 to

65,000 and nearly stable. The seasonal change of the stock size by stratum was similar to that in the Central area.

(2) Dominant species

Table 3.20 (A: *Amrigue*, B *Al-Awam*) presents, for each survey season and each stratum, the top five species in terms of high estimated stock size. They correspond to species selected as the top five in CPUA by stratum (see Table 3.19).

Here, predominant species are considered those within the top five of total stock size in any season, adopting a lower cutoff amount of 1,000 tonnes for the area surveyed by the *Amrigue* and a minimum of 10,000 tonnes for that explored by the *Al-Awam*. Geographical and vertical distributions for the stock size of them were both investigated. However, the target species, the southern pink shrimp *Penaeus notialis* in the *Amrigue* survey area and the smooth-hound *Mustelus mustelus*, the Senegalese hake *Merluccius senegalensis*, the bluespotted seabream *Pagrus caeruleostictus*, the red pandora *Pagellus bellottii* in the *Al-Awam* survey area, were described in 3.4.5.

1) Amrigue survey area

a) Spiny butterfly ray *Gymnura altavela*

The total stock size by season was 1,060, 1,000, 2,070 and 1,356 tonnes respectively. The stock size in the Banc d'Arguin accounted for 10%, 37%, 10% and 71% of the total stock size by season respectively.

b) Smoothmouth sea catfish *Arius heudelotii*

The total stock size in Phase 1 cold and warm seasons was 355 and 247 tonnes respectively. And that in the Phase 2 cold and warm seasons was 2,975 and 2,974 tonnes. The stock size in the Banc d'Arguin comprised 97%, 90%, 12% and 47% of the total stock size by season respectively.

c) Rubberlip grunt *Plectorhinchus mediterraneus*

The total stock size by season was about 100 tonnes or less, except for 1,066 tonnes of that in the Phase 1 cold season. 90% or more of the total stock size in each season was found in other area.

d) Senegal sea bream *Diplodus bellottii*

The total stock size by season was 10,522, 1,783, 1,227 and 6,311 tonnes respectively. About 90% of the total stock size was found in the Banc d'Arguin in all seasons except in the Phase 1 warm season.

e) Lesser African threadfin *Galeoides decadactylus*

The total stock size was 258 and 665 tonnes in the cold season and it was between 4,058 and 4,916 tonnes in the warm season. Over 80% of the total stock size was found in the Banc d'Arguin in all seasons except in the Phase 1 warm season.

f) Planehead filefish *Stephanolepis hispidus*

The total stock size by season was 1,402, 421, 544 and 1,123 tonnes respectively. 71 to 98% of the total stock size was found in other area in all seasons except in the Phase 2 cold season.

The stock size of the target species in each season accounted for 6 and 10% of the total stock size.

2) *Al-Awam* survey area

The description below is based on the data presented in Table 3.20 (B). For a number of dominant species, data are lacking in some survey seasons in the Tables.

a) Blackbelly rosefish *Helicolenus dactylopterus dactylopterus*

The total stock size by season was 10,821, 28,651, 9,049 and 16,652 tonnes respectively. It increased over the warm season and decreased over the cold season. The total stock size in both the seasons was larger in Phase 1 than in Phase 2. The stock size of the Central area in the cold and warm seasons accounted for about 90% and 60% of the total stock size respectively. The stock size at the 200-400m stratum in each season made up more than 80%, in many cases near 100%, of the total stock size.

b) Offshore rockfish *Pontinus kuhlii*

The total stock size by season was 14,973, 3,518, 3,194 and 2,689 tonnes respectively. The total stock size decreased gradually and its decline from the cold season to the warm season in Phase 1 was remarkably steep. The subarea accounted for about 60% of the total stock size by season shifted from the Northern area to the Southern area. Also, the stratum made up about 60% of the stock size in each area was 80-200m stratum except for the Northern area in the Phase 1 cold season and the Central area in the Phase 2 warm season.

c) Thinlip splitfin *Synagrops microlepis*

The total stock size by season was 5,082, 11,731, 2,074 and 8,149 tonnes respectively. It increased over the warm season and decreased over the cold season. The total stock size in the cold and warm seasons was larger in Phase 1 than in Phase 2. More than 80% of the total stock size by season was found in the Central and Southern areas. Over 50% of the stock size in each subarea was found at the 80-200m, especially its ratio was high in Phase 2.

d) Bastard grunt *Pomadasys incisus*

The total stock size in all seasons except in the Phase 1 cold season was 10,566, 36,843 and 40,271 tonnes respectively. It was increased over time. Nearly 90% of the total stock size in the Phase 2 cold and warm seasons was found in the Northern area, and more than 74% of the stock size in the Northern area was found at the 3-20m stratum. In the Phase 2 cold season, nearly 100% of the stock size in each area was distributed at the 3-20m stratum. However, the ratio of the stock size at 3-20m stratum to the stock size in each area decreased, especially in the Southern area.

e) Rubberlip grunt *Plectorhinchus mediterraneus*

The total stock size in the Phase 2 cold season was 75,394 tonnes, but that in the other three seasons was less than 10,000 tonnes. The geographical and vertical variation of the stock size was here considered, restricted to Phase 2 in which the data at the 3-20m stratum was obtained. The stock size in the Northern area accounted for over 50% of the total stock size in the cold and warm seasons. The ratio of the stock size in each subarea to the total stock size decreased from the Northern area to the Southern area. Nearly 100% of the stock size in each area was found at the 3-20m stratum except the Northern area in the warm season, which showed about 50%.

f) Large-eye dentex *Dentex macrophthlamus*

The total stock size in all seasons except in the Phase 2 warm season was 11,558, 1,706 and 4,646 tonnes respectively. It was inclined to increase over the cold season and to decrease over the warm season. About 80% of the total stock size was found in the Central area, and 80% or more of the stock size in the Central area was at the 80-200m stratum.

g) Senegal sea bream *Diplodus bellottii*

The total stock size was considered only for Phase 2 in which the data at the 3-20m stratum could be obtained. It was about 100,000 tonnes (about 25% of the total stock size for all nectobenthos) in the cold and warm seasons, and over 97% of it was found at the 3-20m stratum in the Northern area.

In addition to the predominant species described above, three other species had stocks over 10,000 tonnes of the total stock size:

In the Phase 2 warm season, the Benguela hake *Merluccius polli* (14,505 tonnes; about 40% of this total stock size was found at the 200-400m stratum in the Central and Southern areas), the deep-body boarfish *Antigonia capros* (13,490 tonnes; 100% of this total stock size was at the 200-400m stratum in the Northern area) and the largehead hairtail *Trichiurus lepturus* (10,081 tonnes; 80% of this total stock size was found at the 80-200m stratum in the Central area).

The stock size of the target species accounted for 10% in the Phase 2 cold season and about 25% in the other three seasons of the total stock.

Table 3.20 Estimated stock size of nectobenthos (tonnes) and top five species.

(A) Amrigue survey area

Top 5 ranked species	Phase 1						Phase 2					
	Cold season			Warm seson			Cold season			Warm seson		
	Banc d'Arguin	Other	Total	Banc d'Arguin	Other	Total	Banc d'Arguin	Other	Total	Banc d'Arguin	Other	Total
<i>Rhinobatos rhinobatos</i>		59	59		* 206	206	62	* 430	491			
<i>Gymnura altavela</i>	102	* 958	* 1060	374	* 626	* 1000	* 2070		* 2070	* 968	388	* 1356
<i>Arius heudelotii</i>	* 346	8	355	228	19	247	* 371	* 2605	* 2975	* 1400	* 1573	* 2974
<i>Halobatrachus didactylus</i>		361	361		7	7		279	279	+	* 664	665
<i>Serranus scriba</i>		527	527	34	* 289	324		114	114		258	258
<i>Pomadasys incisus</i>	* 360	156	516	139	17	156	61	22	83	282	340	622
<i>Plectorhinchus mediterraneus</i>	14	* 1052	* 1066	+		+		25	25	16	114	130
<i>Diplodus bellottii</i>	* 1158	* 9364	* 10522	* 1723	60	* 1783	129	* 1098	* 1227	* 810	* 5500	* 6311
<i>Galeoides decadactylus</i>	105	153	258	* 4050	8	* 4058	* 632	33	* 665	* 4098	* 818	* 4916
<i>Sciaena umbra</i>		* 571	571									
<i>Drepane africana</i>	10		10	* 845		* 845				25		25
<i>Psettodes belcheri</i>	107	82	189	* 402	* 316	* 718	* 599	268	* 867	551	135	686
<i>Cynoglossus senegalensis</i>				* 445	94	539	284	277	560	22		22
<i>Stephanolepis hispidus</i>	* 238	* 1164	* 1402	62	* 359	421	253	* 292	544	28	* 1095	1123
<i>Ephippion guttifer</i>	* 624	438	* 1062	71		71	* 298		298	569		569
<u><i>Sepia officinalis</i></u>	179	542	722				189	* 281	470	207	177	384
<u><i>Penaeus notialis</i></u>	12	60	72	305	46	351	98	23	121	* 925	417	* 1342
<u><i>Mustelus mustelus</i></u>	135	33	168									
<u><i>Epinephelus aeneus</i></u>		24	24	3		3	4		4	3		3
<u><i>Pagrus caeruleostictus</i></u>	41		41	8	112	120	16	1	17	58		58
<u><i>Dentex canariensis</i></u>	58	65	123	22	44	66	5	16	21		74	74
<u><i>Pagellus bellottii</i></u>	29		29	7	7	14				12	1	13
<u><i>Argyrosomus regius</i></u>				2	10	11				17	56	72
<u><i>Pseudupeneus pragensis</i></u>	12	25	37	42	96	137		32	32	1	21	22
<u><i>Solea senegalensis</i></u>	11	45	56	157	119	275	80		80	150	82	232
<u><i>Loligo vulgaris</i></u>		78	78		+	+					20	20
<u><i>Octopus vulgaris</i></u>								48	48	16	228	244
All of other species	684	1718	2402	423	450	873	528	480	1008	1255	1256	2511
Total	4226	17483	21709	9341	2885	12227	5677	6323	12000	11414	13217	24631

Remarks : Underline; target species, *: top five stock sizes in each category, +: stock size less than 1 tonne.

Table 3.20 continued.

(B) Al-Awam survey area, I: Phase I cold season

Top 5 ranked species	North					Central					South					Total
	Stratum				Total	Stratum				Total	Stratum				Total	
	20-30m	30-80m	80-200m	200-400m		20-30m	30-80m	80-200m	200-400m		20-30m	30-80m	80-200m	200-400m		
<i>Raja miraletus</i>	19	10	23		53	4	81	29		113	* 558	52	12		621	787
<i>Raja straeleni</i>			63	* 354	417		46	569		615			116	5	120	1152
<i>Pterothrissus belloci</i>			213	51	265			852	48	900		208	* 1669	21	1898	3063
<i>Chlorophthalmus agassizi</i>			+	188	188			* 1863	* 2571	* 4434			293	* 379	672	5295
<i>Brotula barbata</i>			14		14		6	421	357	784		* 824	* 1718	228	* 2770	3568
<i>Caelorhynchus caelorhynchus caelorhynchus</i>				* 710	710				283	283			140	140	140	1133
<u><i>Merluccius senegalensis</i></u>		* 764	* 658	* 1125	* 2547		176	* 1849	* 4010	* 6035		382	* 1213	* 1088	* 2683	* 11264
<i>Hoplostethus cadenati</i>														* 287	287	287
<u><i>Zeus faber</i></u>		57	258		314	+	* 557	1156		1712	23	234	729		987	3014
<i>Capros aper</i>		3	11	* 3247	* 3261			309	2	311		+	18		19	3591
<i>Helicolenus dactylopterus dactylopterus</i>		+		10	11			55	* 9807	* 9862			1	* 948	948	* 10821
<i>Pontinus kuhlii</i>			28	* 9315	* 9343			* 1881	* 965	2846		9	* 1824	* 951	* 2784	* 14973
<i>Synagrops microlepis</i>	3		* 647	2	652		+	1039	* 1195	2234		* 1053	1044	99	2196	5082
<u><i>Epinephelus aeneus</i></u>	20				20	96	184			280	* 70				70	371
<i>Brachydeuterus auritus</i>			1		1					2	* 1499	2			1501	1505
<i>Plectorhynchus mediterraneus</i>		51	31		82	* 689	174	176		1038	5	7			12	1133
<i>Dentex macrophthalmus</i>	4	8	* 603		615	7	* 1740	* 7348	33	* 9128	1	358	* 1439	17	1816	* 11558
<i>Dentex maroccanus</i>		37	74		111		* 1113	370		1483		* 2236	100		* 2336	3930
<i>Diplodus bellottii</i>	7	* 854			861											861
<u><i>Pagellus bellottii</i></u>	* 112	* 1901			* 2012	* 422	* 833	106		1360	* 89	151			241	3613
<u><i>Pseudupeneus prayensis</i></u>	5	38			43	* 415	211			626	5	99			103	772
<i>Uranoscopus sp.</i>	* 44	106			150	1	65	2		68		89	73		163	381
<i>Gobiidae</i>	3	* 689	46		739		24	5		28	8	53	14		75	842
<i>Acanthurus monroviae</i>						* 183		77		259						259
<i>Trichiurus lepturus</i>			* 278		278		9	46	29	84	* 241	* 804	202	23	1270	1633
<i>Syacium muerurum</i>	* 113	10			123	8	4			12	61	12			73	207
<i>Loligo vulgaris</i>	* 129	515			644	61	4	7		72	7	11			18	734
<i>Octopus vulgaris</i>	* 240	* 599	* 559	17	* 1415	* 237	* 1844	* 1692	3	* 3777	55	* 1204	1160	1	* 2420	* 7612
<u><i>Mustelus mustelus</i></u>		73			73											73
<u><i>Mugil capurrii</i></u>								37		37						37
<u><i>Pagrus caeruleostictus</i></u>						42	95			137	48				48	185
<u><i>Dentex angolensis</i></u>			270		270		125	181		306	3	143	64		210	785
<u><i>Dentex canariensis</i></u>	9	28			37	107	381	158		646	20	12			32	715
<u><i>Argyrosomus regius</i></u>											3				3	3
<i>Sepia officinalis</i>	10	11			21						42	11			52	74
<u><i>Penaeus notialis</i></u>		1			1	+	+			1	1	5			6	9
<u><i>Parapenaeus longirostris</i></u>			1	3	5			23	121	144		22	47	133	202	351
<u><i>Palinurus mauritanicus</i></u>				4	4											4
All of other species	120	803	1081	1130	3135	265	1598	4458	3247	9568	263	820	1916	369	3368	16070
Total	338	6561	4860	16157	28417	2536	9269	24712	22672	59188	3002	8800	13654	4687	30144	117748

Remarks : Underline: target species, *: top five stock sizes in each category, +: stock size less than 1 tonne.

Table 3.20 continued.

3-60

Top 5 ranked species	North						Central						South						Total							
	Stratum					Total	Stratum					Total	Stratum					Total								
	20-30m	30-80m	80-200m	200-400m	400-600m		3-20m	20-30m	30-80m	80-200m	200-400m		400-600m	3-20m	20-30m	30-80m	80-200m			200-400m						
<i>Galeus polii</i>					* 620	620													620							
<i>Mustelus mustelus</i>	* 2150	24				2174									73				73	2247						
<i>Centrophorus uyato</i>											* 137	137								137						
<i>Rhinobatos rhinobatus</i>	* 805	59				864	151	164	548			663	292	165	589				843	2371						
<i>Raja miraletus</i>	24					24			344	55		399	1	* 1230	55	12			1298	1721						
<i>Myliobatis aquila</i>	73					73	469					469	* 2922						2922	3464						
<i>Pterothrissus bellotti</i>										18	528	546	29		5	* 511	80		624	1171						
<i>Chlorophthalmus agassizi</i>				130	180	180				8	* 4884	32	* 4924			* 21	* 1856	1857	1857	6961						
<i>Malacocephalus laevis</i>											28	* 278	306						306	306						
<i>Coelorhynchus coelorhynchus</i>					* 1809	1809						1249	2					390	390	3450						
<i>Laemonema yarrilli</i>													* 289	289					289	289						
<i>Merluccius senegalensis</i>		3	85	* 1199	1287	1287				* 825	* 6971	* 1679	* 9475		* 885	* 1930	2816	* 13578	13578							
<i>Zeus faber</i>		97	* 137	233	233	233		43		87			130		31	121	151	151	514							
<i>Zenopsis canchifer</i>			2	116	118	118				116	* 1626	1742			9	* 427	436	436	2296							
<i>Capros aper</i>			3	* 2817	* 2822	2822				20	43	63			1		1	1	2886							
<i>Helicolenus dactylopterus dactylopterus</i>		9	4	* 8961	* 8975	8975				47	* 17768	* 223	* 18038			281	* 1357	1639	* 28651							
<i>Pomxus kuhli</i>			3	3	3	3						* 1282	1001				* 860	372	1232	3518						
<i>Synagrops microlepis</i>				* 1787	173	1960						* 3521	* 3419	12			* 1353	* 1465	2819	* 11731						
<i>Pomadouris incisus</i>	* 3583	30			* 3613	3613						1501	* 1182	217					2900	* 3347	142	565	* 4053	* 10566		
<i>Pomadouris perotaci</i>												2175	16						2191	1420	30		1450	3641		
<i>Pomadouris rogeri</i>												151	3	17					170	* 3227	52	146	* 3425	3595		
<i>Eraochelys curvatus</i>	19				19	19				136	* 1260	* 982	1						2399	340	152	* 3334	* 583	* 4409	6828	
<i>Plectorhynchus mediterraneus</i>	1	+			1	1						* 1266	10	211					1488	* 5548	101	259		* 5908	7397	
<i>Dentex macrophthalmus</i>			4	* 175	14	193						21	* 1274	53					1348				165	1706		
<i>Diplodus bellotti</i>	* 6609	* 148			* 6757	6757						830							830	75			75	7662		
<i>Lithognathus mormyrus</i>												232	* 638	69					940	7	* 1065			1072	2012	
<i>Pagellus acarne</i>				* 253	253	253																		253	253	
<i>Pagellus bellotti</i>	304	* 3179			* 3483	3483						525	* 884	* 7656	65				* 9129	+	* 312	* 4717		* 5029	* 17641	
<i>Galeorides decadactylus</i>	22				22	22						* 1742	9	24					1775	1642	* 358	6		1986	3783	
<i>Pseudupeneus praeensis</i>	18	12			30	30						631	315	* 664	1				1662	292	* 259	* 1065		1615	3308	
<i>Drepane africana</i>												47							47	* 2045	9	15		2069	2116	
<i>Gobiidae</i>		35	* 454		489	489						95							95			4	65	65	653	
<i>... piurus</i>		1			1	2						84	43	86	* 459	68			739	135	23	287	38	77	561	1302
<i>... tris</i>	* 699	* 1789	1		2490	2490						2	* 436	198					636			350	488	838	3964	
<i>... garis</i>	115	* 1565	* 665	10	2355	2355						375	* 390	* 1129	247	16			2157		* 300	* 1199	262	1761	6274	
<i>... rri</i>																				15				15	15	
<i>... acneus</i>	19				19	19						70							70	76	3	4		82	172	
<i>... aleostictus</i>												751	162						913	1298	67	132		1497	2410	
<i>... lensis</i>																						152	67	219	219	
<i>... riensis</i>	69	91			159	159						265	68	174					508	5	124	373		502	1170	
<i>Argyrosomus regius</i>	217				217	217						84	13						97	330				336	644	
<i>Solea senegalensis</i>	9	19			28	28																			28	
<i>Sepia officinalis</i>	45	138		1	184	184						318	38	171	49				577	71	109	106	102	387	1148	
<i>Penaeus notialis</i>	6				6	6						7	+	3					10	31		1		31	47	
<i>Parapenaeus longirostris</i>			6	30	56	56						8	54	4	67							10	14	85	108	252
<i>Palinurus mauritanicus</i>				6	6	6																			6	
<i>Panulirus regius</i>												5													5	
All of other species	1591	638	377	1323	3929	3929	5192	474	1705	1447	1416	245	10476	5589	587	2503	1097	896	10672	25073						
Total	16378	8096	3701	17278	45454	17078	5672	14297	9826	39124	2900	88897	28736	3834	16955	6981	8926	65433	199783							

Remarks : Underline; target species, *, top five stock sizes in each category, +; stock size less than 1 tonne.

Table 3.20 continued.

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Top 5 ranked species	(B) Al-Awam survey area, 1: Phase 2 cold season														
	North				Central					South					Total
	Stratum			Total	Stratum				Total	Stratum				Total	
3-20m	20-30m	30-80m	80-200m		3-20m	20-30m	30-80m	80-200m		200-400m	3-20m	20-30m	30-80m		80-200m
<i>Mustelus mustelus</i>	* 4896		80	* 4887	10				10					4	4902
<i>Raja miraletus</i>	94	5	5	104	102	39			140	101	* 228	195	38	562	806
<i>Pteromylaeus bovinus</i>						* 315			315						315
<i>Pteroinnissus bellaci</i>				109	109		+	560	5	565	19		216	* 577	845
<i>Chlorophthalmus agassizii</i>				32	32		-	* 3717	* 431	* 4148		4	* 2833	* 185	* 3019
<i>Malacoccephalus occidentalis</i>								130	* 329	459			14	142	157
<i>Merluccius polli</i>			3	82	85		69	* 1356	* 2123	* 3548		376	487	* 255	1116
<i>Merluccius senegalensis</i>		3	* 889	* 1259	2151		12	67	270	350		19	81	131	250
<i>Halobatrachus didactylus</i>	1524	77	8	1609	310	* 40	1			352	38	6	34	3	81
<i>Haplosetheus cadenanii</i>									15	15				* 1592	1592
<i>Zeus faber</i>			21	* 137	159			* 175	363	537	9	2	206	516	732
<i>Helicolenus daeylepterus daeylepterus</i>				+	+			24	* 8240	* 8264			55	* 730	785
<i>Pentirus kuhli</i>				21	21				* 1322	* 516	1838		15	* 1294	36
<i>Synagrops microlepis</i>				3	3		+		* 1038	27	1066		124	* 866	15
<i>Epigonus telescopus</i>									19	19					* 184
<i>Pomadasys incisus</i>	* 33197	* 521		* 33719	989				989	* 2035	13	88		* 2136	* 36843
<i>Pomadasys jubelini</i>									2269	176					176
<i>Brachydeuterus curinus</i>	35		* 291	325	249	* 167	1		416	* 2956	* 982	9		* 3947	4689
<i>Plectrolinchus mediterraneus</i>	* 55653	46		* 55699	* 12530	57	70	69	* 12706	* 6775	77	130	7	* 6989	* 75594
<i>Pagrus caeruleostictus</i>	1624	26		1650	* 2820	8	163	4	2994	* 1634	81	23			1737
<i>Boops boops</i>	1	* 156	2	160	160	10	10	13	33		19	1		21	213
<i>Dentex macropthalmus</i>				* 215	215		56	* 3318	91	3465			* 494	468	4
<i>Dentex maroccanus</i>			2	36	37		43	451	474				* 406	304	710
<i>Diplodus sargus cadenanii</i>	* 4290		6	* 4296							339				339
<i>Diplodus bellottii</i>	* 96700	16		* 96716	152				152	14				14	* 96882
<i>Pagellus bellottii</i>	1912	* 209	* 248	2370	1033	* 165	* 723	408	2329	5	* 121	* 1996	3		2128
<i>Spondylitoma cantharus</i>	1056	* 82	165	1303	60	8			68	18			5	22	1393
<i>Galeoides decadactylus</i>	1559			1559	* 3564	1	1		* 3566	* 2280	1			* 2281	* 7406
<i>Pseudotolithus senegalensis</i>	484			484	1358				1358	1414	* 177	3			1594
<i>Pseudupeneus pruvenis</i>	232	77	19	329	* 2146	33	69	5	2253	228	56	98			382
Gobiidae	2		* 358	* 143	503			* 211	9	220		9	312	31	551
<i>Trichurus lepturus</i>	47	4	4	55	254		14	118	23	408	489	* 185	* 526	137	33
<i>Micruchirus buscanon</i>	2	1	70	113	185	+	7	* 198	232	1	439		151	91	242
<i>Loligo vulgaris</i>	454	* 144	187	785	231	* 42	8	2	282	41	14	22			77
<i>Octopus vulgaris</i>	149	27	* 302	* 128	607	190	16	* 792	612	4	1614	16	* 534	* 581	1132
<i>Mugil capurrii</i>										30				15	45
<i>Mugil cephalus</i>						83			83	15					98
<i>Epinephelus aeneus</i>	11	21		32	64				64	46					46
<i>Dentex argenteus</i>													8		8
<i>Dentex canariensis</i>	2815	40	34	2889	60	1	42	14	117	35	41	17			94
<i>Paralichthys olivacea</i>	840			840	318				318	95	1	10			106
<i>Paralichthys mediterranea</i>	37	4		40	40	2			42						83
<i>Paralichthys mediterranea</i>	1011	21		1032	268	2			270	132	21				153
<i>Paralichthys mediterranea</i>	31			31	56	+			56	12	6				18
<i>Paralichthys mediterranea</i>				9	9			+	51	13	64		10	122	154
<i>Paralichthys mediterranea</i>														22	22
<i>Paralichthys mediterranea</i>										2					2
Other species	14172	146	269	329	14915	8740	82	573	2736	1424	13555	7070	124	1219	1820
Total	222735	1626	2965	2618	229945	37875	976	3230	16598	13530	72209	26052	2162	7237	10356

Time, larger species; *, top five stock sizes in each category; +, stock size less than 1 tonne.

Table 3.20 continued.

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Top 5 ranked species	North							Central						South						Total
	Stratum					Total	Stratum					Total	Stratum					Total		
	3-20m	20-30m	30-80m	80-200m	200-400m		3-20m	20-30m	30-80m	80-200m	200-400m		3-20m	20-30m	30-80m	80-200m	200-400m			
<i>Leptocharias mitini</i>	650	* 983	445			2087	918	203	* 306		1428	122		64		187	3701			
<i>Mustelus mustelus</i>	* 14591	* 5169	* 2898	19		* 22677								256		256	* 22933			
<i>Raja marulius</i>	5	38	120			161			298		298	34		* 834	10	878	1337			
<i>Gymnura altavela</i>	1321		773			2094	412	246			658	244	* 247			491	3243			
<i>Rhinoptera marginata</i>							773	255			1029	* 2179				2179	3267			
<i>Pterothrissus bellaci</i>				* 1606		1606			297	369	666			1	* 439	293	733			
<i>Arius heudeloti</i>	491	* 325	148			965	180	* 354	143		657	260	* 313	108		680	2302			
<i>Chlorophthalmus agassizi</i>				19	141	160				* 330	* 4040	4369			144	* 3502	* 3647			
<i>Melaecephalus occidentalis</i>					* 793	793					106	106			4	13	17			
<i>Caetornichus caetornichus caetornichus</i>					* 1328	1328					468	468				113	113			
<i>Merluccius polii</i>				2	136	138				* 1023	* 6598	* 7620			* 468	* 6279	* 6747			
<i>Merluccius senegalensis</i>					* 335	* 1023	1358				189	337	526			132	16			
<i>Zenopsis conulifer</i>				3	319	322					7	* 1787	1794			6	* 1117			
<i>Antigonia capros</i>					* 13490	* 13490					+	+			+	+	13490			
<i>Heterostichus decaplopus decaplopus</i>				20	* 4817	4837				47	* 10804	* 10851			137	* 826	963			
<i>Pontinus kuhlii</i>				42	13	54					* 389	513	901			* 1534	198			
<i>Synagrops microlepis</i>					* 863	92	955				* 3313	* 1790	* 5103			* 1455	* 635			
<i>Eucinostomus melanopterus</i>							89	44			154	167	* 288	61		517	650			
<i>Pomadasys incisus</i>	* 25478	14	* 8729			* 34221	* 4337	* 402	* 338		5077	259	242	473		973	* 40271			
<i>Pomadasys jubelini</i>							* 1411	19	5		1435	* 3402	198	37		* 3637	5072			
<i>Brachydeuterus auritus</i>	17		67			84	84	* 318	* 599		1658	566	* 262	* 2265	3	* 3097	4839			
<i>Plectorhynchus mediterraneus</i>	1107	167	856			2130	* 1564	+	98		1662	275	3			277	4069			
<i>Parus caeruleus tictus</i>	* 41097	45	91			* 41233	* 1128	9	174		1311	511	106	19		636	* 43180			
<i>Boops boops</i>						11	14		* 4113		4127			40	4	44	4183			
<i>Dentex maroccanus</i>				11		11			44	33	76			305	* 421	726	813			
<i>Diplodus bellotti</i>	* 98258	69	* 2101			100459	794	3			797	6				6	* 101262			
<i>Parallus bellotti</i>	702	* 1236	* 6238			6176	101	* 399	* 5479		* 5979	10	37	* 2546		2593	* 16748			
<i>Galeoides decadenus</i>	472		35			507	* 3545	166	69		3780	* 2748	216	41		* 3005	7292			
<i>Pseudotolithus senegalensis</i>								109	14		123	* 729	37	6		772	855			
<i>Umbrina canariensis</i>			146	3		149		4	4	19	26	11		* 701	4	716	891			
<i>Pseudupeneus prayensis</i>	30	97	219	1		347	800	* 352	178		1330	129	* 434	200		763	2440			
<i>Drepane africana</i>							420	4			425	* 561	6			667	1092			
<i>Trichurus lepturus</i>	23	20	36	* 328		408	25	143	31	* 8035	536	* 8771	355	102	283	50	112			
<i>Stromateus fiavola</i>	* 6366	86	18			6470	95	28	13		136	194	24			217	6824			
<i>Psettodes belcheri</i>	1265	* 190				1455	3				3						1458			
<i>Loligo vulgaris</i>	89	31	* 1061	46		1227			181	51	232			190	23	212	1671			
<i>Octopus vulgaris</i>	77	117	899	* 726	16	1835	146	171	303	261	881		17	* 604	183	804	3521			
<i>Mugil cephalus</i>						19											19			
<i>Zeus faber</i>			94	150		244			49	122	5	177		7	49	56	477			
<i>Epinephelus aeneus</i>	209	74	197			480	30	+			30	30	2	2		34	545			
<i>Dentex angolensis</i>										9	9						9			
<i>Dentex canariensis</i>	1106	100	58			1264	67	+	31		98	1		20		21	1383			
<i>Arius caninus regalis</i>	82		94			176	195	11	31		238	13	2	13		27	442			
<i>Solea senegalensis</i>						9											9			
<i>Sepia officinalis</i>	274	175	55			504	102	67	96		265	47	19	17		85	852			
<i>Parasurus notialis</i>						4	1	1	14		15	3	1	2		6	25			
<i>Parapenaeus longirostris</i>				19	25	43				12	68	79		6	36	40	83			
<i>Palinurus mauritanicus</i>						19											19			
<i>Panulirus regalis</i>	91					91										8	99			
All of other species	13721	942	1871	550	1438	18522	2829	388	600	1089	1435	6341	2543	314	969	816	271			
Total	207561	9884	27290	4741	23651	273126	20719	3680	13209	15227	28855	81690	15506	2870	10069	5917	15417			

Remarks : Underline: target species, *: top five stock sizes in each category, +, stock size less than 1 tonne.

3.4.5 CPUA and stock size of target species

(I) Fishes

Among the 14 target species, the golden grey mullet *Liza aurata*, the flathead mullet *Mugil cephalus* and the narrowhead grey mullet *Mugil capurrii* are not presented here, as the first species was not caught and the CPUA in entire area of the later two species was lower than 10 through the survey. Below are the CPUA and the estimated stock size of the 11 target species .

1) Smooth-hound *Mustelus mustelus*

The smooth-hound is distributed over an area defined by the eastern Atlantic coast, from the British Isles and France down to South Africa, and including the Mediterranean and the Madeira and Canary Islands. It is a demersal species that occurs near the ocean floor, over a portion of the continental shelf and the continental slope, from the coast to water depths of at least 350m (FishBase database, <http://www.fishbase.org>, hereinafter referred to as «Fish Base»).

a) Distribution of CPUA

Figure 3.10 illustrates, for each survey season, the CPUA distribution for the smooth-hound. This species is distributed mainly in the Northern shallow area of less than 80m in water depth.

b) CPUA by stratum

Table 3.21 shows the CPUA of the smooth-hound obtained at each stratum and in each area.

In the *Amrigue* survey area, the smooth-hound was captured only in the Phase 1 cold season. The mean CPUA by area was 29 in the Banc d'Arguin and 6 in the other area. It is likely that, if this species was not caught outside the Phase 1 cold season, it does not mean necessarily that it is absent from the Northern coastal area, but that the catch capacity of the *Amrigue* and its gear (beam trawl) was too low (see Figure 3.10). This is also conceivable for the species, among those described below, that are littoral and high swimming, as well as for large-size fishes.

On the other hand, in the *Al-Awam* survey area, the mean CPUA by stratum varied between 3 and 4,006, except naturally where the smooth-hound was not captured. The mean CPUA of above 1,000 was found only at areas shallower than 30m water depth in the Northern area and in the warm season. The highest CPUA recorded throughout the survey was 10,337 (Phase 2 warm season, 20-30m stratum in the Northern area).

c) Stock size

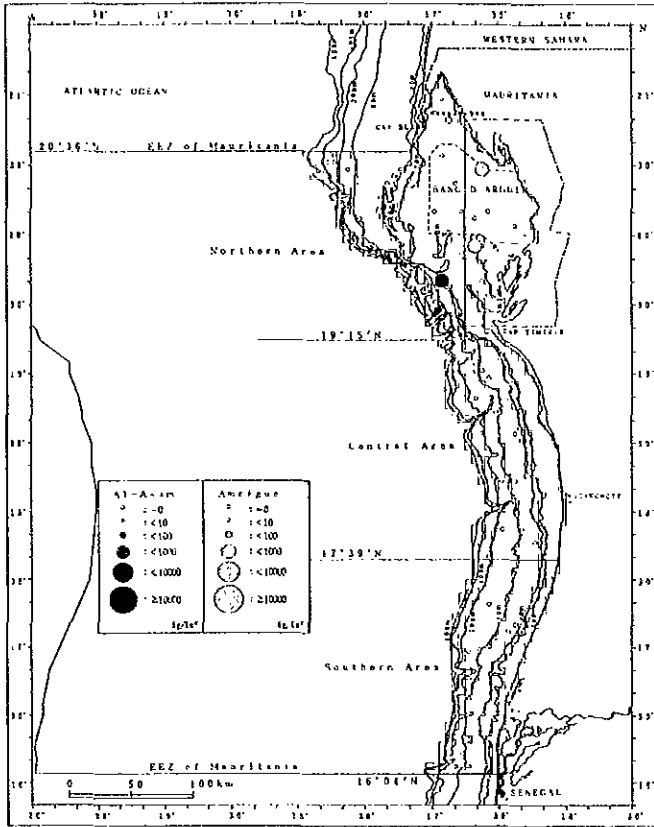
Table 3.22 shows estimates of the stock size for the smooth-hound.

In the *Amrigue* survey area, the estimate of the total stock size in the Phase 1 cold season was 168 tonnes with a 95% confidence interval of ± 207 tonnes (coefficient of variation, hereinafter referred to as CV, of 57%). The stock size in the Banc d'Arguin accounted for 80% of the total stock.

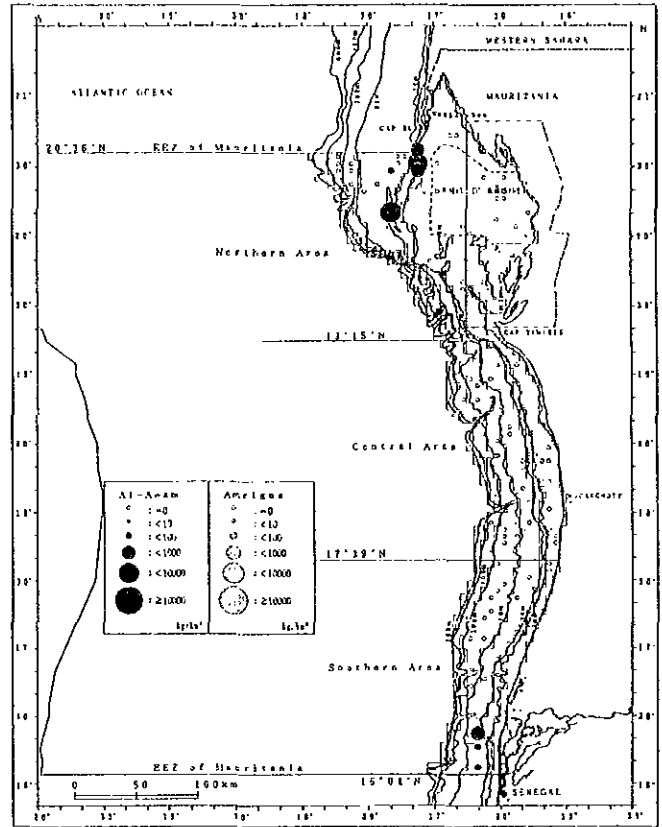
In the *Al-Awam* survey area, the estimate of the total stock size in the Phase 1 cold and warm seasons was 73 and 2,247 tonnes respectively (95% confidence interval of ± 121 and $\pm 2,386$ tonnes, CV of 100 and 50% respectively). In Phase 2, the estimate of the total stock size in the cold and warm seasons was respectively 4,902 and 22,933 tonnes (95% confidence interval of $\pm 2,043$ and $\pm 8,383$ tonnes, CV of

51 and 35%). In both phases, 97 to 100% of the total stock size were concentrated in the Northern area. As for the vertical distribution of the total stock size, in the cold season, the ratio at the 3-20m stratum was by far the highest (98%), while in the warm season, the ratios of four strata (3-20m to 80-200m) were respectively 64%, 23%, 14% and <1%. Results in Phase 2 suggest that migrating stocks of this species were more significant in the warm season than in the cold season, and that fishes live along the coast in the cold season, but offshore in the warm season.

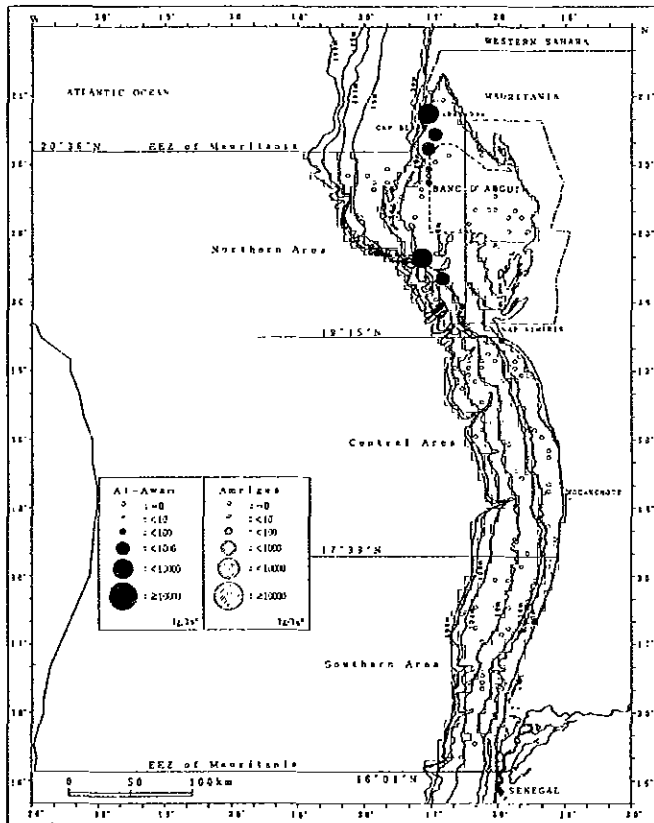
(A) Phase 1 cold season



(B) Phase 1 warm season



(C) Phase 2 cold season



(D) Phase 2 warm season

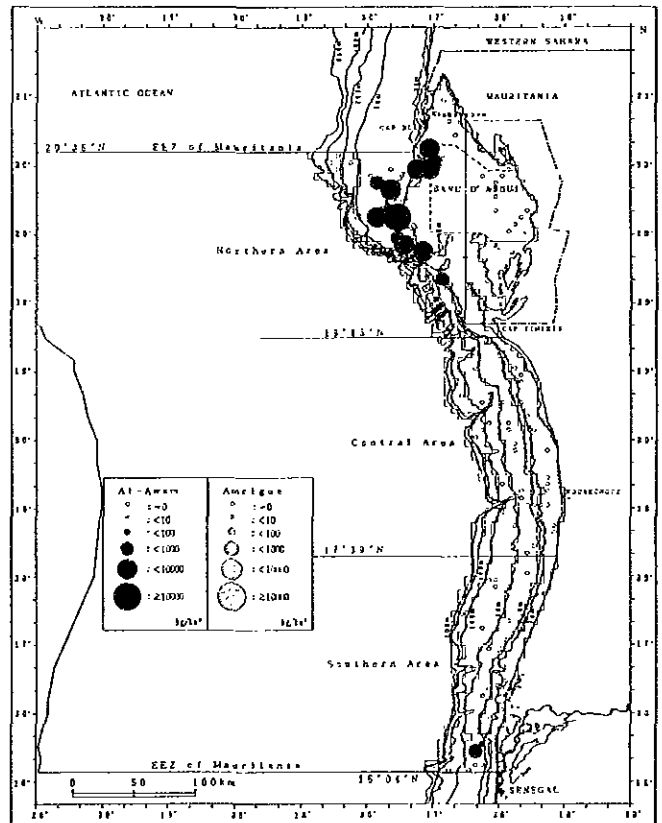


Figure 3.10 Distribution of CPUA for smooth-hound *Mustelus mustelus*.

Table 3.21 CPUA of smooth-hound *Mustelus mustelus* by stratum.

(A) Amrigue survey area

Northern coastal area (Stratum: 3-20m)	Phase 1							Phase 2							
	Cold season			Warm season				Cold season			Warm season				
	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range			
Banc d'Arguin	28.5	56.5	0.0 ~ 130.7	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0
Other	5.6	16.9	0.0 ~ 50.7	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0

(B) Al-Awam survey area

Subarea	Stratum	Phase 1							Phase 2						
		Cold season			Warm season				Cold season			Warm season			
		Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range		
North	3-20m	-	-	-	-	-	-	-	813.0	1,125.4	24.7 ~ 3,052.2	2,468.0	2,278.7	712.9 ~ 5,715.4	
	20-30m	0.0	0.0	0.0 ~ 0.0	1,665.9	1,728.3	322.8 ~ 4,095.6	0.0	0.0	0.0 ~ 0.0	4,006.0	5,547.1	0.0 ~ 10,337.3		
	30-80m	24.9	70.4	0.0 ~ 199.1	8.4	20.5	0.0 ~ 50.2	27.5	77.8	0.0 ~ 220.1	991.2	1,144.7	0.0 ~ 2,942.0		
	80-200m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	16.7	28.9	0.0 ~ 50.0		
	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	-	-	-	-	0.0	0.0	0.0 ~ 0.0	
Central	400-600m	-	-	-	-	-	-	-	-	-	-	-	-	-	
	3-20m	-	-	-	0.0	0.0	0.0 ~ 0.0	3.8	15.1	0.0 ~ 60.4	0.0	0.0	0.0 ~ 0.0		
	20-30m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0		
	30-80m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0		
	80-200m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0		
South	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0		
	400-600m	-	-	-	0.0	0.0	0.0 ~ 0.0	-	-	-	-	-	-		
	3-20m	-	-	-	0.0	0.0	0.0 ~ 0.0	3.0	9.0	0.0 ~ 27.0	0.0	0.0	0.0 ~ 0.0		
	20-30m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0		
	30-80m	0.0	0.0	0.0 ~ 0.0	27.7	60.2	0.0 ~ 189.9	0.0	0.0	0.0 ~ 0.0	97.0	300.0	0.0 ~ 999.3		
80-200m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0			
200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0			
400-600m	-	-	-	-	-	-	-	-	-	-	-	-	-		

Remarks: S. D.: standard deviation, - : no trawl.

Table 3.22 Stock size estimates of smooth-hound *Mustelus mustelus*.

(A) *Amrigue* survey area

Subarea	Stratum	Area in km ²	Stock size in tonnes			
			Phase 1		Phase 2	
			Cold season	Warm season	Cold season	Warm season
North	Banc d'Arguin	4,741	135	0	0	0
	3-20m	5,912	33	0	0	0
	Total	10,653	168	0	0	0
95% confidence interval			±207	±0	±0	±0
CV: coefficient of variation			57%	0%	0%	0%

(B) *Al-Awam* survey area

Subarea	Stratum	Area in km ²	Stock size in tonnes			
			Phase 1		Phase 2	
			Cold season	Warm season	Cold season	Warm season
North	3-20m	5,912	-	-	4,806	14,591
	20-30m	1,290	0	2,150	0	5,169
	30-80m	2,924	73	24	80	2,898
	80-200m	1,147	0	0	0	19
	200-400m	936	0	0	-	0
	Total	12,209	73	2,174	4,887	22,677
	95% confidence interval			±129	±3,309	±3,360
CV: coefficient of variation			100%	51%	51%	35%
Central	3-20m	2,783	-	0	10	0
	20-30m	835	0	0	0	0
	30-80m	2,870	0	0	0	0
	80-200m	2,767	0	0	0	0
	200-400m	1,453	0	0	0	0
	400-600m	848	-	0	-	-
	Total	8,773	0	0	10	0
95% confidence interval			±0	±0	±28	±0
CV: coefficient of variation			0%	0%	100%	0%
South	3-20m	1,485	-	0	4	0
	20-30m	805	0	0	0	0
	30-80m	2,640	0	73	0	256
	80-200m	3,025	0	0	0	0
	200-400m	994	0	0	0	0
	Total	8,949	0	73	4	256
	95% confidence interval			±0	±105	±13
CV: coefficient of variation			0%	69%	100%	93%
All	3-20m	10,180	-	0	4,821	14,591
	20-30m	2,930	0	2,150	0	5,169
	30-80m	8,434	73	97	80	3,154
	80-200m	6,939	0	0	0	19
	200-400m	3,383	0	0	0	0
	400-600m	848	-	0	-	-
	Total	22,534	73	2,247	4,902	22,933
95% confidence interval			±121	±2,386	±2,043	±8,383
CV: coefficient of variation			100%	50%	51%	35%

Remark. - : no trawl.

2) Senegalese hake *Merluccius senegalensis*

The percentage of bycatch in Senegalese hake catch in Phase 1 was not known, but it is very likely that the Benguela hake *Merluccius polli* could have been captured along with this species. This was confirmed by a re-identification study done in the CNROP laboratory on a sample of specimens captured in Phase 1.

It should therefore be kept aware that the results obtained for this species in Phase 1 risk being masked by Benguela hake by catch. On the other hand, in Phase 2, these two species were carefully sorted and precise data were obtained for each species. The conclusions presented below are thus based mainly on Phase 2 results. Data related to the Benguela hake are also indicated for reference.

The Senegalese hake, distributed over the East Atlantic from the coasts of Northwest Africa (Morocco) to those of Guinea, is a demersal species that occur at water depths between 15 and 500m (Fish Base). In the territorial waters of the IRM, the Senegalese hake occurs over the continental shelf and the continental slope at a water depth of 800m. But it is mostly found at depths between 200 and 600m, with a maximum density between 150 and 300m (Dah *et al.*, 1991).

The Benguela hake occurs in the tropical portion of the East Atlantic, off West Africa, from Mauritania to Angola. According to certain reports, it is also found in Southwest Africa near Cape Frio, off Namibia. It inhabits depths between 50 and 600m, its habitat being of the bathydemersal type (FishBase).

a) Distribution of CPOA

Figures 3.11.1 and 3.11.2 show the CPOA distribution of the Senegalese hake and the Benguela hake. The CPOA mixed both hakes in Phase 1 is shown in these Figures, but the following restricts to Phase 2. It appears that both species migrate during the warm season toward deeper areas: while in the cold season they were found in water depths of about 30m, in the warm season they occurred at over 80m in water depth. For both species, high CPOA was concentrated at depths below 200m, a phenomenon more accentuated in the warm season. This result is compatible with the migration from inshore to offshore observed during the warm season by the CRODT/CNROP (1988).

While the Benguela hake was distributed mainly south of Cape Timiris, the Senegalese hake is distributed over a very wide area.

In the Amrigue survey area, none of them was collected in the survey period.

b) CPOA by stratum

Tables 3.23.1 and 3.23.2 show the CPOA observed at each stratum in each area for the Senegalese hake and the Benguela hake. The CPOA mixed both hakes in Phase 1 is shown in these Tables, but the following restricts to Phase 2. Except for a single case, the mean CPOA by stratum in both species was the highest at the 200-400m stratum, whatever the season. The mean CPOA by stratum of the Senegalese hake was high in the Northern area, while that of the Benguela hake was high in the Central and Southern areas, particularly high at 200-400m stratum in the warm season (4,541 and 6,317 respectively).

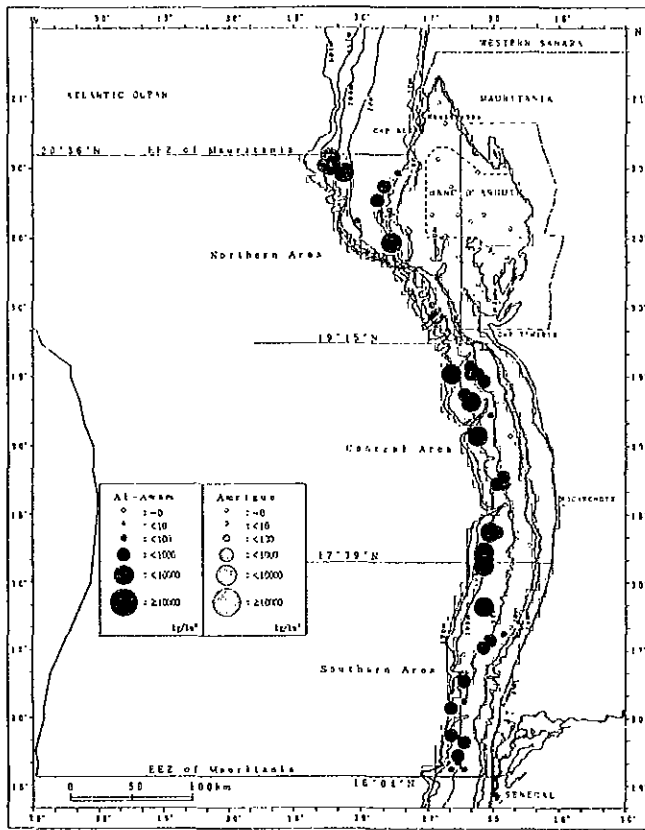
c) Stock size

Tables 3.24.1 and 3.24.2 show estimates of the stock size for the Senegalese hake and the Benguela hake. As it is likely that the estimated stock size in Phase 1 actually included both species, the results obtained in Phase 2 are first described separately for each species, and then presented for both.

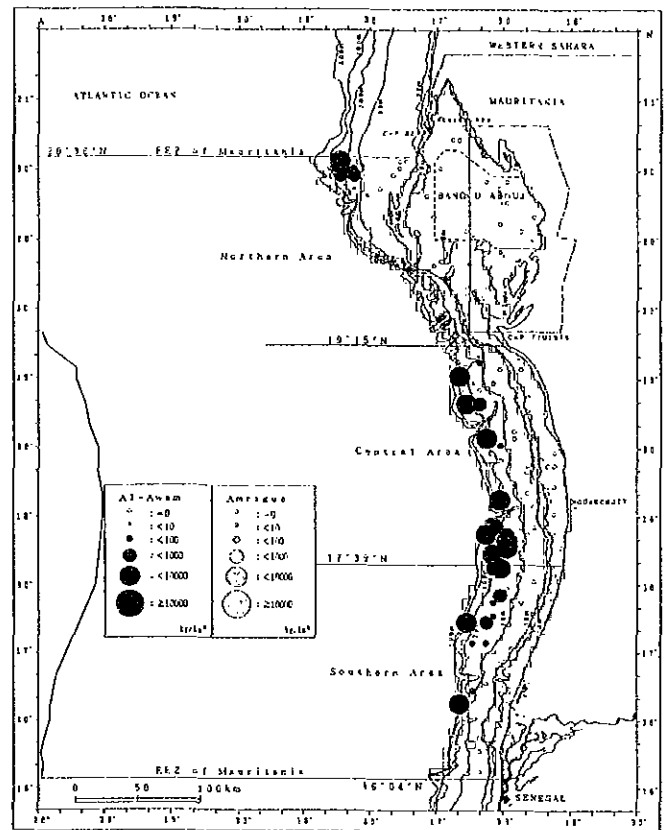
The estimate of the total stock size for the Senegalese hake in the cold and warm seasons in Phase 2 was 2,731 and 2,032 tonnes respectively (95% confidence interval respectively of $\pm 2,021$ and $\pm 1,461$ tonnes, CV of 44 and 21%). The estimate of the total stock size for the Benguela hake was 4,749 and 14,505 tonnes respectively (95% confidence interval of $\pm 2,279$ and $\pm 10,600$ tonnes, CV of 16 and 23%). As for the geographical distribution of the total stock size for the Senegalese hake, the Northern area represented between 67 and 78%, with this ratio progressively declining from north to south. For the Benguela hake, the Central and Southern areas represented respectively 53-75% of the total. In terms of vertical distribution, the Senegalese hake comprised 52% at the 80-200m stratum in the cold season (not surveyed at the 200-400m stratum in the Northern area) and 68% at the 200-400m stratum, while the Benguela hake occupied 50% and 90% at the 200-400m stratum in the cold and warm seasons respectively. During the warm season, the stock size of both species was concentrated at the 200-400m stratum, while in the cold season it tended to migrate into shallower waters. Of course, the estimated stock size of both species did not include the stocks at water depths over 400m (where the stock size in the Central area was estimated from a single trawl: 1,679 tonnes), and the stock size estimation in the entire area was underevaluated.

Considering both species together and that Senegalese hake stocks did include those of the Benguela hake in Phase 1, estimated stock size was, in survey order, 11,264, 13,578, 7,480 and 16,537 tonnes. The total stock size of both species together was low in the cold season and high in the warm season. The Central area comprised 50-70% of the total stock size while the 200-400m stratum took up 55-88% (Phase 2 cold season excepted). Also, analyzing stock composition from the results in Phase 2, the Benguela hake seemed to be dominant, with 63% in the cold season and 88% in the warm season. While Dah *et al.* (1991) indicated that the Senegalese hake was the most among the three hake species (the two above and the common hake *Merluccius merluccius*) caught in the IRM territorial waters, Phase 2 results suggest an evolution in stock composition of the hake species (also, the common hake was not caught).

(A) Phase 1 cold season

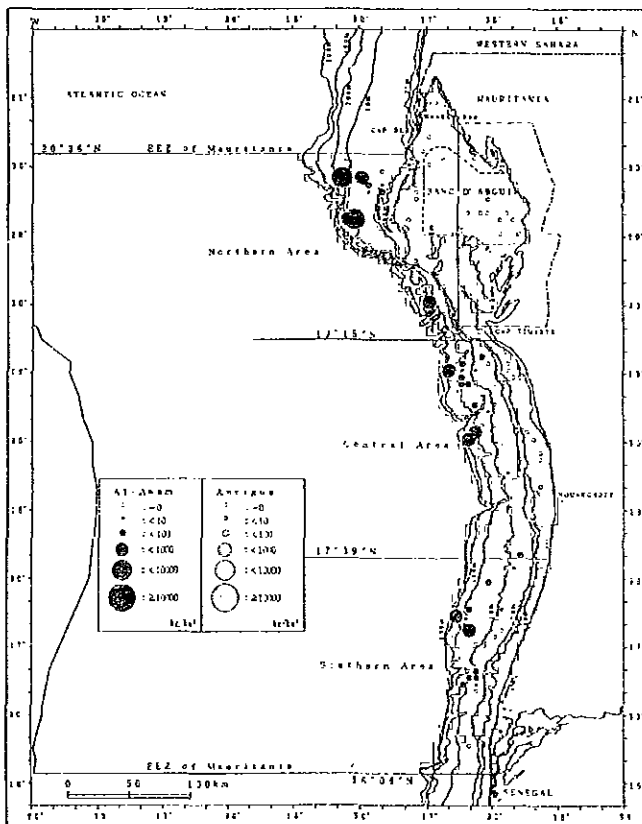


(B) Phase 1 warm season



Remark. The CPUA in (A) and (B) seems to include *Merluccius polli*.

(C) Phase 2 cold season



(D) Phase 2 warm season

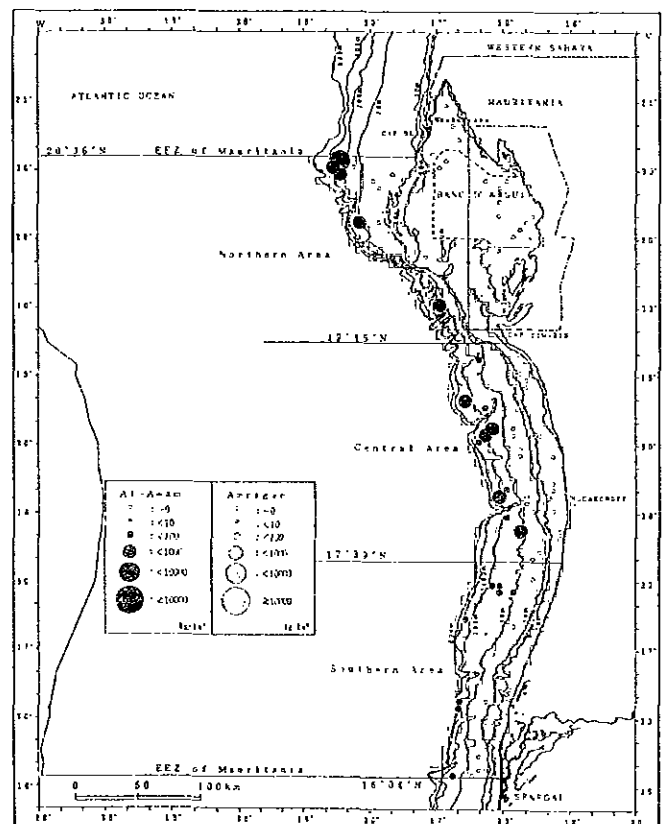
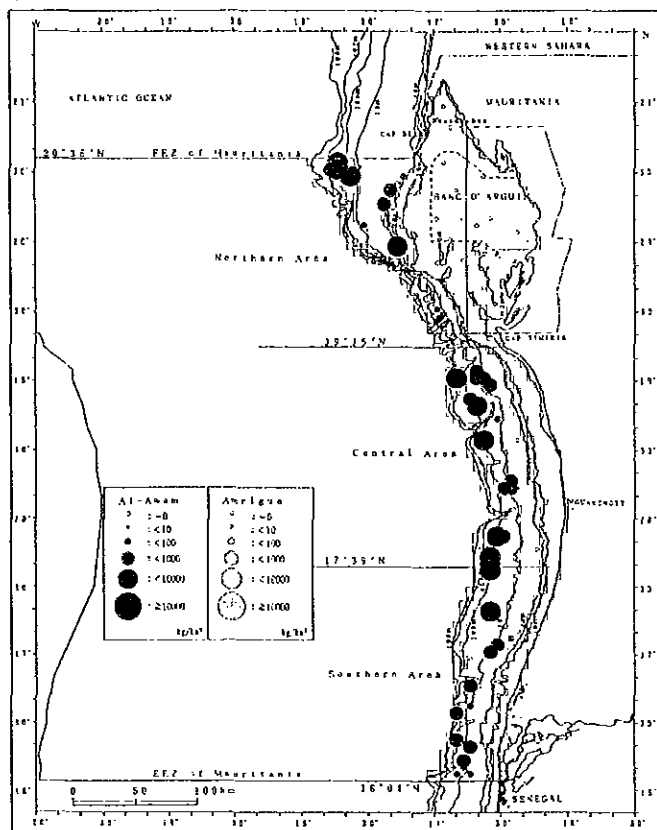
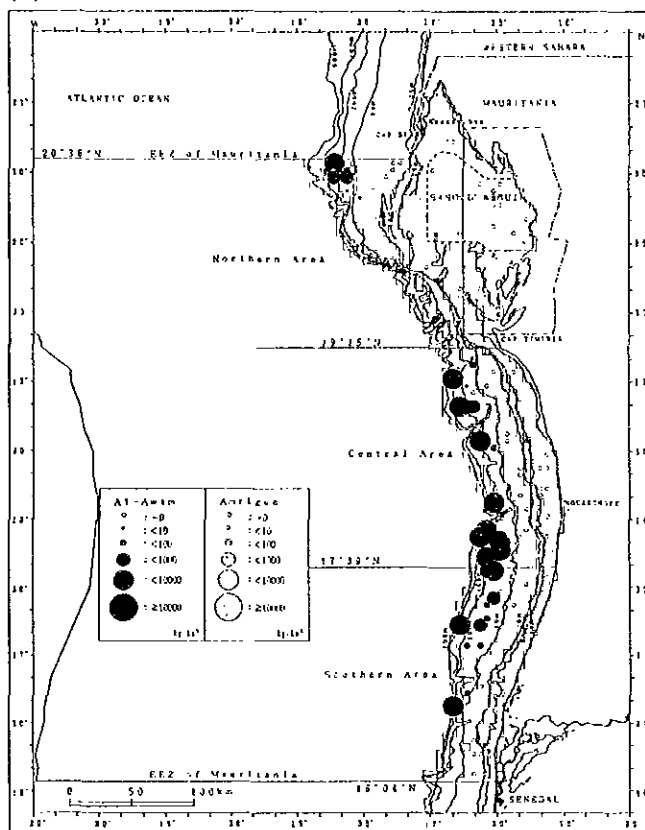


Figure 3.11.1 Distribution of CPUA for Senegalese hake *Merluccius senegalensis*.

(A) Phase 1 cold season

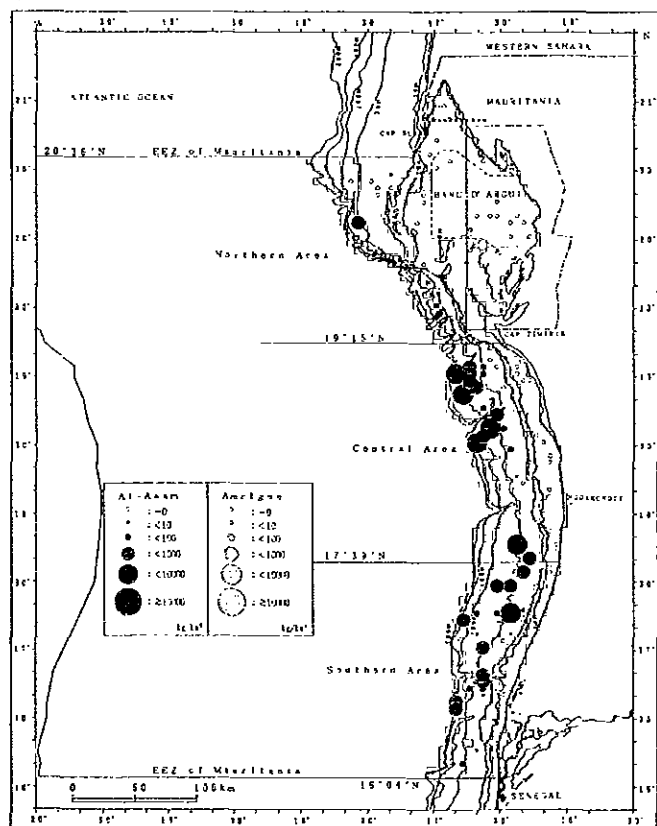


(B) Phase 1 warm season



Remark. The CPUA in (A) and (B) seems to include *Merluccius senegalensis*.

(C) Phase 2 cold season



(D) Phase 2 warm season

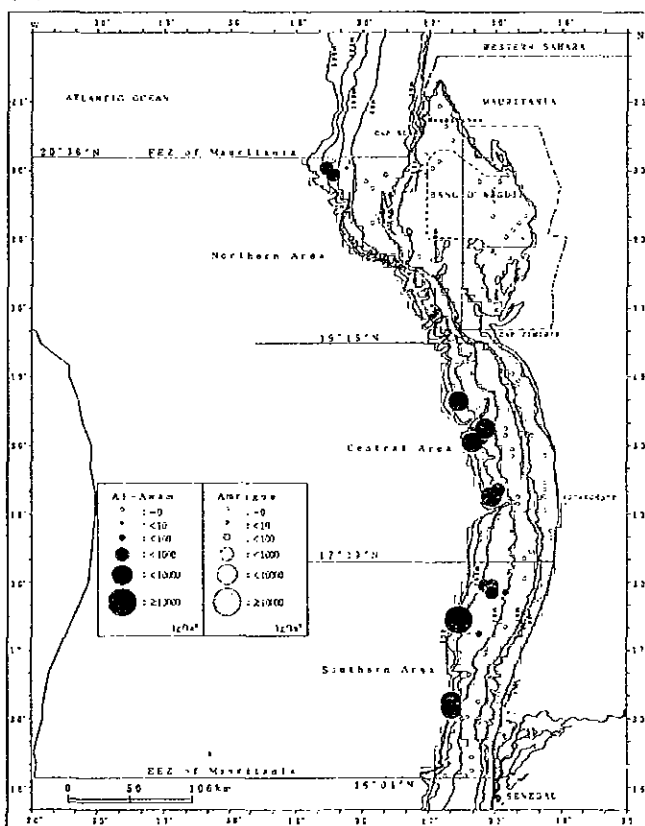


Figure 3.11.2 Distribution of CPUA for Benguela hake *Merluccius polli*.

Table 3.23.1 CUPA of Senegalese hake *Merluccius senegalensis* by stratum.

(A) *Amrique* survey area

Northern coastal area (Stratum: 3-20m)	Phase 1								Phase 2					
	Cold season			Warm season			Cold season			Warm season				
	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range		
Banc d'Arguin	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0		
Other	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0		

(B) *Al-Awam* survey area

Subarea	Stratum	Phase 1						Phase 2					
		Cold season			Warm season			Cold season			Warm season		
		Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range
North	3-20m	-	-	-	-	-	-	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0
	20-30m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	2.5	5.0	0.0 ~ 9.9	0.0	0.0	0.0 ~ 0.0
	30-80m	261.2	498.6	0.0 ~ 1,448.0	1.0	2.5	0.0 ~ 6.0	303.9	714.2	0.0 ~ 2,057.2	0.0	0.0	0.0 ~ 0.0
	80-200m	573.9	979.9	0.0 ~ 1,705.4	74.4	60.9	5.4 ~ 120.4	1,097.7	1,393.3	200.2 ~ 2,702.8	292.0	365.9	0.0 ~ 702.5
	200-400m	1,201.9	606.3	561.6 ~ 1,767.1	1,281.2	500.3	935.3 ~ 1,855.0	-	-	-	1,093.7	566.6	741.7 ~ 1,747.2
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-
Central	3-20m	-	-	-	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0
	20-30m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0
	30-80m	61.3	116.4	0.0 ~ 339.5	0.0	0.0	0.0 ~ 0.0	4.3	8.2	0.0 ~ 24.2	0.0	0.0	0.0 ~ 0.0
	80-200m	668.2	729.1	0.0 ~ 2,086.2	298.1	507.4	0.0 ~ 1,287.5	24.3	26.6	0.0 ~ 65.1	68.1	77.0	5.8 ~ 218.7
	200-400m	2,759.9	1,620.4	1,072.0 ~ 4,457.0	4,798.5	2,492.2	2,345.0 ~ 9,033.7	186.0	159.5	0.0 ~ 377.2	232.1	181.8	33.5 ~ 422.5
	400-600m	-	-	-	1,979.0	0.0	1,979.0 ~ 1,979.0	-	-	-	-	-	-
South	3-20m	-	-	-	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0
	20-30m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0
	30-80m	144.6	231.6	0.0 ~ 693.2	0.0	0.0	0.0 ~ 0.0	7.1	12.7	0.0 ~ 39.5	0.0	0.0	0.0 ~ 0.0
	80-200m	401.1	547.0	0.0 ~ 1,511.0	292.8	550.0	0.0 ~ 1,681.9	26.8	47.0	0.0 ~ 147.8	43.5	29.8	9.4 ~ 76.1
	200-400m	1,094.2	1,155.6	277.1 ~ 1,911.4	1,942.0	1,307.4	525.2 ~ 3,101.9	131.6	227.9	0.0 ~ 394.7	16.0	8.3	11.1 ~ 25.7
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-

Remarks. S. D.: standard deviation, - : no trawl. The CUPA in *Al-Awam* survey area of phase 1 seems to include *Merluccius polli*.

Table 3.23.2 CUPA of Benguela hake *Merluccius polli* by stratum.

(A) *Amrique* survey area

Northern coastal area (Stratum: 3-20m)	Phase 1						Phase 2					
	Cold season			Warm season			Cold season			Warm season		
	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range
Banc d'Arguin	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0
Other	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0

(B) *Al-Awam* survey area

Subarea	Stratum	Phase 1						Phase 2					
		Cold season			Warm season			Cold season			Warm season		
		Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range
North	3-20m	-	-	-	-	-	-	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0
	20-30m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0
	30-80m	261.2	498.6	0.0 ~ 1,448.0	1.0	2.5	0.0 ~ 6.0	0.9	2.6	0.0 ~ 7.5	0.0	0.0	0.0 ~ 0.0
	80-200m	573.9	979.9	0.0 ~ 1,705.4	74.4	60.9	5.4 ~ 120.4	71.7	113.5	0.0 ~ 202.5	1.6	1.4	0.0 ~ 2.7
	200-400m	1,201.9	606.3	561.6 ~ 1,767.1	1,281.2	500.3	935.3 ~ 1,855.0	-	-	-	145.4	137.4	0.0 ~ 273.2
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-
Central	3-20m	-	-	-	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0
	20-30m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0
	30-80m	61.3	116.4	0.0 ~ 339.5	0.0	0.0	0.0 ~ 0.0	23.9	35.4	0.0 ~ 101.5	0.0	0.0	0.0 ~ 0.0
	80-200m	668.2	729.1	0.0 ~ 2,086.2	298.1	507.4	0.0 ~ 1,287.5	489.9	537.4	3.7 ~ 1,565.4	369.6	848.3	0.0 ~ 2,275.6
	200-400m	2,759.9	1,620.4	1,072.0 ~ 4,457.0	4,798.5	2,492.2	2,345.0 ~ 9,033.7	1,461.7	661.8	671.3 ~ 2,291.1	4,541.3	2,782.7	2,369.0 ~ 8,566.5
	400-600m	-	-	-	1,979.0	0.0	1,979.0 ~ 1,979.0	-	-	-	-	-	-
South	3-20m	-	-	-	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0
	20-30m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0
	30-80m	144.6	231.6	0.0 ~ 693.2	0.0	0.0	0.0 ~ 0.0	142.4	323.6	0.0 ~ 1,101.3	0.0	0.0	0.0 ~ 0.0
	80-200m	401.1	547.0	0.0 ~ 1,511.0	292.8	550.0	0.0 ~ 1,681.9	160.9	226.1	3.7 ~ 737.9	154.7	132.9	0.0 ~ 364.3
	200-400m	1,094.2	1,155.6	277.1 ~ 1,911.4	1,942.0	1,307.4	525.2 ~ 3,101.9	255.0	62.5	203.0 ~ 324.3	6,317.0	4,400.7	3,319.1 ~ 11,369.2
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-

Remarks. S. D.: standard deviation, - : no trawl. The CUPA in *Al-Awam* survey area of phase 1 seems to include *Merluccius senegalensis*.

Table 3.24.1 Stock size estimates of Senegalese hake *Merluccius senegalensis*.

(A) *Amrique* survey area

Subarea	Stratum	Area in km ²	Stock size in tonnes			
			Phase 1		Phase 2	
			Cold season	Warm season	Cold season	Warm season
North	Banc d'Arguin	4,741	0	0	0	0
	3-20m	5,912	0	0	0	0
	Total	10,653	0	0	0	0
	95% confidence interval		±0	±0	±0	±0
	CV: coefficient of variation		0%	0%	0%	0%

(B) *Al-Awam* survey area

Subarea	Stratum	Area in km ²	Stock size in tonnes			
			Phase 1		Phase 2	
			Cold season	Warm season	Cold season	Warm season
North	3-20m	5,912	-	-	0	0
	20-30m	1,290	0	0	3	0
	30-80m	2,924	764	3	889	0
	80-200m	1,147	658	85	1,259	335
	200-400m	936	1,125	1,199	-	1,023
	Total	12,209	2,547	1,287	2,151	1,358
	95% confidence interval		±1,811	±1,674	±3,301	±2,315
	CV: coefficient of variation		35%	21%	55%	29%
Central	3-20m	2,783	-	0	0	0
	20-30m	835	0	0	0	0
	30-80m	2,870	176	0	12	0
	80-200m	2,767	1,849	825	67	189
	200-400m	1,453	4,010	6,971	270	337
	400-600m	848	-	1,679	-	-
	Total	8,773	6,035	9,475	350	526
95% confidence interval		±3,178	±5,777	±213	±307	
	CV: coefficient of variation		22%	16%	34%	29%
South	3-20m	1,485	-	0	0	0
	20-30m	805	0	0	0	0
	30-80m	2,640	382	0	19	0
	80-200m	3,025	1,213	885	81	132
	200-400m	994	1,088	1,930	131	16
	Total	8,949	2,683	2,816	230	148
	95% confidence interval		±1,656	±2,143	±203	±63
	CV: coefficient of variation		39%	33%	61%	25%
All	3-20m	10,180	-	0	0	0
	20-30m	2,930	0	0	3	0
	30-80m	8,434	1,322	3	920	0
	80-200m	6,939	3,721	1,796	1,407	655
	200-400m	3,383	6,222	10,101	401	1,377
	400-600m	848	-	1,679	-	-
	Total	22,534	11,264	13,578	2,731	2,032
95% confidence interval		±4,348	±7,186	±2,021	±1,461	
	CV: coefficient of variation		17%	13%	44%	21%

Remarks. - : no trawl. The stock size in *Al-Awam* survey area of phase 1 seems to include *Merluccius polli*.

Table 3.24.2 Stock size estimates of Benguela hake *Merluccius polli*.

(A) *Amrigue* survey area

Subarea	Stratum	Area in km ²	Stock size in tonnes			
			Phase 1		Phase 2	
			Cold season	Warm season	Cold season	Warm season
North	Banc d'Arguin	4,741	0	0	0	0
	3-20m	5,912	0	0	0	0
	Total	10,653	0	0	0	0
	95% confidence interval		±0	±0	±0	±0
	CV: coefficient of variation		0%	0%	0%	0%

(B) *Al-Awam* survey area

Subarea	Stratum	Area in km ²	Stock size in tonnes			
			Phase 1		Phase 2	
			Cold season	Warm season	Cold season	Warm season
North	3-20m	5,912	-	-	0	0
	20-30m	1,290	0	0	0	0
	30-80m	2,924	764	3	3	0
	80-200m	1,147	658	85	82	2
	200-400m	936	1,125	1,199	-	136
	Total	12,209	2,547	1,287	85	138
	95% confidence interval		±1,811	±1,674	±203	±354
CV: coefficient of variation		35%	21%	89%	54%	
Central	3-20m	2,783	-	0	0	0
	20-30m	835	0	0	0	0
	30-80m	2,870	176	0	69	0
	80-200m	2,767	1,849	825	1,356	1,023
	200-400m	1,453	4,010	6,971	2,123	6,598
	400-600m	848	-	1,679	-	-
	Total	8,773	6,035	9,475	3,548	7,620
95% confidence interval		±3,178	±5,777	±1,646	±5,319	
CV: coefficient of variation		22%	16%	19%	29%	
South	3-20m	1,485	-	0	0	0
	20-30m	805	0	0	0	0
	30-80m	2,640	382	0	376	0
	80-200m	3,025	1,213	885	487	468
	200-400m	994	1,088	1,930	253	6,279
	Total	8,949	2,683	2,816	1,116	6,747
	95% confidence interval		±1,656	±2,143	±648	±6,538
CV: coefficient of variation		39%	33%	31%	38%	
All	3-20m	10,180	-	0	0	0
	20-30m	2,930	0	0	0	0
	30-80m	8,434	1,322	3	447	0
	80-200m	6,939	3,721	1,796	1,925	1,493
	200-400m	3,383	6,222	10,101	2,377	13,012
	400-600m	848	-	1,679	-	-
	Total	22,534	11,264	13,578	4,749	14,505
95% confidence interval		±4,348	±7,186	±2,279	±10,600	
CV: coefficient of variation		17%	13%	16%	23%	

Remarks - : no trawl. The stock size in *Al-Awam* survey area of phase 1 seems to include *Merluccius senegalensis*.

3) John dory *Zeus faber*

The John dory is a species distributed all over the world. It is found in the East Atlantic from Norway to South Africa, as well as in the Mediterranean and in the Black Sea. It is a benthopelagic species, usually solitary, occurring near the sea floor at water depths between 5 and 400m (FishBase). In the territorial waters of the IRM, it is found over the entire continental shelf between 20 and 250m in water depth. The most individuals, however, were observed over sandy and muddy bottom between 50 and 100m in water depth (Dah *et al.*, 1991).

a) Distribution of CPUA

Figure 3.12 shows the CPUA distribution of the John dory by survey season. This species is distributed over the survey area, but in the cold season, it was found near the coast and in great quantities. Regardless of season, the John dory was registered in highest numbers at the 80-200m stratum. As it happens with the two hake species mentioned above, it seems to migrate in the warm season toward deeper areas. Summer migration deepwards of the John dory across the continental shelf and slope was reported by Josse *et Garcia* (1986).

In the *Anrrique* survey area, none of this species was caught through the survey.

b) CPUA by stratum

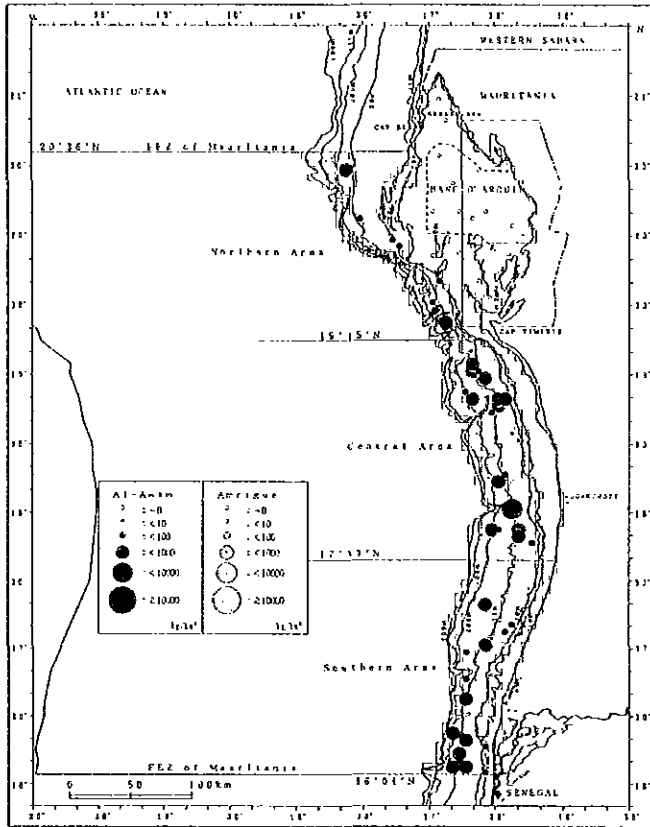
Table 3.25 shows the CPUA obtained at each stratum in each area for the John dory. The maximum value 2,721 was observed in the Phase 1 cold season at the 80-200m stratum in the Central area. Regardless of season, the mean CPUA by stratum was in every area higher at the 80-200m stratum (variation interval throughout the survey: 16-418). The mean CPUA at the 80-200m stratum was higher in the cold season than in the warm season. In the cold season, it was higher in the Central area or in the Southern area, but in the warm season, higher in the Northern area.

c) Stock size

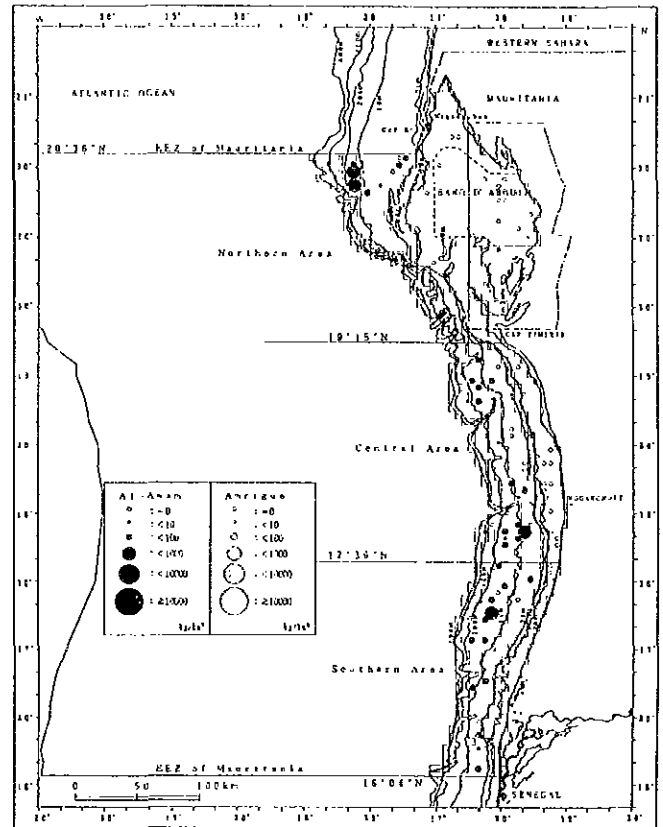
Table 3.26 shows estimates of the stock size for the John dory. The total stock size was significant in the cold season (3,014 and 1,428 tonnes in Phase order) and low in the warm season (514 and 477 tonnes in Phase order). In both seasons, the total stock size was more in Phase 1. On the geographical distribution of the total stock size, the Central area (Phase 1) or the Southern area (Phase 2) represented 51% and 57% in the cold season respectively, while in the warm season, the Northern area represented 45% and 51% respectively. As for its vertical distribution, the 80-200m stratum took up about 70% of the total regardless of season, the 30-80m stratum representing approximately 30%.

Stock size decrease of the John dory observed in the warm season (that is, its increase in the cold season) suggests a summer migration northwards, as reported by Domain (1980): from July to September, numerous individuals are dispersed onto the cold northern regions.

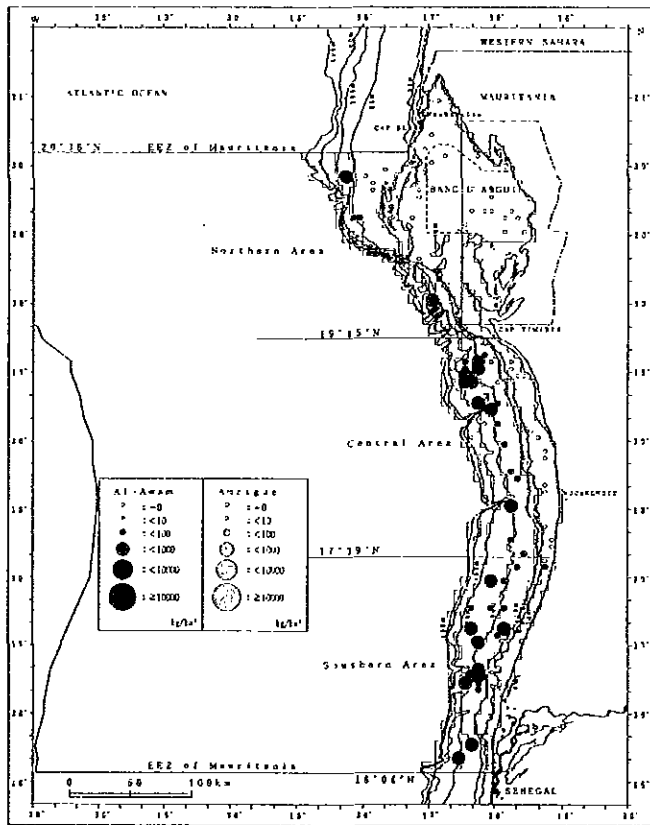
(A) Phase 1 cold season



(B) Phase 1 warm season



(C) Phase 2 cold season



(D) Phase 2 warm season

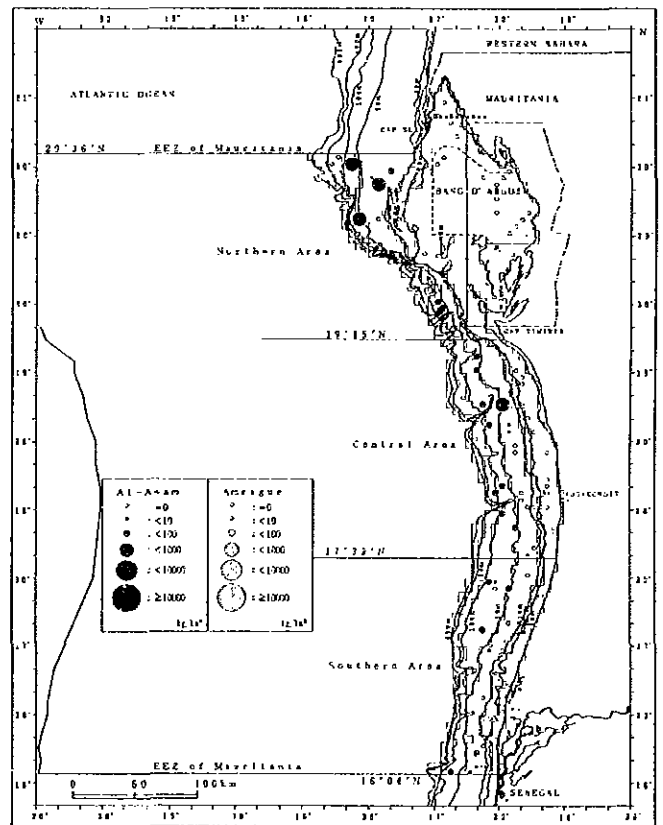


Figure 3.12 Distribution of CPUE for John dory *Zeus faber*.

Table 3.25 CUA of John dory *Zeus faber* by stratum.

(A) *Amrique* survey area

Northern coastal area (Stratum: 3-20m)	Phase 1								Phase 2							
	Cold season			Warm season			Cold season			Warm season						
	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range				
Banc d'Arguin	0.0	0.0	0.0 ~	0.0	0.0	0.0 ~	0.0	0.0	0.0 ~	0.0	0.0	0.0 ~	0.0	0.0	0.0 ~	0.0
Other	0.0	0.0	0.0 ~	0.0	0.0	0.0 ~	0.0	0.0	0.0 ~	0.0	0.0	0.0 ~	0.0	0.0	0.0 ~	0.0

(B) *Al-Awam* survey area

Subarea	Stratum	Phase 1								Phase 2							
		Cold season			Warm season			Cold season			Warm season						
		Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range				
North	3-20m	-	-	-	-	-	-	-	-	0.0	0.0	0.0 ~	0.0	0.0	0.0	0.0 ~	0.0
	20-30m	0.0	0.0	0.0 ~	0.0	0.0	0.0	0.0 ~	0.0	0.0	0.0 ~	0.0	0.0	0.0	0.0 ~	0.0	0.0
	30-80m	19.3	24.5	0.0 ~	65.9	33.1	44.5	0.0 ~	98.0	7.3	14.9	0.0 ~	41.5	32.2	59.2	0.0 ~	158.6
	80-200m	224.8	188.7	90.4 ~	440.5	119.1	93.1	19.5 ~	204.0	119.7	81.4	25.9 ~	171.1	130.4	79.4	39.2 ~	184.6
	200-400m	0.0	0.0	0.0 ~	0.0	0.0	0.0	0.0 ~	0.0	-	-	-	-	0.0	0.0	0.0 ~	0.0
400-600m	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Central	3-20m	-	-	-	-	0.0	0.0	0.0 ~	0.0	0.0	0.0	0.0 ~	0.0	0.0	0.0	0.0 ~	0.0
	20-30m	0.1	0.3	0.0 ~	0.5	0.0	0.0	0.0 ~	0.0	0.0	0.0	0.0 ~	0.0	0.0	0.0	0.0 ~	0.0
	30-80m	194.0	276.1	0.0 ~	943.1	15.1	41.9	0.0 ~	147.0	60.8	44.2	0.0 ~	129.2	17.1	49.1	0.0 ~	156.7
	80-200m	417.6	818.7	0.0 ~	2,720.7	31.3	25.0	2.6 ~	79.0	131.1	93.0	0.0 ~	271.5	44.2	27.6	20.2 ~	94.5
	200-400m	0.0	0.0	0.0 ~	0.0	0.0	0.0	0.0 ~	0.0	0.0	0.0	0.0 ~	0.0	3.7	7.3	0.0 ~	14.7
400-600m	-	-	-	-	0.0	0.0	0.0 ~	0.0	-	-	-	-	-	-	-	-	
South	3-20m	-	-	-	-	0.0	0.0	0.0 ~	0.0	5.9	17.6	0.0 ~	52.8	0.0	0.0	0.0 ~	0.0
	20-30m	29.2	26.5	0.5 ~	52.7	0.0	0.0	0.0 ~	0.0	2.2	4.0	0.0 ~	8.2	0.0	0.0	0.0 ~	0.0
	30-80m	88.7	91.5	0.0 ~	241.4	11.6	16.2	0.0 ~	49.4	77.8	70.4	0.0 ~	231.9	2.7	6.4	0.0 ~	21.5
	80-200m	241.1	213.5	52.1 ~	560.8	39.9	39.2	0.0 ~	116.8	170.6	112.0	39.2 ~	366.6	16.2	13.6	0.0 ~	35.8
	200-400m	0.0	0.0	0.0 ~	0.0	0.0	0.0	0.0 ~	0.0	0.0	0.0	0.0 ~	0.0	0.0	0.0	0.0 ~	0.0
400-600m	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Remarks. S. D.: standard deviation, - : no trawl.

Table 3.26 Stock size estimates of John dory *Zeus faber*.

(A) Amrigue survey area

Subarea	Stratum	Area in km ²	Stock size in tonnes			
			Phase 1		Phase 2	
			Cold season	Warm season	Cold season	Warm season
North	Banc d'Arguin	4,741	0	0	0	0
	3-20m	5,912	0	0	0	0
	Total	10,653	0	0	0	0
95% confidence interval			±0	±0	±0	±0
CV: coefficient of variation			0%	0%	0%	0%

(B) Al-Awam survey area

Subarea	Stratum	Area in km ²	Stock size in tonnes			
			Phase 1		Phase 2	
			Cold season	Warm season	Cold season	Warm season
North	3-20m	5,912	-	-	0	0
	20-30m	1,290	0	0	0	0
	30-80m	2,924	57	97	21	94
	80-200m	1,147	258	137	137	150
	200-400m	936	0	0	-	0
	Total	12,209	314	233	159	244
	95% confidence interval			±294	±190	±230
CV: coefficient of variation			41%	35%	35%	33%
Central	3-20m	2,783	-	0	0	0
	20-30m	835	+	0	0	0
	30-80m	2,870	557	43	175	49
	80-200m	2,767	1,156	87	363	122
	200-400m	1,453	0	0	0	5
	400-600m	848	-	0	-	-
	Total	8,773	1,712	130	537	177
95% confidence interval			±1,457	±85	±223	±102
CV: coefficient of variation			44%	31%	17%	30%
South	3-20m	1,485	-	0	9	0
	20-30m	805	23	0	2	0
	30-80m	2,640	234	31	206	7
	80-200m	3,025	729	121	516	49
	200-400m	994	0	0	0	0
	Total	8,949	987	151	732	56
	95% confidence interval			±508	±83	±277
CV: coefficient of variation			26%	28%	17%	31%
All	3-20m	10,180	-	0	9	0
	20-30m	2,930	24	0	2	0
	30-80m	8,434	847	171	401	150
	80-200m	6,939	2,143	344	1,016	321
	200-400m	3,383	0	0	0	5
	400-600m	848	-	0	-	-
	Total	22,534	3,014	514	1,428	477
95% confidence interval			±1,806	±187	±466	±237
CV: coefficient of variation			27%	19%	12%	21%

Remarks. - : no trawl, +: less than 1 tonne.

4) White grouper *Epinephelus aeneus*

The white grouper is distributed along the East Atlantic coasts of western Africa, down to the south of Angola, and also in the South Mediterranean. It is a demersal species found at reefs or sandy and muddy bottoms, at water depths between 20 and 200m (FishBase). In the territorial waters of the IRM, it occurs mainly at the reefs of the coast south of Cape Timiris, at the depths between 10 and 60m, while juveniles inhabit inshore waters between 25 and 55 m water depth (Dah *et al.*, 1991).

a) Distribution of CPUA

Figure 3.13 shows the CPUA distribution of the white grouper. This species was found at water depths of less than 80m. It was found to be distributing over a wider area in the warm season. In the cold season, it was rare to find it north of Cape Timiris. The CPUA of the white grouper was not high throughout the survey. According to Domain (1980), the white grouper migrates between north and south: in the warm season (August-October), it occurs between 19 and 23° N, then it descends southwards when the water temperature lowers; in February-March, it is found between 10 and 16° N, then it migrates again northwards in April, when the water temperature rises again. The cold and warm seasons in this survey corresponded respectively to April-May and September-October, and the results obtained were compatible with the observations of Domain (1980).

b) CPUA by stratum

Table 3.27 shows the CPUA for the white grouper obtained at each stratum in each area.

In the *Amrigue* survey area, the mean CPUA by area was less than 1, except that of 4 in the Phase 1 cold season.

In the *Al-Awam* survey area, the mean CPUA by stratum in each area did not exceed 115 throughout the survey.

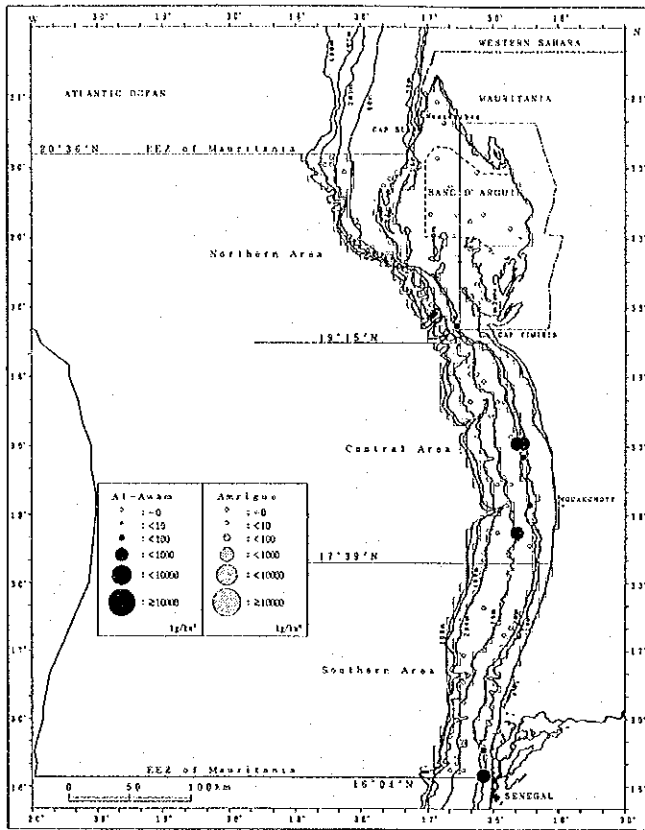
c) Stock size

Table 3.28 shows estimates of the stock size for the white grouper.

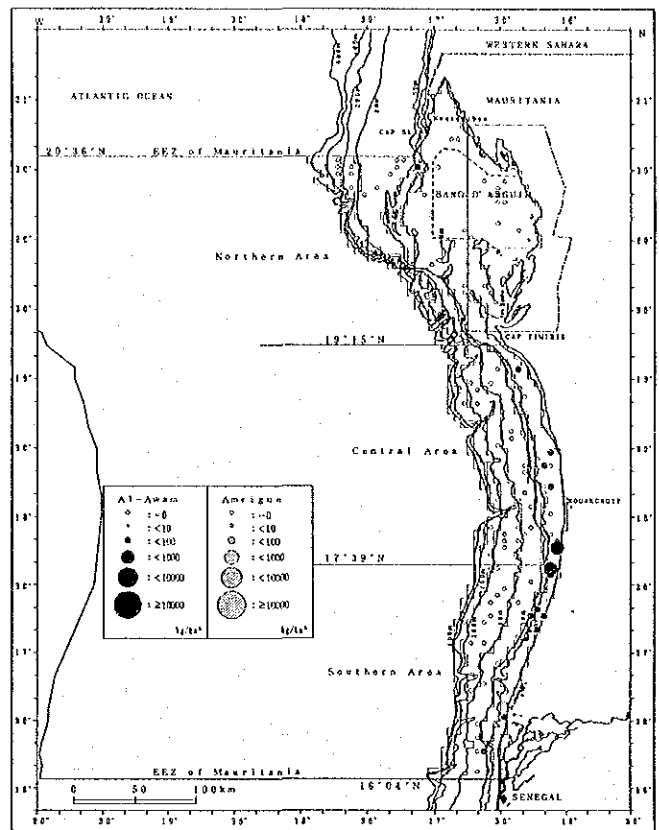
In the *Amrigue* survey area, the total stock size in each season varied between 3 and 24 tonnes. This difference is not very significant considering the amplitude of the 95% confidence interval.

In the *Al-Awam* survey area, the total stock size in each season varied between 141 and 545 tonnes. As for the geographical distribution of the total stock size in Phase 2, in which data were obtained at the 3-20m stratum, the Central area comprised 45% in the cold season, and the Northern area 88% in the warm season. In terms of vertical distribution, the 3-20m stratum comprised 49-85% of the total (higher ratio in the cold season).

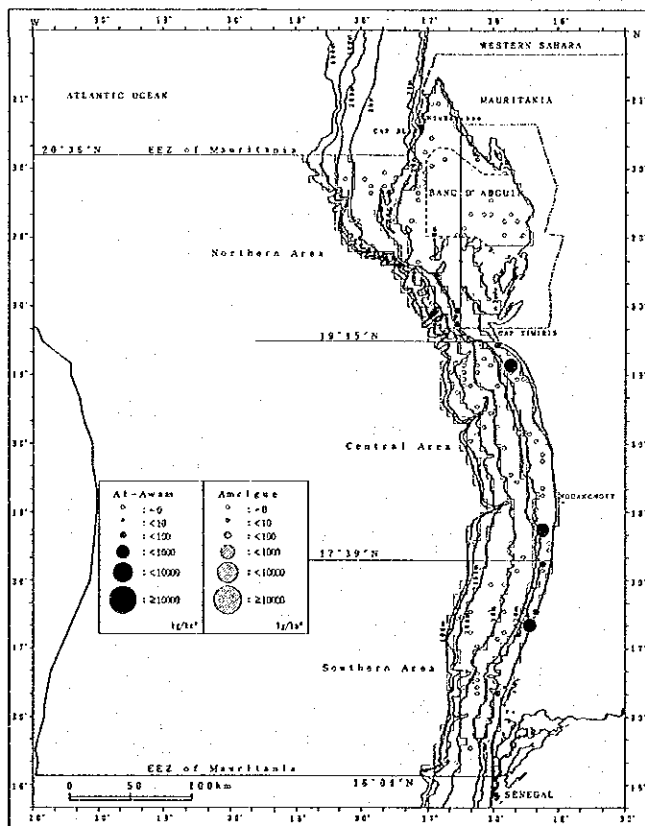
(A) Phase 1 cold season



(B) Phase 1 warm season



(C) Phase 2 cold season



(D) Phase 2 warm season

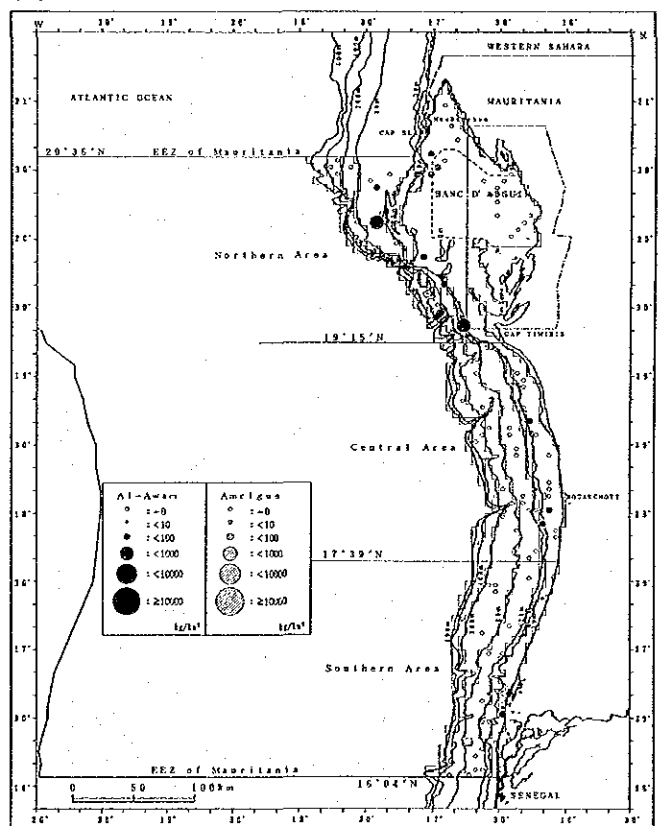


Figure 3.13 Distribution of CPUA for white grouper *Epinephelus aeneus*.

Table 3.27 CPUA of white grouper *Epinephelus aeneus* by stratum.

(A) Amrigue survey area

Northern coastal area (Stratum: 3-20m)	Phase 1						Phase 2					
	Cold season			Warm season			Cold season			Warm season		
	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range
Banc d'Arguin	0.0	0.0	0.0 ~ 0.0	0.6	1.7	0.0 ~ 6.0	0.8	2.2	0.0 ~ 8.1	0.6	1.4	0.0 ~ 4.6
Other	4.0	11.9	0.0 ~ 35.8	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0

(B) Al-Awam survey area

Subarea	Stratum	Phase 1						Phase 2					
		Cold season			Warm season			Cold season			Warm season		
		Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range
North	3-20m	-	-	-	-	-	-	1.8	4.9	0.0 ~ 12.9	35.3	31.9	11.5 ~ 82.4
	20-30m	15.9	35.5	0.0 ~ 79.4	14.7	29.4	0.0 ~ 58.8	16.2	32.5	0.0 ~ 64.7	57.4	75.7	0.0 ~ 143.2
	30-80m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	67.5	164.5	0.0 ~ 471.4
	80-200m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0
	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	-	-	-	0.0	0.0	0.0 ~ 0.0
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-
Central	3-20m	-	-	-	25.2	55.5	0.0 ~ 201.7	22.9	57.1	0.0 ~ 210.2	10.9	23.4	0.0 ~ 72.3
	20-30m	115.0	140.6	0.0 ~ 319.3	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.2	0.5	0.0 ~ 1.0
	30-80m	64.2	177.2	0.0 ~ 606.7	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0
	80-200m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0
	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0
	400-600m	-	-	-	0.0	0.0	0.0 ~ 0.0	-	-	-	-	-	-
South	3-20m	-	-	-	51.0	52.6	0.0 ~ 156.1	30.8	43.5	0.0 ~ 119.1	20.4	33.5	0.0 ~ 82.3
	20-30m	87.2	82.8	0.0 ~ 164.6	3.8	6.6	0.0 ~ 11.4	0.0	0.0	0.0 ~ 0.0	2.3	4.6	0.0 ~ 9.2
	30-80m	0.0	0.0	0.0 ~ 0.0	1.4	4.4	0.0 ~ 13.9	0.0	0.0	0.0 ~ 0.0	0.6	2.0	0.0 ~ 6.7
	80-200m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0
	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-

Remarks. S. D.: standard deviation, - : no trawl.

Table 3.28 Stock size estimates of white grouper *Epinephelus aeneus*.

(A) *Amrigue* survey area

Subarea	Stratum	Area in km ²	Stock size in tonnes			
			Phase 1		Phase 2	
			Cold season	Warm season	Cold season	Warm season
North	Banc d'Arguin	4,741	0	3	4	3
	3-20m	5,912	24	0	0	0
	Total	10,653	24	3	4	3
95% confidence interval			±42	±5	±6	±5
CV: coefficient of variation			100%	67%	73%	56%

(B) *Al-Awam* survey area

Subarea	Stratum	Area in km ²	Stock size in tonnes			
			Phase 1		Phase 2	
			Cold season	Warm season	Cold season	Warm season
North	3-20m	5,912	-	-	11	209
	20-30m	1,290	20	19	21	74
	30-80m	2,924	0	0	0	197
	80-200m	1,147	0	0	0	0
	200-400m	936	0	0	-	0
	Total	12,209	20	19	32	480
	95% confidence interval			±52	±45	±66
CV: coefficient of variation			100%	100%	74%	42%
Central	3-20m	2,783	-	70	64	30
	20-30m	835	96	0	0	+
	30-80m	2,870	184	0	0	0
	80-200m	2,767	0	0	0	0
	200-400m	1,453	0	0	0	0
	400-600m	848	-	0	-	-
	Total	8,773	280	70	64	30
95% confidence interval			±356	±104	±110	±50
CV: coefficient of variation			56%	57%	62%	55%
South	3-20m	1,485	-	76	46	30
	20-30m	805	70	3	0	2
	30-80m	2,640	0	4	0	2
	80-200m	3,025	0	0	0	0
	200-400m	994	0	0	0	0
	Total	8,949	70	82	46	34
	95% confidence interval			±130	±101	±72
CV: coefficient of variation			55%	34%	47%	50%
All	3-20m	10,180	-	146	120	269
	20-30m	2,930	187	22	21	76
	30-80m	8,434	184	4	0	199
	80-200m	6,939	0	0	0	0
	200-400m	3,383	0	0	0	0
	400-600m	848	-	0	-	-
	Total	22,534	371	172	141	545
95% confidence interval			±439	±161	±167	±342
CV: coefficient of variation			44%	30%	36%	37%

Remarks. - : no trawl, +: less than 1 tonne.

5) Meagre *Argyrosomus regius*

The meagre is distributed in the East Atlantic from Norway to Gibraltar and in Congo, as well as in the Mediterranean and in the Black Sea. It is a benthopelagic species that lives along the coasts at water depths between 15 and 300m, near the bottom of the continental shelf, at surface or middle layers (FishBase).

a) Distribution of CPUA

Figure 3.14(1) shows the CPUA distribution of the meagre. In the survey area, this species was found along the coast at water depths of less than 80m. Frequency of occurrence was high in the warm season and south of Cape Timiris. The individuals captured by the *Anrigue* were all juveniles (see 3.4.6); they were more numerous in the Phase 2 warm season. It is known that individuals of this species, both adult and immature, migrate along the coast or between the coast and offshore depending on the water temperature (Fish Base). Also, according to Dah *et al.*(1991), the adult individuals, after having spawned in the Banc d'Arguin and in Lévrier Bay between March and June, migrate in October southwards and toward Senegal following the expansion of the upwellings. They stay in January and February between 12 and 14° N, and then start feeding migration north around February, when water temperature begins to rise again, and reach again their spawning grounds. However, according to Tixerant (1974) and Limouzy (1981), the immature individuals, particularly those less than 20 cm in size, stay throughout the year in Lévrier Bay or in the Banc d'Arguin. Results obtained in the present survey probably indicate the migratory routes, the descent southwards in the cold season, the ascent northwards in the warm season or the standing of immatures in Mauritanian waters.

b) CPUA by stratum

Table 3.29 shows the CPUA for the meagre obtained at each stratum in each region.

In the *Anrigue* survey area, the meagre was collected only in the warm season. The mean CPUA by area was lower than 10.

In the *Al-Awam* survey area, the meagre was found in all areas and three seasons except in the Phase 1 cold season, but the mean CPUA at each stratum in each area did not exceed 222 (highest value achieved in the Phase 1 warm season at the 3-20m stratum in the Southern area).

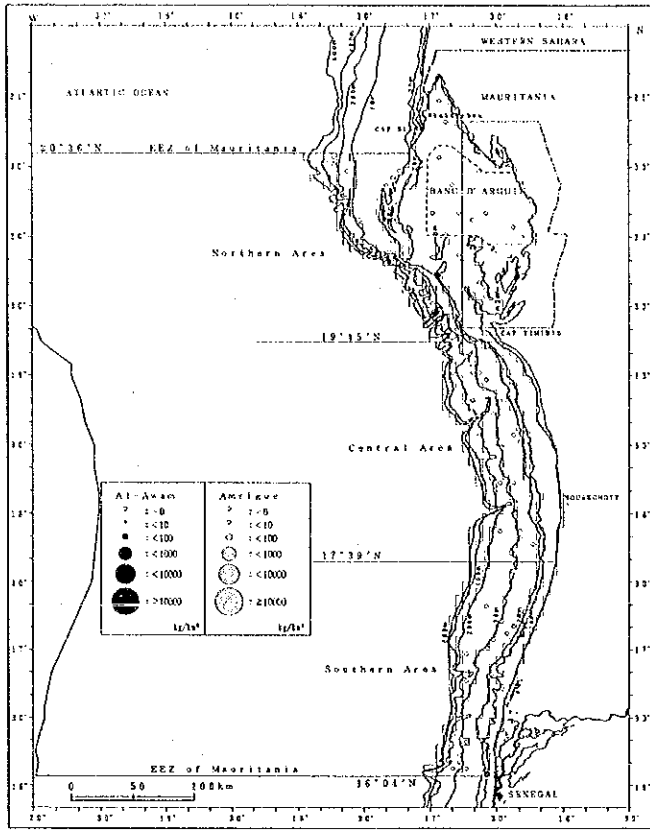
c) Stock size

Table 3.30 shows estimates of the stock size for the meagre.

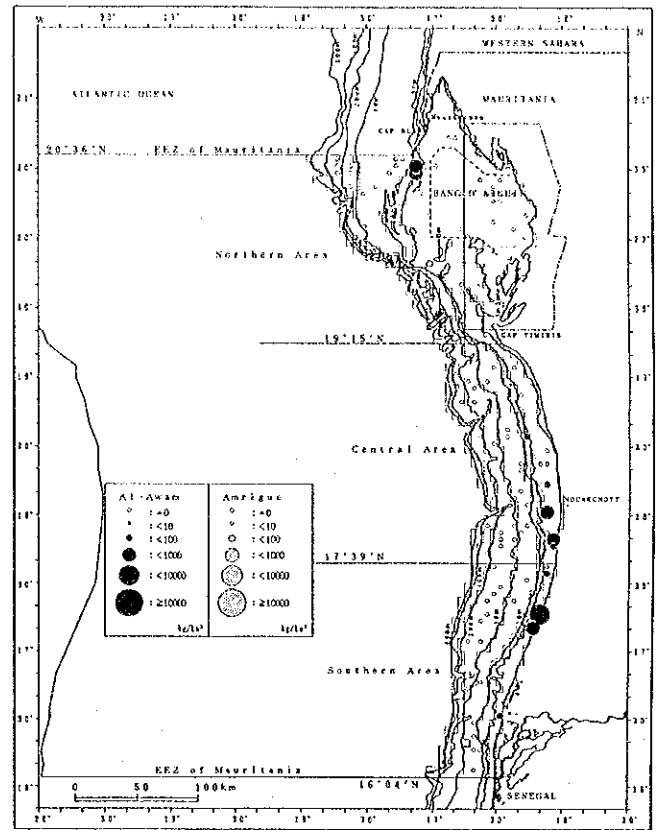
In the *Anrigue* survey area, the total stock size in the warm seasons was 11 and 72 tonnes by Phase respectively. This difference was not much significant considering the amplitude of the 95% confidence interval (respectively ± 15 and ± 61 tonnes).

As for the *Al-Awam* survey area, shown below are the results of Phase 2, for which were obtained the data related to the 3-20m stratum, the main distribution area for this species. The estimate of the total stock size in the cold and warm seasons was respectively 1,264 and 442 tonnes, with a 95% confidence interval respectively of ± 960 and ± 578 tonnes and a CV of 47 and 43%. In terms of geographical distribution of the total stock size, the stock size in the Northern area accounted for 66% of the total in the cold season and the Central area 54% in the warm season. As for the vertical distribution, the stock size at the 3-20m stratum comprised between 66 and 99% of the total in both seasons, but concentration was much higher in the cold season.

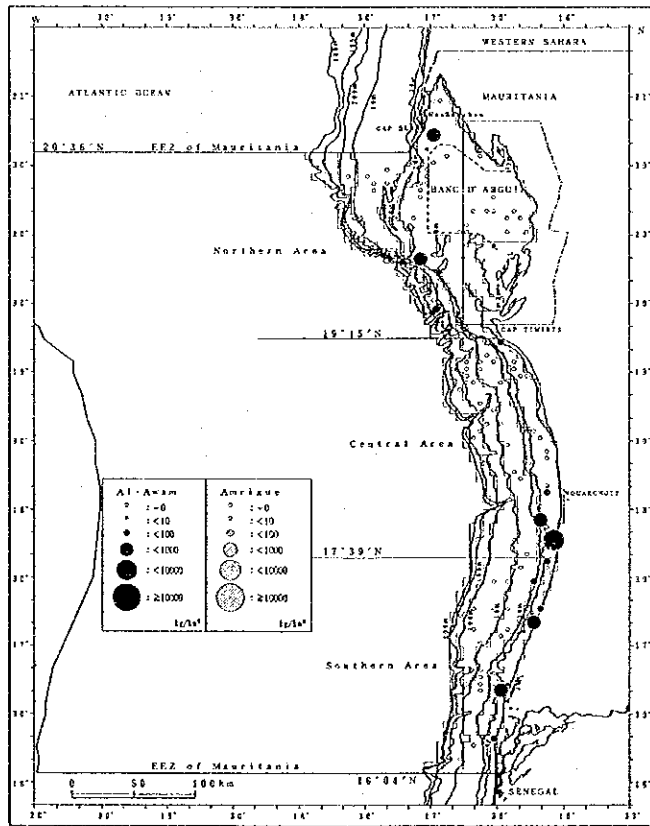
(A) Phase 1 cold season



(B) Phase 1 warm season



(C) Phase 2 cold season



(D) Phase 2 warm season

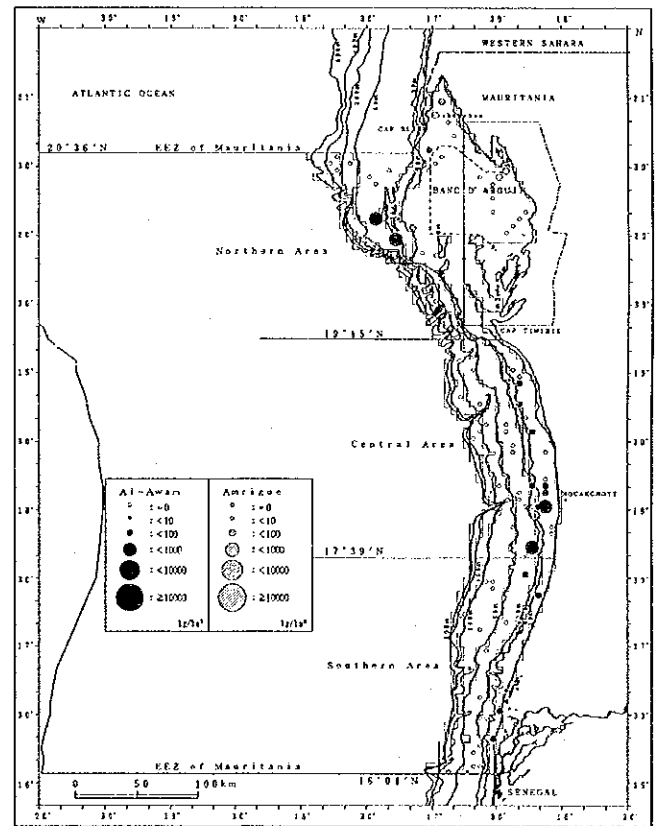


Figure 3.14(1) Distribution of CPUA for meagre *Argyrosomus regius*.

Table 3.29 CPUA of meagre *Argyrosomus regius* by stratum.

(A) *Amrique* survey area

Northern coastal area (Stratum: 3-20m)		Phase 1							Phase 2						
		Cold season			Warm season				Cold season			Warm season			
		Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range		
Banc d'Arguin		0.0	0.0	0.0 ~ 0.0	0.4	1.1	0.0 ~ 4.2	0.0	0.0	0.0 ~ 0.0	3.5	10.0	0.0 ~ 36.4		
Other		0.0	0.0	0.0 ~ 0.0	1.6	5.7	0.0 ~ 19.7	0.0	0.0	0.0 ~ 0.0	9.4	19.9	0.0 ~ 53.3		

(B) *Al-Awam* survey area

Subarea	Stratum	Phase 1							Phase 2						
		Cold season			Warm season				Cold season			Warm season			
		Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range		
North	3-20m	-	-	-	-	-	-	-	142.0	240.5	0.0 ~ 535.0	14.0	27.9	0.0 ~ 55.9	
	20-30m	0.0	0.0	0.0 ~ 0.0	168.4	240.1	0.0 ~ 509.3	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0		
	30-80m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	32.1	59.5	0.0 ~ 135.3		
	80-200m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0		
	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	-	-	-	-	0.0	0.0	0.0 ~ 0.0	
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-	-	
Central	3-20m	-	-	-	30.3	71.6	0.0 ~ 208.7	114.2	358.9	0.0 ~ 1,436.2	70.2	215.5	0.0 ~ 843.6		
	20-30m	0.0	0.0	0.0 ~ 0.0	15.2	30.3	0.0 ~ 60.6	0.0	0.0	0.0 ~ 0.0	13.6	27.1	0.0 ~ 54.3		
	30-80m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	10.9	34.4	0.0 ~ 108.7		
	80-200m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0		
	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0		
	400-600m	-	-	-	0.0	0.0	0.0 ~ 0.0	-	-	-	-	-	-		
South	3-20m	-	-	-	221.9	415.6	0.0 ~ 1,149.9	64.2	100.1	0.0 ~ 302.1	8.5	10.9	0.0 ~ 27.9		
	20-30m	3.8	6.5	0.0 ~ 11.3	0.0	0.0	0.0 ~ 0.0	1.1	2.2	0.0 ~ 4.4	2.2	3.3	0.0 ~ 6.9		
	30-80m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	3.9	12.9	0.0 ~ 42.8	4.9	14.9	0.0 ~ 49.7		
	80-200m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0		
	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0		
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-		

Remarks. S. D.: standard deviation, - : no trawl.

Table 3.30 Stock size estimates of meagre *Argyrosomus regius*.

(A) *Amrique* survey area

Subarea	Stratum	Area in km ²	Stock size in tonnes			
			Phase 1		Phase 2	
			Cold season	Warm season	Cold season	Warm season
North	Banc d'Arguin	4,741	0	2	0	17
	3-20m	5,912	0	10	0	56
	Total	10,653	0	11	0	72
	95% confidence interval		±0	±15	±0	±61
	CV: coefficient of variation		0%	86%	0%	64%

(B) *Al-Awam* survey area

Subarea	Stratum	Area in km ²	Stock size in tonnes			
			Phase 1		Phase 2	
			Cold season	Warm season	Cold season	Warm season
North	3-20m	5,912	-	-	840	83
	20-30m	1,290	0	217	0	0
	30-80m	2,924	0	0	0	94
	80-200m	1,147	0	0	0	0
	200-400m	936	0	0	-	0
	Total	12,209	0	217	840	176
	95% confidence interval		±0	±405	±685	±207
CV: coefficient of variation		0%	71%	64%	58%	
Central	3-20m	2,783	-	84	318	195
	20-30m	835	0	13	0	11
	30-80m	2,870	0	0	0	31
	80-200m	2,767	0	0	0	0
	200-400m	1,453	0	0	0	0
	400-600m	848	-	0	-	-
	Total	8,773	0	97	318	238
95% confidence interval		±0	±135	±678	±445	
CV: coefficient of variation		0%	55%	79%	67%	
South	3-20m	1,485	-	330	95	13
	20-30m	805	3	0	1	2
	30-80m	2,640	0	0	10	13
	80-200m	3,025	0	0	0	0
	200-400m	994	0	0	0	0
	Total	8,949	3	330	106	27
	95% confidence interval		±8	±663	±163	±32
CV: coefficient of variation		100%	66%	48%	48%	
All	3-20m	10,180	-	414	1,253	291
	20-30m	2,930	3	230	1	13
	30-80m	8,434	0	0	10	138
	80-200m	6,939	0	0	0	0
	200-400m	3,383	0	0	0	0
	400-600m	848	-	0	-	-
	Total	22,534	3	644	1,264	442
95% confidence interval		±7	±740	±960	±578	
CV: coefficient of variation		100%	42%	47%	43%	

Remark. - : no trawl.

6) West African goatfish *Pseudupeneus prayensis*

The West African goatfish is found in the East Atlantic from Morocco (Agadir) to Angola. It is a demersal species inhabiting sandy or muddy bottoms at water depths between 10 and 300m (FishBase).

a) Distribution of CPUA

Figure 3.14(2) shows the CPUA distribution for the West African goatfish. This species was found to be distributing mainly in waters shallower than 80m in water depth. The relatively high CPUA was obtained, regardless of the season, in the area south of Cape Timiris, but it often occurred also in the Northern area in the warm season. According to Dah *et al.* (1991), the West African goatfish does not undertake great migrations and is generally found south of 19°N. When eventually going beyond Cape Timiris in the hot season, no significant concentration would be observed at the level of Cape Blanc. The results obtained in the present survey were compatible to those observations.

b) CPUA by stratum

Table 3.31 shows the CPUA for the West African goatfish at each stratum in each area.

In the *Amrigue* survey area, the mean CPUA by stratum had a maximum value of 16 (in the other area in the Phase 2 warm season), but was less than 10 elsewhere.

In the *Al-Awam* survey area, the CPUA by stratum was, in the Northern area, less than 100 at all strata regardless of the season. But in many cases, it exceeded 100 at the three strata in water depths less than 80m in the Central and Southern areas.

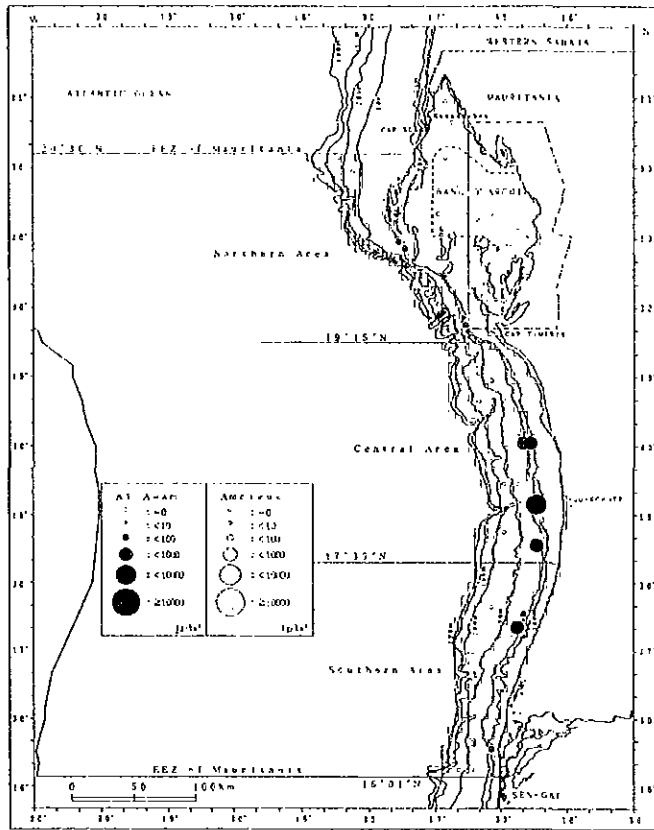
c) Stock size

Table 3.32 shows estimates of the stock size for the West African goatfish.

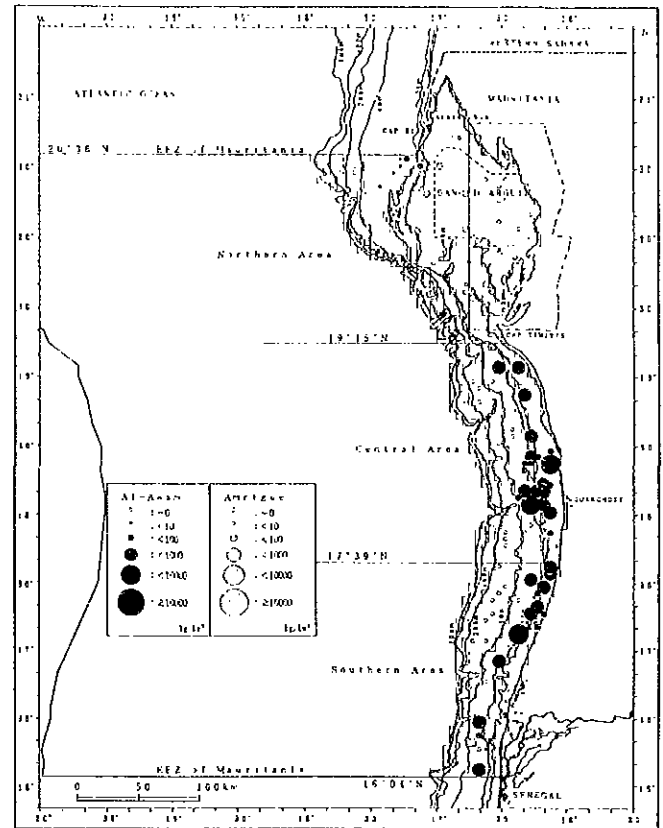
In the *Amrigue* survey area, the estimates of the total stock size for this species was between 22 and 37 tonnes (except for 137 tonnes in the Phase 1 warm season). This difference between the total stock size of each season was not much significant considering the amplitude of the 95% confidence interval. The stock size in other area occupied over 70% of the total in all seasons.

In the *Al-Awam* survey area, the total stock size declined in survey order except in the Phase 1 cold season: 3,308, 2,963 and 2,440 tonnes respectively (95% confidence intervals respectively of $\pm 1,889$, $\pm 4,462$ and $\pm 1,669$ tonnes, CV of 25, 43 and 19%). The stock size in the Central area accounted for 50–76% of the total stock size in those three seasons. As for the vertical distribution, the stock size at the 3-20m stratum accounted for 88% of the total in the Phase 2 cold season. Conversely, in the warm season, the total stock size was spread around the three strata at water depths shallower than 80m. In Phase 1, the ratios were 29, 18 and 53% from the shallower to the deeper stratum, while in Phase 2 they were 40, 36 and 24%. Those seasonal characteristics of the vertical distribution of the stock suggest a migration from inshore to offshore for this species.

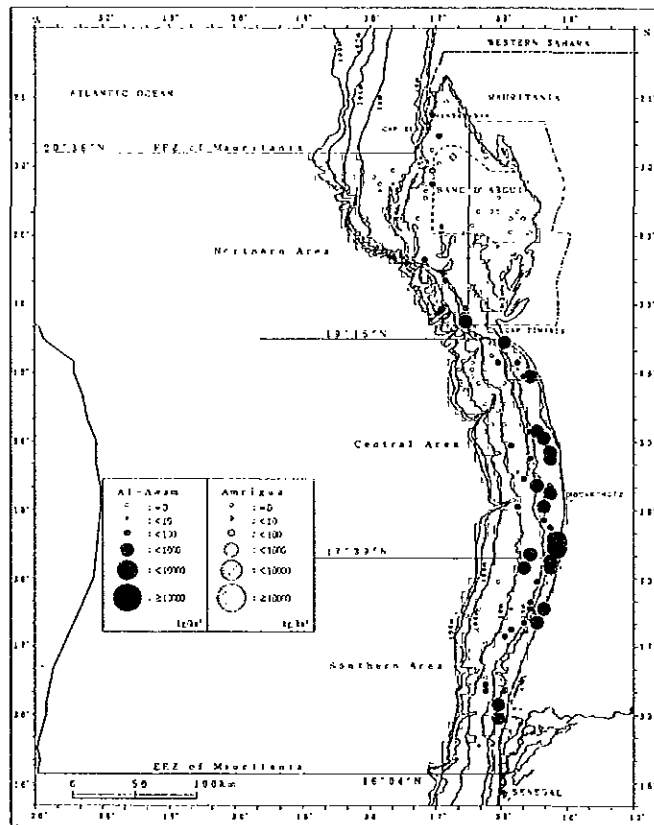
(A) Phase 1 cold season



(B) Phase 1 warm season



(C) Phase 2 cold season



(D) Phase 2 warm season

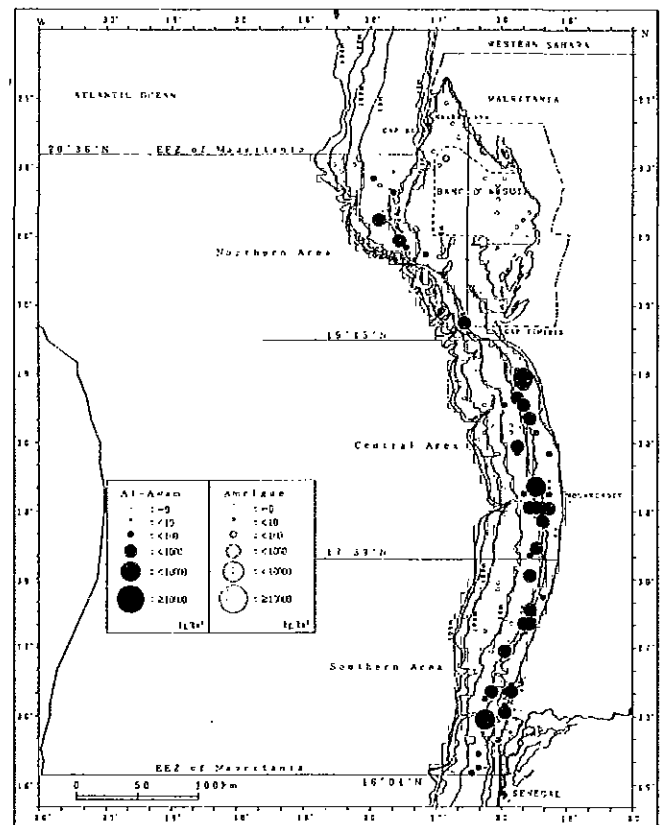


Figure 3.14(2) Distribution of CPUA for West African goatfish *Pseudupeneus prayensis*.

Table 3.31 CPUA of West African goatfish *Pseudupeneus prayensis* by stratum.

(A) Anrique survey area

Northern coastal area (Stratum: 3-20m)	Phase 1						Phase 2					
	Cold season			Warm season			Cold season			Warm season		
	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range
Banc d'Arguin	2.5	5.3	0.0 ~ 14.9	8.8	22.9	0.0 ~ 85.1	0.0	0.0	0.0 ~ 0.0	0.2	0.6	0.0 ~ 2.4
Other	4.2	12.5	0.0 ~ 37.6	16.2	20.3	0.0 ~ 55.0	5.4	14.6	0.0 ~ 56.4	3.6	9.4	0.0 ~ 25.0

(B) Al-Awam survey area

Subarea	Stratum	Phase 1						Phase 2					
		Cold season			Warm season			Cold season			Warm season		
		Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range
North	3-20m	-	-	-	-	-	-	39.2	22.8	0.0 ~ 70.2	5.1	10.3	0.0 ~ 20.5
	20-30m	3.9	8.6	0.0 ~ 19.3	14.2	27.1	0.0 ~ 54.8	60.1	115.8	0.0 ~ 233.7	75.5	124.7	1.0 ~ 219.5
	30-80m	13.0	27.7	0.0 ~ 79.6	4.1	4.3	0.0 ~ 11.5	6.6	16.3	0.0 ~ 46.8	74.7	111.3	0.0 ~ 279.7
	80-200m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.9	1.5	0.0 ~ 2.7
	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	-	-	-	0.0	0.0	0.0 ~ 0.0
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-
Central	3-20m	-	-	-	244.9	367.7	0.0 ~ 1,322.8	771.3	1,809.3	4.3 ~ 7,421.2	287.5	394.9	0.6 ~ 1,064.4
	20-30m	497.0	845.0	0.0 ~ 1,753.6	377.8	352.2	33.0 ~ 754.6	39.0	52.8	0.0 ~ 116.4	422.0	484.3	71.3 ~ 1,130.0
	30-80m	73.5	171.8	0.0 ~ 459.1	231.3	434.6	0.0 ~ 1,371.9	23.9	42.8	0.0 ~ 135.3	61.9	88.6	0.0 ~ 272.9
	80-200m	0.0	0.0	0.0 ~ 0.0	0.5	1.7	0.0 ~ 5.8	2.0	6.2	0.0 ~ 19.6	0.0	0.0	0.0 ~ 0.0
	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0
	400-600m	-	-	-	0.0	0.0	0.0 ~ 0.0	-	-	-	-	-	-
South	3-20m	-	-	-	196.4	225.7	0.0 ~ 575.2	153.7	164.6	0.0 ~ 449.7	87.1	94.0	9.6 ~ 247.5
	20-30m	6.1	8.1	0.0 ~ 15.3	321.3	215.2	87.3 ~ 510.5	68.9	76.1	6.3 ~ 177.0	538.4	559.5	9.7 ~ 1,257.1
	30-80m	37.3	93.9	0.0 ~ 284.9	403.4	771.5	0.0 ~ 2,429.3	37.1	45.1	0.0 ~ 134.7	75.6	125.3	0.0 ~ 394.0
	80-200m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0
	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-

Remarks. S. D.: standard deviation, - : no trawl.

Table 3.32 Stock size estimates of West African goatfish *Pseudupeneus prayensis*.

(A) Amrigue survey area

Subarea	Stratum	Area in km ²	Stock size in tonnes			
			Phase 1		Phase 2	
			Cold season	Warm season	Cold season	Warm season
North	Banc d'Arguin	4,741	12	42	0	1
	3-20m	5,912	25	96	32	21
	Total	10,653	37	137	32	22
	95% confidence interval		±46	±87	±40	±24
	CV: coefficient of variation		71%	32%	70%	97%

(B) Al-Awam survey area

Subarea	Stratum	Area in km ²	Stock size in tonnes			
			Phase 1		Phase 2	
			Cold season	Warm season	Cold season	Warm season
North	3-20m	5,912	-	-	232	30
	20-30m	1,290	5	18	77	97
	30-80m	2,924	38	12	19	219
	80-200m	1,147	0	0	0	1
	200-400m	936	0	0	-	0
	Total	12,209	43	30	329	347
	95% confidence interval		±53	±42	±244	±446
	CV: coefficient of variation		68%	60%	28%	43%
Central	3-20m	2,783	-	681	2,146	800
	20-30m	835	415	315	33	352
	30-80m	2,870	211	664	69	178
	80-200m	2,767	0	1	5	0
	200-400m	1,453	0	0	0	0
	400-600m	848	-	0	-	-
	Total	8,773	626	1,662	2,253	1,330
	95% confidence interval		±949	±1,057	±3,499	±1,043
CV: coefficient of variation		61%	28%	56%	27%	
South	3-20m	1,485	-	292	228	129
	20-30m	805	5	259	56	434
	30-80m	2,640	99	1,065	98	200
	80-200m	3,025	0	0	0	0
	200-400m	994	0	0	0	0
	Total	8,949	103	1,615	382	763
	95% confidence interval		±199	±1,402	±306	±769
CV: coefficient of variation		80%	41%	25%	33%	
All	3-20m	10,180	-	973	2,606	960
	20-30m	2,930	425	592	166	883
	30-80m	8,434	347	1,741	186	596
	80-200m	6,939	0	1	5	1
	200-400m	3,383	0	0	0	0
	400-600m	848	-	0	-	-
	Total	22,534	772	3,308	2,963	2,440
95% confidence interval		±1,136	±1,889	±4,462	±1,669	
CV: coefficient of variation		51%	25%	43%	19%	

Remark. - : no trawl.

7) Bluespotted seabream *Pagrus caeruleostictus*

The bluespotted seabream is distributed in the East Atlantic from Portugal and the Strait of Gibraltar down to Angola and in the Mediterranean. It is a benthopelagic species inhabiting over hard bottom at water depths down to 200m (FishBase).

a) Distribution of CPUA

Figure 3.15 shows the CPUA distribution of the bluespotted seabream. This species was widely distributed at water depths less than 80m. This distribution was centered at the 3-20m stratum, where high CPUA was obtained. The bluespotted seabream was also widely found in the *Amrigue* survey area. According to Dah *et al.* (1991), the bluespotted seabream inhabits, along the IRM coast, waters shallower than 50m. Particularly, it would be found in great quantities south of Cape Timiris, in the Banc d'Arguin and, above all in the hot season, in Lévrier Bay. Results of this survey confirmed those observations.

b) CPUA by stratum

Table 3.33 shows the CPUA for the bluespotted seabream at each stratum in each area.

In the *Amrigue* survey area, the mean CPUA by stratum peaked at 19 (in the other area in the Phase 1 warm season). All individuals of this species captured by the *Amrigue* were juveniles (see 3.4.6).

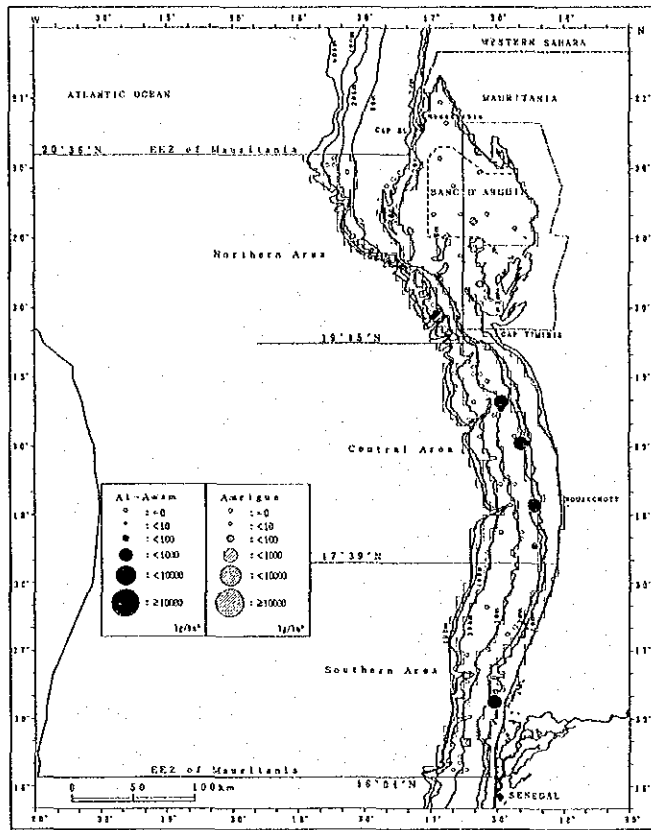
As for the *Al-Awam* survey area, only the results obtained in Phase 2 are presented here. In the cold season as in the warm season, the mean CPUA by stratum in each area was highest at the 3-20m stratum. Geographical distribution of the mean CPUA at the 3-20m stratum shows seasonal characteristics. In the cold season, the CPUA increased from the Northern area to the Southern area (respectively 275, 1,013 and 1,100); in the warm season, it decreased from north to south (respectively 6,952, 406 and 344).

c) Stock size

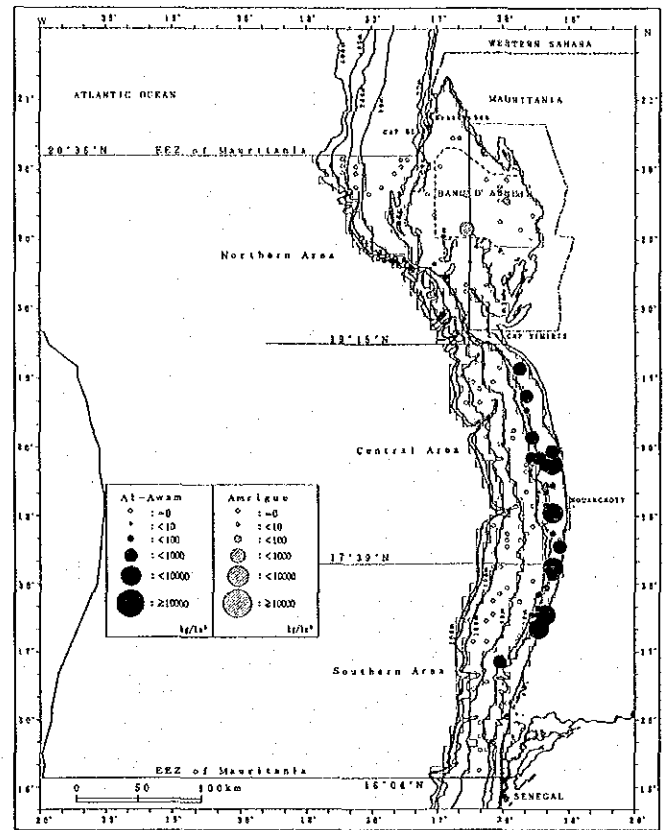
Table 3.34 shows estimates of the stock size for the bluespotted seabream. The total stock size in Phase 2 clearly increased between the cold season and the warm season, from 6,381 to 43,180 tonnes (95% confidence interval respectively of $\pm 8,816$ and $\pm 14,553$ tonnes, CV of 42 and 67%). In the cold season, the stock size in the Central area accounted for about 50% of the total, and the Northern area occupied 95% of the total in the warm season. Over 95% of the total stock size in the cold and warm seasons was concentrated at the 3-20m stratum.

Stock concentration in the Central area observed in the cold season and the concentration in the Northern area observed in the warm season suggest that the bluespotted seabream exhibits the spawning migration (spawning sporadically between spring and autumn, Fish Base) along the coastline.

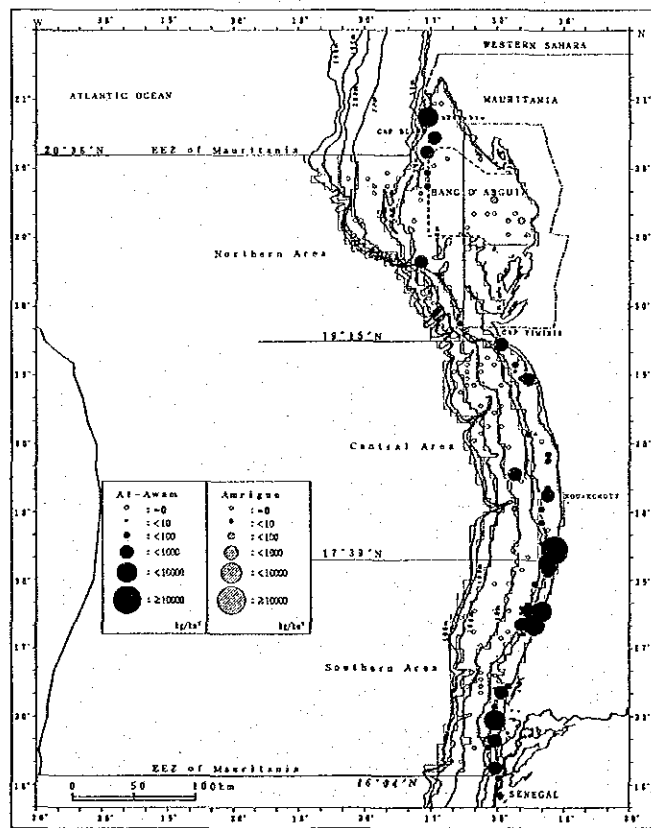
(A) Phase 1 cold season



(B) Phase 1 warm season



(C) Phase 2 cold season



(D) Phase 2 warm season

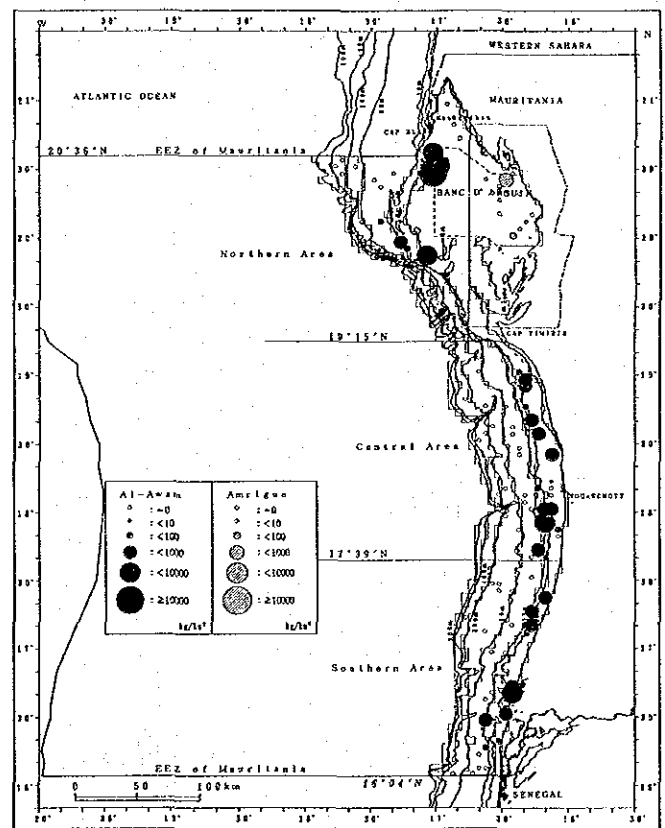


Figure 3.15 Distribution of CPUA for bluespotted seabream *Pagrus caeruleostictus*.

Table 3.33 CPUA of bluespotted seabream *Pagrus caeruleostictus* by stratum.

(A) Amrique survey area

Northern coastal area (Stratum: 3-20m)	Phase 1						Phase 2					
	Cold season			Warm season			Cold season			Warm season		
	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range
Banc d'Arguin	8.6	13.2	0.0 ~ 31.6	1.7	4.3	0.0 ~ 16.8	3.4	6.0	0.0 ~ 16.9	12.3	36.3	0.0 ~ 140.9
Other	0.0	0.0	0.0 ~ 0.0	18.9	60.9	0.0 ~ 212.1	0.1	0.6	0.0 ~ 2.2	0.0	0.0	0.0 ~ 0.0

(B) Al-Awam survey area

Subarea	Stratum	Phase 1						Phase 2					
		Cold season			Warm season			Cold season			Warm season		
		Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range
North	3-20m	-	-	-	-	-	-	274.7	384.1	0.0 ~ 1,102.3	6,951.5	9,785.8	1,449.3 ~ 21,606.3
	20-30m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	20.2	40.5	0.0 ~ 81.0	34.6	41.7	5.0 ~ 82.3
	30-80m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	31.3	49.0	0.0 ~ 130.3
	80-200m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0
	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	-	-	-	0.0	0.0	0.0 ~ 0.0
Central	400-600m	-	-	-	-	-	-	-	-	-	-	-	-
	3-20m	-	-	-	270.0	386.8	0.0 ~ 1,303.2	1,013.3	3,570.5	0.0 ~ 14,379.5	405.5	569.7	0.0 ~ 2,192.1
	20-30m	50.6	68.4	0.0 ~ 144.8	194.2	227.2	4.9 ~ 460.1	9.4	18.8	0.0 ~ 37.5	11.2	21.5	0.0 ~ 43.4
	30-80m	33.0	59.6	0.0 ~ 179.4	0.0	0.0	0.0 ~ 0.0	56.7	188.0	0.0 ~ 623.6	60.5	191.4	0.0 ~ 605.3
	80-200m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	1.3	4.1	0.0 ~ 12.9	0.0	0.0	0.0 ~ 0.0
South	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0
	400-600m	-	-	-	0.0	0.0	0.0 ~ 0.0	-	-	-	-	-	-
	3-20m	-	-	-	873.7	1,270.8	0.0 ~ 3,529.9	1,099.8	1,123.9	22.6 ~ 3,539.1	344.1	402.5	0.0 ~ 1,189.0
	20-30m	59.5	103.0	0.0 ~ 178.5	83.2	12.1	72.5 ~ 96.4	100.3	76.9	25.7 ~ 180.4	131.4	139.1	6.4 ~ 307.9
	30-80m	0.0	0.0	0.0 ~ 0.0	50.1	158.3	0.0 ~ 500.6	8.6	24.9	0.0 ~ 83.0	7.1	23.5	0.0 ~ 78.1

Remarks. S. D.: standard deviation. - : no trawl.

Table 3.34 Stock size estimates of bluespotted seabream *Pagrus caeruleostictus*.

(A) Anrigue survey area

Subarea	Stratum	Area in km ²	Stock size in tonnes			
			Phase 1		Phase 2	
			Cold season	Warm season	Cold season	Warm season
North	Banc d'Arguin	4,741	41	8	16	58
	3-20m	5,912	0	112	1	0
	Total	10,653	41	120	17	58
	95% confidence interval		±49	±161	±17	±134
	CV: coefficient of variation		51%	87%	44%	76%

(B) Al-Awam survey area

Subarea	Stratum	Area in km ²	Stock size in tonnes			
			Phase 1		Phase 2	
			Cold season	Warm season	Cold season	Warm season
North	3-20m	5,912	-	-	1,624	41,097
	20-30m	1,290	0	0	26	45
	30-80m	2,924	0	0	0	91
	80-200m	1,147	0	0	0	0
	200-400m	936	0	0	-	0
	Total	12,209	0	0	1,650	41,233
	95% confidence interval		±0	±0	±1,144	±24,572
CV: coefficient of variation		0%	0%	52%	70%	
Central	3-20m	2,783	-	751	2,820	1,128
	20-30m	835	42	162	8	9
	30-80m	2,870	95	0	163	174
	80-200m	2,767	0	0	4	0
	200-400m	1,453	0	0	0	0
	400-600m	848	-	0	-	-
	Total	8,773	137	913	2,994	1,311
95% confidence interval		±134	±811	±6,698	±1,328	
CV: coefficient of variation		42%	32%	83%	34%	
South	3-20m	1,485	-	1,298	1,634	511
	20-30m	805	48	67	81	106
	30-80m	2,640	0	132	23	19
	80-200m	3,025	0	0	0	0
	200-400m	994	0	0	0	0
	Total	8,949	48	1,497	1,737	636
	95% confidence interval		±124	±2,150	±2,100	±778
CV: coefficient of variation		100%	45%	32%	33%	
All	3-20m	10,180	-	2,049	6,077	42,737
	20-30m	2,930	90	229	115	160
	30-80m	8,434	95	132	185	284
	80-200m	6,939	0	0	4	0
	200-400m	3,383	0	0	0	0
	400-600m	848	-	0	-	-
	Total	22,534	185	2,410	6,381	43,180
95% confidence interval		±193	±2,383	±8,816	±14,553	
CV: coefficient of variation		40%	31%	42%	67%	

Remark. - : no trawl.

8) *Angola dentex Dentex angolensis*

The *Angola dentex* is distributed in the East Atlantic from Morocco to Angola. It is a demersal species inhabiting very different kinds of bottom at water depths between 15 and 300m (FishBase).

a) Distribution of CPUA

Figure 3.16 shows the CPUA distribution of the *Angola dentex*. In the Phase 1 cold season, this species was found at water depths between 20 and 200m. In the following seasons, it only appeared in the Southern area or in the Central area, in a localized manner. The CPUA was equally low.

According to Dah *et al.* (1991), in Mauritanian territorial waters, the *Angola dentex* occurs in great quantities north of Cape Timiris, but numerous individuals would migrate to deeper waters in the warm season. In the cold season, this species would be spread around in areas shallower than 180m.

It is not known whether or not the results that the distribution observed in the present survey is not compatible with those observations, and that *Angola dentex* captures were rare, could be explained by displacements or migrations outward the survey area, or by an exhaustion of resources, etc.

It is also considered that this species was divided into the other *Dentex* species at the identification works on board.

In the Anrigue survey area, none of this species was caught through the survey.

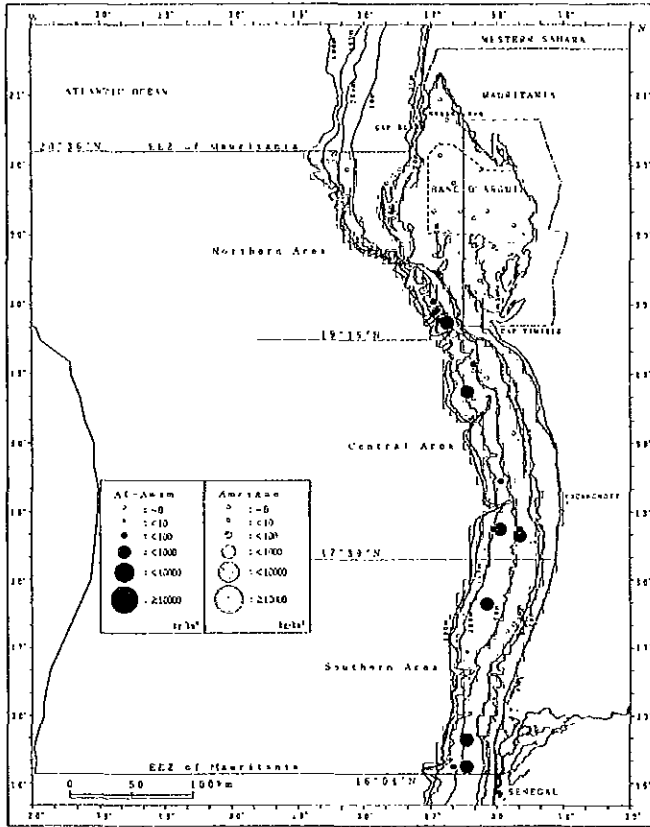
b) CPUA by stratum

Table 3.35 shows the CPUA for the *Angola dentex* at each stratum in each area. In the Phase 1 cold season, the mean CPUA at the 80-200m stratum in the Northern area was relatively high, 235. Except for this case, the mean CPUA by stratum was lower than 100, particularly in Phase 2 when it never exceeded 5.

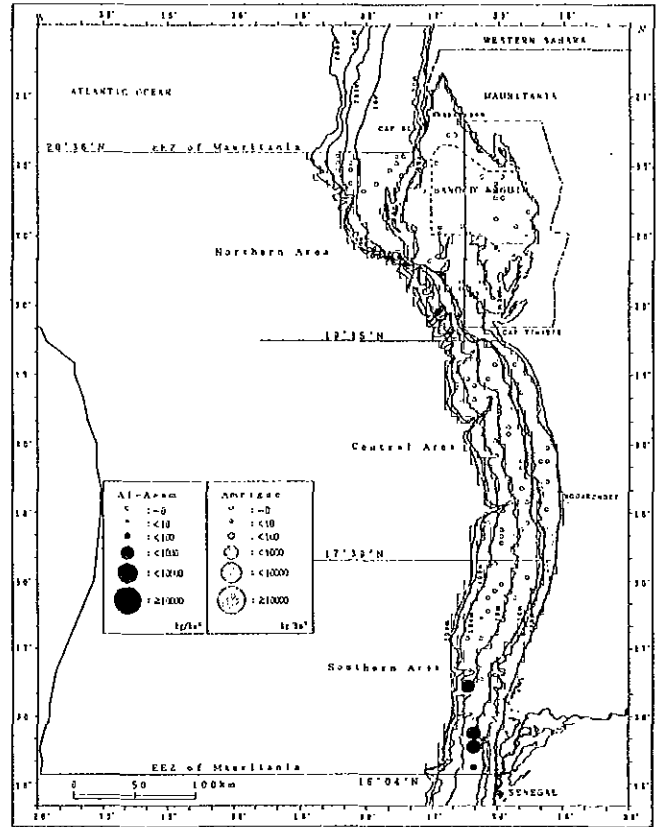
c) Stock size

Table 3.36 shows estimates of the stock size for the *Angola dentex*. The total stock size declined clearly in survey order: respectively 785, 219, 8 and 9 tonnes. The reason of a rapid decrease in its stock size is not known as abovementioned. In the Phase 1 cold season, the total stock size (785 tonnes with a 95% confidence interval of ± 566 tonnes and a CV of 38%) was more or less equally distributed between the Northern, Central and Southern areas. The 80-200m stratum comprised 66% of the total. In the Phase 1 warm season and in the Phase 2 cold season, the stock existed only in the Southern area, while in the Phase 2 warm season, it did only in the Central area.

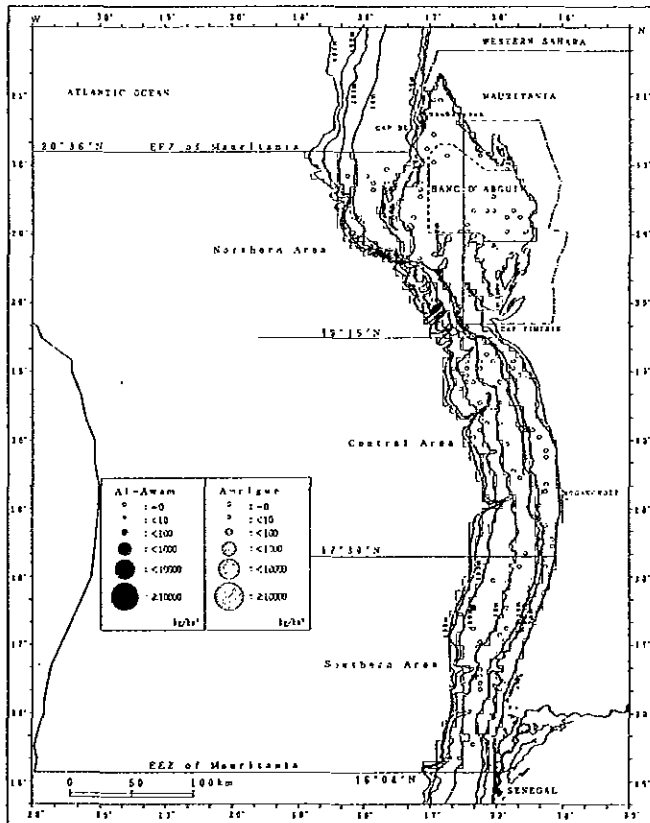
(A) Phase 1 cold season



(B) Phase 1 warm season



(C) Phase 2 cold season



(D) Phase 2 warm season

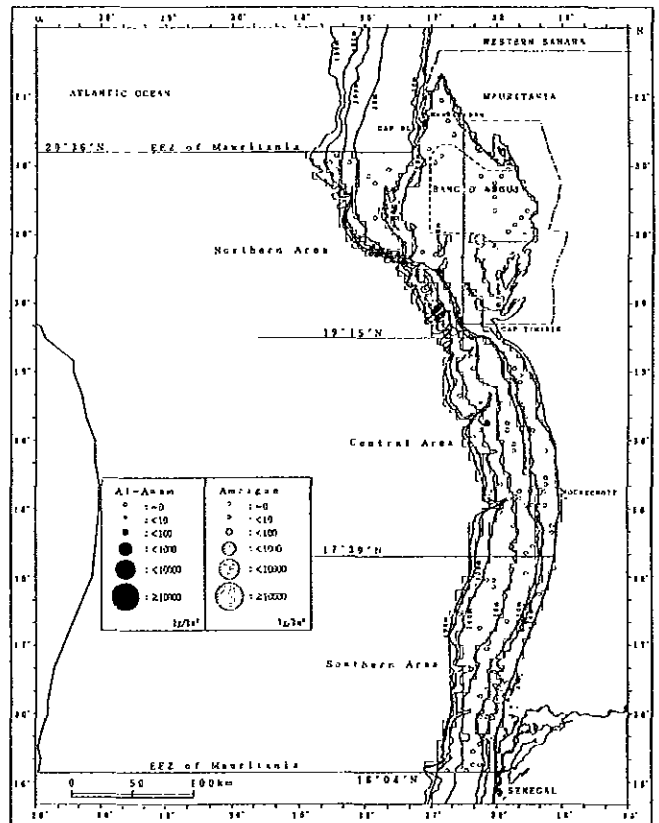


Figure 3.16 Distribution of CPUA for *Angola dentex* *Dentex angolensis*.

Table 3.35 CUPA of Angola dentex *Dentex angolensis* by stratum.

(A) *Amiguel* survey area

Northern coastal area (Stratum: 3-20m)	Phase 1								Phase 2							
	Cold season			Warm season			Cold season			Warm season						
	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range				
Banc d'Arguin	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	
Other	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	

(B) *Al-Awam* survey area

Subarea	Stratum	Phase 1								Phase 2							
		Cold season			Warm season			Cold season			Warm season						
		Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range				
North	3-20m	-	-	-	-	-	-	-	-	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0		
	20-30m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0		
	30-80m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0		
	80-200m	235.1	334.5	0.0 ~ 618.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0		
	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	-	-	-	-	0.0	0.0	0.0 ~ 0.0	
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Central	3-20m	-	-	-	-	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0			
	20-30m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0		
	30-80m	43.7	130.1	0.0 ~ 451.6	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0		
	80-200m	65.2	122.0	0.0 ~ 386.1	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0	0.0	0.0 ~ 0.0	3.4	6.4	0.0 ~ 16.7		
	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0		
	400-600m	-	-	-	-	0.0	0.0	0.0 ~ 0.0	0.0	0.0	-	-	-	-	-		
South	3-20m	-	-	-	-	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0			
	20-30m	3.2	5.5	0.0 ~ 9.5	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0		
	30-80m	54.0	127.0	0.0 ~ 379.4	57.5	111.0	0.0 ~ 295.2	0.0	0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0		
	80-200m	21.3	48.5	0.0 ~ 130.3	22.1	65.1	0.0 ~ 195.7	2.8	8.4	0.0 ~ 25.1	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	
	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0		
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-	-	-		

Remarks. S. D.: standard deviation, - : no trawl.

Table 3.36 Stock size estimates of Angola dentex *Dentex angolensis*.

(A) Amrligue survey area

Subarea	Stratum	Area in km ²	Stock size in tonnes			
			Phase 1		Phase 2	
			Cold season	Warm season	Cold season	Warm season
North	Banc d'Arguin	4,741	0	0	0	0
	3-20m	5,912	0	0	0	0
	Total	10,653	0	0	0	0
95% confidence interval			±0	±0	±0	±0
CV: coefficient of variation			0%	0%	0%	0%

(B) Al-Awam survey area

Subarea	Stratum	Area in km ²	Stock size in tonnes			
			Phase 1		Phase 2	
			Cold season	Warm season	Cold season	Warm season
North	3-20m	5,912	-	-	0	0
	20-30m	1,290	0	0	0	0
	30-80m	2,924	0	0	0	0
	80-200m	1,147	270	0	0	0
	200-400m	936	0	0	-	0
	Total	12,209	270	0	0	0
	95% confidence interval			±402	±0	±0
CV: coefficient of variation			82%	0%	0%	0%
Central	3-20m	2,783	-	0	0	0
	20-30m	835	0	0	0	0
	30-80m	2,870	125	0	0	0
	80-200m	2,767	181	0	0	9
	200-400m	1,453	0	0	0	0
	400-600m	848	-	0	-	-
	Total	8,773	306	0	0	9
95% confidence interval			±307	±0	±0	±9
CV: coefficient of variation			50%	0%	0%	72%
South	3-20m	1,485	-	0	0	0
	20-30m	805	3	0	0	0
	30-80m	2,640	143	152	0	0
	80-200m	3,025	64	67	8	0
	200-400m	994	0	0	0	0
	Total	8,949	210	219	8	0
95% confidence interval			±279	±219	±12	±0
CV: coefficient of variation			60%	52%	100%	0%
All	3-20m	10,180	-	0	0	0
	20-30m	2,930	3	0	0	0
	30-80m	8,434	268	152	0	0
	80-200m	6,939	515	67	8	9
	200-400m	3,383	0	0	0	0
	400-600m	848	-	0	-	-
	Total	22,534	785	219	8	9
95% confidence interval			±566	±226	±15	±12
CV: coefficient of variation			38%	52%	100%	72%

Remark. - : no trawl.

9) Canary dentex *Dentex canariensis*

The Canary dentex is distributed in the East Atlantic from Cape Bojador and Western Sahara occidental to Angola. It is a benthopelagic species that inhabits various substrata, particularly near rocky bottoms at water depths of up to 150m (exceptionally, 450m). This species forms small schools, but large-size individuals are probably solitary (FishBase).

a) Distribution of CPUA

Figure 3.17 shows the CPUA distribution of the Canary dentex. This species was widely distributed at water depth less than 80m. It was also present in the *Amrigue* survey area.

b) CPUA by stratum

Table 3.37 shows the CPUA for the Canary dentex at each stratum in each area. In the *Amrigue* survey area, the mean CPUA by area was generally below 10. In the *Al-Awam* survey area, the Canary dentex occurred in all areas and seasons. The mean CPUA by stratum peaked at 476 at the 3-20m stratum in the Northern area in the Phase 2 cold season. Except for that value, the mean CPUA by stratum was lower than 200, and often even lower than 100, with the depth-dependent trend : lower the value as the depth increased.

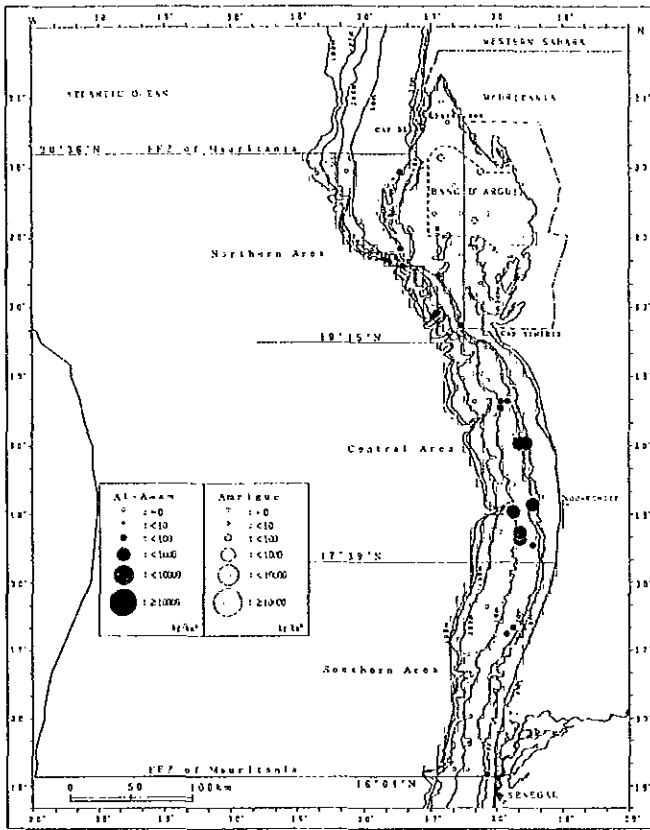
c) Stock size

Table 3.38 shows estimates of the stock size for the Canary dentex.

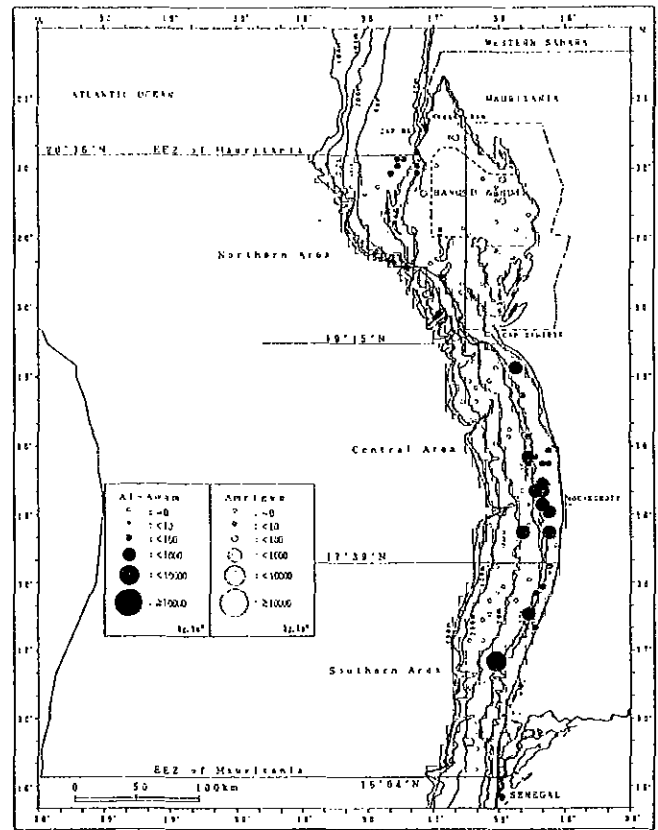
In the *Amrigue* survey area, the total stock size of this species varied between 21 and 123 tonnes. After a peak value recorded in the Phase 1 cold season, the total stock size decreased until the Phase 2 cold season, then went up again in the warm season. But those variations were not significant considering the 95% confidence interval of the total stock size in each season. The other area accounted for over 50% of the total stock size.

As for the total stock size of this species in the *Al-Awam* survey area, only Phase 2 results are presented here, during which period data on the 3-20m stratum were recorded. The total stock size in the cold and warm seasons was respectively 3,099 and 1,383 tonnes, with a 95% confidence interval of $\pm 1,107$ and ± 399 tonnes and a CV of 42 and 49%. In both phases, the Northern area occupied about 90% of the total stock size, and the 3-20m stratum accounted for over 90% of the stock size in the Northern area.

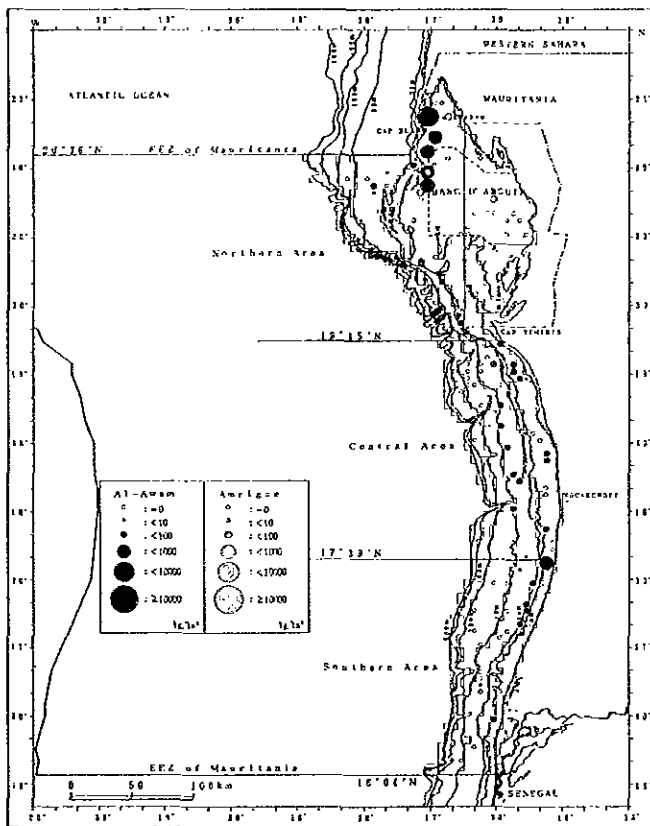
(A) Phase 1 cold season



(B) Phase 1 warm season



(C) Phase 2 cold season



(D) Phase 2 warm season

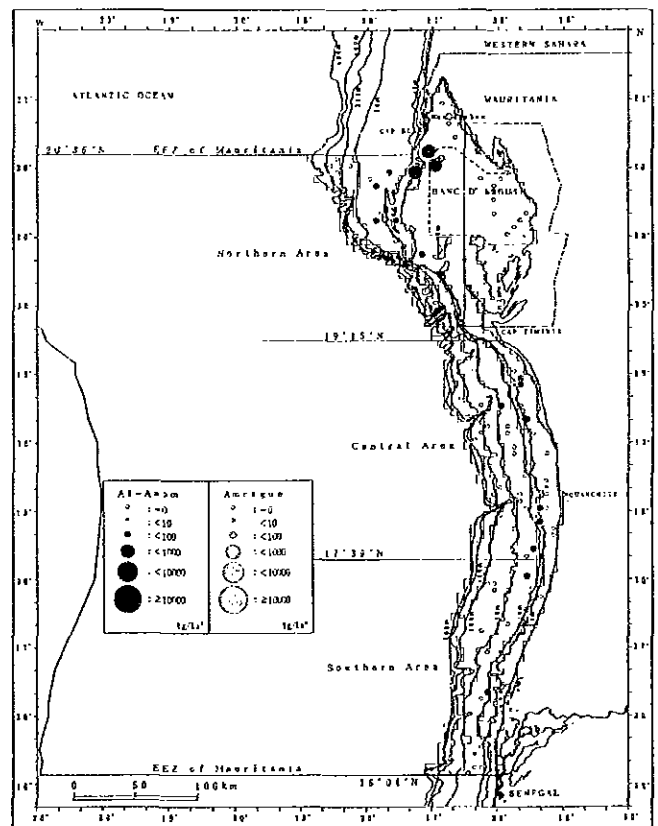


Figure 3.17 Distribution of CPUA for Canary dentex *Dentex canariensis*.

Table 3.37 CPUA of Canary dentex *Dentex canariensis* by stratum.

(A) *Amrique* survey area

Northern coastal area (Stratum: 3-20m)	Phase 1						Phase 2					
	Cold season			Warm season			Cold season			Warm season		
	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range
Banc d'Arguin	12.2	26.1	0.0 ~ 80.4	4.6	10.1	0.0 ~ 36.5	1.0	3.2	0.0 ~ 12.2	0.0	0.0	0.0 ~ 0.0
Other	11.0	22.1	0.0 ~ 56.4	7.4	9.8	0.0 ~ 31.7	2.8	5.8	0.0 ~ 15.0	12.6	23.1	0.0 ~ 62.5

(B) *Al-Awam* survey area

Subarea	Stratum	Phase 1						Phase 2						
		Cold season			Warm season			Cold season			Warm season			
		Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	
North	3-20m	-	-	-	-	-	-	476.1	582.7	2.7 ~ 1,727.6	187.1	226.6	0.0 ~ 495.9	
	20-30m	6.6	14.8	0.0 ~ 33.1	53.3	38.6	0.0 ~ 82.1	31.2	37.5	0.0 ~ 75.1	77.7	116.7	0.0 ~ 211.9	
	30-80m	9.7	15.9	0.0 ~ 38.2	31.0	32.1	0.0 ~ 82.2	11.7	19.6	0.0 ~ 58.5	19.8	30.3	0.0 ~ 80.5	
	80-200m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	
	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	-	-	-	-	0.0	0.0	0.0 ~ 0.0
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-	-
Central	3-20m	-	-	-	95.4	84.6	0.0 ~ 239.5	21.5	26.0	0.0 ~ 64.0	23.9	37.1	0.0 ~ 97.2	
	20-30m	128.1	185.7	0.0 ~ 397.1	81.9	67.5	21.5 ~ 168.8	1.3	2.5	0.0 ~ 5.0	0.2	0.5	0.0 ~ 1.0	
	30-80m	132.8	262.6	0.0 ~ 923.8	60.6	208.2	0.0 ~ 721.9	14.6	18.7	0.0 ~ 55.8	10.8	29.0	0.0 ~ 92.0	
	80-200m	57.2	180.9	0.0 ~ 572.1	0.0	0.0	0.0 ~ 0.0	5.0	15.7	0.0 ~ 49.5	0.0	0.0	0.0 ~ 0.0	
	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	
	400-600m	-	-	-	0.0	0.0	0.0 ~ 0.0	-	-	-	-	-	-	
South	3-20m	-	-	-	3.5	5.6	0.0 ~ 13.9	23.9	49.4	0.0 ~ 135.3	0.8	1.3	0.0 ~ 3.5	
	20-30m	24.7	36.6	0.0 ~ 66.8	154.6	188.4	41.5 ~ 372.1	51.4	50.2	6.1 ~ 95.7	0.0	0.0	0.0 ~ 0.0	
	30-80m	4.4	8.3	0.0 ~ 21.0	141.2	446.6	0.0 ~ 1,412.2	6.3	11.5	0.0 ~ 36.7	7.4	14.5	0.0 ~ 43.4	
	80-200m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	
	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-	

Remarks. S. D.: standard deviation, - : no trawl.

Table 3.38 Stock size estimates of Canary dentex *Dentex canariensis*.

(A) *Amrigue* survey area

Subarea	Stratum	Area in km ²	Stock size in tonnes			
			Phase 1		Phase 2	
			Cold season	Warm season	Cold season	Warm season
North	Banc d'Arguin	4,741	58	22	5	0
	3-20m	5,912	65	44	16	74
	Total	10,653	123	66	21	74
95% confidence interval			±115	±39	±18	±61
CV: coefficient of variation			49%	32%	46%	69%

(B) *Al-Awam* survey area

Subarea	Stratum	Area in km ²	Stock size in tonnes			
			Phase 1		Phase 2	
			Cold season	Warm season	Cold season	Warm season
North	3-20m	5,912	-	-	2,815	1,106
	20-30m	1,290	9	69	40	100
	30-80m	2,924	28	91	34	58
	80-200m	1,147	0	0	0	0
	200-400m	936	0	0	-	0
	Total	12,209	37	159	2,889	1,264
	95% confidence interval			±36	±103	±1,799
CV: coefficient of variation			50%	29%	45%	53%
Central	3-20m	2,783	-	265	60	67
	20-30m	835	107	68	1	+
	30-80m	2,870	381	174	42	31
	80-200m	2,767	158	0	14	0
	200-400m	1,453	0	0	0	0
	400-600m	848	-	0	-	-
	Total	8,773	646	508	117	98
95% confidence interval			±583	±383	±65	±94
CV: coefficient of variation			43%	36%	24%	38%
South	3-20m	1,485	-	5	35	1
	20-30m	805	20	124	41	0
	30-80m	2,640	12	373	17	20
	80-200m	3,025	0	0	0	0
	200-400m	994	0	0	0	0
	Total	8,949	32	502	94	21
	95% confidence interval			±49	±769	±96
CV: coefficient of variation			59%	76%	35%	56%
All	3-20m	10,180	-	271	2,910	1,174
	20-30m	2,930	135	262	83	100
	30-80m	8,434	421	637	93	108
	80-200m	6,939	158	0	14	0
	200-400m	3,383	0	0	0	0
	400-600m	848	-	0	-	-
	Total	22,534	715	1,170	3,099	1,383
95% confidence interval			±712	±890	±1,107	±399
CV: coefficient of variation			39%	37%	42%	49%

Remarks. - : no trawl, +: less than 1 tonne.

10) Red pandora *Pagellus bellottii*

The red pandora is found in the Atlantic coast from the Strait of Gibraltar down to Angola. It is a subtropical demersal that forms schools generally at water depths of less than 100m (FishBase).

a) Distribution of CPUA

Figure 3.18 shows the CPUA distribution of the red pandora. This species was found to be widely distributed over the continental shelf at water depths of less than 200m. Its distribution is focused in area at the water depths of 20-80m, where high CPUA was concentrated. In the warm season, its distribution became denser and high CPUA was centered at the 30-80m stratum. In the cold season, high CPUA was distributed in shallower areas. This distribution pattern suggests the stock of this species is divided in two subpopulations, one in the Northern area and the other south of Cape Timiris.

According to Dah *et al.* (1991), the red pandora, like the white grouper and the West African goatfish, has an affinity with Saharan species and undertakes a seasonal migration. The fact that in the warm season the CPUA density and the frequency of occurrence of high CPUA increase, suggests an enlargement of the quantity of individuals that migrate into Mauritanian territorial waters.

b) CPUA by stratum

Table 3.41 shows the CPUA for the red pandora by each stratum in each area.

In the *Amrigue* survey area, the mean CPUA by area did not exceed 6 (the red pandora was not captured in the Phase 2 cold season).

The mean CPUA by stratum for this species in the *Al-Awam* survey area was low in the cold season and high in the warm season at the 20-30m and 30-80m strata in each area. On the contrary, at the 3-20m stratum, it was high in the cold season and low in the warm season. The highest mean CPUA by stratum was more often observed at the 30-80m stratum in each area, regardless of the season. Particularly, the mean CPUA at the 30-80m stratum in each area in the warm season varied between 964 and 2,134 and, except for two instances, it was close to 2,000.

c) Stock size

Table 3.42 shows estimates of the stock size for the red pandora.

In the *Amrigue* survey area, the estimate of the total stock size was between 13 and 29 tonnes, except in the Phase 2 cold season when this species was not caught. This difference was not much significant considering the amplitude of the 95% confidence interval. The stock size in the Banc d'Arguin accounted for 50 to 100% of the total.

In the *Al-Awam* survey area, presuming that the stock at the 3-20m stratum in Phase 1 was in the same order as that in Phase 2, it would have meant that the total stock size was approximately 7,000 tonnes in the cold season and a little less than 20,000 tonnes in the warm season, relatively stable status.

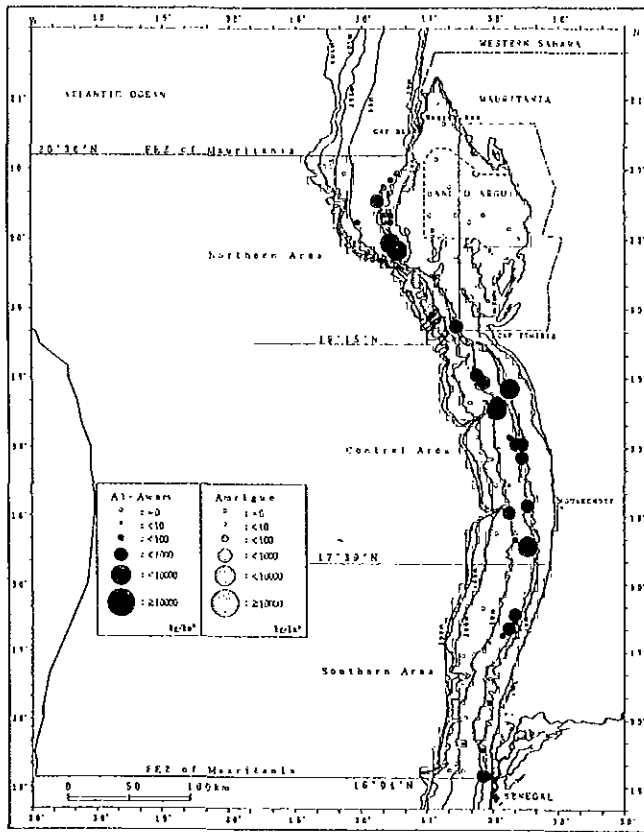
Geographical and vertical distributions of the red pandora were studied in Phase 2. The total stock size in the cold and warm seasons was respectively 6,826 and 16,748 tonnes, with a 95% confidence interval of respectively $\pm 3,483$ and $\pm 8,342$ tonnes (CV of 25 and 18%). In the cold season, the Northern, Central and Southern areas each occupied approximately one-third of the total stock size, while the 3-20m

and 30-80m strata each accounted for half of the total. In the warm season, the respective ratio was 49, 36 and 15% from north to south, while the 30-80m stratum accounted for 85% of the total.

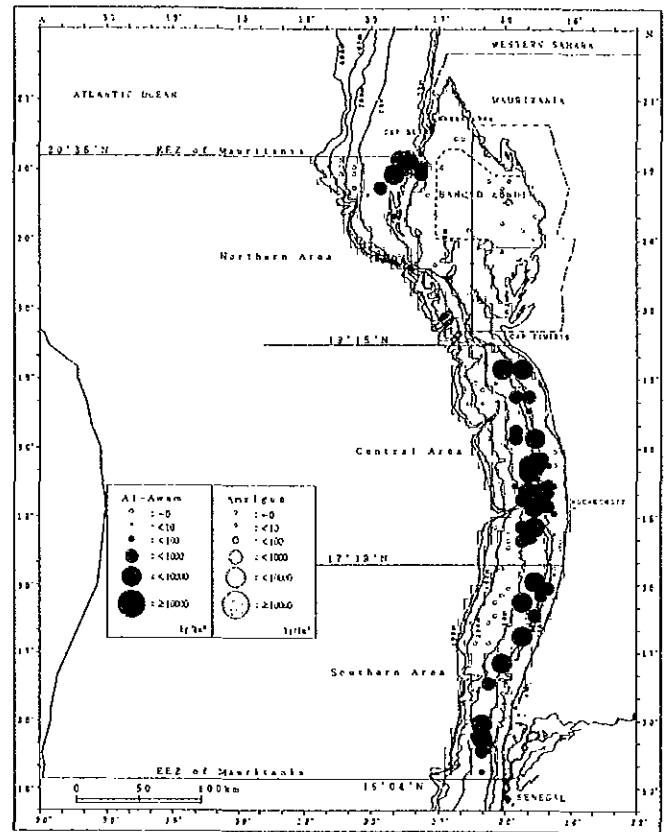
Seasonal variations in this distribution pattern suggest a migration of the red pandora between north and south as well as between coast and offshore.

The ratio of the red pandora stock to the total stock size of all captured species was 1.9% in the cold season and 4.2% in the warm season (see Table 3.20(b), III and IV).

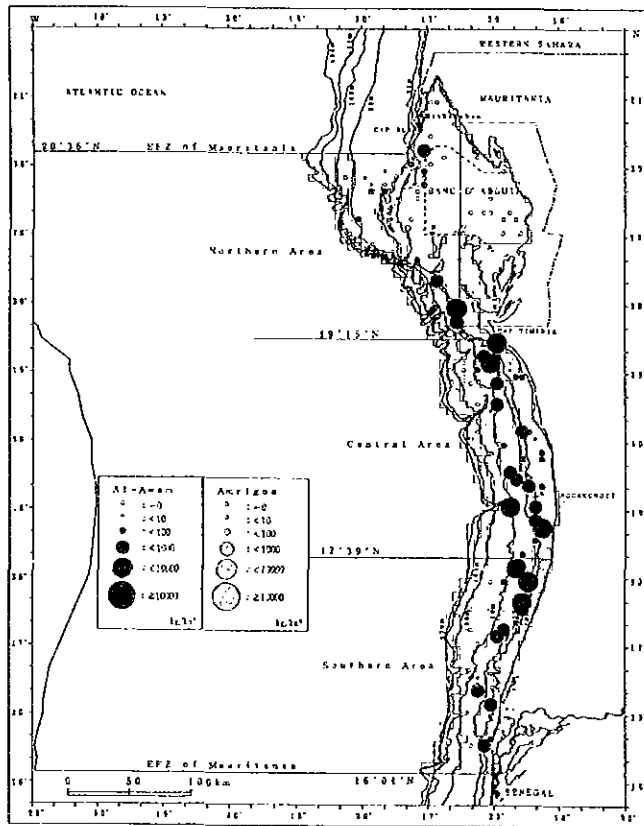
(A) Phase 1 cold season



(B) Phase 1 warm season



(C) Phase 2 cold season



(D) Phase 2 warm season

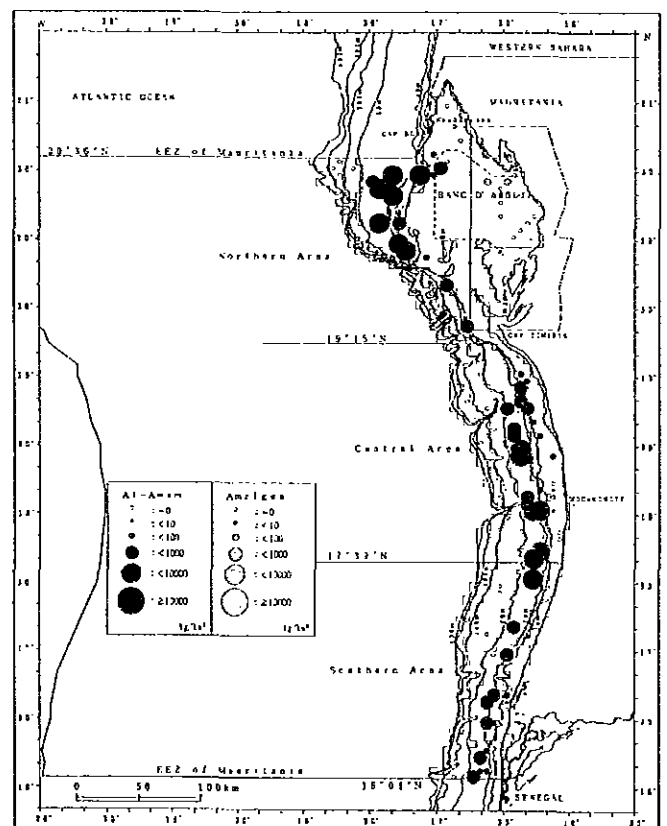


Figure 3.18 Distribution of CPUA for red pandora *Pagellus bellottii*.

Table 3.39 CUPA of red pandora *Pagellus bellottii* by stratum.

(A) *Amrique* survey area

Northern coastal area (Stratum: 3-20m)	Phase 1							Phase 2					
	Cold season			Warm season				Cold season			Warm season		
	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	
Banc d'Arguin	6.2	17.3	0.0 ~ 52.3	1.5	3.2	0.0 ~ 10.9	0.0	0.0	0.0 ~ 0.0	2.6	7.4	0.0 ~ 27.3	
Other	0.0	0.0	0.0 ~ 0.0	1.2	3.0	0.0 ~ 10.7	0.0	0.0	0.0 ~ 0.0	0.1	0.2	0.0 ~ 0.6	

(B) *Al-Awam* survey area

Subarea	Stratum	Phase 1							Phase 2					
		Cold season			Warm season				Cold season			Warm season		
		Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	
North	3-20m	-	-	-	-	-	-	-	323.4	547.4	0.0 ~ 1,394.5	118.7	129.9	49.0 ~ 313.4
	20-30m	86.5	105.9	15.2 ~ 272.0	235.6	274.9	18.5 ~ 631.6	162.2	278.6	2.4 ~ 578.2	958.0	994.1	316.9 ~ 2,103.1	
	30-80m	650.1	1,033.2	16.4 ~ 2,788.8	1,087.3	780.6	0.2 ~ 1,782.2	84.9	214.6	0.0 ~ 615.5	2,133.5	1,606.2	582.3 ~ 4,484.2	
	80-200m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	
	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	-	-	-	-	0.0	0.0	0.0 ~ 0.0
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-	-
Central	3-20m	-	-	-	188.5	303.8	0.0 ~ 1,045.9	371.3	846.7	0.0 ~ 2,835.1	36.2	53.0	0.0 ~ 186.6	
	20-30m	505.6	548.1	137.0 ~ 1,315.3	1,058.7	561.8	255.4 ~ 1,447.9	197.5	206.7	11.3 ~ 482.0	478.5	490.9	58.2 ~ 1,094.3	
	30-80m	290.2	503.7	0.0 ~ 1,612.8	2,667.6	2,468.4	1.3 ~ 6,692.3	252.0	335.8	0.0 ~ 1,093.5	1,909.2	2,077.4	127.0 ~ 5,606.3	
	80-200m	38.2	120.8	0.0 ~ 382.0	23.5	49.4	0.0 ~ 138.0	147.4	463.7	0.0 ~ 1,467.1	0.0	0.0	0.0 ~ 0.0	
	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	
	400-600m	-	-	-	0.0	0.0	0.0 ~ 0.0	-	-	-	-	-	-	
South	3-20m	-	-	-	0.1	0.4	0.0 ~ 1.1	5.3	15.9	0.0 ~ 47.6	6.7	17.3	0.0 ~ 52.3	
	20-30m	110.8	133.3	12.6 ~ 262.5	388.0	241.0	159.1 ~ 639.5	149.8	108.2	22.7 ~ 284.3	46.3	79.8	0.0 ~ 165.1	
	30-80m	57.4	84.0	0.0 ~ 214.3	1,786.5	2,032.5	31.8 ~ 5,946.4	755.9	1,148.3	0.0 ~ 3,768.9	964.4	1,976.5	0.0 ~ 6,338.5	
	80-200m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	1.1	3.3	0.0 ~ 10.0	0.0	0.0	0.0 ~ 0.0	
	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-	

Remarks. S. D.: standard deviation. - : no trawl.

Table 3.40 Stock size estimates of red pandora *Pagellus bellottii*.

(A) Amrigue survey area

Subarea	Stratum	Area in km ²	Stock size in tonnes			
			Phase 1		Phase 2	
			Cold season	Warm season	Cold season	Warm season
North	Banc d'Arguin	4,741	29	7	0	12
	3-20m	5,912	0	7	0	1
	Total	10,653	29	14	0	13
	95% confidence interval		±61	±12	±0	±28
	CV: coefficient of variation		94%	46%	0%	71%

(B) Al-Awam survey area

Subarea	Stratum	Area in km ²	Stock size in tonnes			
			Phase 1		Phase 2	
			Cold season	Warm season	Cold season	Warm season
North	3-20m	5,912	-	-	1,912	702
	20-30m	1,290	112	304	209	1,236
	30-80m	2,924	1,901	3,179	248	6,238
	80-200m	1,147	0	0	0	0
	200-400m	936	0	0	-	0
	Total	12,209	2,012	3,483	2,370	8,176
	95% confidence interval		±2,031	±2,123	±1,677	±7,335
CV: coefficient of variation		53%	27%	53%	23%	
Central	3-20m	2,783	-	525	1,033	101
	20-30m	835	422	884	165	399
	30-80m	2,870	833	7,656	723	5,479
	80-200m	2,767	106	65	408	0
	200-400m	1,453	0	0	0	0
	400-600m	848	-	0	-	-
	Total	8,773	1,360	9,129	2,329	5,979
95% confidence interval		±1,143	±5,286	±1,799	±4,296	
CV: coefficient of variation		36%	23%	33%	32%	
South	3-20m	1,485	-	+	8	10
	20-30m	805	89	312	121	37
	30-80m	2,640	151	4,717	1,996	2,546
	80-200m	3,025	0	0	3	0
	200-400m	994	0	0	0	0
	Total	8,949	241	5,029	2,128	2,593
	95% confidence interval		±251	±4,135	±2,059	±3,651
CV: coefficient of variation		40%	34%	43%	61%	
All	3-20m	10,180	-	525	2,953	812
	20-30m	2,930	623	1,500	495	1,673
	30-80m	8,434	2,885	15,551	2,967	14,263
	80-200m	6,939	106	65	411	0
	200-400m	3,383	0	0	0	0
	400-600m	848	-	0	-	-
	Total	22,534	3,613	17,641	6,826	16,748
95% confidence interval		±2,351	±7,538	±3,483	±8,342	
CV: coefficient of variation		33%	16%	25%	18%	

Remarks. - : no trawl, +: less than 1 tonne.

11) Senegalese sole *Solea senegalensis*

The Senegalese sole is found in the East Atlantic from the Bay of Biscay down to Senegal. It is a demersal and a very strong littoral species (FishBase).

a) Distribution of CPUTA

Figure 3.19 shows the CPUTA distribution of the Senegalese sole.

It appears that this species was distributed mainly in the Northern coastal area, which corresponds to the *Amrigne* survey area. In the *Al-Awam* survey area, it was found only in very low quantities at water depths of less than 80m, and spottily distributed. In the Phase I cold season, the Senegalese sole was not captured at all. However, it is conceivable that it is indeed present in the *Al-Awam* survey area at water depths of less than 8 m, where the vessel could not operate.

b) CPUTA by stratum

Table 3.41 shows the CPUTA for the Senegalese sole at each stratum in each area.

In the *Amrigne* survey area, the highest CPUTA for this species was 275. The mean CPUTA by stratum was generally lower than 30, and higher in the warm season than in the cold season.

In the *Al-Awam* survey area, the highest value of CPUTA was 158, the mean CPUTA by stratum being generally lower than 10 in all areas.

c) Stock size

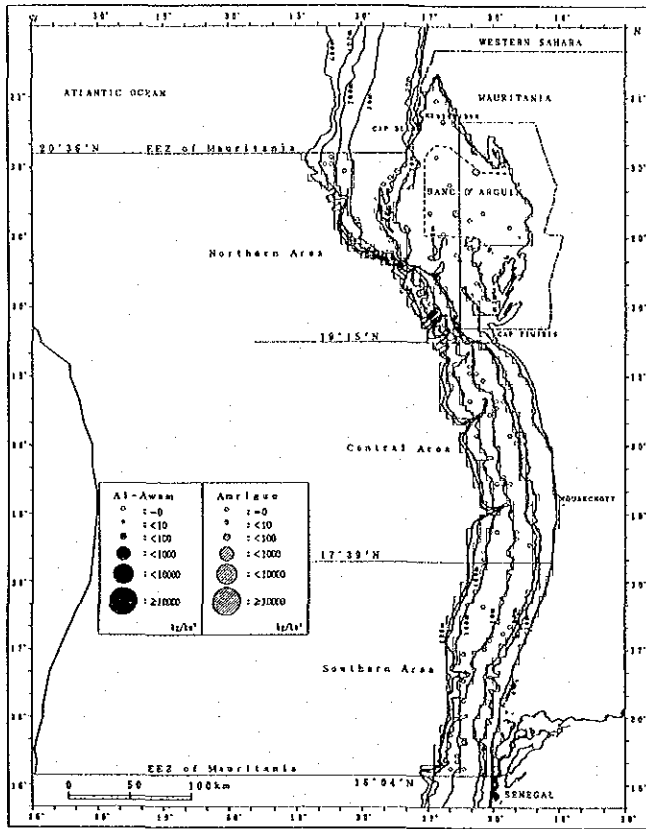
Table 3.42 shows estimates of the stock size for the Senegalese sole.

In the *Amrigne* survey area, the estimate of the total stock size in the cold season of Phase I and Phase 2 was 56 and 80 tonnes respectively, while it in the warm season was 232 and 275 tonnes respectively. In the Phase I cold season, the stock size in the other area accounted for 80% of the total, while in the other seasons, the stock size in the Banc d'Arguin comprised between 57 and 100% of the total.

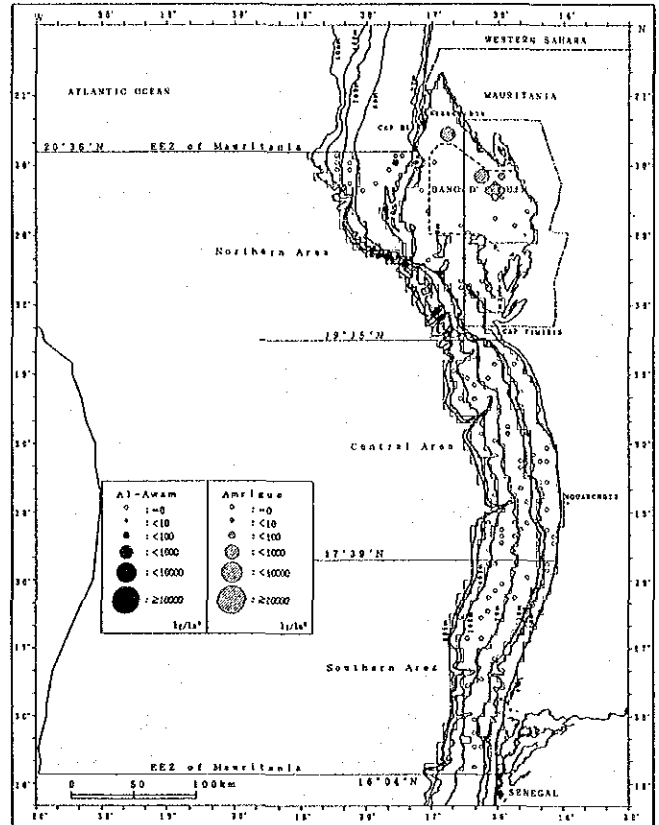
In the *Al-Awam* survey area, the total stock size was between 0 and 83 tonnes. The Senegalese sole stock was considerably lower level among all target fish species.

The only two species for which the estimated stock size from data obtained by the *Amrigne* (whose catch capacity is inferior to that of the *Al-Awam*) was superior to that based on data from the *Al-Awam* were the Senegalese sole and the southern pink shrimp *Penaeus notialis*, described below.

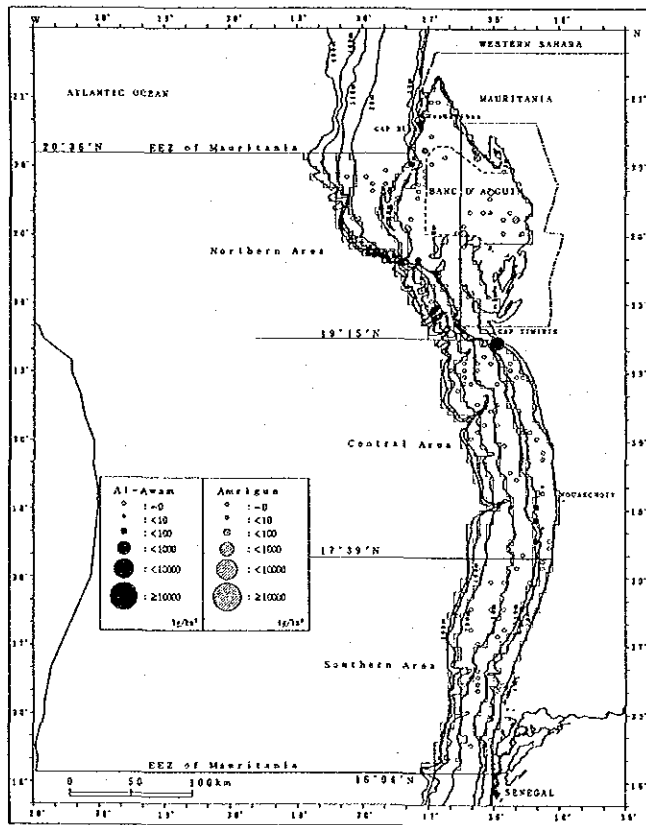
(A) Phase 1 cold season



(B) Phase 1 warm season



(C) Phase 2 cold season



(D) Phase 2 warm season

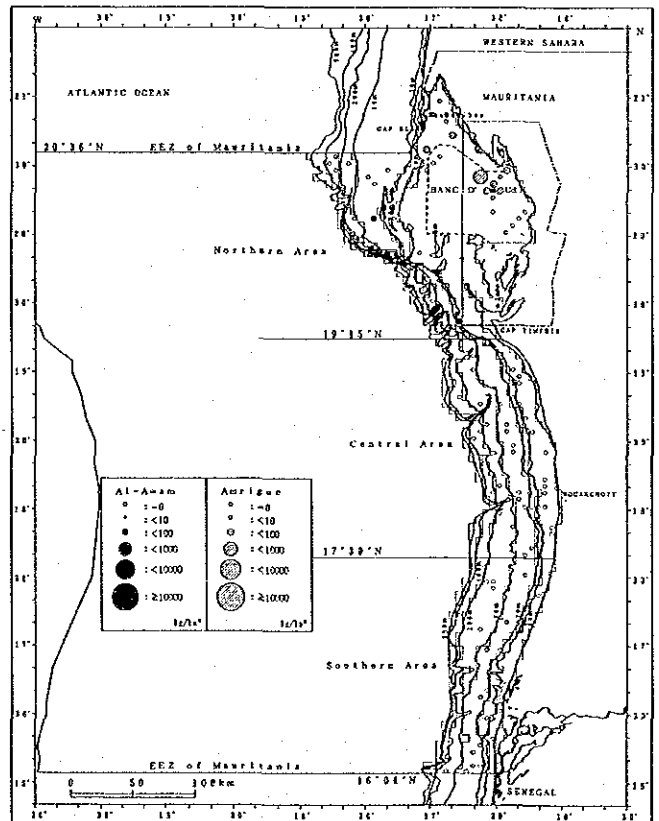


Figure 3.19 Distribution of CPUA for Senegalese sole *Solea senegalensis*.

Table 3.41 CUPA of Senegalese sole *Solea senegalensis* by stratum.

(A) Anrique survey area

Northern coastal area (Stratum: 3-20m)	Phase 1							Phase 2					
	Cold season			Warm season				Cold season			Warm season		
	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	
Banc d'Arguin	2.3	7.0	0.0 ~ 21.1	33.1	60.7	0.0 ~ 231.5	16.8	31.4	0.0 ~ 87.8	31.6	71.4	0.0 ~ 274.7	
Other	7.7	23.0	0.0 ~ 68.9	20.1	69.5	0.0 ~ 240.8	0.0	0.0	0.0 ~ 0.0	13.9	24.1	0.0 ~ 55.6	

(B) Al-Awam survey area

Subarea	Stratum	Phase 1							Phase 2					
		Cold season			Warm season				Cold season			Warm season		
		Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	Mean	S. D.	Range	
North	3-20m	-	-	-	-	-	-	-	6.2	10.8	0.0 ~ 25.8	0.0	0.0	0.0 ~ 0.0
	20-30m	0.0	0.0	0.0 ~ 0.0	6.9	13.9	0.0 ~ 27.7	3.0	6.0	0.0 ~ 11.9	3.4	5.9	0.0 ~ 10.3	
	30-80m	0.0	0.0	0.0 ~ 0.0	6.4	15.7	0.0 ~ 38.4	0.0	0.0	0.0 ~ 0.0	1.7	4.7	0.0 ~ 13.4	
	80-200m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	
	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	-	-	-	-	0.0	0.0	0.0 ~ 0.0
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-	-
Central	3-20m	-	-	-	0.0	0.0	0.0 ~ 0.0	14.4	40.2	0.0 ~ 158.2	0.0	0.0	0.0 ~ 0.0	
	20-30m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	2.7	5.4	0.0 ~ 10.8	0.0	0.0	0.0 ~ 0.0	
	30-80m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	
	80-200m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	
	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	
	400-600m	-	-	-	0.0	0.0	0.0 ~ 0.0	-	-	-	-	-	-	
South	3-20m	-	-	-	0.3	0.8	0.0 ~ 2.4	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	
	20-30m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	
	30-80m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	
	80-200m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	
	200-400m	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	0.0	0.0	0.0 ~ 0.0	
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-	

Remarks. S. D.: standard deviation, - : no trawl.

Table 3.42 Stock size estimates of Senegalese sole *Solea senegalensis*.

(A) *Amrigue* survey area

Subarea	Stratum	Area in km ²	Stock size in tonnes			
			Phase 1		Phase 2	
			Cold season	Warm season	Cold season	Warm season
North	Banc d'Arguin	4,741	11	157	80	150
	3-20m	5,912	45	119	0	82
	Total	10,653	56	275	80	232
	95% confidence interval		±82	±255	±89	±269
	CV: coefficient of variation		83%	51%	48%	44%

(B) *Al-Awam* survey area

Subarea	Stratum	Area in km ²	Stock size in tonnes			
			Phase 1		Phase 2	
			Cold season	Warm season	Cold season	Warm season
North	3-20m	5,912	-	-	37	0
	20-30m	1,290	0	9	4	4
	30-80m	2,924	0	19	0	5
	80-200m	1,147	0	0	0	0
	200-400m	936	0	0	-	0
	Total	12,209	0	28	40	9
	95% confidence interval		±0	±35	±32	±19
CV: coefficient of variation		0%	75%	61%	71%	
Central	3-20m	2,783	-	0	40	0
	20-30m	835	0	0	2	0
	30-80m	2,870	0	0	0	0
	80-200m	2,767	0	0	0	0
	200-400m	1,453	0	0	0	0
	400-600m	818	-	0	-	-
	Total	8,773	0	0	42	0
95% confidence interval		±0	±0	±77	±0	
CV: coefficient of variation		0%	0%	66%	0%	
South	3-20m	1,485	-	+	0	0
	20-30m	805	0	0	0	0
	30-80m	2,640	0	0	0	0
	80-200m	3,025	0	0	0	0
	200-400m	994	0	0	0	0
	Total	8,949	0	+	0	0
	95% confidence interval		±0	±1	±0	±0
CV: coefficient of variation		0%	100%	0%	0%	
All	3-20m	10,180	-	+	77	0
	20-30m	2,930	0	9	6	4
	30-80m	8,434	0	19	0	5
	80-200m	6,939	0	0	0	0
	200-400m	3,383	0	0	0	0
	400-600m	848	-	0	-	-
	Total	22,534	0	28	83	9
95% confidence interval		±0	±25	±99	±11	
CV: coefficient of variation		0%	74%	45%	71%	

Remarks. - : no trawl, +: less than 1 tonne.