(3) Crustaceans

Presented below are the biological findings obtained for the four species targeted in this survey.

1) Southern pink shrimp *Penaeus notialis*

a) Body length range and mean body length

Table 3.113 (page 3-355) presents the minimum, maximum and mean total length obtained for the southern pink shrimp. The southern pink shrimp and the Senegalese sole were the only two species of which the samples obtained in the *Amrigue* survey area were more numerous than those obtained in the *Al-Awam* survey area.

In the *Amrigue* survey area, the total length of the southern pink shrimp varied between 40 and 200 mm throughout the survey. The mean total length in each survey season was higher in the cold season than in the warm season. The mean total length by area was lower in the Banc d'Arguin in all seasons.

In the *Al-Awam* survey area, the total length varied between 40 and 235 mm throughout the survey. In the Central and Southern areas, the mean total length by area was higher in the warm season. In some areas, the mean total length by area was different depending on the survey season. The mean length by stratum does not seem to depend on depth.

b) Size composition

Figure 3.85 (page 3-352, 3-356 to 3-359) illustrates the evaluation of size composition for the southern pink shrimp. The total length class is indicated at intervals of 1cm. For convenience, three groups were defined: (i) small-size (total length less than 7cm), (ii) medium-size (length between 7 and 15cm), (iii) large-size (length over 15cm).

b-1) *Amrigue* survey area

The total stock size in number basically comprised the medium-size group. The predominant mode class of that group varied according to the season: in the cold season, it appeared at the 14-15cm class, while in the warm season it occurred between 10 and 12cm class. In the cold season, the medium-size group was displaced towards the large-size ones. The small-size group was particularly salient in the warm season, while the large-size group was conspicuous in the cold season (not in number of individuals, but in frequency of occurrence).

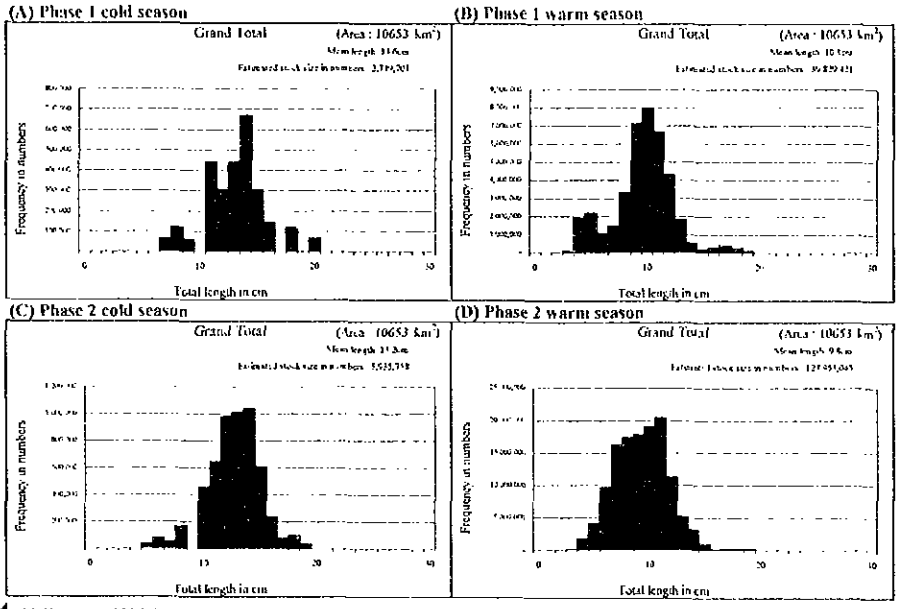
b-2) *Al-Awam* survey area

In the cold season, the total stock size in number basically formed by the medium-size group, but in the warm season the forming groups were those of medium- and large-size. The small-size group was found only in the Phase 2 warm season. In the Phase 1 cold season, the predominant mode of the medium-size group appeared at the 11-12cm class, but in the other three seasons, it occurred at classes between 13 and 15cm. In the Phase 2 cold season, a distinct mode was observed at the 11-12cm class; the stock in number at the class was of the same order than that at the predominant mode class of the Phase 1 cold season. The dominant mode of the large-size group was distributed within three classes between 16 and 19cm. In the Phase 2 warm season, another predominant mode appeared at the 20-21cm class.

It is possible to summarize the distribution of those three groups in the following manner from the

size composition by stratum and by area. ①The small-size group that appeared only in the Phase 2 warm season, was distributed only at the 30-80 m stratum in the Southern area. ②The medium-size group was distributed over the entire area, mainly in the Southern area in Phase 1 and in the Central area in Phase 2. ③In the Phase 1 cold season, the large-size group was distributed only at the 30-80 m stratum in the Southern area, but with a distribution pattern similar to the middle-size group during the other three seasons.

***Amrigue* survey area**



***Al-Awam* survey area**

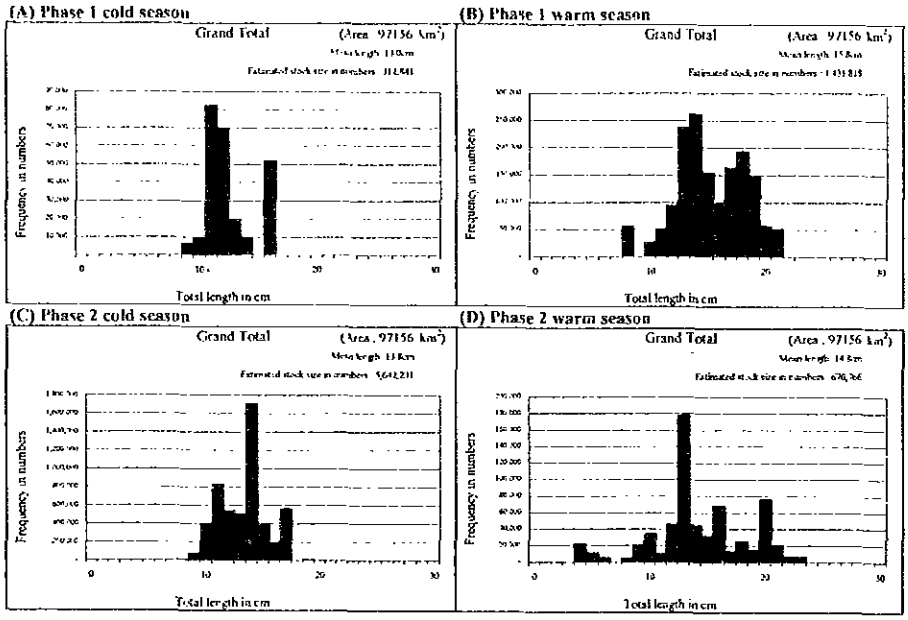


Figure 3.85 Size composition for southern pink shrimp *Penaeus notialis*.

c) Length-weight relationship

Figure 3.86 presents the relationship between body length and weight for the southern pink shrimp. The length-weight equations obtained from all samples were the following:

Phase 1 cold season	: $BW = 4.407\times10^{-2}\times TL^{2.455}$	(r=0.9174)
Phase 1 warm season	: $BW = 1.929\times10^{-2}\times TL^{2.662}$	(r=0.9758)
Phase 2 cold season	: $BW = 4.744\times10^{-2}\times TL^{2.296}$	(r=0.9174)
Phase 2 warm season	: $BW = 1.527\times10^{-2}\times TL^{2.831}$	(r=0.9791)

where, BW : body weight (g), TL : total length (cm) and r : the coefficient of correlation.

According to Burkovsky *et al.* (1989), the spawning period of the southern pink shrimp found in the territorial waters of the IRM would be in August. The sudden increase in weight of this species observed between 15 and 18cm in the cold season (April-May) (a majority of females, see Figure 3.87) may suggest gonadal development.

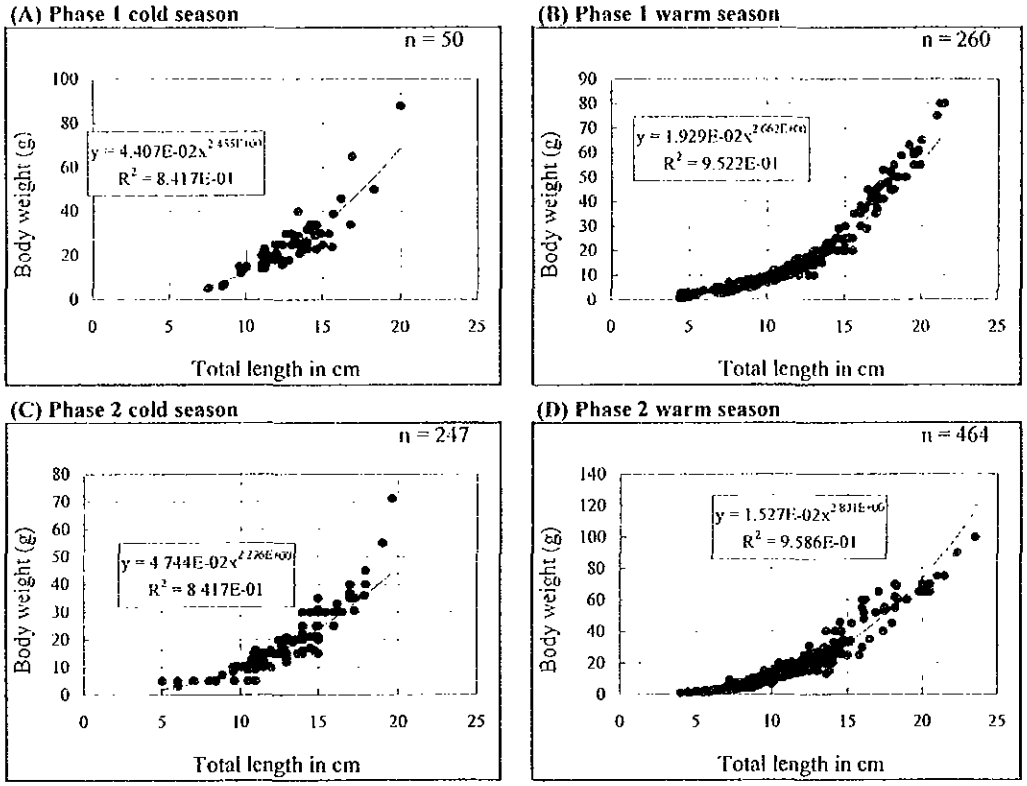


Figure 3.86 Length-weight relationship for southern pink shrimp *Penaeus notialis*.

d) Length and weight by sex

Table 3.114 (page 3-360) shows the total length and body weight observed in each sex for the southern pink shrimp. No individual of indetermined sex was observed.

In the *Amrigue* survey area, the total length varied between 45 and 200 mm for females and between 40 and 168 mm for males throughout the survey. The mean size of both males and females was larger in the cold season than in the warm season.

In the *Al-Awam* survey area, the total length varied between 50 and 235 mm for females and between 40 and 212 mm for males. For all seasons, the mean length and mean weight of females were larger than those of males. The difference was particularly significant in the warm season.

e) Sex ratio

Table 3.115 (page 3-361) summarizes the sex ratio for the southern pink shrimp. Figure 3.87 (page 3-362) presents its distribution by length class. The female maturity stage was not visually observed.

In the *Amrigue* survey area, the sex ratio of this species varied between 0.48 and 0.81 in all seasons except in the Phase 2 cold season, in which the males and females were nearly equal in number (0.98). The females were in greater number, particularly in the Phase 1 cold season. The sex ratio by area was low in the Banc d'Arguin, where the females were even more predominant.

In the *Al-Awam* survey area, the overall sex ratio of this species varied between 0.30 and 0.84 in all seasons except in the Phase 2 cold season, in which the males were in the majority (sex ratio 1.18). Geographical and vertical variations of the sex ratio were not analyzed due to the lack of sufficient data.

The size-dependent change of the sex ratio was observed. After the Phase 1 warm season, the sex ratio shifted from 0 to 200-300% between 60 and 100 mm, even 140 mm, but decreased afterwards. Beyond 160-170 mm, the totality or the great majority of individuals were females.

Table 3.113 Body length range and mean body length for southern pink shrimp *Penaeus notialis*.

(A) ***Amrigue*** **survey area**

Northern coastal area (Stratum: 3-20m)	Phase 1						Phase 2					
	Cold season			Warm season			Cold season			Warm season		
	Specimens	Range	Mean	Specimens	Range	Mean	Specimens	Range	Mean	Specimens	Range	Mean
Banc d'Arguin	12	75 ~ 144	114.0	148	44 ~ 198	102.1	88	50 ~ 190	124.0	269	40 ~ 182	99.3
Other	25	110 ~ 200	141.7	22	83 ~ 172	134.1	13	100 ~ 180	137.7	114	70 ~ 183	110.4
All area	37	75 ~ 200	132.7	170	44 ~ 198	106.3	101	50 ~ 190	125.8	383	40 ~ 183	102.6

(B) ***Al-Awam*** **survey area**

Subarea	Stratum	Phase 1						Phase 2					
		Cold season			Warm season			Cold season			Warm season		
		Specimens	Range	Mean	Specimens	Range	Mean	Specimens	Range	Mean	Specimens	Range	Mean
North	3-20m	-	-	-	-	-	-	4	130 ~ 173	153.3	0		
	20-30m	0			8	152 ~ 215	185.1	1	196	196.0	0		
	30-80m	6	100 ~ 140	122.2	0			0			1	133	133.0
	80-200m	0			0			0			0		
	200-400m	0			0			-	-	-	0		
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-
	3-600m	6	100 ~ 140	122.2	8	152 ~ 215	185.1	5	130 ~ 196	161.8	1	133	133.0
Central	3-20m	-	-	-	20	107 ~ 180	141.8	50	88 ~ 179	130.5	1	133	133.0
	20-30m	2	95 ~ 124	109.5	0			0			11	88 ~ 145	108.4
	30-80m	2	113 ~ 121	117.0	20	120 ~ 197	148.1	0			42	105 ~ 235	167.0
	80-200m	0			0			0			0		
	200-400m	0			0			0			0		
	400-600m	-	-	-	0			-	-	-	-	-	-
	3-600m	4	95 ~ 124	113.3	40	107 ~ 197	145.0	50	88 ~ 179	130.5	54	88 ~ 235	154.4
South	3-20m	-	-	-	40	85 ~ 200	158.1	70	84 ~ 170	117.0	6	146 ~ 182	160.5
	20-30m	0			0			20	96 ~ 150	116.3	4	128 ~ 184	169.5
	30-80m	3	114 ~ 169	136.3	2	120	120.0	1	165	165.0	16	40 ~ 146	94.8
	80-200m	0			0			0			0		
	200-400m	0			0			0			0		
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-
	3-600m	3	114 ~ 169	136.3	42	85 ~ 200	156.3	91	84 ~ 170	117.4	26	40 ~ 184	121.5

Remark. - : no trawl.

Figure3.85 (A) continued.

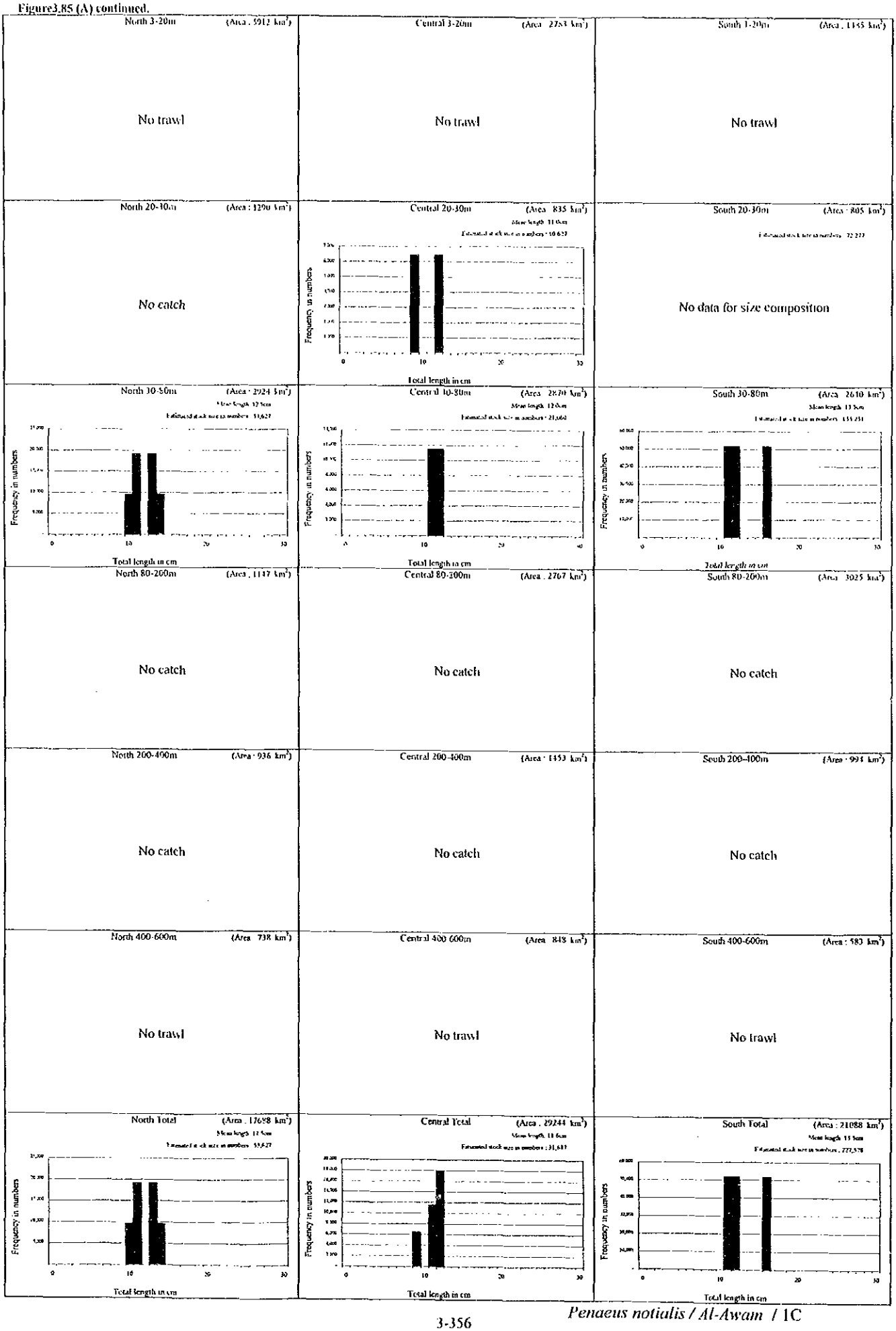


Figure3.85 (B) continued.

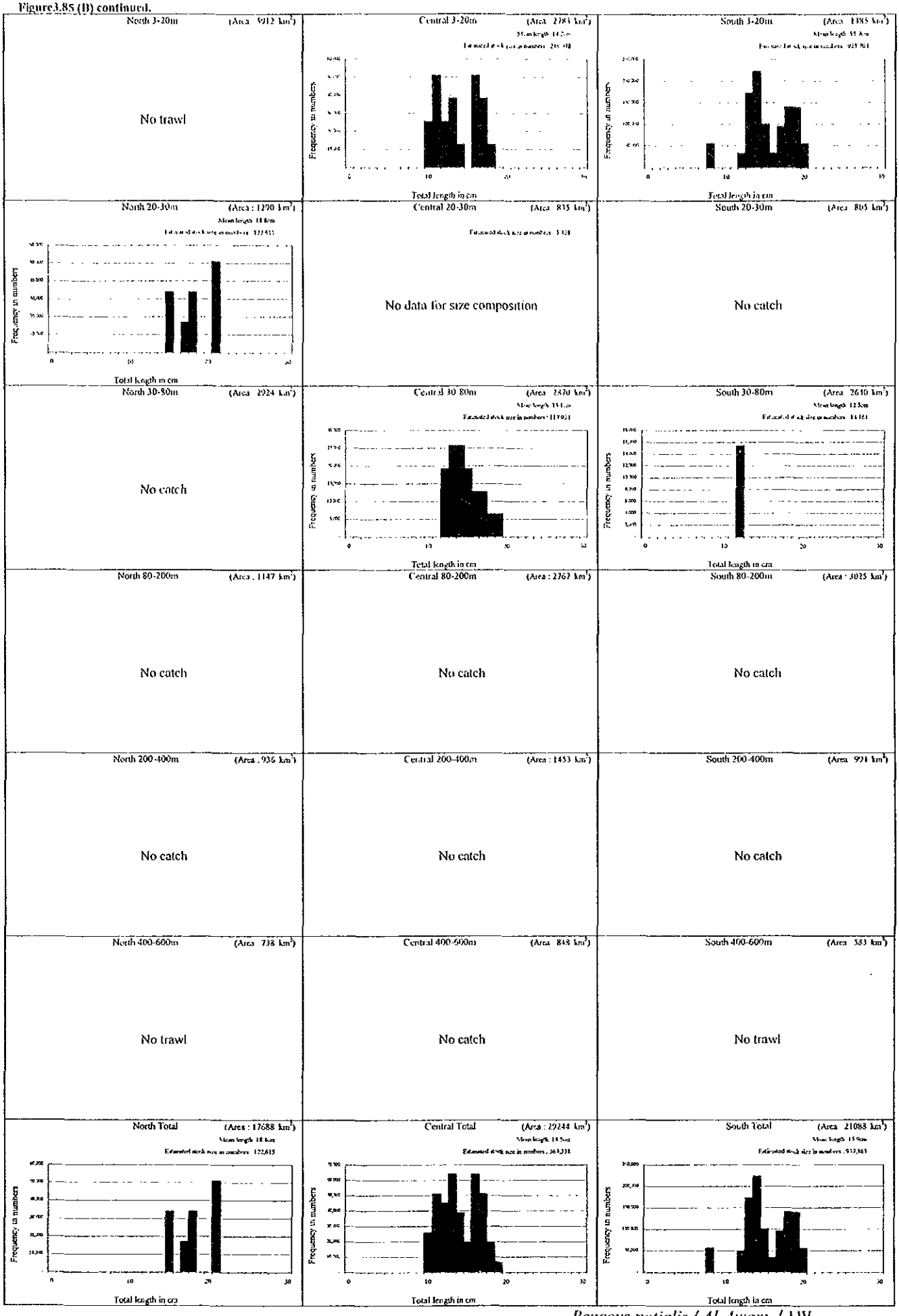


Figure3.85 (C) continued.

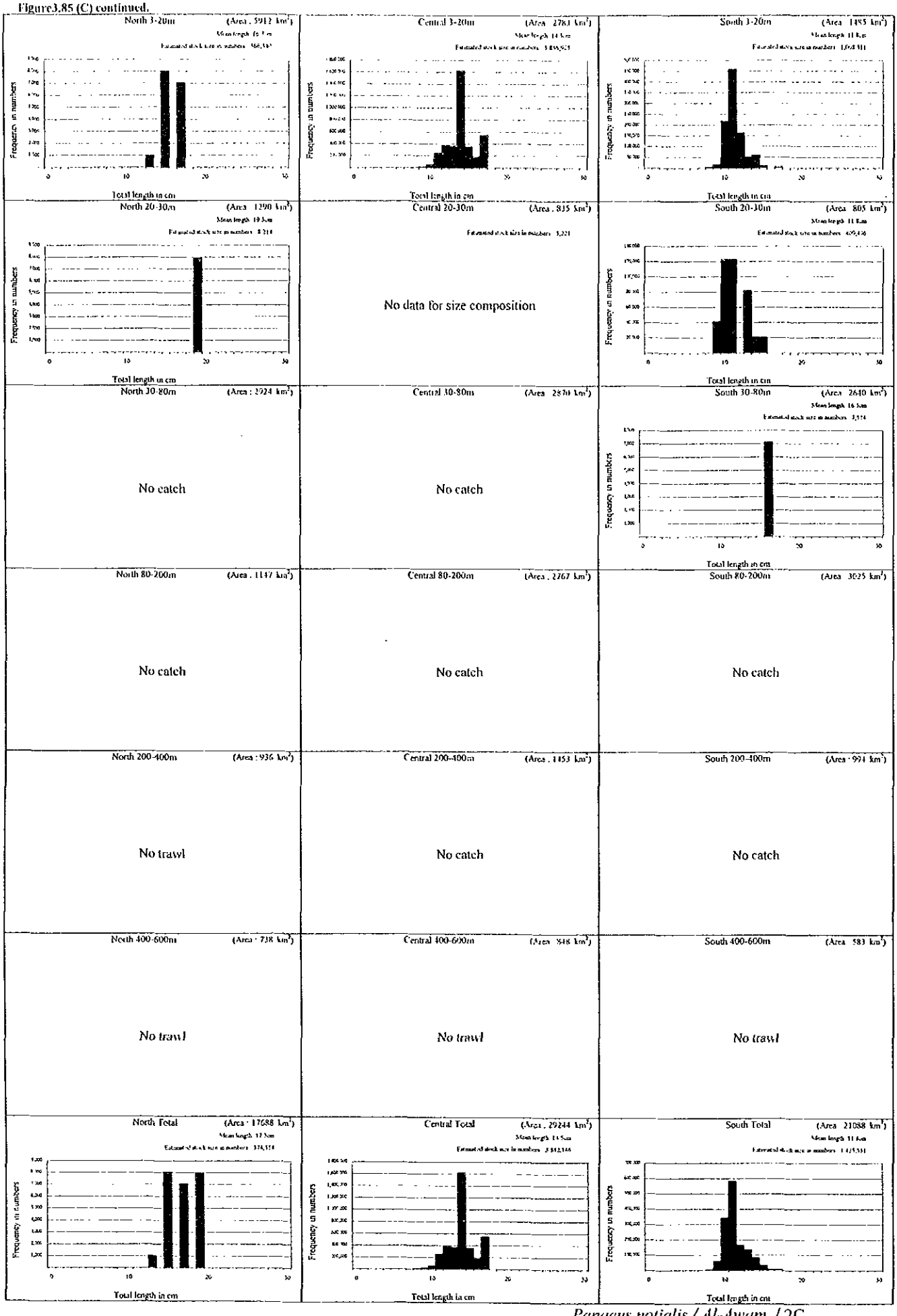


Figure3.85 (D) continued.

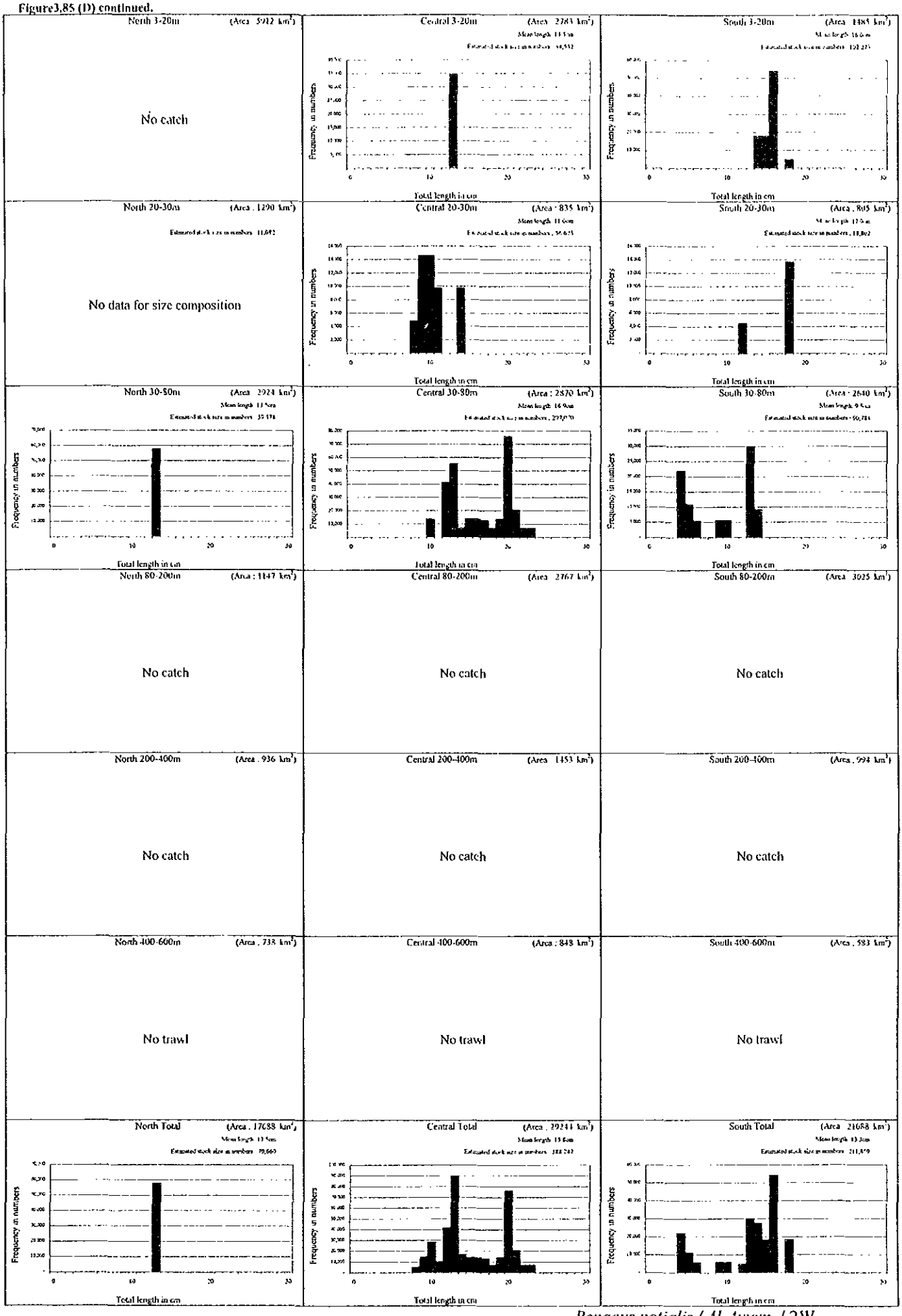


Table 3.114 Length and weight by sex for southern pink shrimp *Penaeus notialis*.

(A) *Amrigue* survey area

Phase	Season	Sex	Individuals of specimens	Total length in mm		Body weight in g	
				Range	Mean	Range	Mean
1	Cold	Male	12	110 ~ 168	130.3	14.0 ~ 34.0	22.9
		Female	25	75 ~ 200	133.9	5.0 ~ 88.0	26.7
		Indeterminate	0				
		Total	37	75 ~ 200	132.7	5.0 ~ 88.0	25.5
	Warm	Male	76	44 ~ 144	104.8	0.6 ~ 25.0	11.4
		Female	94	51 ~ 198	107.6	2.0 ~ 63.0	14.7
		Indeterminate	0				
		Total	170	44 ~ 198	106.3	0.6 ~ 63.0	13.2
2	Cold	Male	50	60 ~ 150	122.7	3.0 ~ 25.0	14.9
		Female	51	50 ~ 190	128.8	5.0 ~ 55.0	18.7
		Indeterminate	0				
		Total	101	50 ~ 190	125.8	3.0 ~ 55.0	16.8
	Warm	Male	144	40 ~ 146	105.8	1.0 ~ 32.0	13.1
		Female	239	45 ~ 183	100.7	1.0 ~ 69.0	13.1
		Indeterminate	0				
		Total	383	40 ~ 183	102.6	1.0 ~ 69.0	13.1

(B) *Al-Awam* survey area

Phase	Season	Sex	Individuals of specimens	Total length in mm		Body weight in g	
				Range	Mean	Range	Mean
1	Cold	Male	3	100 ~ 113	107.7	15.0 ~ 20.0	17.0
		Female	10	95 ~ 169	127.2	15.0 ~ 65.0	30.7
		Indeterminate	0				
		Total	13	95 ~ 169	122.7	15.0 ~ 65.0	27.6
	Warm	Male	36	107 ~ 212	138.4	9.0 ~ 80.0	20.6
		Female	46	85 ~ 215	163.6	5.0 ~ 80.0	37.7
		Indeterminate	0				
		Total	82	85 ~ 215	152.5	5.0 ~ 80.0	30.2
2	Cold	Male	79	88 ~ 173	119.8	5.0 ~ 31.0	14.8
		Female	67	84 ~ 196	127.6	5.0 ~ 71.3	18.7
		Indeterminate	0				
		Total	146	84 ~ 196	123.4	5.0 ~ 71.3	16.6
	Warm	Male	37	40 ~ 160	117.0	1.0 ~ 30.0	17.8
		Female	44	50 ~ 235	166.0	1.6 ~ 100.0	50.9
		Indeterminate	0				
		Total	81	40 ~ 235	143.6	1.0 ~ 100.0	35.8

Table 3.115 Sex ratio for southern pink shrimp *Penaeus notialis*.

(A) *Amrigue* survey area

Northern coastal area (Stratum: 3-20m)	Phase 1 cold season			Phase 1 warm season			Phase 2 cold season			Phase 2 warm season		
	Specimens		Sex ratio	Specimens		Sex ratio	Specimens		Sex ratio	Specimens		Sex ratio
	♀	♂	(♂/♀)	♀	♂	(♂/♀)	♀	♂	(♂/♀)	♀	♂	(♂/♀)
Banc d'Arguin	10	2	0.20	84	64	0.76	46	42	0.91	178	91	0.51
Other	15	10	0.67	10	12	1.20	5	8	1.60	61	53	0.87
All area	25	12	0.48	94	76	0.81	51	50	0.98	239	144	0.60

(B) *Al-Awam* survey area

Subarea	Stratum	Phase 1 cold season			Phase 1 warm season			Phase 2 cold season			Phase 2 warm season		
		Specimens		Sex ratio	Specimens		Sex ratio	Specimens		Sex ratio	Specimens		Sex ratio
		♀	♂	(♂/♀)	♀	♂	(♂/♀)	♀	♂	(♂/♀)	♀	♂	(♂/♀)
North	3-20m	-	-	-	-	-	-	2	2	1.00	0	0	E
	20-30m	0	0	E	4	4	1.00	1	0	0.00	0	0	E
	30-80m	4	2	0.50	0	0	E	0	0	E	0	1	E
	80-200m	0	0	E	0	0	E	0	0	E	0	0	E
	200-400m	0	0	E	0	0	E	-	-	-	0	0	E
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-
	All stratum	4	2	0.50	4	4	1.00	3	2	0.67	0	1	E
Central	3-20m	-	-	-	14	6	0.43	19	31	1.63	1	0	0.00
	20-30m	2	0	0.00	0	0	E	0	0	E	4	7	1.75
	30-80m	1	1	1.00	10	10	1.00	0	0	E	25	17	0.68
	80-200m	0	0	E	0	0	E	0	0	E	0	0	E
	200-400m	0	0	E	0	0	E	0	0	E	0	0	E
	400-600m	-	-	-	0	0	E	-	-	-	-	-	-
	All stratum	3	1	0.33	24	16	0.67	19	31	1.63	30	24	0.80
South	3-20m	-	-	-	17	15	0.88	34	36	1.06	6	0	0.00
	20-30m	0	0	E	0	0	E	10	10	1.00	3	1	0.33
	30-80m	3	0	0.00	1	1	1.00	1	0	0.00	5	11	2.20
	80-200m	0	0	E	0	0	E	0	0	E	0	0	E
	200-400m	0	0	E	0	0	E	0	0	E	0	0	E
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-
	All stratum	3	0	0.00	18	16	0.89	45	46	1.02	14	12	0.86
All	3-20m	-	-	-	31	21	0.68	55	69	1.25	7	0	0.00
	20-30m	2	0	0.00	4	4	1.00	11	10	0.91	7	8	1.14
	30-80m	8	3	0.38	11	11	1.00	1	0	0.00	30	29	0.97
	80-200m	0	0	E	0	0	E	0	0	E	0	0	E
	200-400m	0	0	E	0	0	E	0	0	E	0	0	E
	400-600m	-	-	-	0	0	E	-	-	-	-	-	-
	All stratum	10	3	0.30	46	36	0.78	67	79	1.18	44	37	0.84

Remarks. -: no trawl, E: Error.

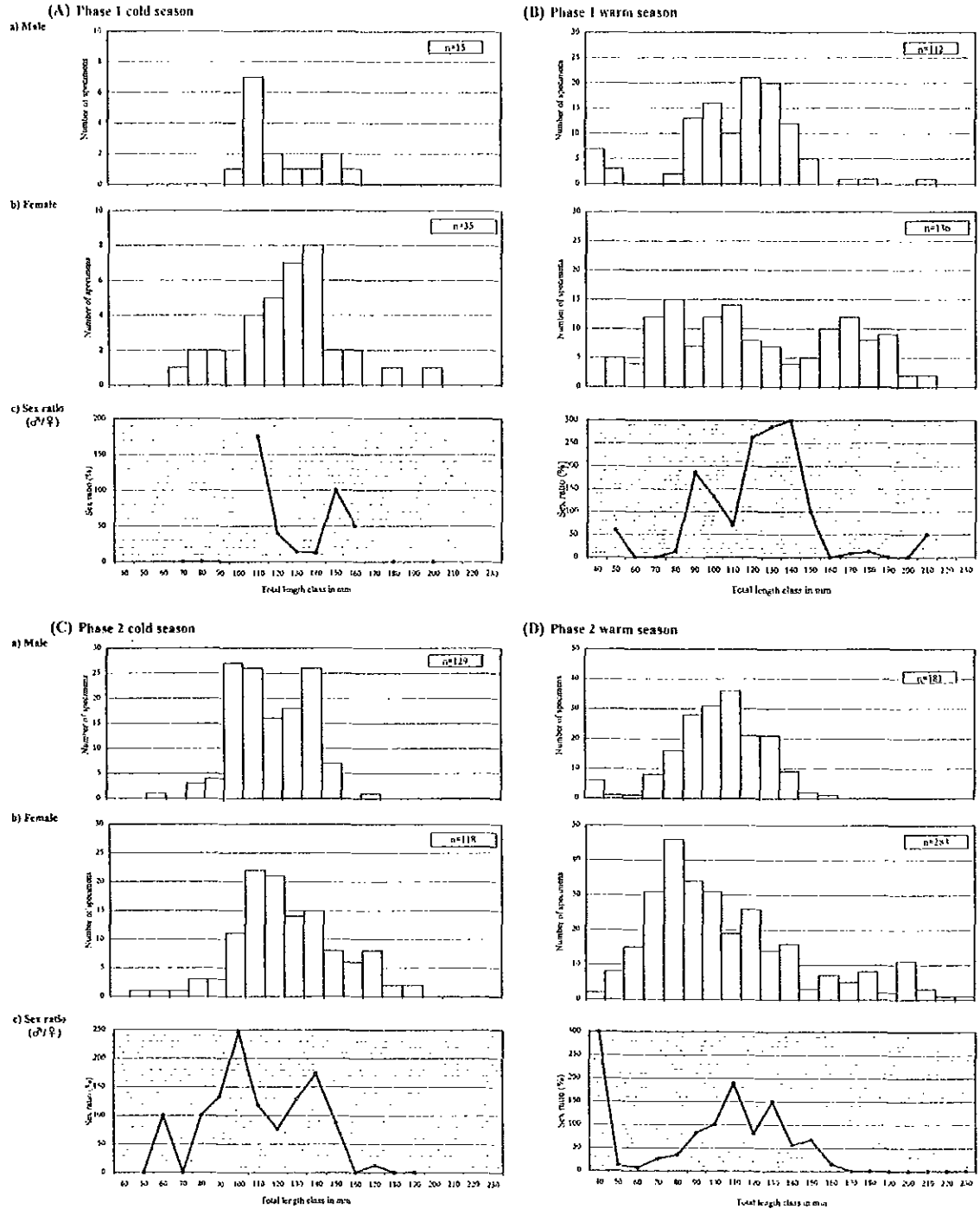


Figure 3.87 Sex ratio by length class for southern pink shrimp *Penaeus notialis*.

2) Deep-water pink shrimp *Parapenaeus longirostris*

a) Body length range and mean body length

Table 3.116 (page 3-366) presents the minimum, maximum and mean total length for the deep-water pink shrimp.

The total length of this species varied between 36 and 180 mm throughout the survey. The mean total length by area was higher in the warm season than in the cold season, except for a single instance (the Southern area in the Phase 2 warm season). In the cold season, the mean total length by area was high in the Central and Southern areas, while in the warm season, it was high in the Northern area and decreased southwards. With one exception (the Southern area in the Phase 1 cold season), the mean total length by stratum depended on depth, increasing with it.

b) Size composition

Figure 3.88 (page 3-364, 3-367 to 3-370) presents the evaluation size composition for the deep-water pink shrimp. The total length class is indicated at intervals of 1cm. For convenience, three groups were defined: (i) small-size (total length less than 6cm), (ii) medium-size (length between 6 and 12cm), (iii) large-size (length over 12cm).

For all seasons, the total stock size in number of the deep-water pink shrimp was mainly composed of the medium-size group. To this main group, the small- and large-size groups are joined in low quantities. According to the season, one or two predominant modes appear in length classes defining the medium-size group. In the Phase 1 cold season and in the Phase 2 warm season, there was a predominant mode at the 9-10cm class (named Mm); in the Phase 1 warm season and in the Phase 2 cold season, a predominant mode was observed at class between the 7 and 9cm (Ms) and another one at class between 10 and 12cm (M*ℓ*). It was not possible to follow the transition of those predominant modes of the medium-size group from the cold season to the warm season, and vice-versa.

The distribution of those three groups was confirmed by the size composition by stratum and by area. ①The small-size group was distributed in all areas in the cold season, mainly at the 30-200 m stratum in the Southern area. In the warm season, that group appeared only in the Southern area, significantly at the 80-200 m stratum. ②The medium-size group was distributed over all areas and at various strata. Within the medium-size shrimp group, Mm was widespread at the 200-400 m stratum in the Central and Southern areas. In the same way, Ms was abundant in the Southern area, as is M*ℓ* in the Central and Southern areas, particularly at the 200-400 m stratum. ③The large-size group was distributed mainly at the 200-400 m stratum and was numerous in the Southern area throughout the survey.

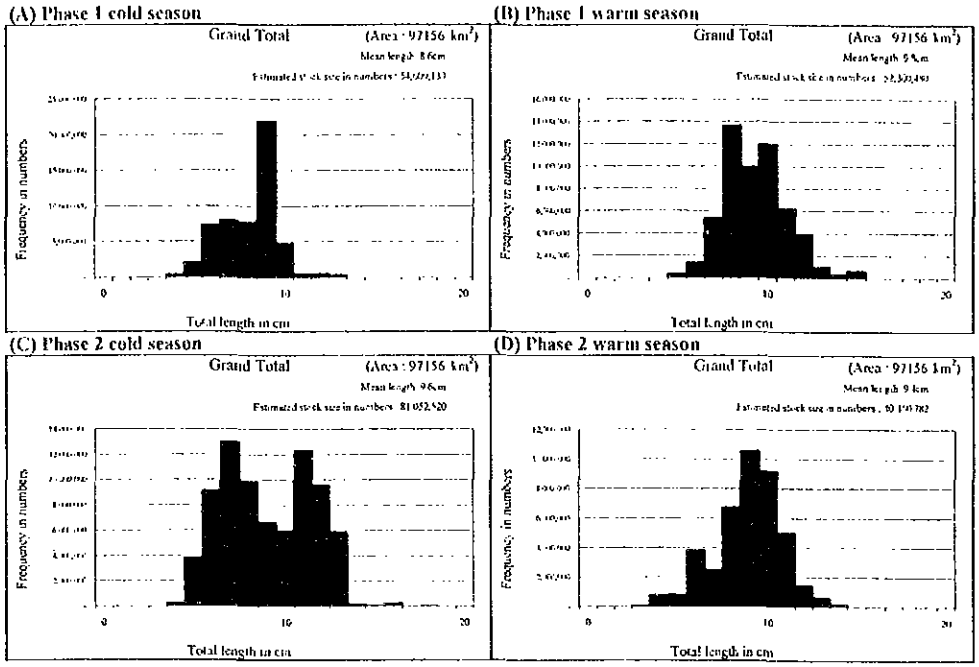


Figure 3.88 Size composition for deep-water pink shrimp *Parapenaeus longirostris*.

c) Length-weight relationship

Figure 3.89 presents the relationship between body length and weight for the deep-water pink shrimp. The length-weight equations obtained from all samples were the following:

Phase 1 cold season	: BW=	$5.191\times10^{-2}\times TL^{2.301}$	(r=0.8939)
Phase 1 warm season	: BW=	$2.224\times10^{-2}\times TL^{2.431}$	(r=0.8736)
Phase 2 cold season	: BW=	$4.748\times10^{-2}\times TL^{2.155}$	(r=0.8880)
Phase 2 warm season	: BW=	$2.276\times10^{-2}\times TL^{2.451}$	(r=0.9263)

where, BW : body weight (g), TL : total length (cm) and r : the coefficient of correlation.

According to Burkovsky *et al.* (1989), the spawning period of this species found in the territorial waters of the IRM would be between December and January. In the warm season (September-October), the individuals larger than 10cm suddenly increase in weight. This could suggest a gonadal development associated to the approaching of the spawning period, in particular an ovulation of the females.

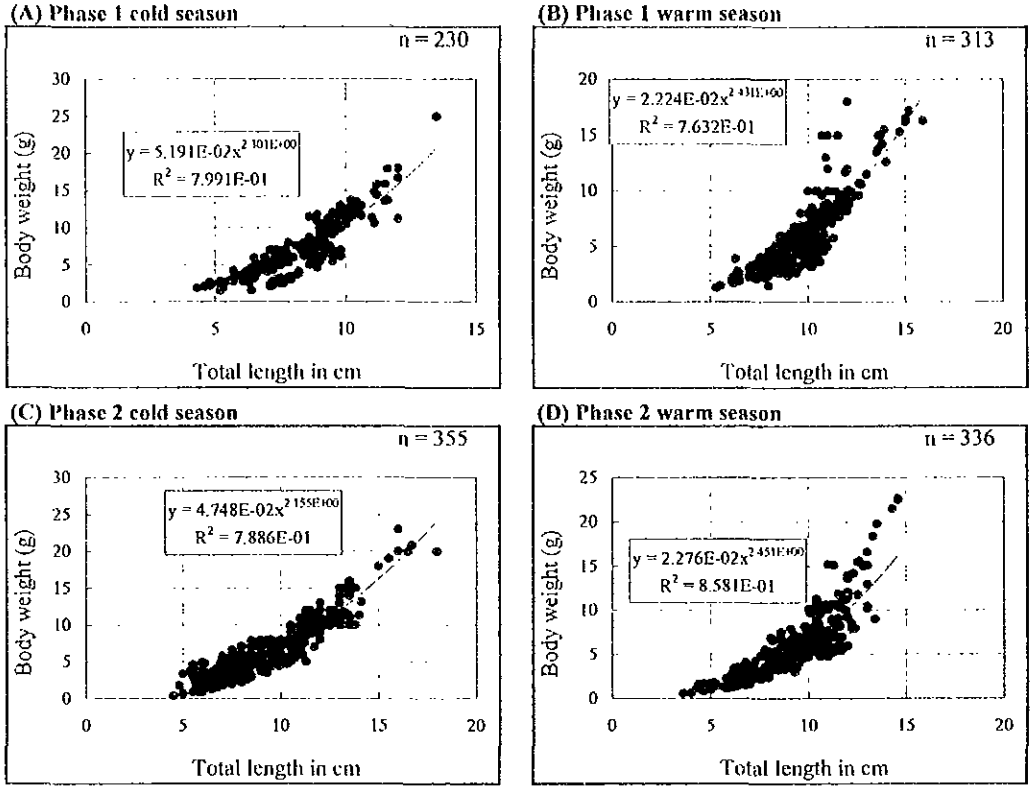


Figure 3.89 Length-weight relationship for deep-water pink shrimp *Parapenaeus longirostris.*

d) Length and weight by sex

Table 3.117 (page 3-371) summarizes the body length and weight observed in each sex for the deep-water pink shrimp. No individual of indetermined sex was found.

The total length by sex varied between 46 and 159 mm for males and between 36 and 180 mm for females. The mean total length of females was larger than that of males in Phase 1, but smaller in Phase 2. The mean weight of females was heavier than that of males throughout the survey.

e) Sex ratio

Table 3.118 (page 3-372) summarizes the sex ratio for the deep-water pink shrimp. Figure 3.90 (page 3-373) presents the sex ratio by length class.

The overall sex ratio varied between 0.62 and 0.83. Females were dominant throughout the survey. Except for three instances (sex ratio 1.11, 1.19 and 2.15), the sex ratio by area also indicated a predominance of females. The sex ratio by stratum did not seem to depend on depth.

The size-dependent change of the sex ratio was observed, but that change took two different forms. In the Phase 1 warm season, the sex ratio shifted from 0% to 300% between 50 and 150 mm, with a certain number of intermediate fluctuations; in the three other seasons, it shifted from 0% between 40 and 60 mm to 150-200% between 70 and 100 mm, and beyond that it decreased to return to 0% between 130 and 160 mm.

Table 3.116 Body length range and mean body length for deep-water pink shrimp *Parapenaeus longirostris* : TL in mm.

(A) *Amrigue* survey area

Northern coastal area (Stratum: 3-20m)	Phase 1						Phase 2					
	Cold season			Warm season			Cold season			Warm season		
	Specimens	Range	Mean	Specimens	Range	Mean	Specimens	Range	Mean	Specimens	Range	Mean
Banc d'Arguin	0			0			0			0		
Other	0			0			0			0		
All area	0			0			0			0		

(B) *Al-Awam* survey area

Subarea	Stratum	Phase 1						Phase 2					
		Cold season			Warm season			Cold season			Warm season		
		Specimens	Range	Mean	Specimens	Range	Mean	Specimens	Range	Mean	Specimens	Range	Mean
North	3-20m	-	-	-	-	-	-	0			0		
	20-30m	0			0			0			0		
	30-80m	0			0			0			0		
	80-200m	20	46 ~ 65	55.9	20	75 ~ 102	88.1	34	45 ~ 90	71.4	25	68 ~ 105	88.2
	200-400m	0			55	65 ~ 159	114.2	-	-	-	33	96 ~ 146	115.4
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-
	3-600m	20	46 ~ 65	55.9	75	65 ~ 159	107.2	34	45 ~ 90	71.4	58	68 ~ 146	103.7
Central	3-20m	-	-	-	0			0			0		
	20-30m	0			0			0			0		
	30-80m	0			0			0			0		
	80-200m	25	53 ~ 91	70.9	20	74 ~ 102	86.1	75	56 ~ 133	87.5	10	82 ~ 95	88.7
	200-400m	45	76 ~ 120	99.4	82	76 ~ 120	100.3	12	85 ~ 180	142.3	72	65 ~ 146	99.3
	400-600m	-	-	-	0			-	-	-	-	-	-
	3-600m	70	53 ~ 120	89.2	102	74 ~ 120	97.5	87	56 ~ 180	95.1	82	65 ~ 146	98.0
South	3-20m	-	-	-	0			0			0		
	20-30m	0			0			0			0		
	30-80m	60	43 ~ 98	72.5	26	65 ~ 104	85.1	40	48 ~ 94	68.0	40	40 ~ 102	70.8
	80-200m	40	68 ~ 98	86.7	47	53 ~ 110	79.8	134	50 ~ 134	94.6	100	36 ~ 116	76.8
	200-400m	40	86 ~ 135	97.4	60	71 ~ 137	103.5	60	110 ~ 167	124.1	56	78 ~ 134	106.8
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-
	3-600m	140	43 ~ 135	83.7	133	53 ~ 137	91.5	234	48 ~ 167	97.6	196	36 ~ 134	84.1

Remark. - : no trawl.

Figure3.88 (A) continued.

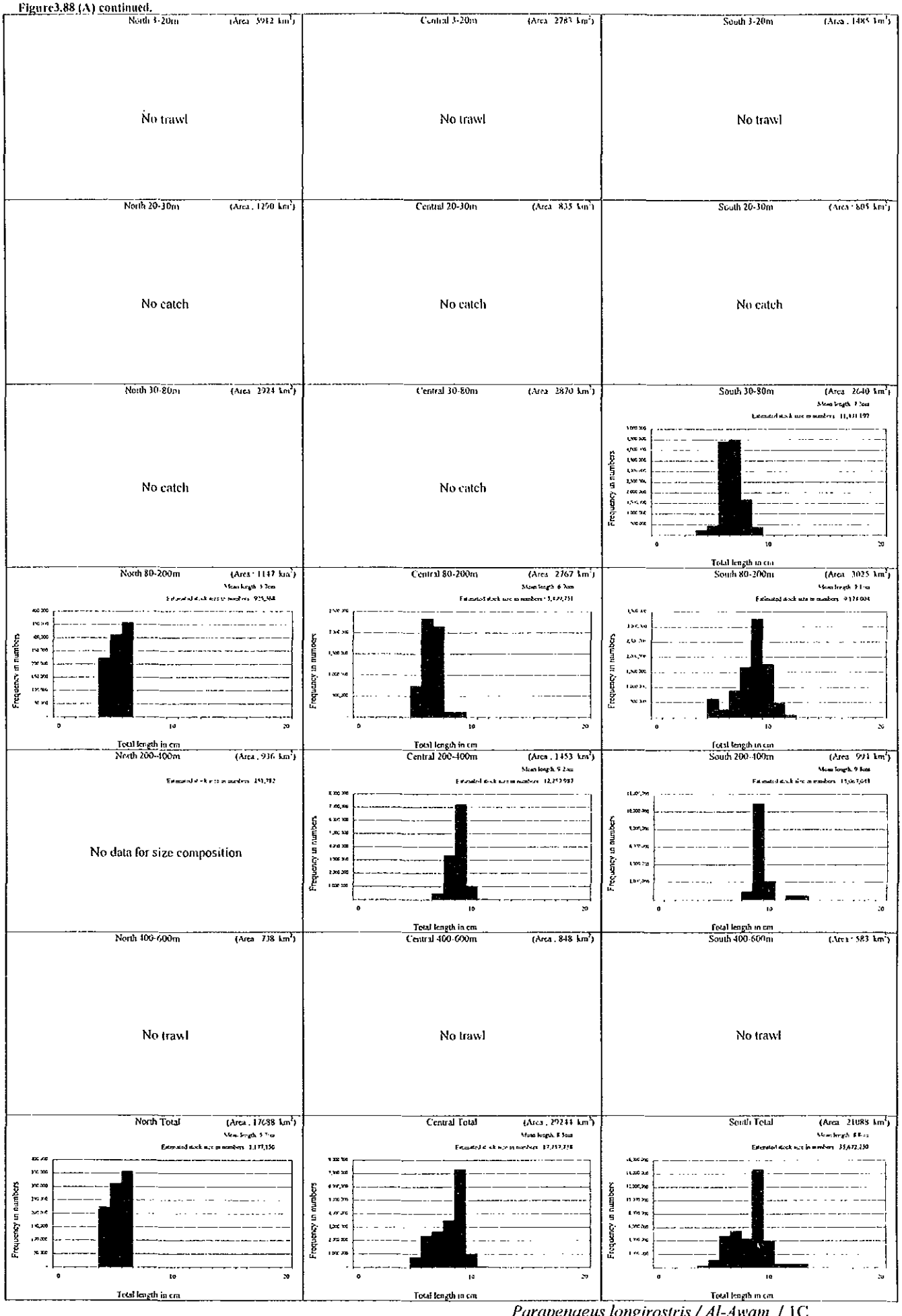


Figure3.88 (B) continued.

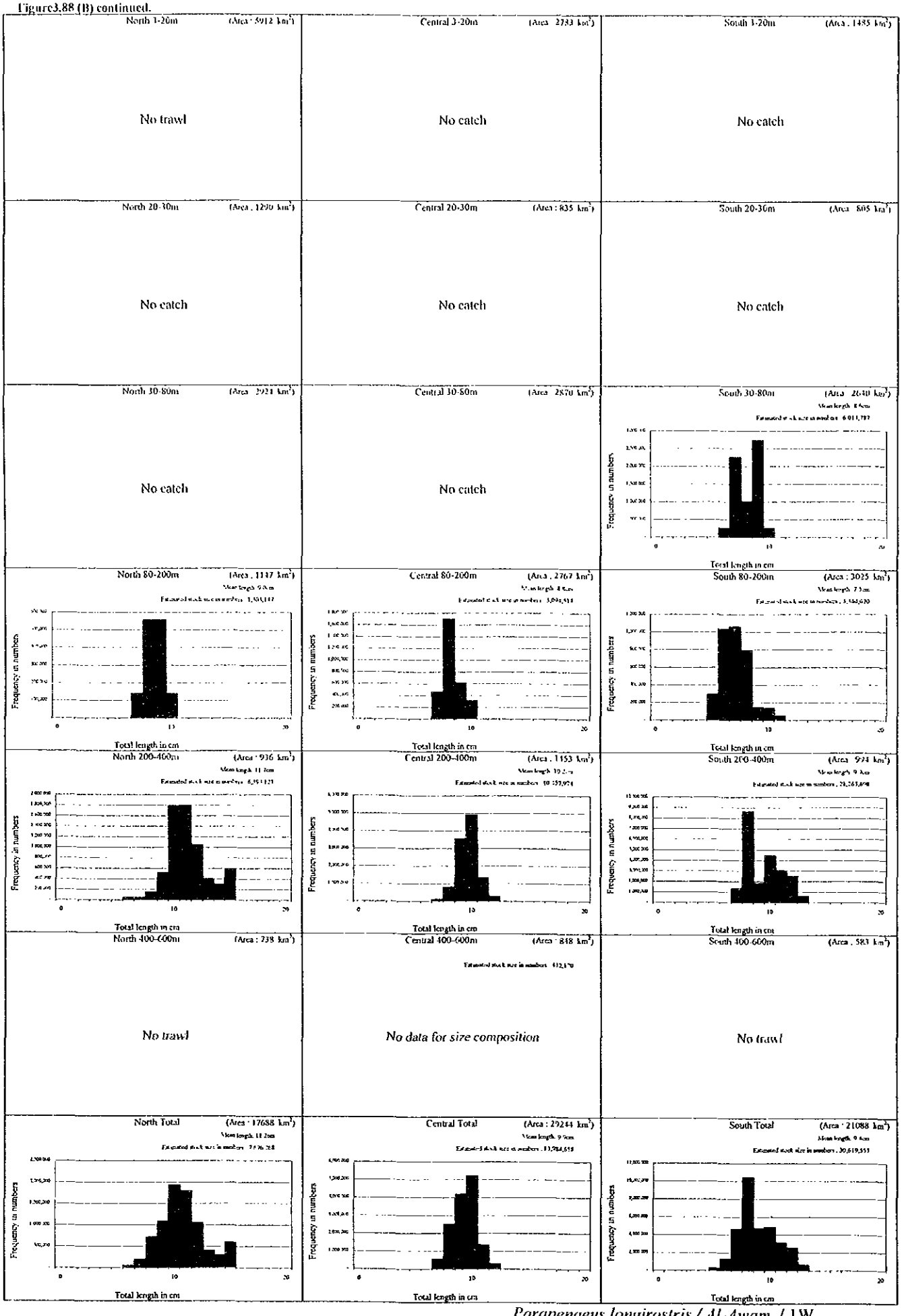


Figure3.88 (C) continued.

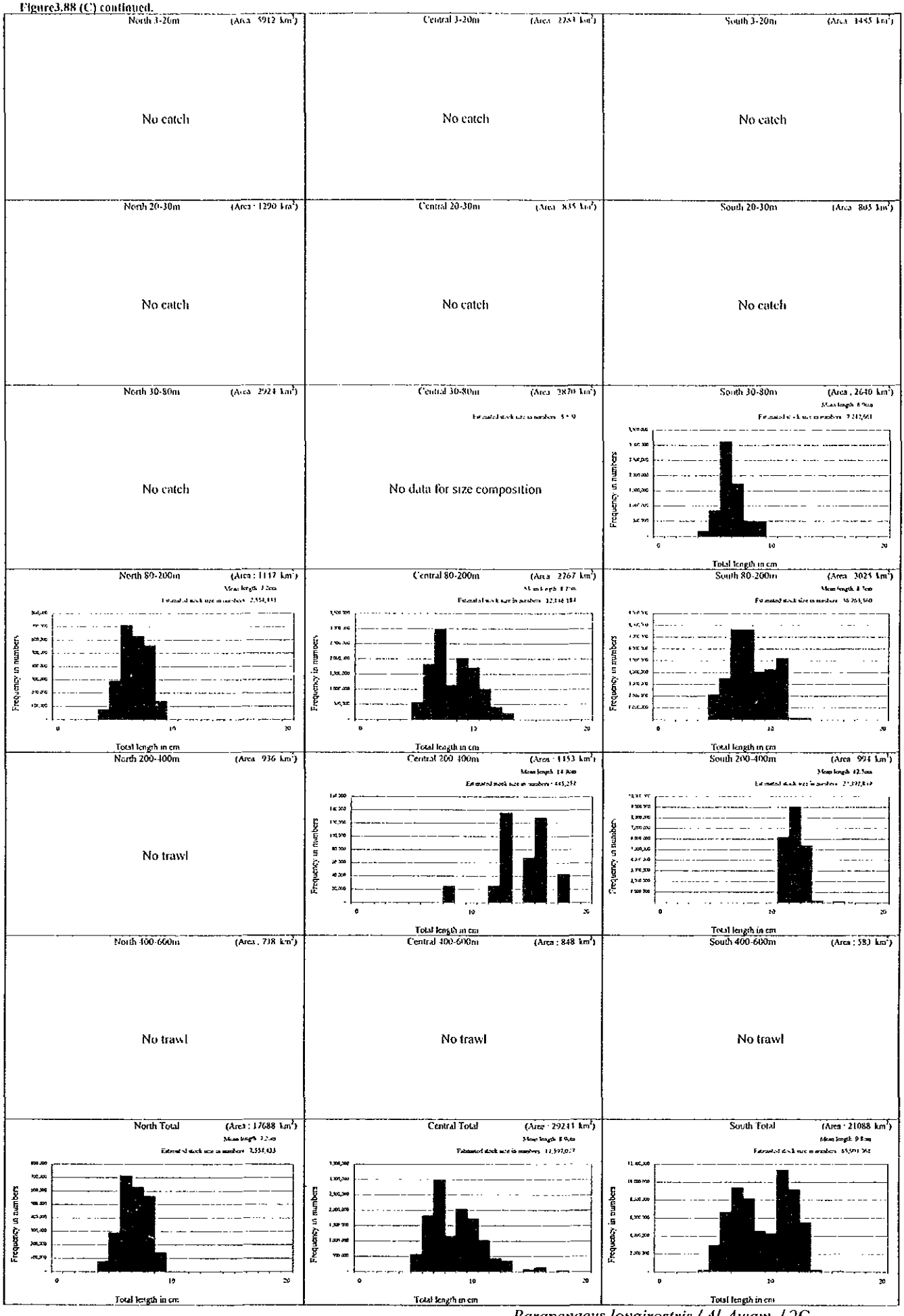


Figure3.88 (D) continued.

North 3-20m (Area : 5912 km²)

No catch

Central 3-20m (Area : 2783 km²)

No catch

South 3-20m (Area 1485 km²)

No catch

North 20-30m (Area 1290 km²)

No catch

Central 20-30m (Area 835 km²)

No catch

South 20-30m (Area : 805 km²)

No catch

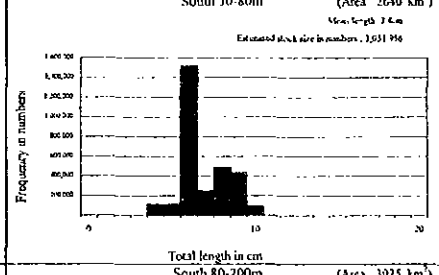
North 30-80m (Area : 2923 km²)

No catch

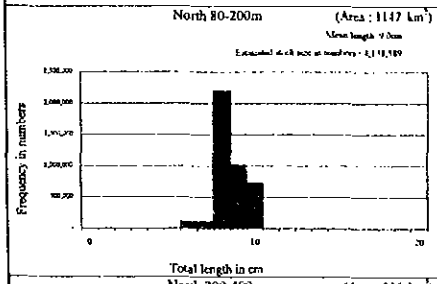
Central 30-80m (Area : 2870 km²)

No catch

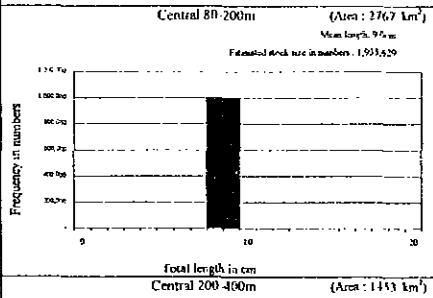
South 30-80m (Area 2640 km²)



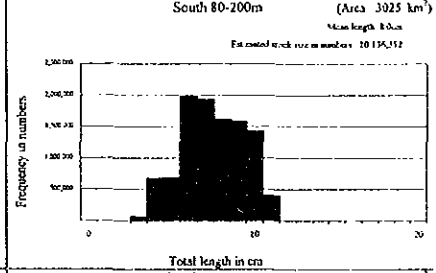
North 80-200m (Area : 1147 km²)



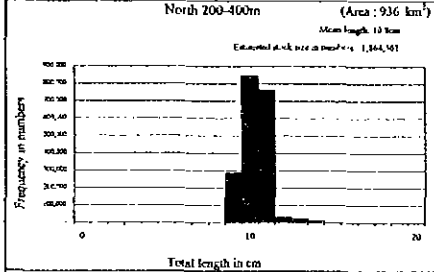
Central 80-200m (Area : 2767 km²)



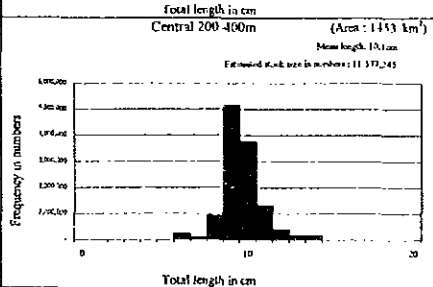
South 80-200m (Area 3025 km²)



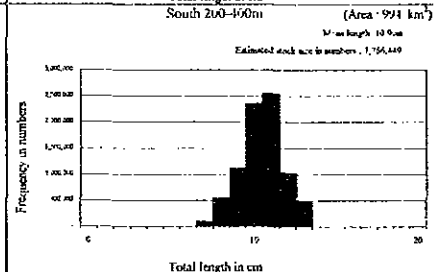
North 200-400m (Area : 936 km²)



Central 200-400m (Area : 1453 km²)



South 200-400m (Area 994 km²)



North 400-600m (Area : 738 km²)

No trawl

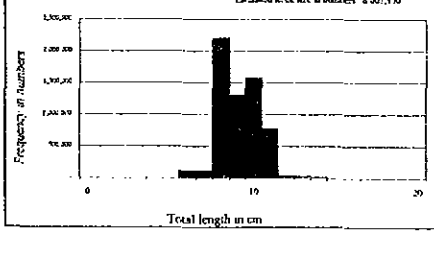
Central 400-600m (Area : 848 km²)

No trawl

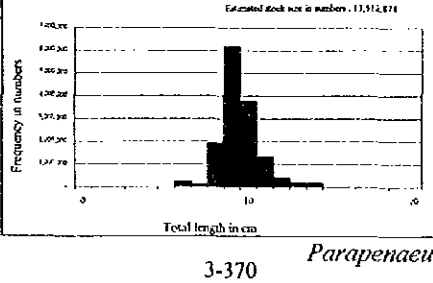
South 400-600m (Area 583 km²)

No trawl

North Total (Area : 17688 km²)



Central Total (Area : 29244 km²)



South Total (Area : 21988 km²)

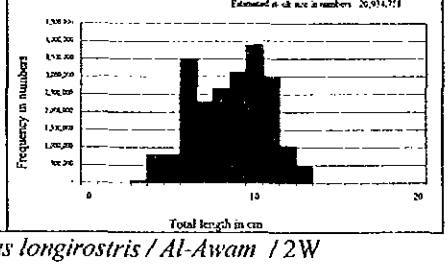


Table 3.117 Body length and weight by sex for deep-water pink shrimp *Parapenaeus longirostris*.

(A) *Amrigue* survey area

Phase	Season	Sex	Individuals of specimens	Total length in mm		Body weight in g	
				Range	Mean	Range	Mean
1	Cold	Male	0				
		Female	0				
		Indeterminate	0				
		Total	0				
	Warm	Male	0				
		Female	0				
		Indeterminate	0				
		Total	0				
2	Cold	Male	0				
		Female	0				
		Indeterminate	0				
		Total	0				
	Warm	Male	0				
		Female	0				
		Indeterminate	0				
		Total	0				

(B) *Al-Awam* survey area

Phase	Season	Sex	Individuals of specimens	Total length in mm		Body weight in g	
				Range	Mean	Range	Mean
1	Cold	Male	89	52 ~ 120	82.2	1.5 ~ 16.7	6.8
		Female	141	43 ~ 135	83.4	1.6 ~ 25.0	7.7
		Indeterminate	0				
		Total	230	43 ~ 135	82.9	1.5 ~ 25.0	7.4
	Warm	Male	117	61 ~ 159	98.3	1.9 ~ 16.5	6.0
		Female	192	53 ~ 152	96.6	1.3 ~ 18.0	6.2
		Indeterminate	0				
		Total	309	53 ~ 159	97.3	1.3 ~ 18.0	6.1
2	Cold	Male	138	56 ~ 140	95.6	1.3 ~ 12.0	6.4
		Female	216	45 ~ 180	93.6	0.4 ~ 23.0	6.9
		Indeterminate	0				
		Total	354	45 ~ 180	94.4	0.4 ~ 23.0	6.7
	Warm	Male	152	46 ~ 130	91.7	0.9 ~ 15.1	5.6
		Female	184	36 ~ 146	90.2	0.6 ~ 22.6	5.9
		Indeterminate	0				
		Total	336	36 ~ 146	90.9	0.6 ~ 22.6	5.8

Table 3.118 Sex ratio for deep-water pink shrimp *Parapenaeus longirostris*.

(A) *Amrigue* survey area

Northern coastal area (Stratum: 3-20m)	Phase 1 cold season			Phase 1 warm season			Phase 2 cold season			Phase 2 warm season		
	Specimens		Sex ratio	Specimens		Sex ratio	Specimens		Sex ratio	Specimens		Sex ratio
	♀	♂	(♂/♀)	♀	♂	(♂/♀)	♀	♂	(♂/♀)	♀	♂	(♂/♀)
Banc d'Arguin	0	0	E	0	0	E	0	0	E	0	0	E
Other	0	0	E	0	0	E	0	0	E	0	0	E
All area	0	0	E	0	0	E	0	0	E	0	0	E

(B) *Al-Awam* survey area

Subarea	Stratum	Phase 1 cold season			Phase 1 warm season			Phase 2 cold season			Phase 2 warm season		
		Specimens		Sex ratio	Specimens		Sex ratio	Specimens		Sex ratio	Specimens		Sex ratio
		♀	♂	(♂/♀)	♀	♂	(♂/♀)	♀	♂	(♂/♀)	♀	♂	(♂/♀)
North	3-20m	-	-	-	-	-	-	0	0	E	0	0	E
	20-30m	0	0	E	0	0	E	0	0	E	0	0	E
	30-80m	0	0	E	0	0	E	0	0	E	0	0	E
	80-200m	16	4	0.25	5	15	3.00	21	13	0.62	13	12	0.92
	200-400m	0	0	E	32	26	0.81	-	-	-	21	12	0.57
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-
	All stratum	16	4	0.25	37	41	1.11	21	13	0.62	34	24	0.71
Central	3-20m	-	-	-	0	0	E	0	0	E	0	0	E
	20-30m	0	0	E	0	0	E	0	0	E	0	0	E
	30-80m	0	0	E	0	0	E	0	0	E	0	0	E
	80-200m	11	14	1.27	16	4	0.25	40	35	0.88	3	7	2.33
	200-400m	21	24	1.14	42	39	0.93	9	3	0.33	23	49	2.13
	400-600m	-	-	-	0	0	E	-	-	-	-	-	-
	All stratum	32	38	1.19	58	43	0.74	49	38	0.78	26	56	2.15
South	3-20m	-	-	-	0	0	E	0	0	E	0	0	E
	20-30m	0	0	E	0	0	E	0	0	E	0	0	E
	30-80m	9	11	1.22	25	1	0.04	32	8	0.25	25	15	0.60
	80-200m	55	25	0.45	31	16	0.52	78	56	0.72	69	31	0.45
	200-400m	29	11	0.38	42	18	0.43	36	23	0.64	30	26	0.87
	400-600m	-	-	-	-	-	-	-	-	-	-	-	-
	All stratum	93	47	0.51	98	35	0.36	146	87	0.60	124	72	0.58
All	3-20m	-	-	-	0	0	E	0	0	E	0	0	E
	20-30m	0	0	E	0	0	E	0	0	E	0	0	E
	30-80m	9	11	1.22	25	1	0.04	32	8	0.25	25	15	0.60
	80-200m	82	43	0.52	52	35	0.67	139	104	0.75	85	50	0.59
	200-400m	50	35	0.70	116	83	0.72	45	26	0.58	74	87	1.18
	400-600m	-	-	-	0	0	E	-	-	-	-	-	-
	All stratum	141	89	0.63	193	119	0.62	216	138	0.64	184	152	0.83

Remarks. -: no trawl, E: Error.

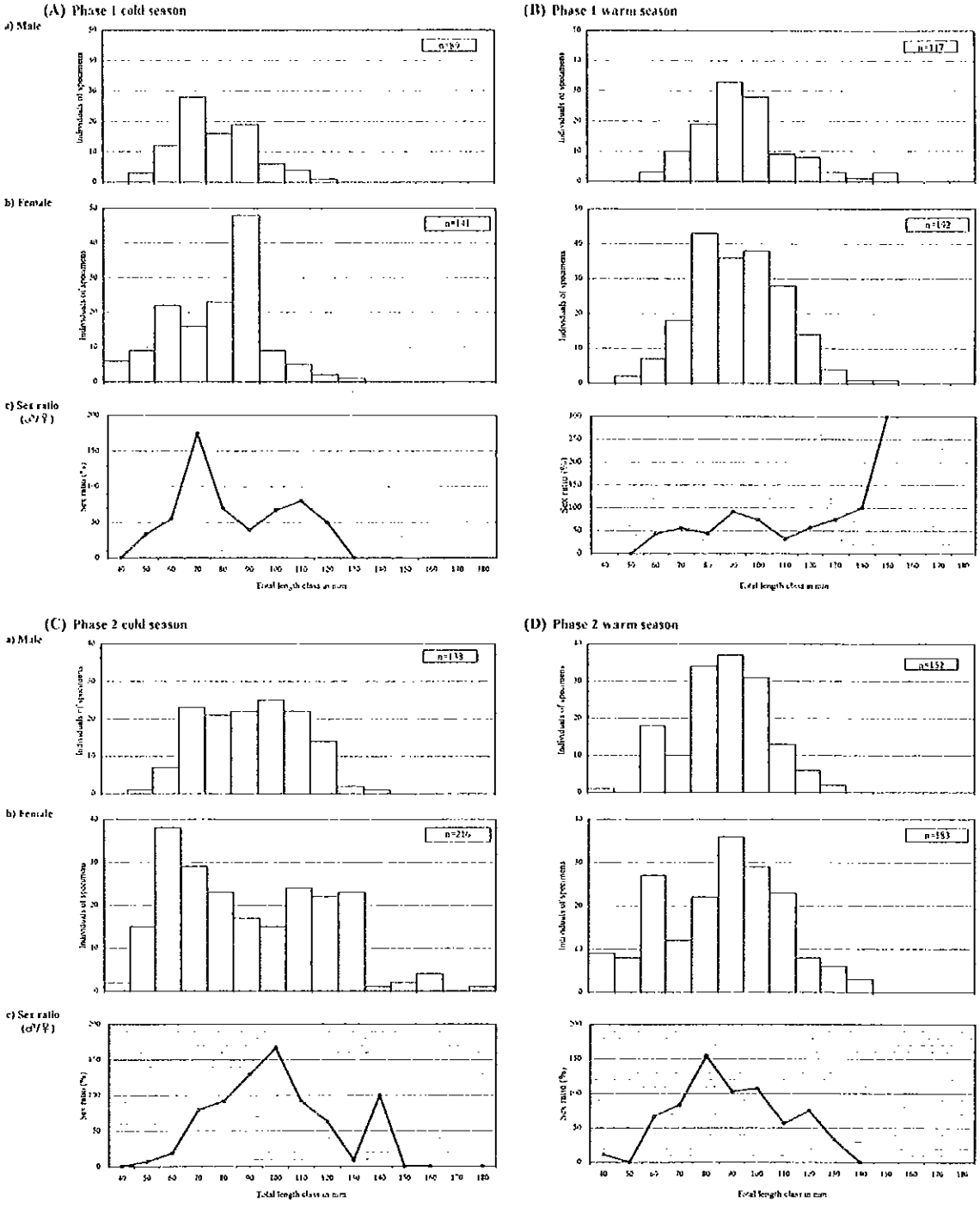


Figure 3.90 Sex ratio by length class for deep-water pink shrimp *Parapenaeus longirostris* .

3) Pink spiny lobster *Palinurus mauritanicus*

The number of specimens for the multi-item biological measurement was 41 in total: 0 in the Phase 1 cold season, 13 in the following warm season (entirely obtained at the 200-400 m stratum in the Northern area), 2 in the Phase 2 cold season (200-400 m stratum in the Southern area) and 26 in the following warm season (200-400 m stratum in the Northern area). Tables and figures related to biological findings are not presented other than minimal necessary data. Listed below are the main biological findings obtained in each survey season.

a) Phase 1 warm season

Range and mean of body length : 97 - 166 mm, 119 mm respectively.

Length-weight relationship : $BW=2.515\times10^{-2}\times TL^{3.088}$ ($r=0.9810$) (see Figure 3.91).

Range and mean of body length for males : 103 - 153 mm, 121 mm respectively.

Range and mean of body length for females : 97 - 166 mm, 118 mm respectively.

Sex ratio:0.86 (6 males, 7 females).

b) Phase 2 cold season

Range and mean of body length : 306 - 350 mm, 328 mm respectively.

Sex ratio : 0.00 (0 males, 2 females).

c) Phase 2 warm season

Range and mean of body length : 103 and 218 mm, 162 mm respectively.

Length-weight relationship: $BW=2.440\times10^{-2}\times TL^{2.991}$ ($r=0.9920$) (see Figure 3.91).

Range and mean of body length for males : 103 - 167 mm, 142 mm respectively.

Range and mean of body length for females : 112 - 218 mm, 171 mm respectively.

Sex ratio : 0.53 (9 males, 17 females).

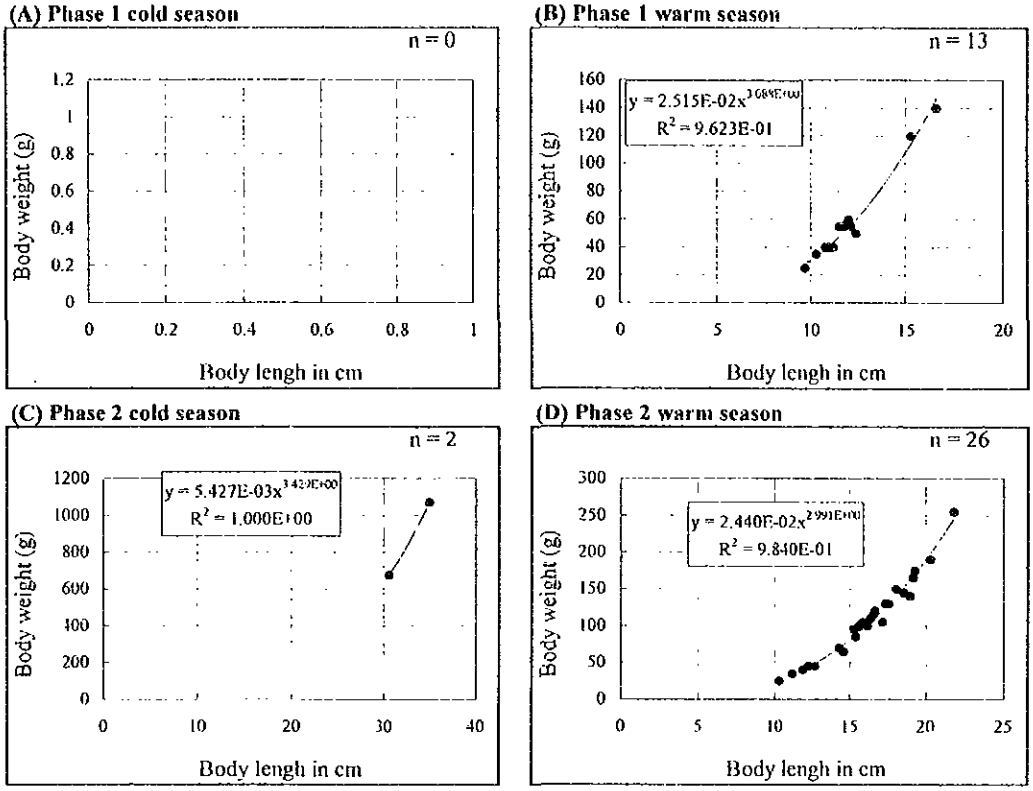


Figure 3.91 Length-weight relationship for pink spiny lobster *Palinurus mauritanicus*.

4) Green spiny lobster *Panulirus regius*

The number of specimens for the multi-item biological measurement was 5 in total: 1 in the Southern area in the Phase 2 cold season, 1 in the Northern area and 3 in the Southern area in the following warm season. Tables and figures related to biological findings are not presented. Listed below are the main biological findings obtained in each survey season.

a) Phase 2 cold season

Size of females : body length of 260 mm, weight of 570 g.

b) Phase 2 warm season

Sex ratio : 0.33 (1 male, 3 females).

Size of male : body length of 250 mm, weight of 525 g.

Range and mean of body length for females : 242 - 357 and 291 mm respectively.

Range and mean of body weight for females : 485 – 2,015 and 929 g respectively.

Female maturity : 2 individuals with body length of 305 and 357 mm in berry.

For reference, the length-weight relationship obtained from data in the Phase 2 warm season is :

$BW = 1.089 \times 10^{-2} \times TL^{3.329}$ ($r = 0.9142$, $n = 5$).

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Appendix Table 3.1 List of species caught at comparative experiment of fishing efficiency area.

Order	Family	Species	Habitat	Reserch vessels	
				Al-Awam	*Amrigue*
1 Carchathiniformes	1 Triakidae	1 *Mustelus mustelus*	demersal	×	×
2 Rajiformes	2 Torpedinidae	2 *Torpedo marmorata*	demersal	×	
	3 Rhinobatidae	3 *Rhinobatos rhinobatos*	demersal	×	
	4 Rajidae	4 *Raja miraletus*	demersal	×	
	5 Dasyatidae	5 *Dasyatis chrysonota marmorata*	demersal	×	
	6 Gymnuridae	6 *Gymnura altavela*	demersal	×	
	7 Myliobatidae	7 *Myliobatis aquila*	benthopelagic	×	
3 Clupeiformes	8 Clupeidae	8 *Sardinella aurita*	pelagic	×	
		9 *Sardinella maderensis*	pelagic	×	
4 Siluriformes	9 Ariidae	10 *Arius heudelotii*	demersal	×	×
5 Batrachoidiformes	10 Batrachoididae	11 *Halobatrachus didactylus*	demersal	×	×
6 Perciformes	11 Moronidae	12 *Dicentrarchus punctatus*	pelagic	×	
	12 Serranidae	13 *Serranus scriba*	demersal	×	×
		14 *Epinephelus aeneus*	demersal	×	
	13 Pomatomidae	15 *Pomatomus saltator*	pelagic	×	
	14 Carangidae	16 *Campogramma glaycos*	benthopelagic	×	
		17 *Chloroscombrus chrysurus*	pelagic	×	×
		18 *Caranx rhonchus*	benthopelagic	×	×
		19 *Trachurus trachurus*	pelagic		×
		20 *Trachurus trecae*	benthopelagic	×	×
		21 *Selene dorsalis*	demersal	×	×
	15 Haemulidae	22 *Pomadasys incisus*	demersal	×	×
		23 *Plectorhinchus mediterraneus*	demersal	×	×
	16 Sparidae	24 *Pagrus caeruleostictus*	benthopelagic	×	
		25 *Dentex canariensis*	benthopelagic	×	×
		26 *Diplodus sargus cadenati*	reef-associated	×	×
		27 *Diplodus bellottii*	benthopelagic	×	×
		28 *Lithognathus mormyrus*	benthopelagic	×	
		29 *Spondyliosoma cantharus*	benthopelagic	×	×
	17 Polynemidae	30 *Galeoides decadactylus*	demersal	×	×
	18 Sciaenidae	31 *Argyrosomus regius*	benthopelagic	×	×
		32 *Pseudotolithus senegalensis*	demersal	×	×
	19 Mullidae	33 *Pseudupeneus prayensis*	demersal	×	×
	20 Labridae	34 *Symphodus roissali*	reef-associated		×
	21 Gobiidae	35 Gobiidae	-		×
	22 Trichiuridae	36 *Trichiurus lepturus*	benthopelagic	×	
7 Pleuronectiformes	23 Paralichthyidae	37 *Syacium micrurum*	benthopelagic		×
	24 Psettodidae	38 *Psettodes belcheri*	demersal	×	×
	25 Citharidae	39 *Citharus linguatula*	demersal	×	×
	26 Soleidae	40 *Solea senegalensis*	demersal	×	
		41 *Dicologoglossa cuneata*	demersal		×
		42 *Microchirus boscanion*	demersal	×	
		43 *Microchirus theophila*	demersal	×	×
		44 *Synaptura lusitanica*	demersal	×	
	27 Cynoglossidae	45 *Cynoglossus* sp.	-		×
8 Tetraodontiformes	28 Monacanthidae	46 *Stephanolepis hispidus*	demersal	×	×
	29 Tetraodontidae	47 *Ephippion guttifer*	demersal		×
		48 *Lagocephalus laevigatus*	pelagic	×	
		49 *Sphoeroides spengleri*	demersal		×
	30 Diodontidae	50 *Chilomycterus spinosus mauretanicus*	benthopelagic	×	×
Teuthoidea	Loliginidae	*Loligo vulgaris*	-		×
	Ommastrephidae	Ommastrephidae	-		×
Sepioidea	Sepiidae	*Sepia bertheloti*	-	×	×
		Sepia officinalis	-	×	×
Stomatopoda	Squillidae	*Squilla mantis*	-	×	
Decapoda	Penaeidae	*Penaeus kerathurus*	-	×	×
		Penaeus notialis	-	×	

Appendix Table 3.2 List of species caught by *Amrigue* (1/2).

Order	Family	Species	Habitat	Sub-northern coastal area							
				Banc d'Arguin				Other			
				1C	1W	2C	2W	1C	1W	2C	2W
1 Carcharhiniformes	1 Leptocharidae	1 *Leptocharias smithii*	demersal	×			×	×			
	2 Triakidae	2 *Mustelus mustelus*	demersal	×				×			
	3 Carcharhinidae	3 *Rhizoprionodon acutus*	demersal				×				
2 Rajiformes	4 Torpedinidae	4 *Torpedo torpedo*	demersal		×			×		×	×
		5 *Torpedo marmorata*	demersal					×			
	5 Rhinobatidae	6 *Rhinobatos rhinobatos*	demersal			×		×	×	×	
		7 *Zanobatus schoenleinii*	demersal	×		×	×	×	×		×
	6 Rajidae	8 *Raja miraletus*	demersal	×				×	×		
		9 *Raja undulata*	demersal					×		×	×
	7 Dasyatidae	10 *Dasyatis chrysonota marmorata*	demersal	×	×	×	×			×	×
	8 Gymnuridae	11 *Gymnura altavela*	demersal	×	×	×	×	×	×		×
3 Clupeiformes	9 Clupeidae	12 *Sardinella aurita*	pelagic				×				
		13 *Sardinella maderensis*	pelagic	×	×	×	×		×	×	×
		14 *Ethmalosa fimbriata*	pelagic		×		×				
4 Siluriformes	10 Ariidae	15 *Arius heudelotii*	demersal	×	×	×	×	×	×	×	×
5 Aulopiformes	11 Synodontidae	16 *Trachinocephalus myops*	reef-associated							×	
6 Batrachoidiformes	12 Batrachoididae	17 *Halobatrachus didactylus*	demersal				×	×	×	×	×
7 Gasterosteiformes	13 Syngnathidae	18 *Syngnathus acus*	demersal		×						
		19 *Hippocampus* sp.					×		×		
	14 Fistulariidae	20 *Fistularia petimba*	demersal				×				
		21 *Fistularia tabacaria*	reef-associated		×		×		×		
8 Scorpaeniformes	15 Dactylopteridae	22 *Dactylopterus volitans*	reef-associated						×	×	
	16 Scorpaenidae	23 *Scorpaena loppei*	demersal					×			
		24 *Scorpaena* sp.			×				×	×	
	17 Triglidae	25 *Lepidotrigla* spp.						×		×	
	18 Platycephalidae	26 *Solitus gruveli*	demersal		×	×	×		×		×
9 Perciformes	19 Moronidae	27 *Dicentrarchus punctatus*	pelagic					×		×	
	20 Serranidae	28 *Serranus scriba*	demersal		×			×	×	×	×
		29 *Epinephelus aeneus*	demersal		×	×	×	×			
		30 *Epinephelus costae*	demersal						×		
		31 *Epinephelus marginatus*	reef-associated					×			
		32 *Mycteroperca rubra*	demersal					×			
	21 Pomatomidae	33 *Pomatomus saltator*	pelagic		×						×
	22 Echeneididae	34 *Echeneis naucrates*	reef-associated	×							
	23 Carangidae	35 *Chloroscombrus chrysurus*	pelagic	×	×	×	×		×		×
		36 *Caranx rhonchus*	benthopelagic		×	×	×		×		×
		37 *Alectis alexandrinus*	pelagic		×		×				
		38 *Selene dorsalis*	demersal		×		×		×		×
	24 Gerreidae	39 *Eucinostomus melanopterus*	demersal		×		×				
	25 Haemulidae	40 *Pomadasys incisus*	demersal	×	×	×	×	×	×	×	×
		41 *Pomadasys jubelini*	demersal			×	×				
		42 *Brachydeuterus auritus*	benthopelagic		×	×	×		×	×	×
		43 *Plectorhinchus mediterraneus*	demersal	×	×		×	×		×	×
	26 Sparidae	44 *Pagrus auriga*	benthopelagic							×	
		45 *Pagrus caeruleostictus*	benthopelagic	×	×	×	×		×	×	
		46 *Dentex canariensis*	benthopelagic	×	×	×		×	×	×	×
		47 *Dentex gibbosus*	benthopelagic				×				×
		48 *Diplodus sargus cadenati*	reef-associated	×		×		×	×	×	
		49 *Diplodus vulgaris*	benthopelagic	×						×	
		50 *Diplodus bellottii*	benthopelagic	×	×	×	×	×	×	×	×
		51 *Lithognathus mormyrus*	benthopelagic		×		×	×			
		52 *Pagellus bellottii*	demersal	×	×		×		×		×
		53 *Spondyliosoma cantharus*	benthopelagic	×	×		×	×		×	×
	27 Polynemidae	54 *Galeoides decadactylus*	demersal	×	×	×	×	×	×	×	×
	28 Sciaenidae	55 *Sciaena umbra*	demersal					×			
		56 *Argyrosomus regius*	benthopelagic		×		×		×		×
		57 *Pseudotolithus senegalensis*	demersal	×	×	×	×				
		58 *Umbrina canariensis*	demersal					×			
	29 Mullidae	59 *Pseudupeneus prayensis*	demersal	×	×		×	×	×	×	×
	30 Drepanidae	60 *Drepane africana*	benthopelagic	×	×		×				
	31 Chaetodontidae	61 *Chaetodon hoefleri*	demersal		×						
	32 Labridae	62 *Symphodus roissali*	reef-associated		×			×	×	×	×
		63 *Xyrichthys novacula*	demersal		×				×		
	33 Scaridae	64 *Nicholsina usta collettei*	demersal	×	×			×		×	
	34 Gobiidae	65 Gobiidae			×		×	×	×	×	×
	35 Ephippidae	66 *Ephippus goreensis*	demersal		×		×				
	36 Sphyraenidae	67 *Sphyraena guachancho*	pelagic						×		
	37 Trichiuridae	68 *Trichiurus lepturus*	benthopelagic						×		
	38 Centrolophidae	69 *Schedophilus pemarco*	benthopelagic						×		
	39 Stromateidae	70 *Stromateus fiatola*	benthopelagic						×		

Appendix Table 3.2 List of species caught by *Amrigue* (2/2).

Order	Family	Species	Habitat	Sub- northern coastal area							
				Banc d'Arguin				Other			
				1C	1W	2C	2W	1C	1W	2C	2W
10 Pleuronectiformes	40 Paralichthyidae	71 *Syacium micrurum*	benthopelagic	×	×	×	×	×	×	×	×
	41 Psettodidae	72 *Psettodes belcheri*	demersal	×	×	×	×	×	×	×	×
	42 Bothidae	73 *Bothus podas*	demersal			×			×		
	43 Soleidae	74 *Pegusa triophthalma*	demersal	×	×	×		×	×	×	×
		75 *Solea senegalensis*	demersal	×	×	×	×	×	×		×
		76 *Dicologlossa cuneata*	demersal	×			×	×	×	×	×
		77 *Dicologlossa hexophthalma*	demersal								×
		78 *Microchirus boscanion*	demersal							×	
		79 *Microchirus theophila*	demersal					×			
		80 *Monochirus hispidus*	demersal							×	
		81 *Synaptura cadenati*	demersal	×			×		×		
		82 *Synaptura lusitanica*	demersal	×		×		×		×	×
		83 *Heteromycteris proboscideus*	demersal						×		
	44 Cynoglossidae	84 *Cynoglossus canariensis*	demersal				×				×
		85 *Cynoglossus monodi*	demersal				×				
		86 *Cynoglossus senegalensis*	demersal		×	×	×		×	×	
		87 *Cynoglossus* sp.		×	×		×	×	×		×
11 Tetraodontiformes	45 Monacanthidae	88 *Stephanolepis hispidus*	demersal	×	×	×	×	×	×	×	×
		89 *Aluterus* sp.			×				×		×
	46 Tetraodontidae	90 *Ephippion guttifer*	demersal	×	×	×	×	×			
		91 *Lagocephalus lagocephalus lagocephalus*	benthopelagic		×						
		92 *Lagocephalus laevigatus*	pelagic		×		×				
		93 *Sphoeroides spengleri*	demersal	×	×	×	×	×	×	×	×
	47 Diodontidae	94 *Chilomycterus reticulatus*	demersal	×							
		95 *Chilomycterus spinosus mauretanicus*	benthopelagic	×	×	×	×			×	
Teuthoidea	Loliginidae	*Loligo vulgaris*						×	×		×
Sepioidea	Sepiidae	*Sepia officinalis*		×		×	×	×		×	×
Octopoda	Octopodidae	*Octopus vulgaris*					×			×	×
Decapoda	Penaeidae	*Penaeus notialis*		×	×	×	×	×	×	×	×

Appendix Table 3.3 List of fishes and target species caught by *Al-Awam* (1/14)

Order / Family / Species	Habitat	Area	Stratum (isobath range in m) 3-20m 1W	3-20m 2C	3-20m 2W	20-30m 1C	20-30m 1W	20-30m 2C	20-30m 2W	30-80m 1C	30-80m 1W	30-80m 2C	30-80m 2W	80-200m 1C	80-200m 1W	80-200m 2C	80-200m 2W	200-400m 1C	200-400m 1W	200-400m 2C	200-400m 2W	400-600m 1W
1 Carcharhiniformes																						
1 Scyliorhinidae																						
1 *Scyliorhinus stellaris*	reef-associated	North													×	×	×	×	×		×	
		Central											×	×	×	×	×	×			×	
		South												×		×	×			×		
2 *Galeus melastomus*	bathydemersal	North																				
		Central																				×
		South																		×		
3 *Galeus polli*	bathydemersal	North															×	×	×		×	
		Central																		×		
		South																		×		
2 Leptochariidae																						
4 *Leptocharias smithii*	demersal	North		×	×		×		×		×		×									
		Central	×	×	×		×		×		×		×		×							
		South	×		×		×				×		×									
3 Triakidae																						
5 *Mustelus mustelus*	demersal	North		×	×		×		×	×	×	×	×			×						
		Central		×																		
		South		×							×		×									
4 Hemigaleidae																						
6 *Paragaleus pectoralis*	demersal	North			×								×									
		Central																				
		South																				
5 Carcharhinidae																						
7 *Rhizoprionodon acutus*	demersal	North		×	×		×		×				×									
		Central	×	×	×		×		×													
		South	×		×			×	×				×									
8 *Sphyrna lewini*	pelagic	North																				
		Central	×				×		×													
		South	×		×		×		×													
2 Hexanchiformes																						
6 Hexanchidae																						
9 *Heptranchias perlo*	bathydemersal	North																				
		Central																				
		South																			×	
3 Squaliformes																						
7 Oxynotidae																						
10 *Oxynotus centrina*	bathydemersal	North																				
		Central														×						
		South																				
8 Centrophoridae																						
11 *Centrophorus uyato*	bathydemersal	North																				
		Central																				×
		South																		×		
9 Squalidae																						
12 *Squalus megalops*	bathydemersal	North																				
		Central																				
		South																		×		
4 Rajiformes																						
10 Torpedinidae																						
13 *Torpedo torpedo*	demersal	North							×	×		×	×									
		Central	×	×		×		×		×	×	×	×	×	×		×					
		South		×	×	×	×	×	×	×	×	×	×	×	×	×	×					
14 *Torpedo marmorata*	demersal	North		×																		
		Central	×	×																		
		South	×									×		×	×							
11 Rhinobatidae																						
15 *Rhinobatos cemiculus*	demersal	North			×				×				×									
		Central																				
		South																				
16 *Rhinobatos rhinobatos*	demersal	North		×			×		×		×		×									
		Central	×	×	×		×		×		×		×									
		South	×	×	×		×		×		×		×									
17 *Zanobatus schoenleinii*	demersal	North		×	×				×													
		Central	×	×	×						×											
		South	×	×	×		×	×	×		×	×										
12 Rajidae																						
18 *Raja brachyura*	demersal	North																				
		Central						×														
		South																				
19 *Raja miraletus*	demersal	North		×	×	×	×	×	×	×		×	×	×								
		Central		×		×		×		×	×		×	×	×							
		South	×	×	×	×		×		×	×	×	×	×	×	×	×		×			
20 *Raja straeleni*	demersal	North					×	×				×		×			×	×	×		×	
		Central								×		×		×	×	×	×		×	×	×	
		South	×				×					×		×	×	×	×	×				
21 *Raja undulata*	demersal	North		×	×				×				×									
		Central													×	×			×			
		South													×							

Appendix Table 3.3 List of fishes and target species caught by *Al-Awam* (2/14)

Order / Family / Species	Habitat	Area	Stratum (isobath range in m) 3-20m 1W	3-20m 2C	3-20m 2W	20-30m 1C	20-30m 1W	20-30m 2C	20-30m 2W	30-80m 1C	30-80m 1W	30-80m 2C	30-80m 2W	80-200m 1C	80-200m 1W	80-200m 2C	80-200m 2W	200-400m 1C	200-400m 1W	200-400m 2C	200-400m 2W	400-600m 1W
4 Rajiformes																						
12 Rajidae																						
22 *Raja* sp.	-	North																×			×	
		Central														×				×		×
		South													×				×			
23 *Rajella barnardi*	bathydemersal	North																				
		Central																×				
		South																				
24 *Leucoraja wallacei*	bathydemersal	North																				
		Central																		×	×	
		South																				
13 Dasyatidae																						
25 *Dasyatis centroura*	demersal	North																				
		Central																				
		South	×		×																	
26 *Dasyatis margarita*	demersal	North																				
		Central	×																			
		South			×																	
27 *Dasyatis chrysonota marmorata*	demersal	North		×	×		×		×													
		Central	×	×	×						×											
		South	×	×	×	×		×	×													
28 *Dasyatis pastinaca*	demersal	North			×		×	×		×												
		Central																				
		South	×		×																	
29 *Dasyatis* sp.	-	North																				
		Central																				
		South	×																			
14 Gymnuridae																						
30 *Gymnura altavela*	demersal	North		×	×							×										
		Central	×	×	×				×		×											
		South	×	×	×				×													
15 Myliobatidae																						
31 *Myliobatis aquila*	benthopelagic	North					×															
		Central	×	×	×																	
		South	×	×	×																	
32 *Pteromylaeus bovinus*	benthopelagic	North																				
		Central						×														
		South	×																			
33 *Rhinoptera marginata*	benthopelagic	North																				
		Central		×	×				×													
		South			×																	
5 Elopiformes																						
16 Elopidae																						
34 *Elops lacerta*	pelagic	North																				
		Central																				
		South	×				×															
6 Albuliformes																						
17 Albulidae																						
35 *Albula vulpes*	reef-associated	North																				
		Central																				
		South										×										
36 *Pterothrissus belloci*	bathydemersal	North												×		×	×	×				
		Central										×		×	×	×	×	×	×	×	×	
		South	×	×						×	×	×	×	×	×	×	×	×	×	×	×	
7 Anguilliformes																						
18 Heterenchelyidae																						
37 *Panturichthys mauritanicus*	demersal	North													×							
		Central		×								×										
		South														×						
19 Chlopsidae																						
38 *Chlopsis bicolor*	demersal	North																				
		Central													×		×					
		South										×				×	×					
20 Muraenidae																						
39 Muraenidae	-	North																				
		Central																				
		South	×																			
21 Synaphobranchidae																						
40 *Synaphobranchidae*	-	North																				
		Central												×								
		South																				
22 Ophichthidae																						
41 *Callechelys leucoptera*	demersal	North		×																		
		Central																				
		South																				
42 *Echelus myrus*	demersal	North												×				×	×		×	
		Central								×						×		×		×	×	
		South																		×	×	

Appendix Table 3.3 List of fishes and target species caught by *Al-Awam* (3/14)

Order / Family / Species	Habitat	Area	3-20m 1W	3-20m 2C	3-20m 2W	20-30m 1C	20-30m 1W	20-30m 2C	20-30m 2W	30-80m 1C	30-80m 1W	30-80m 2C	30-80m 2W	80-200m 1C	80-200m 1W	80-200m 2C	80-200m 2W	200-400m 1C	200-400m 1W	200-400m 2C	200-400m 2W	400-600m 1W
7 Anguilliformes																						
22 Ophichthidae																						
43 *Ophisurus serpens*	demersal	North																				
		Central												×		×		×				
		South				×				×		×		×		×		×				
44 *Pisodonophis semicinctus*	demersal	North																				
		Central		×																		
		South	×	×	×						×		×									
45 *Apterichtus anguiformis*	demersal	North																				
		Central									×											
		South																				
46 *Mystriophis rostellatus*	demersal	North		×																		
		Central			×											×			×	×		
		South																×		×	×	
23 Muraenesocidae																						
47 *Cynoponticus ferox*	demersal	North																				
		Central												×				×	×			
		South		×		×						×				×				×		
24 Nemichthyidae																						
48 *Nemichthys scolopaceus*	bathypelagic	North																×				
		Central																				
		South																				
25 Congridae																						
49 *Ariosoma balearicum*	demersal	North								×		×										
		Central				×				×	×			×		×		×			×	×
		South				×						×										
50 *Paraconger notialis*	demersal	North																	×			
		Central																	×	×		
		South																		×		
51 *Xenomystax* sp.	-	North									×				×	×						
		Central														×						
		South														×				×		
52 *Conger conger*	demersal	North																	×			
		Central																				
		South																				
26 Nettastomatidae																						
53 Nettastomatidae	-	North																				
		Central													×							
		South																				
8 Clupeiformes																						
27 Engraulidae																						
54 *Engraulis encrasicolus*	pelagic	North		×		×		×	×	×	×	×					×					
		Central						×				×			×		×					
		South		×		×		×														
28 Pristigasteridae																						
55 *Ilisha africana*	pelagic	North																				
		Central	×	×					×													
		South	×	×	×		×	×	×													
29 Clupeidae																						
56 *Sardina pilchardus*	pelagic	North				×		×		×		×					×					
		Central		×		×						×										
		South		×				×			×											
57 *Sardinella aurita*	pelagic	North		×	×	×	×	×	×	×	×	×	×									
		Central	×	×	×	×	×	×	×		×	×	×	×		×	×					
		South	×	×	×	×	×	×	×	×	×		×		×		×					
58 *Sardinella maderensis*	pelagic	North		×	×	×	×	×		×	×	×	×									
		Central	×	×	×		×		×		×	×										
		South	×	×	×	×	×	×	×				×									
9 Siluriformes																						
30 Ariidae																						
59 *Arius heudelotii*	demersal	North		×	×		×		×		×		×									
		Central	×	×	×		×		×				×									
		South	×	×	×		×		×		×		×									
10 Osmeriformes																						
31 Alepocephalidae																						
60 *Xenodermichthys copei*	bathypelagic	North																×				
		Central																				×
		South																		×		
11 Stomiiformes																						
32 Gonostomatidae																						
61 Gonostomatidae	-	North																×				
		Central																		×		×
		South																×		×		
33 Sternoptychidae																						
62 *Argyropelecus* sp.	-	North																				
		Central																		×		
		South																×				

Appendix Table 3.3 List of fishes and target species caught by *Al-Awam* (4/14)

Order / Family / Species	Habitat	Area	Stratum (isobath range in m) 3-20m 1W	3-20m 2C	3-20m 2W	20-30m 1C	20-30m 1W	20-30m 2C	20-30m 2W	30-80m 1C	30-80m 1W	30-80m 2C	30-80m 2W	80-200m 1C	80-200m 1W	80-200m 2C	80-200m 2W	200-400m 1C	200-400m 1W	200-400m 2C	200-400m 2W	400-600m 1W
11 Stomiiformes																						
34 Photichthyidae																						
63 *Polymetme corythaeola*	bathypelagic	North																				
		Central																		×		
		South																		×		
35 Stomiidae																						
64 *Stomias boa boa*	bathypelagic	North																×				
		Central																				×
		South																				
65 *Stomias* sp.	-	North																×				
		Central																				×
		South																				
66 Melanostomiinae	-	North																				
		Central																				×
		South																				
12 Aulopiformes																						
36 Aulopidae																						
67 *Aulopus filamentosus*	demersal	North																				
		Central						×						×	×	×	×					
		South						×						×	×	×				×		
37 Chlorophthalmidae																						
68 *Chlorophthalmus agassizi*	bathydemersal	North												×		×	×	×	×		×	
		Central										×		×	×	×	×	×	×	×	×	×
		South										×		×	×	×	×	×	×	×	×	
69 *Parasudis fraserbrunneri*	bathydemersal	North																×				
		Central																×	×		×	
		South																×			×	
38 Synodontidae																						
70 *Synodus saurus*	demersal	North																				
		Central																×				
		South																				
71 *Synodus* sp.	-	North																				
		Central					×				×			×								
		South												×	×							
72 *Trachinocephalus myops*	reef-associated	North																				
		Central		×				×			×		×									
		South						×					×									
73 *Saurida brasiliensis*	demersal	North								×	×	×	×		×	×	×	×				
		Central				×				×	×	×	×	×	×	×	×		×			
		South								×	×	×	×	×	×	×	×					
13 Myctophiformes																						
39 Myctophidae																						
74 *Diaphus* sp.	-	North																×				
		Central																	×			
		South																	×			
75 *Lampanyctus* sp.	-	North																×				
		Central																		×		
		South																				
76 Myctophidae	-	North																×	×		×	
		Central																×	×	×	×	
		South																×	×	×	×	
14 Ophidiiformes																						
40 Ophidiidae																						
77 *Brotula barbata*	benthopelagic	North												×	×	×	×					
		Central					×			×				×	×	×	×	×	×	×	×	
		South		×						×	×	×	×	×	×	×	×	×	×	×		
78 *Ophidion rochei*	demersal	North													×	×			×		×	
		Central						×												×		
		South										×				×				×		
15 Gadiformes																						
41 Macrouridae																						
79 *Nezumia* sp.	-	North																×	×		×	
		Central																		×	×	
		South																	×	×		
80 *Malacocephalus laevis*	benthopelagic	North																×				
		Central																	×			×
		South																			×	
81 *Malacocephalus occidentalis*	benthopelagic	North																×	×		×	
		Central												×		×		×		×	×	
		South												×		×	×		×	×	×	
82 *Malacocephalus* sp.	-	North																×	×			
		Central												×				×	×			
		South																×	×	×		
83 *Caelorinchus caelorhincus caelorhincus*	benthopelagic	North																×	×		×	
		Central																×	×	×	×	×
		South																×	×	×	×	
84 *Caelorinchus* sp.	-	North																×	×			
		Central																×	×			×
		South												×						×		

Appendix Table 3.3 List of fishes and target species caught by *Al-Awam* (5/14)

Order / Family / Species	Habitat	Area	3-20m			20-30m				30-80m				80-200m				200-400m				400-600m
			1W	2C	2W	1C	1W	2C	2W	1C	1W	2C	2W	1C	1W	2C	2W	1C	1W	2C	2W	1W
15 Gadiformes																						
41 Macrouridae																						
85 Macrouridae	-	North																				
		Central																				
		South																×				
42 Moridae																						
86 *Gadella maraldi*	benthopelagic	North																×				
		Central																×				×
		South														×			×	×		
87 *Laemonema laureysi*	benthopelagic	North																×				
		Central																			×	
		South								×				×							×	
88 *Laemonema yarrellii*	benthopelagic	North																				
		Central																			×	×
		South																		×		
89 *Laemonema* sp.	-	North											×			×					×	
		Central												×			×		×	×	×	
		South								×				×	×	×	×	×	×	×		
43 Merlucciidae																						
90 *Merluccius polli*	demersal	North										×				×	×				×	
		Central										×				×	×			×	×	
		South										×				×	×			×	×	
91 *Merluccius senegalensis*	demersal	North						×		×	×	×		×	×	×	×	×	×		×	
		Central								×		×		×	×	×	×	×	×	×	×	×
		South								×		×		×	×	×	×	×	×	×	×	
92 *Merluccius* sp.	-	North								×				×								
		Central								×				×				×				
		South				×				×				×				×				
16 Batrachoidiformes																						
44 Batrachoididae																						
93 *Halobatrachus didactylus*	demersal	North		×	×	×	×	×	×	×	×	×										
		Central	×	×		×		×		×	×	×										
		South	×	×		×	×	×		×		×				×						
17 Lophiiformes																						
45 Lophiidae																						
94 *Lophiodes kempi*	demersal	North																				
		Central																				×
		South												×								
95 *Lophius budegassa*	bathydemersal	North																	×		×	
		Central																				
		South																				
96 *Lophius vaillanti*	bathydemersal	North																	×			
		Central																				
		South																				
97 *Lophius* spp.	-	North												×				×			×	
		Central												×	×	×		×	×	×	×	
		South								×				×		×		×	×	×	×	
46 Antennariidae																						
98 *Antennarius pardalis*	demersal	North								×		×										
		Central								×	×											
		South								×	×	×										
99 *Antennarius senegalensis*	demersal	North																				
		Central							×				×									
		South										×	×	×								
47 Chaunacidae																						
100 *Chaunax pictus*	bathydemersal	North																				
		Central																				×
		South																				
48 Ogcocephalidae																						
101 *Dibranchus atlanticus*	demersal	North																				
		Central																				
		South																		×		
18 Mugiliformes																						
49 Mugilidae																						
102 *Mugil capurrii*	benthopelagic	North																				
		Central												×								
		South	×	×												×						
103 *Mugil cephalus*	benthopelagic	North											×									
		Central		×																		
		South		×																		
104 *Mugil curema*	benthopelagic	North																				
		Central			×																	
		South																				
19 Beryciformes																						
50 Trachichthyidae																						
105 *Gephyroberyx darwinii*	benthopelagic	North																				
		Central																	×	×		
		South																×				

Appendix Table 3.3 List of fishes and target species caught by *Al-Awam* (6/14)

Order / Family / Species	Habitat	Area	Stratum (isobath range in m) 3-20m 1W	2C	2W	20-30m 1C	1W	2C	2W	30-80m 1C	1W	2C	2W	80-200m 1C	1W	2C	2W	200-400m 1C	1W	2C	2W	400-600m 1W
19 Beryciformes																						
50 Trachichthyidae																						
106 *Hoplostethus cadenati*	bathypelagic	North																				
		Central																		×	×	×
		South																×		×		
107 *Hoplostethus mediterraneus*	benthopelagic	North																×	×		×	
		Central																×	×	×	×	
		South																		×	×	
51 Berycidae																						
108 *Beryx splendens*	benthopelagic	North																			×	
		Central																				
		South																		×		
20 Zeiformes																						
52 Zeidae																						
109 *Zeus faber*	benthopelagic	North								×	×	×	×	×	×	×	×					
		Central				×				×	×	×	×	×	×	×	×				×	
		South		×		×		×		×	×	×	×	×	×	×	×					
110 *Zenopsis conchifer*	benthopelagic	North												×	×	×	×	×	×		×	
		Central										×		×	×	×	×	×	×	×	×	
		South										×		×	×	×	×	×	×	×	×	
53 Caproidae																						
111 *Antigonia capros*	demersal	North																			×	
		Central									×			×	×	×	×		×			
		South										×		×	×	×	×					
112 *Capros aper*	demersal	North								×		×		×	×	×	×	×	×		×	
		Central										×		×	×	×	×	×	×	×	×	
		South								×		×		×	×	×	×				×	
21 Gasterosteiformes																						
54 Syngnathidae																						
113 *Syngnathus acus*	demersal	North										×	×									
		Central								×	×											
		South								×												
114 *Hippocampus algiricus*	demersal	North									×											
		Central																				
		South																				
115 *Hippocampus* sp	-	North									×											
		Central																				
		South																				
55 Aulostomidae																						
116 *Aulostomus strigosus*	demersal	North																				
		Central			×																	
		South																				
56 Fistulariidae																						
117 *Fistularia petimba*	demersal	North			×				×		×		×				×					
		Central	×		×		×	×	×		×		×		×							
		South	×				×	×	×		×		×									
118 *Fistularia tabacaria*	reef-associated	North			×				×		×											
		Central	×	×	×		×		×		×		×									
		South	×		×		×		×		×		×									
119 *Fistularia* sp.	-	North																				
		Central				×																
		South								×												
22 Scorpaeniformes																						
57 Dactylopteridae																						
120 *Dactylopterus volitans*	reef-associated	North			×								×									
		Central	×	×	×		×		×		×				×							
		South	×	×			×		×		×											
58 Scorpaenidae																						
121 *Helicolenus dactylopterus dactylopterus*	bathydemersal	North								×	×				×	×	×	×	×		×	
		Central												×	×	×	×	×	×	×	×	×
		South								×				×	×	×	×	×	×	×	×	
122 *Scorpaena angolensis*	demersal	North												×								
		Central												×								
		South																				
123 *Scorpaena elongata*	demersal	North												×				×	×		×	
		Central												×	×	×	×	×	×	×	×	
		South													×	×	×	×		×	×	
124 *Scorpaena loppei*	demersal	North																				
		Central																				
		South										×										
125 *Scorpaena normani*	demersal	North												×		×	×					
		Central								×		×		×	×	×	×	×	×	×	×	
		South								×		×		×	×	×	×		×			
126 *Scorpaena stephanica*	demersal	North			×	×				×	×			×	×	×	×					
		Central	×		×	×				×	×	×	×	×	×	×	×		×	×	×	
		South	×	×			×				×	×	×		×	×	×		×	×		
127 *Scorpaena* sp.	-	North						×	×	×		×	×			×	×					
		Central	×	×	×			×		×	×	×	×	×		×	×					
		South				×		×		×		×	×	×		×				×		

Appendix Table 3.3 List of fishes and target species caught by *Al-Awam* (7/14)

Order / Family / Species	Habitat	Area	Stratum (isobath range in m) 3-20m 1W	2C	2W	20-30m 1C	1W	2C	2W	30-80m 1C	1W	2C	2W	80-200m 1C	1W	2C	2W	200-400m 1C	1W	2C	2W	400-600m 1W
22 Scorpaeniformes																						
58 Scorpaenidae																						
128 *Pontinus kuhlii*	bathydemersal	North												×	×	×	×	×			×	
		Central												×	×	×	×	×	×	×	×	
		South								×		×		×	×	×	×	×	×	×	×	
59 Triglidae																						
129 *Trigla lyra*	bathydemersal	North																×	×		×	
		Central													×					×	×	×
		South															×			×		
130 *Chelidonichthys gabonensis*	demersal	North									×		×									
		Central						×		×	×	×	×	×	×	×	×		×			
		South									×	×	×		×							
131 *Chelidonichthys obscurus*	demersal	North					×				×											
		Central		×				×				×										
		South														×						
132 *Chelidonichthys lastoviza*	demersal	North																				
		Central								×												
		South																				
133 *Chelidonichthys* spp.	-	North		×		×				×	×	×	×	×								
		Central	×	×		×		×		×	×	×	×									
		South		×	×	×				×		×	×	×		×	×		×			
134 *Lepidotrigla* spp.	-	North						×		×	×	×	×	×	×	×	×	×	×		×	
		Central		×		×		×		×	×	×	×	×	×	×	×	×	×	×	×	
		South				×		×		×	×	×	×	×	×	×	×					
135 *Peristedion cataphractum*	demersal	North																×	×		×	
		Central												×	×			×	×	×	×	
		South																×		×	×	
60 Platycephalidae																						
136 *Solitas gruveli*	demersal	North				×				×		×	×									
		Central					×			×	×	×	×			×	×					
		South						×		×	×	×	×	×		×				×		
23 Perciformes																						
61 Moronidae																						
137 *Dicentrarchus punctatus*	pelagic	North		×																		
		Central																				
		South																				
62 Acropomatidae																						
138 *Synagrops microlepis*	bathypelagic	North				×					×			×	×	×	×	×	×		×	
		Central						×		×				×	×	×	×	×	×	×	×	×
		South								×		×		×	×	×	×	×	×	×	×	
63 Serranidae																						
139 *Serranus accraensis*	demersal	North																				
		Central												×								
		South											×									
140 *Serranus africanus*	demersal	North													×	×						
		Central	×																			
		South									×		×	×	×	×						
141 *Serranus cabrilla*	bathydemersal	North								×	×	×		×	×	×	×					
		Central								×	×	×	×	×	×	×	×					
		South	×							×	×	×	×	×	×	×	×					
142 *Serranus scriba*	demersal	North		×	×			×		×	×											
		Central	×	×	×	×			×								×					
		South	×	×							×		×									
143 *Serranus* sp.	-	North										×										
		Central	×	×												×						
		South		×												×						
144 *Anthias anthias*	reef-associated	North												×								
		Central										×	×									
		South									×											
145 *Epinephelus aeneus*	demersal	North		×	×	×	×	×	×				×									
		Central	×	×	×	×			×	×												
		South	×	×	×	×	×		×		×		×									
146 *Epinephelus caninus*	demersal	North														×						
		Central	×							×	×	×		×								
		South	×				×			×												
147 *Epinephelus costae*	demersal	North			×				×													
		Central	×	×	×											×						
		South		×	×							×										
148 *Epinephelus goreensis*	demersal	North												×								
		Central																				
		South											×	×								
149 *Epinephelus marginatus*	reef-associated	North								×												
		Central																				
		South	×													×						
150 *Cephalopholis taeniops*	demersal	North																				
		Central					×															
		South	×																			
151 *Mycteroperca rubra*	demersal	North																				
		Central			×											×						
		South	×							×												

Appendix Table 3.3 List of fishes and target species caught by *Al-Awam* (8/14)

Order / Family / Species	Habitat	Area	Stratum (isobath range in m) 3-20m 1W	3-20m 2C	3-20m 2W	20-30m 1C	20-30m 1W	20-30m 2C	20-30m 2W	30-80m 1C	30-80m 1W	30-80m 2C	30-80m 2W	80-200m 1C	80-200m 1W	80-200m 2C	80-200m 2W	200-400m 1C	200-400m 1W	200-400m 2C	200-400m 2W	400-600m 1W
23 Perciformes																						
63 Serranidae																						
152 *Rypticus saponaceus*	reef-associated	North		×	×																	
		Central	×	×	×																	
		South	×	×		×	×				×		×									
153 Serranidae	-	North																				
		Central	×																			
		South			×																	
64 Priacanthidae																						
154 *Priacanthus arenatus*	reef-associated	North									×		×									
		Central									×		×									
		South									×		×		×							
65 Apogonidae																						
155 *Apogon imberbis*	reef-associated	North				×																
		Central	×				×															
		South																				
66 Epigonidae																						
156 *Epigonus constanciae*	bathydemersal	North																				
		Central																×				×
		South																		×		
157 *Epigonus denticulatus*	bathydemersal	North																×	×			
		Central																		×		
		South																		×		
158 *Epigonus telescopus*	bathydemersal	North																×			×	
		Central																		×	×	
		South																×		×		
159 *Epigonus* sp.	-	North																×				
		Central																				
		South																	×			
67 Malacanthidae																						
160 *Branchiostegus semifasciatus*	demersal	North												×	×	×	×					
		Central										×		×	×	×						
		South								×		×		×		×						
68 Pomatomidae																						
161 *Pomatomus saltator*	pelagic	North		×			×	×					×									
		Central		×	×						×											
		South	×																			
69 Echeneididae																						
162 *Echeneis naucrates*	reef-associated	North							×													
		Central	×	×	×		×	×	×		×		×		×							
		South	×							×						×						
163 *Remora remora*	pelagic	North																				
		Central	×						×													
		South	×																			
70 Carangidae																						
164 *Trachinotus ovatus*	pelagic	North																				
		Central	×		×				×													
		South	×		×				×		×											
165 *Campogramma glaycos*	benthopelagic	North		×	×	×	×		×		×		×			×						
		Central	×	×	×		×		×		×		×									
		South		×																		
166 *Seriola dumerili*	reef-associated	North				×				×												
		Central																				
		South																				
167 *Seriola fasciata*	benthopelagic	North											×									
		Central																				
		South																				
168 *Seriola rivoliana*	benthopelagic	North																				
		Central												×								
		South																				
169 *Chloroscombrus chrysurus*	pelagic	North		×	×		×						×									
		Central	×	×	×		×		×		×		×									
		South	×	×	×	×	×	×	×		×		×									
170 *Caranx crysos*	Pelagic	North																				
		Central			×																	
		South			×																	
171 *Caranx rhonchus*	benthopelagic	North		×	×	×	×	×	×	×	×	×	×									
		Central	×	×	×	×	×	×	×	×	×	×	×		×		×					
		South	×	×	×	×	×	×	×	×	×	×	×		×		×					
172 *Caranx senegallus*	benthopelagic	North																				
		Central	×		×																	
		South	×	×	×		×				×											
173 *Decapterus punctatus*	benthopelagic	North					×						×									
		Central	×		×		×		×		×		×									
		South							×				×									
174 *Alectis alexandrinus*	pelagic	North			×								×									
		Central	×	×	×		×				×		×									
		South	×	×	×		×		×		×		×									

Appendix Table 3.3 List of fishes and target species caught by *Al-Awam* (9/14)

Order / Family / Species	Habitat	Area	Stratum (isobath range in m) 3-20m 1W	3-20m 2C	3-20m 2W	20-30m 1C	20-30m 1W	20-30m 2C	20-30m 2W	30-80m 1C	30-80m 1W	30-80m 2C	30-80m 2W	80-200m 1C	80-200m 1W	80-200m 2C	80-200m 2W	200-400m 1C	200-400m 1W	200-400m 2C	200-400m 2W	400-600m 1W
23 Perciformes																						
70 Carangidae																						
175 *Trachurus trachurus*	pelagic	North		×		×		×		×	×	×		×	×	×	×	×	×		×	
		Central				×		×		×		×		×	×	×	×	×	×	×	×	
		South				×		×		×		×		×		×				×		
176 *Trachinus trecae*	benthopelagic	North		×		×	×	×	×	×	×	×	×	×	×	×	×	×				
		Central		×		×		×		×	×	×	×	×	×	×	×	×	×	×		
		South	×	×		×	×	×		×	×	×	×	×	×	×	×			×		
177 *Selene dorsalis*	demersal	North		×	×							×										
		Central	×	×	×		×		×		×		×									
		South	×	×	×		×		×		×	×	×			×						
178 *Uraspis helvola*	benthopelagic	North																				
		Central																				
		South										×										
71 Bramidae																						
179 *Brama brama*	bathypelagic	North																				
		Central																		×		
		South																				
72 Emmelichthyidae																						
180 *Erythrocles monodi*	pelagic	North																				
		Central												×								
		South																				
73 Lutjanidae																						
181 *Lutjanus fulgens*	demersal	North																				
		Central																				
		South				×																
74 Gerreidae																						
182 *Eucinostomus melanopterus*	demersal	North																				
		Central	×	×	×		×		×													
		South	×	×	×		×		×		×		×									
75 Haemulidae																						
183 *Pomadasys incisus*	demersal	North		×	×		×	×	×	×	×		×									
		Central	×	×	×		×		×	×	×		×									
		South	×	×	×		×	×	×		×	×	×									
184 *Pomadasys perotaei*	benthopelagic	North																				
		Central	×	×			×															
		South	×		×	×	×															
185 *Pomadasys jubelini*	demersal	North																				
		Central		×	×				×				×									
		South		×	×				×				×									
186 *Pomadasys rogeri*	benthopelagic	North			×				×				×									
		Central	×	×	×		×		×		×		×									
		South	×	×	×	×	×	×	×		×		×									
187 *Brachydeuterus auritus*	benthopelagic	North		×	×		×			×		×	×									
		Central	×	×	×		×	×	×		×	×	×	×	×							
		South	×	×	×	×	×	×	×	×	×	×	×		×		×					
188 *Parapristipoma octolineatum*	demersal	North					×				×			×								
		Central	×			×				×	×	×	×	×		×						
		South		×							×											
189 *Plectorhinchus mediterraneus*	demersal	North		×	×		×	×	×	×	×		×	×								
		Central	×	×	×	×	×	×	×	×	×	×	×	×		×						
		South	×	×	×	×	×	×	×	×	×	×				×						
76 Sparidae																						
190 *Pagrus auriga*	benthopelagic	North			×									×								
		Central	×	×	×	×				×		×	×									
		South		×								×										
191 *Pagrus caeruleostictus*	benthopelagic	North		×	×			×	×				×									
		Central	×	×	×	×	×	×	×	×		×	×			×						
		South	×	×	×	×	×	×	×		×	×	×									
192 *Pagrus pagrus*	benthopelagic	North			×								×	×								
		Central	×	×						×		×	×	×		×						
		South								×		×	×	×								
193 *Boops boops*	demersal	North		×	×	×	×	×		×	×	×	×									
		Central	×		×	×	×	×		×	×	×	×	×	×	×	×					
		South				×		×	×	×	×	×	×	×	×		×					
194 *Dentex angolensis*	demersal	North												×								
		Central								×				×			×					
		South				×				×	×			×	×	×						
195 *Dentex canariensis*	benthopelagic	North		×	×	×	×	×	×	×	×	×	×									
		Central	×	×	×	×	×	×	×	×	×	×	×	×		×						
		South	×	×	×	×	×	×		×	×	×	×									
196 *Dentex gibbosus*	benthopelagic	North			×				×		×		×			×						
		Central			×				×	×		×	×			×						
		South			×				×		×	×	×									
197 *Dentex macrophthalmus*	benthopelagic	North				×				×	×			×	×	×	×		×			
		Central				×				×	×	×		×	×	×	×	×	×	×	×	
		South				×				×		×		×	×	×	×	×		×		

Appendix Table 3.3 List of fishes and target species caught by *Al-Awam* (10/14)

Order / Family / Species	Habitat	Area	Stratum (Isobath range in m) 3-20m 1W	3-20m 2C	3-20m 2W	20-30m 1C	20-30m 1W	20-30m 2C	20-30m 2W	30-80m 1C	30-80m 1W	30-80m 2C	30-80m 2W	80-200m 1C	80-200m 1W	80-200m 2C	80-200m 2W	200-400m 1C	200-400m 1W	200-400m 2C	200-400m 2W	400-600m 1W
23 Perciformes																						
76 Sparidae																						
198 *Dentex maroccanus*	demersal	North								×	×	×	×	×	×	×	×					
		Central								×	×	×	×	×	×	×	×					
		South								×	×	×	×	×	×	×	×					
199 *Diplodus sargus cadenati*	reef-associated	North		×	×		×			×		×										
		Central			×																	
		South	×	×																		
200 *Diplodus fasciatus*	benthopelagic	North																				
		Central																				
		South		×																		
201 *Diplodus vulgaris*	benthopelagic	North					×	×		×												
		Central	×	×	×	×				×												
		South		×	×			×														
202 *Diplodus bellottii*	benthopelagic	North		×	×	×	×	×	×	×	×		×									
		Central	×	×	×				×													
		South	×	×	×																	
203 *Diplodus puntazzo*	benthopelagic	North								×												
		Central	×	×																		
		South		×																		
204 *Lithognathus mormyrus*	benthopelagic	North		×									×									
		Central	×	×	×		×		×		×											
		South	×	×	×		×		×			×										
205 *Pagellus acarne*	benthopelagic	North		×		×				×	×			×		×						
		Central		×						×		×	×	×		×						
		South												×								
206 *Pagellus bellottii*	demersal	North		×	×	×	×	×	×	×	×	×	×									
		Central	×	×	×	×	×	×	×	×	×	×	×	×	×	×						
		South	×	×	×	×	×	×	×	×	×	×	×			×						
207 *Spondyliosoma cantharus*	benthopelagic	North		×	×	×	×	×	×	×	×	×	×									
		Central	×	×	×	×	×	×	×	×	×		×									
		South		×						×	×		×			×						
77 Centracanthidae																						
208 *Spicara alta*	benthopelagic	North												×								
		Central								×	×	×			×	×	×					
		South								×				×	×	×	×					
78 Polynemidae																						
209 *Galeoides decadactylus*	demersal	North		×	×		×			×			×									
		Central	×	×	×		×	×	×		×	×	×									
		South	×	×	×		×	×	×		×		×									
210 *Pentanemus quinquarius*	demersal	North																				
		Central		×																		
		South	×	×																		
79 Sciaenidae																						
211 *Sciaena umbra*	demersal	North																				
		Central								×												
		South												×								
212 *Argyrosomus regius*	benthopelagic	North		×	×		×						×									
		Central	×	×	×		×		×				×									
		South	×	×	×	×		×	×			×	×									
213 *Pseudotolithus senegalensis*	demersal	North		×																		
		Central	×	×					×				×									
		South	×	×	×	×	×	×	×			×	×									
214 *Umbrina canariensis*	demersal	North					×			×		×	×	×		×	×					
		Central	×	×					×	×	×	×	×	×	×	×	×	×		×		
		South	×	×	×			×		×	×	×	×	×	×	×	×					
215 *Pentheroscion mbizi*	demersal	North																				
		Central							×					×								
		South								×		×	×									
216 *Pteroscion peli*	benthopelagic	North																				
		Central	×	×					×													
		South	×	×	×			×	×			×								×		
80 Mullidae																						
217 *Mullus surmuletus*	demersal	North												×								
		Central												×								
		South																				
218 *Pseudupeneus prayensis*	demersal	North		×	×	×	×	×	×	×	×	×	×				×					
		Central	×	×	×	×	×	×	×	×	×	×	×		×	×						
		South	×	×	×	×	×	×	×	×	×	×	×									
81 Drepanidae																						
219 *Drepane africana*	benthopelagic	North																				
		Central	×	×	×				×													
		South	×	×	×		×		×		×											
82 Chaetodontidae																						
220 *Chaetodon hoefleri*	demersal	North						×					×									
		Central	×	×	×	×	×		×		×		×									
		South	×	×	×			×			×	×	×									
221 *Prognathodes marcellae*	demersal	North																				
		Central								×		×										
		South																				

Appendix Table 3.3 List of fishes and target species caught by *Al-Awam* (11/14)

Order / Family / Species	Habitat	Area	Stratum (isobath range in m) 3-20m 1W	2C	2W	20-30m 1C	1W	2C	2W	30-80m 1C	1W	2C	2W	80-200m 1C	1W	2C	2W	200-400m 1C	1W	2C	2W	400-600m 1W
23 Perciformes																						
83 Cepolidae																						
222 *Cepola pauciradiata*	demersal	North				×				×	×	×		×	×	×	×	×				
		Central								×	×	×		×	×	×	×			×		
		South								×			×	×		×						
84 Pomacentridae																						
223 *Chromis chromis*	reef-associated	North																				
		Central					×			×	×	×	×									
		South									×											
85 Labridae																						
224 *Coris julis*	demersal	North																				
		Central		×	×																	
		South																				
225 *Bodianus speciosus*	reef-associated	North																				
		Central	×	×																		
		South		×	×																	
226 *Xyrichthys novacula*	demersal	North																				
		Central	×	×	×	×	×	×	×		×	×										
		South							×													
227 Labridae	-	North																				
		Central																				
		South	×																			
86 Scaridae																						
228 *Nicholsina usta collettei*	demersal	North			×	×	×		×	×			×									
		Central	×	×	×	×	×		×													
		South																				
87 Percophidae																						
229 *Bembrops heterurus*	demersal	North																				
		Central												×	×	×	×	×	×	×	×	
		South												×	×	×	×	×	×	×		
88 Trachinidae																						
230 *Trachinus draco*	demersal	North				×	×	×	×	×	×	×	×									
		Central		×		×		×		×	×	×			×		×					
		South							×	×		×										
231 *Trachinus radiatus*	demersal	North					×															
		Central																				
		South																				
89 Uranoscopidae																						
232 *Uranoscopus scaber*	demersal	North									×											
		Central				×					×	×										
		South						×		×		×			×	×						
233 *Uranoscopus polli*	demersal	North								×			×									
		Central		×						×	×		×	×	×							
		South							×			×	×	×	×	×						
234 *Uranoscopus* sp.	-	North				×		×		×		×	×									
		Central		×		×		×		×		×	×	×								
		South							×	×	×	×	×	×		×						
90 Blenniidae																						
235 *Blennius normani*	demersal	North															×					
		Central															×					
		South								×			×	×			×					
236 Blenniidae	-	North				×								×	×							
		Central								×	×	×			×	×				×		
		South								×		×		×	×	×	×					
91 Callionymidae																						
237 *Callionymus* sp.	-	North																				
		Central												×	×			×				
		South												×						×		
238 *Synchiropus phaeton*	demersal	North																				
		Central												×	×	×				×		
		South														×						
92 Gobiidae																						
239 *Thorogobius angolensis*	demersal	North														×						
		Central																		×		
		South												×	×							
240 Gobiidae	-	North		×	×	×				×	×	×	×	×	×	×	×					
		Central								×	×	×	×	×	×	×	×					
		South				×		×		×	×	×	×	×	×	×	×					
93 Ephippidae																						
241 *Ephippus goreensis*	demersal	North																				
		Central	×	×																		
		South	×	×									×									
94 Acanthuridae																						
242 *Acanthurus monroviae*	demersal	North																				
		Central	×			×								×								
		South	×	×																		
95 Sphyraenidae																						
243 *Sphyraena guachancho*	pelagic	North			×		×						×									
		Central	×	×	×		×		×		×		×									
		South	×		×		×		×		×		×									

Appendix Table 3.3 List of fishes and target species caught by *Al-Awam* (12/14)

Order / Family / Species	Habitat	Area	Stratum (isobath range in m) 3-20m 1W	3-20m 2C	3-20m 2W	20-30m 1C	20-30m 1W	20-30m 2C	20-30m 2W	30-80m 1C	30-80m 1W	30-80m 2C	30-80m 2W	80-200m 1C	80-200m 1W	80-200m 2C	80-200m 2W	200-400m 1C	200-400m 1W	200-400m 2C	200-400m 2W	400-600m 1W
23 Perciformes																						
95 Sphyraenidae																						
244 *Sphyraena sphyraena*	pelagic	North		×			×															
		Central		×	×			×				×										
		South	×	×	×			×				×				×						
96 Gempylidae																						
245 *Ruvettus pretiosus*	benthopelagic	North																				
		Central																		×		
		South																				
97 Trichiuridae																						
246 *Trichiurus lepturus*	benthopelagic	North		×	×			×	×		×	×	×	×		×	×		×			
		Central	×	×	×		×		×	×	×	×	×	×	×	×	×	×	×	×	×	
		South	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	
247 *Lepidopus caudatus*	benthopelagic	North														×						
		Central																				
		South																				
98 Scombridae																						
248 *Scomber japonicus*	pelagic	North						×		×		×	×			×						
		Central		×				×		×		×	×	×			×					
		South				×		×		×				×								
249 *Scomberomorus tritor*	pelagic	North			×								×									
		Central	×	×	×																	
		South																				
250 *Sarda sarda*	pelagic	North																				
		Central													×		×					
		South																				
99 Xiphiidae																						
251 *Xiphias gladius*	pelagic	North																				
		Central																	×		×	
		South																				
100 Centrolophidae																						
252 *Schedophilus velaini*	bathypelagic	North														×			×		×	
		Central		×											×	×		×		×		
		South		×														×		×		
253 *Schedophilus pemarco*	benthopelagic	North																×				
		Central																				
		South		×				×				×										
101 Nomeidae																						
254 *Psenes* spp.	-	North									×											
		Central													×							
		South																				
102 Ariommatidae																						
255 *Ariomma bondi*	demersal	North									×				×							
		Central													×		×					
		South													×		×					
103 Stromateidae																						
256 *Stromateus fiatola*	benthopelagic	North		×	×		×		×				×									
		Central		×	×		×		×				×									
		South	×	×	×	×	×		×		×											
24 Pleuronectiformes																						
104 Paralichthyidae																						
257 *Syacium micrurum*	benthopelagic	North			×	×	×	×	×	×	×		×				×		×			
		Central	×	×	×	×	×	×	×	×	×	×	×		×	×			×			
		South				×	×	×	×	×	×	×	×		×	×			×			
105 Psettodidae																						
258 *Psettodes belcheri*	demersal	North		×	×		×		×													
		Central	×	×	×																	
		South																				
106 Citharidae																						
259 *Citharus linguatula*	demersal	North		×		×		×		×	×	×	×	×	×	×	×					
		Central		×			×	×		×	×	×	×	×	×	×	×		×			
		South	×					×		×	×	×	×	×	×	×	×					
107 Bothidae																						
260 *Bothus podas*	demersal	North		×		×	×	×	×	×	×	×	×									
		Central	×	×	×	×	×	×	×	×	×	×										
		South	×		×	×	×	×	×			×	×									
261 *Arnoglossus imperialis*	demersal	North				×			×	×	×	×	×	×	×	×	×					
		Central				×	×	×		×	×	×	×	×	×	×	×					
		South								×	×	×	×	×	×	×	×					
262 *Chascanopsetta lugubris*	bathydemersal	North																				
		Central																				
		South																		×	×	×
263 *Monolene microstoma*	bathypelagic	North										×		×	×							
		Central				×		×		×		×		×	×	×	×	×	×	×	×	
		South								×		×		×			×					
108 Soleidae																						
264 *Pegusa lascaris*	demersal	North																				
		Central		×														×				
		South							×	×												

Appendix Table 3.3 List of fishes and target species caught by *Al-Awam* (13/14)

Order / Family / Species	Habitat	Area	Stratum (isobath range in m) 3-20m 1W	2C	2W	20-30m 1C	1W	2C	2W	30-80m 1C	1W	2C	2W	80-200m 1C	1W	2C	2W	200-400m 1C	1W	2C	2W	400-600m 1W
24 Pleuronectiformes																						
108 Soleidae																						
265 *Solea senegalensis*	demersal	North		×			×	×	×		×		×									
		Central		×				×														
		South	×																			
266 *Dicologlossa cuneata*	demersal	North		×	×	×	×	×		×	×	×						×				
		Central		×		×		×			×	×	×		×	×					×	
		South		×		×		×				×	×	×	×		×			×		
267 *Dicologlossa hexophthalma*	demersal	North																				
		Central								×	×		×			×						
		South				×		×	×		×	×	×	×		×						
268 *Microchirus boscanion*	demersal	North		×		×		×		×	×	×	×	×	×	×	×					
		Central		×		×		×		×	×	×	×	×	×	×	×	×	×			
		South						×		×		×		×	×	×	×				×	
269 *Microchirus frechkopi*	demersal	North											×	×								
		Central								×		×		×								
		South				×				×	×	×	×	×		×						
270 *Microchirus theophila*	demersal	North										×		×		×	×					
		Central				×				×	×			×	×	×						
		South								×	×				×							
271 *Microchirus variegatus*	demersal	North								×												
		Central												×		×						
		South								×				×								
272 *Microchirus wittei*	demersal	North																				
		Central													×							
		South												×	×							
273 *Microchirus* sp.	-	North					×			×						×			×			
		Central	×							×					×				×			
		South													×	×				×		
274 *Monochirus hispidus*	demersal	North						×		×	×	×										
		Central		×		×		×		×												
		South									×	×		×								
275 *Synaptura cadenati*	demersal	North		×																		
		Central		×	×																	
		South		×																		
276 *Synaptura lusitanica*	demersal	North		×																		
		Central	×	×	×																	
		South			×																	
277 *Vanstraelenia chirophthalmus*	demersal	North																			×	
		Central														×				×		
		South																			×	
278 Soleidae	-	North																				
		Central																×				
		South																				
109 Cynoglossidae																						
279 *Symphurus nigrescens*	demersal	North							×							×	×					
		Central														×	×				×	
		South												×	×		×	×				
280 *Cynoglossus canariensis*	demersal	North																				
		Central																				
		South	×	×	×	×							×									
281 *Cynoglossus monodi*	demersal	North																				
		Central																				
		South	×																			
282 *Cynoglossus senegalensis*	demersal	North																				
		Central		×	×											×						
		South	×		×								×									
283 *Cynoglossus* sp.	-	North		×												×			×			
		Central	×	×								×				×			×			
		South	×	×		×	×	×		×		×	×	×	×	×			×			
25 Tetraodontiformes																						
110 Balistidae																						
284 *Balistes punctatus*	demersal	North																				
		Central	×	×				×			×											
		South	×	×																		
111 Monacanthidae																						
285 *Stephanolepis hispidus*	demersal	North		×	×		×		×													
		Central	×	×	×		×		×		×											
		South							×													
286 *Aluterus* sp.	-	North				×		×			×											
		Central	×	×	×	×		×	×													
		South		×		×		×	×		×											
112 Tetraodontidae																						
287 *Ephippion guttifer*	demersal	North		×	×				×													
		Central	×	×	×																	
		South	×		×																	
288 *Lagocephalus lagocephalus lagocephalus*	benthopelagic	North													×							
		Central	×				×				×				×	×			×			
		South			×							×	×		×							

Appendix Table 3.3 List of fishes and target species caught by *Al-Awam* (14/14)

Order / Family / Species	Habitat	Area	Stratum (isobath range in m) 3-20m 1W	2C	2W	20-30m 1C	1W	2C	2W	30-80m 1C	1W	2C	2W	80-200m 1C	1W	2C	2W	200-400m 1C	1W	2C	2W	400-600m 1W
25 Tetraodontiformes																						
112 Tetraodontidae																						
289 *Lagocephalus laevigatus*	pelagic	North		×	×				×		×		×		×							
		Central	×	×	×			×			×		×		×				×			
		South	×		×			×	×	×			×		×							
290 *Lagocephalus* sp.	-	North											×		×							
		Central																				
		South								×				×	×							
291 *Sphoeroides spengleri*	demersal	North		×		×			×		×	×	×				×				×	
		Central	×	×	×	×	×	×	×	×	×	×	×		×		×					
		South	×				×			×	×	×	×	×			×					
292 *Sphoeroides pachygaster*	demersal	North												×		×	×					
		Central	×													×	×					
		South							×			×				×	×					
113 Diodontidae																						
293 *Chilomycterus reticulatus*	demersal	North			×																	
		Central	×	×	×						×		×									
		South		×	×				×		×		×									
294 *Chilomycterus spinosus mauretanicus*	benthopelagic	North		×	×	×			×				×									
		Central	×	×	×		×		×				×									
		South	×	×	×	×	×				×		×				×					
Teuthoidea																						
Loliginidae																						
Loligo vulgaris	-	North		×	×	×	×	×	×	×	×	×	×		×		×					
		Central		×		×	×	×		×	×	×	×	×	×	×	×					
		South		×		×		×		×	×	×	×		×		×					
Sepioidea																						
Sepiidae																						
Sepia officinalis	-	North		×	×	×	×	×	×	×	×		×						×			
		Central	×	×	×		×	×	×		×		×		×							
		South	×	×	×	×	×	×	×	×	×		×		×							
Octopoda																						
Octopodidae																						
Octopus vulgaris	-	North		×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×		×	
		Central	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×	×		
		South		×		×	×		×	×	×	×	×	×	×	×	×	×				
Decapoda																						
Penaeidae																						
Penaeus notialis	-	North		×			×	×	×	×			×									
		Central	×	×	×	×	×	×	×	×	×		×									
		South	×	×	×	×		×	×	×	×	×	×									
Parapenaeus longirostris	-	North												×	×	×	×	×	×		×	
		Central										×		×	×	×	×	×	×	×	×	×
		South								×	×	×	×	×	×	×	×	×	×	×	×	
Palinuridae																						
Palinurus mauritanicus	-	North																×	×		×	
		Central																				
		South																		×		
Panulirus regius	-	North			×																	
		Central	×																			
		South		×	×																	

Appendix Table 3.4 List of species other than fishes and target species caught by *Al-Awam* (1/2).

Phylum	Class	Order	Family	Species
MOLLUSCA	Gastropoda	Mesogastoropoda	Aporrhaidae	Aporrhaidae
			Cassidae	Cassidae
			Cymatiidae	*Argobuccinum olearium*
				Charonia sp.
			Cypraeidae	Cypraeidae
			Naticidae	*Naticarius* sp.
			Xenophoridae	*Xenophora crispa*
		Neogastropoda	Columbellidae	*Columbella* sp.
			Conidae	*Conus* sp.
			Fasciolariidae	*Fusinus* sp.
			Muricidae	*Bolinus brandaris*
				Murex sp.
				Phyllonotus trunculus
				Thais haemastoma
			Nassariidae	*Hinia* sp.
			Olividae	*Olivia* sp.
			Volutidae	*Cymbium* spp.
				Volutidae
	Bivalvia	Pteriomorphia	Pectinidae	*Chlamys* sp.
			Pinnidae	*Atrina fragilis*
			Pteriidae	*Pteria hirundo*
		Heterodonta	Veneridae	*Chamelea gallina*
				Circomphalus casinus
				Pitar rudis
	Cephalopoda	Sepioidea	Sepiidae	*Sepiella ornata*
				Sepia bertheloti
				Sepia elegans
				Sepia officinalis
				Sepia orbignyana
				Sepiidae
			Sepiolidae	*Sepiola* sp.
		Teuthoidea	Loliginidae	*Alloteuthis africana*
				Alloteuthis sp.
				Loligo vulgaris
				Loliginidae
			Enoploteuthidae	*Abralia veranyi*
			Histioteuthidae	*Histioteuthis dofleini*
			Ommastrephidae	*Illex coindetii*
				Ommastrephes pteropus
				Todarodes sagittatus
				Todarodes eblanae
				Ommastrephidae
			-	Teuthoidea
		Octopoda	Bolitaenidae	*Japetella diaphana*
			Octopodidae	*Octopus vulgaris*
				Octopus burryi
				Octopus sp.
				Eledone sp.
				Bathypolypus sponsalis
				Octopodidae

Appendix Table 3.4 List of species other than fishes and target species caught by *Al-Awam* (2/2).

Phylum	Class	Order	Family	Species
ARTHROPODA	Crustacea	Stomatopoda	Squillidae	*Squilla mantis*
		Decapoda	Aristeidae	*Aristaeomorpha foliacea*
			Glyphocrangonidae	*Glyphocrangon* sp.
			Pandalidae	*Heterocarpus ensifer*
				Plesionika acanthonotus
				Plesionika carinata
				Plesionika heterocarpus
				Plesionika martia
				Plesionika sp.
			Pasiphaeidae	*Pasiphaea* sp.
			Penaeidae	*Metapenaeopsis miersi*
				Parapenaeopsis atlantic
				Penaeus kerathurus
				Penaeus notialis
				Parapenaeus longirostris
				Penaeidae
			Sergestidae	*Sergestes* sp.
				Sergia sp.
			Sicyoniidae	*Sicyonia galeata*
			Solenoceridae	*Solenocera africana*
				Solenocera sp.
			Palinuridae	*Palinurus mauritanicus*
				Panulirus regius
			Scyllaridae	*Scyllarus* sp.
			Galatheidae	*Munida* sp.
			Raninidae	*Raninoides* sp.
			Calappidae	*Acanthocarpus* sp.
				Calappa granulata
				Calappa peli
				Calappa rubroguttata
			Cancridae	*Cancer bellianus*
			Homolidae	*Paromola cuvieri*
			Majidae	*Maja squinado*
				Pisinae sp.
				Stenorhynchus seticornis
			Parthenopidae	*Platylambrus* sp.
			Portunidae	*Bathynectes* sp.
				Callinectes sp.
				Portunus sp.
ECHINODERMATA	Holothuroidea	Aspidochirotida	Stichopodidae	*Stichopus* sp.

Appendix Table 3.5 The definition of the habitat by Fish Base.

benthopelagic

Living and feeding near the bottom as well as in midwaters or near the surface. Feeding on benthic as well as free swimming organisms. Many freshwater fish are opportunistic feeders that forage on the bottom as well as in midwater and near the surface.

benthopélagique

qui vie et se nourrit près du fond aussi bien que dans [midwaters] ou vers la surface d'eau. Se nourrit des organismes benthiques aussi bien que des organismes pélagiques. Beaucoup de poissons d'eau douce sont des consommateurs opportunistes qui fourragent sur le fond aussi bien que dans la zone pélagique et à la surface d'eau.

pelagic

Living and feeding in the open sea; associated with the surface or middle depths of a body of water; free swimming in the seas, oceans or open waters; not in association with the bottom. Many pelagic fish feed on plankton. In FishBase, referring to surface or mid water from 0 to 200 m depth.

pélagique

Vivant et se nourrissant en haute mer ; associé à la surface ou aux profondeurs moyennes des masses d'eau; qui nagent en mer, dans l'océan ou au large ; n'est pas lié au fond de la mer. Beaucoup de poissons pélagiques se nourrissent de plancton.

bathydemersal

Living and feeding on the bottom below 200 m.

bathydémersal

Qui vit et se nourrit sur le fond en dessous de 200 mètres de profondeur d'eau.

bathypelagic

Region of the oceanic zone between 1,000 m to 4,000 m; between the mesopelagic layer above and the abyssopelagic layer below. Living or feeding in open aters at depths between 1,000 and 4,000 m.

bathypélagique

Région de la zone océanique entre 1,000 à 4,000 mètres; entre la couche mésopélagique au-dessus et la couche abyssopélagique au-dessous. Habitant ou s'alimentant dans les eaux ouvertes à profondeurs entre 1,000 et 4,000 mètres.

demersal

Sinking to or lying on the bottom; living on or near the bottom and feeding on benthic organisms.

démersal

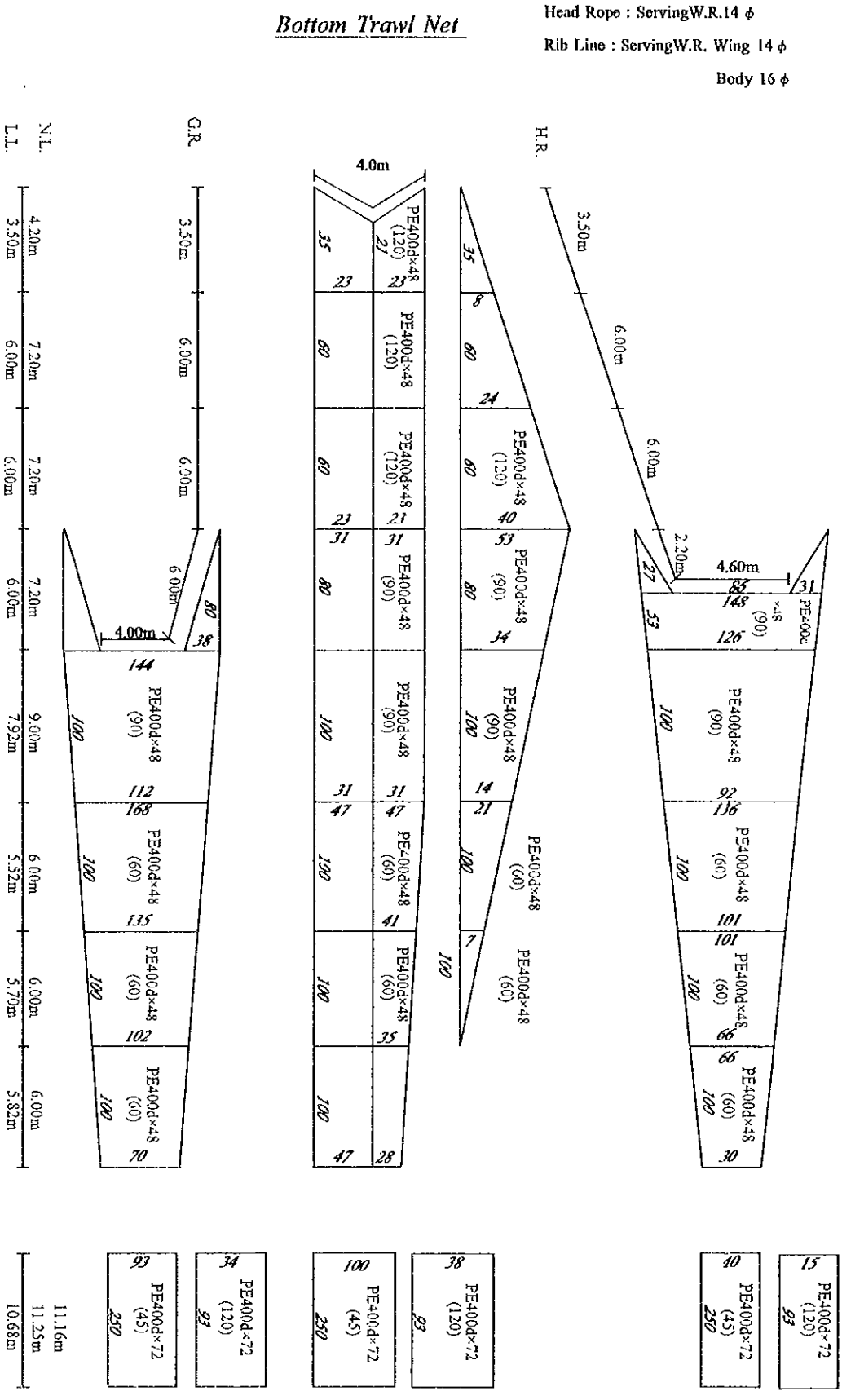
De couler à ou s'allonger sur le fond; de vivre sur ou proche du fond et de se nourrir sur les organismes benthiques.

reef-associated

Living and feeding on or near coral reefs.

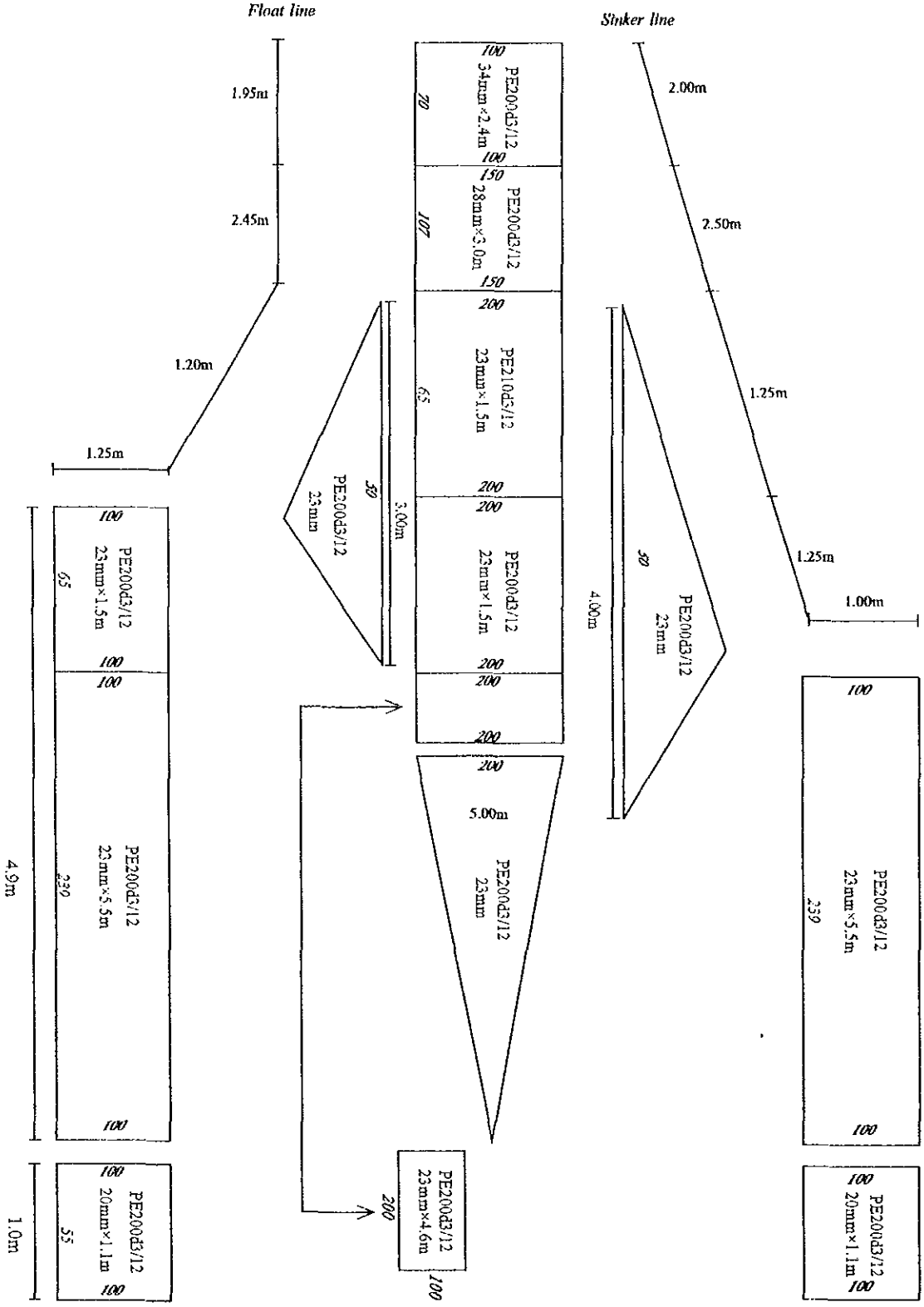
récifal

(No data)

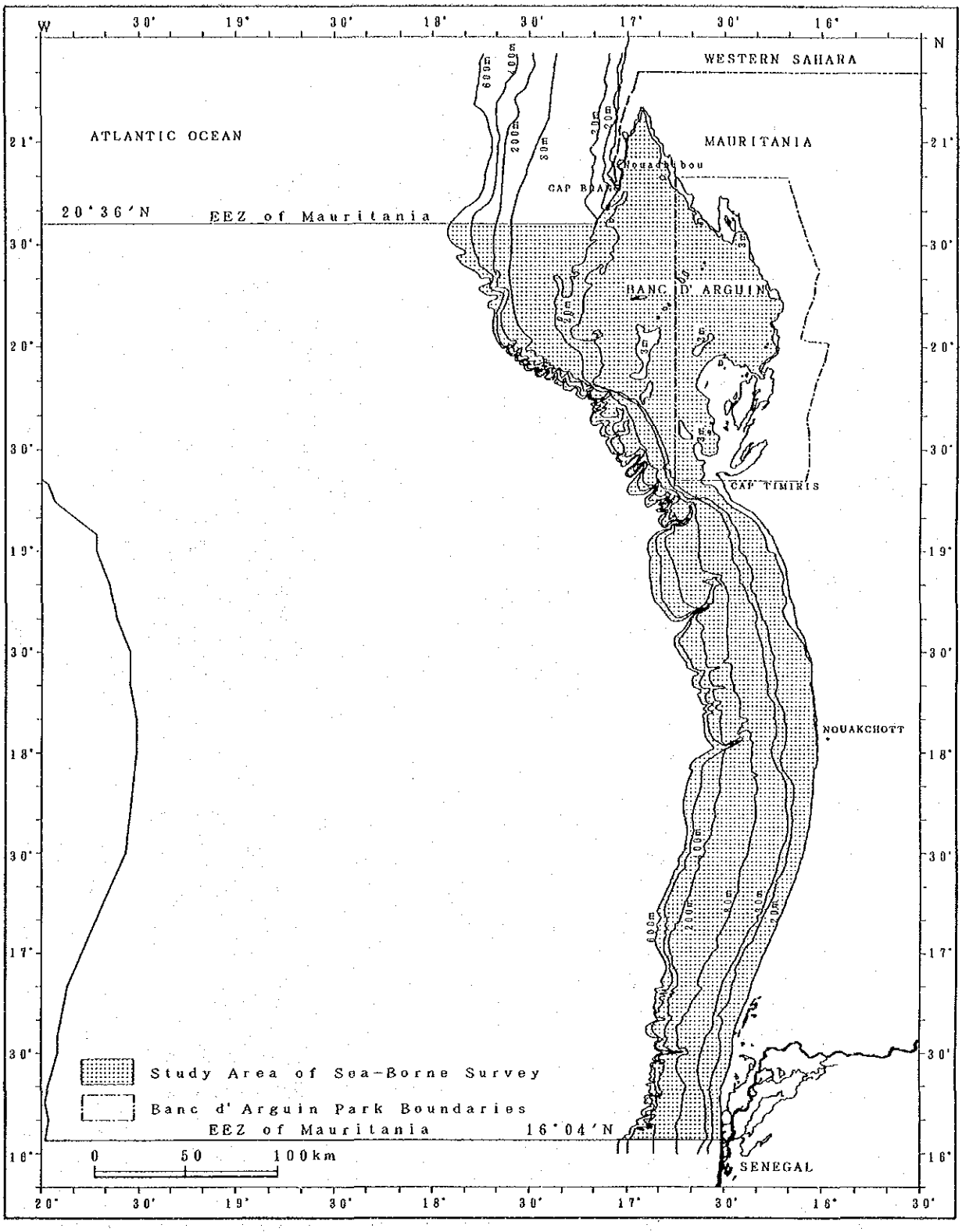


Appendix Figure 3.1.1 Fishing gear used in the survey (*Al-Awam* : Bottom trawl net). Roman type indicates the number of fibres and mesh size in terms of "knot to knot" in parentheses. Italic type indicates the number of meshes.

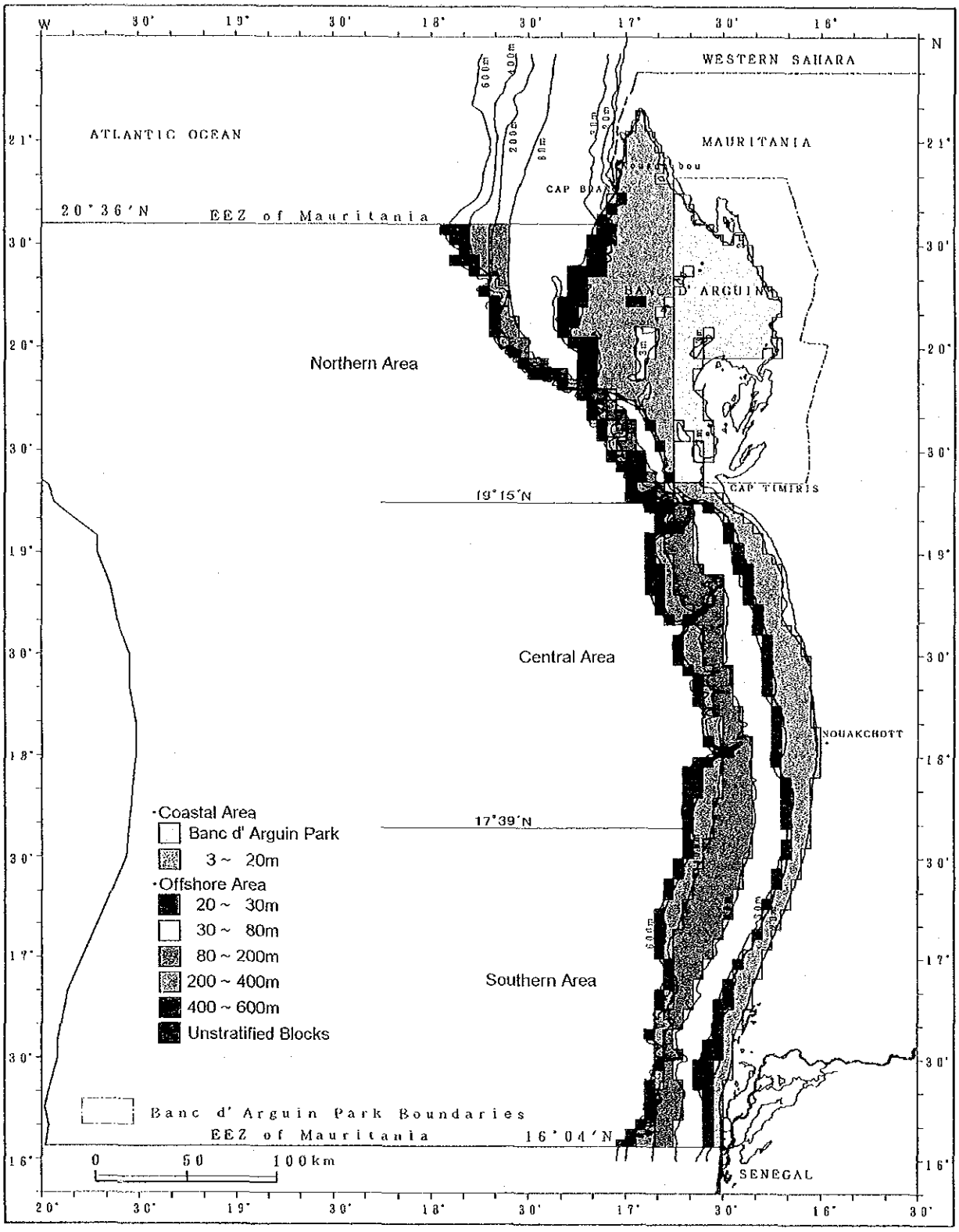
Beam Trawl Net



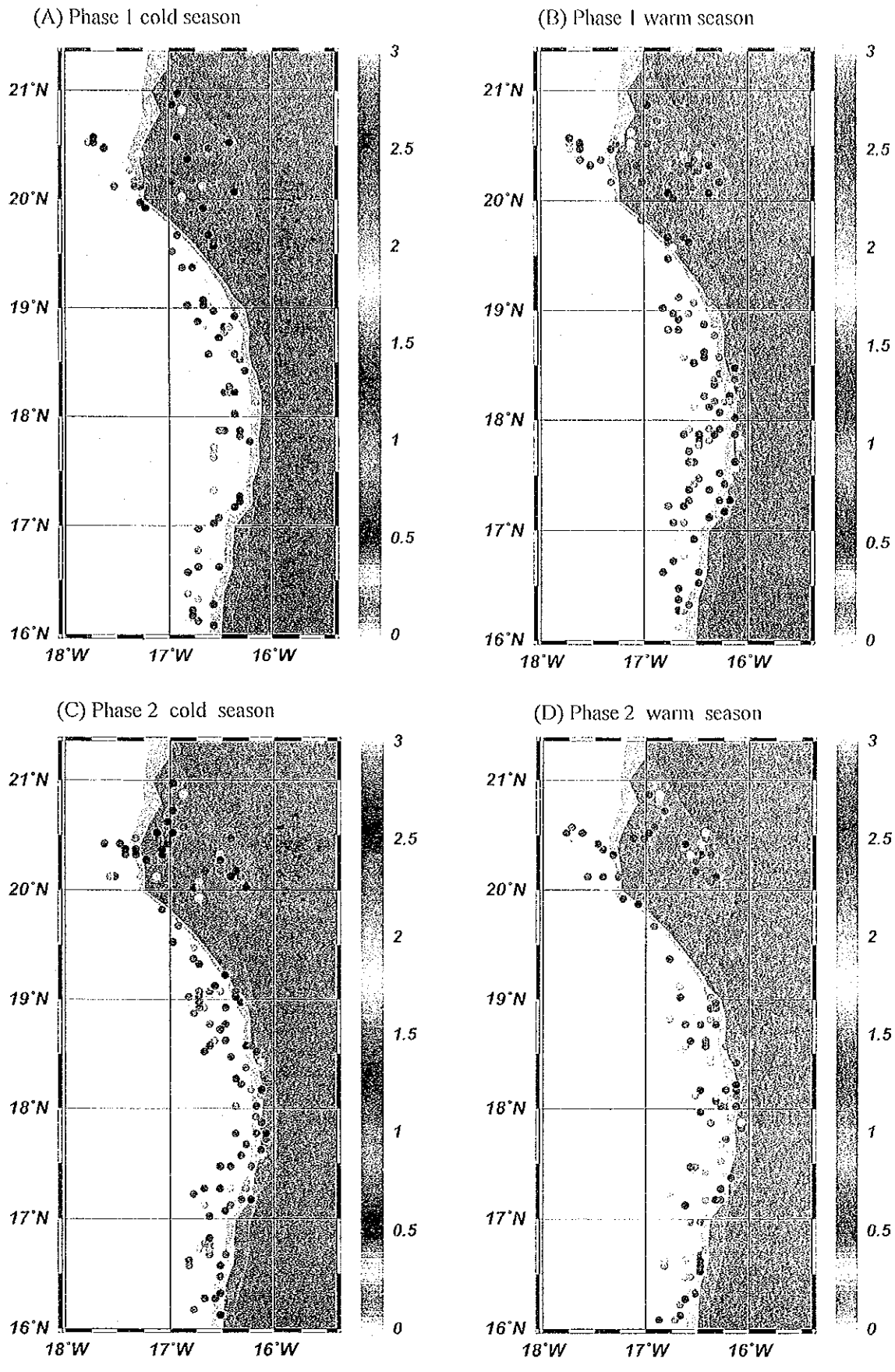
Appendix Figure 3.1.1 Fishing gear used in the survey (*Amrigue* : Beam trawl net). Roman type indicates the number of fibres and mesh size in terms of "knot to knot" in parentheses. Italic type indicates the number of meshes.



Appendix Figure 3.2 Resources survey area revised isobath chart .



Appendix Figure 3.3 Stratification of the resources survey area after revised the new stratification.



Appendix Figure 3.4 Horizontal distribution of diversity index H'.

4. MESH SELECTIVITY STUDY FOR TARGET SPECIES

4.1 Objective

Among the several fishery regulations to be adopted for the sustainable and efficient utilization of fishery resources, mesh-size regulation is a method that aims to prevent the by-catch of small-size fish of non-target species or the catch of juveniles and youngs of target species. In the IRM, regulations have been adopted in 1989 specifying the minimum mesh size of cod-end for bottom trawling should be 70 mm mainly for octopus fishing and 50 mm for shrimp catching (89/100/PCMSN, Articles 13 and 14). In the Sea-borne Survey, data related to the mesh selectivity for target species were collected and analyzed, in order to provide a documented foundation for mesh-size regulations.

4.2 Methods

4.2.1 Data on mesh selectivity collected during the resources survey by bottom trawl

During the survey by the *Al-Awam*, a covernet of 20 mm in inner diameter of mesh was attached around the three sizes of cod-end (45 mm, 70 mm and 100 mm respectively) of the trawl net. Data on body length composition were collected at each trawl station where catch in number of target species was comparatively more numerous, discriminating between catches made by the cod-end or the covernet. The results of this survey allowed for the gathering of information on mesh selectivity.

In the mesh selectivity by the covernet method, a masking effect due to the covernet placement should be considered. This time, however, no comparative experiments between catches of cod-ends respectively with and without a covernet were performed.

4.2.2 Mesh size measurement

Mesh sizes of the three kinds of cod-end and the covernet described above were properly measured on board. Slide calipers were used for measuring the inner distance between knots (considering two legs and one knot) in particular two files on both sides of the upper center, at ten meshes on one side – that is, a total of twenty meshes. Results are summarized in Appendix Table 4.1.

4.2.3 Determination of the selectivity curve, 50% retention length and selection range

Collected data were analyzed after the number of specimens was normalized in function of the number of catch. Mesh selectivity is often represented by a logistic equation having as a variable the body length of target species, the optimum value of which being the goal of the analysis. Because of that optimum value, through a probabilistic approach to the mesh selectivity process, a method has been proposed for the maximum likelihood parameter estimates for the binomial distribution of the probability variation of ratio between the number of fish passing through the mesh and the number of fish retained by the net (Hiramatsu, 1992; Millar, 1993). The present study employed the method for the estimation of parameters by means of a logistic equation according to Tôkai (1997).

In this logistic equation, the function $S(l)$ of mesh selectivity with respect to body length l is represented as follows:

$$S(l) = 1 / [1 + \exp(\alpha \quad l \quad + \beta)]$$

α and β being the parameters of the logistic equation. The body length of 50% of the fish retained by the net after having gotten into it (50% retention length = L_{50}) and the selection span SP indicating the selection range L_{75} - L_{25} relate to α and β as follows:

$$50\% \text{ retention length } (L_{50}) = -\beta / \alpha$$

$$\text{selection span (SP)} = -2 \ln (3) / \alpha$$

In fact, the method consists of estimating L_{50} and SP as a initial value from the data collected, and to obtain the likelihood $L(\alpha, \beta)$ for each class of body length by means of the following equation:

$$L(\alpha,\beta) = {}_N C_{Ncod}\, p(l)^{Ncod} [1 - p(l)]^{N\,cover}$$

where N : total number at a given body length class
$Ncod$: number in the cod-end of N
$Ncover$: number in the covernet of N
$P(l) = 1 / [1 + \exp(\alpha l + \beta)]$

To calculate the likelihood at each body length class, logarithmically transformed values were considered. Then those log-likelihood at all body length classes were combined, optimization for maximum likelihood was made, parameters α and β of the logistic equation were determined in order to obtain a mesh selectivity curve, and L_{50} and SP values were calculated.

4.2.4 Fitness of data to theoretical model

For the estimation of the fitness of the data to the theoretical model, Akaike's Information Criterion (AIC) was adopted, calculated as below. The smaller the index obtained, the better fitting are the data to the theoretical model.

$$AIC = -2 \times \sum ({}_N C_{Ncod}\, p(l)^{Ncod} [1 - p(l)]^{N\,cover}) + 2 \times 2$$

where N : total number at a given body length class
$Ncod$: number in the cod-end of N
$Ncover$: number in the covernet of N
$P(l) = 1 / [1 + \exp(\alpha l + \beta)]$

4.3 Results

Among the target species, those found in a relatively large number of trawl stations and for which data were obtained on body length composition by cod-end and covernet respectively are: Senegalese hake *Merluccius senegalensis*, Benguela hake *Merluccius polli*, Cunene horse mackerel *Trachurus trecae*, meagre *Argyrosomus regius*, West African goatfish *Pseudupeneus prayensis*, bluespotted seabream *Pagrus caerulostictus*, Canary dentex *Dentex canariensis*, red pandora *Pagellus bellottii*, European squid *Loligo vulgaris* and deep-water pink shrimp *Parapenaeus longirostris* – ten species altogether.

Appendix Table 4.2 shows catch composition at trawl stations as obtained from mesh selectivity data. Appendix Table 4.3 presents mesh selectivity parameters as established by the aforementioned ten species.

In some trawl stations, selectivity parameters obtained from case-by-case analyses produced impractical numerical values for one or more of the following reasons:

1) Too small a catch for proper analysis.
2) Small catch with a large size range leading to very few fish per length group. Often associated with case 5, below.
3) Insufficient escapement, usually because of a lack of individuals within the selection range.
4) No overlap between the length frequency distributions of cod-end and covernet catches.
5) Very patchy length frequency distributions with a number of length groups within the selection range not represented in the catch.

Of the selectivity parameters estimated by mesh size for the aforementioned ten species, shown in Appendix Table 4.3, in principle those pointed out by the lowest value of AIC (in the Appendix Table indicated by screen) are presented in Table 4.1 and on Figures 4.1 to 4.10.

As for the common octopus *Octopus vulgaris*, Inejih *et al.* of IMROP (2002) tried to estimate the mesh selectivity for the 70mm cod-end by combining all the data obtained from the cold and warm seasons of phase 2 (in 2001). The results are shown in Annex 4 for the purpose of reference.

Table 4.1 Summarized selectivity parameters.

Species	Body length	Mesh size (mm)		L_{50}	SP	AIC
		Nominated	Measured*	(mm)	(mm)	
Senegalese hake *Merluccius senegalensis*	Total length	45	39.6	88	30	43.645
		70	62.5	213	49	55.143
		100	-	-	-	-
Benguela hake *Merluccius polli*	Total length	45	-	-	-	-
		70	62.3	184	65	27.610
		100	-	-	-	-
Cunene horse mackerel *Trachurus trecae*	Fork length	45	39.2	125	24	15.246
		70	62.3	181	61	26.402
		100	92.8	198	60	81.038
Meagre *Argyrosomus regius*	Total length	45	-	-	-	-
		70	62.0	170	25	19.417
		100	-	-	-	-
West African goatfish *Pseudupeneus prayensis*	Fork length	45	39.0	99	28	26.570
		70	63.8	182	10	5.641
		100	-	-	-	-
Bluespotted seabream *Pagrus caeruleostictus*	Fork length	45	-	-	-	-
		70	63.8	115	22	12.685
		100	97.7	204	20	14.989
Canary dentex *Dentex canariensis*	Fork length	45	-	-	-	-
		70	62.5	148	19	18.725
		100	-	-	-	-
Red pandora *Pagellus bellottii*	Fork length	45	39.6	82	38	20.339
		70	62.0	156	20	14.218
		100	-	-	-	-
European squid *Loligo vulgaris*	Mantle length	45	39.9	66	18	30.746
		70	62.3	84	46	26.006
		100	-	-	-	-
Deep-water pink shrimp *Parapenaeus longirostris*	Total length	45	39.9	95	15	50.452
		70	-	-	-	-
		100	-	-	-	-

*: Measured mesh size means 2 legs and 1 knot.

4.3.1 Selectivity

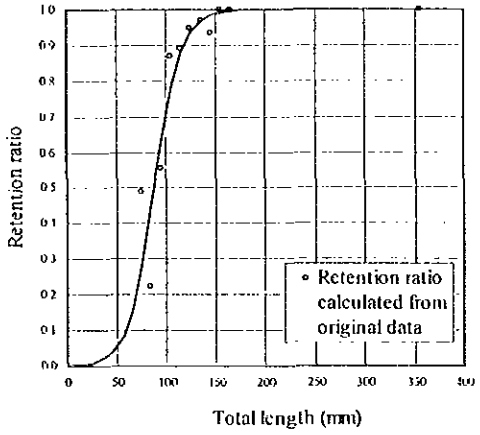
(1) Senegalese hake *Merluccius senegalensis*

Only one trawl with the cod-end of 45 mm mesh had data suitable for individual analysis, and two with the cod-end of 70 mm mesh (Appendix Table 4.3, 1/6). Figure 4.1 shows the selectivity curves as established by the AIC. Values of L_{50} for mesh sizes 45 mm and 70 mm were, respectively, 88 mm and 213 mm; corresponding SP values were 30 mm and 49 mm respectively.

The possible inclusion of a few individuals of Benguela hake *Merluccius polli* in the catch makes a cautious verification necessary for any future data gathering and analysis aiming at estimating the value of L_{50} and SP.

A. 39.6mm cod-end

Survey season	Phase 1, cold season
Trawl number	To – 14
Mesh size of cod-end	45 mm
Mesh size of covernet	20 mm
Catch numbers in cod-end	289
Catch numbers in covernet	47
Sample numbers in cod-end	100
Sample numbers in covernet	47
Range of total length in cod-end	70 – 350 mm
Range of total length in covernet	70 – 150 mm
Mean total length in cod-end	126 mm
Mean total length in covernet	102 mm
L_{50}	88 mm
SP (L_{75}-L_{25})	30 mm
AIC (Akaike's Information Criterion)	43.645



B. 62.5mm cod-end

Survey season	Phase 2, cold season
Trawl number	To -71
Mesh size of cod-end	70 mm
Mesh size of covernet	20 mm
Catch numbers in cod-end	747
Catch numbers in covernet	81
Sample numbers in cod-end	100
Sample numbers in covernet	81
Range of total length in cod-end	220 – 290 mm
Range of total length in covernet	230 – 290 mm
Mean total length in cod-end	268 mm
Mean total length in covernet	257 mm
L_{50}	213 mm
SP (L_{75}-L_{25})	49 mm
AIC (Akaike's Information Criterion)	55.143

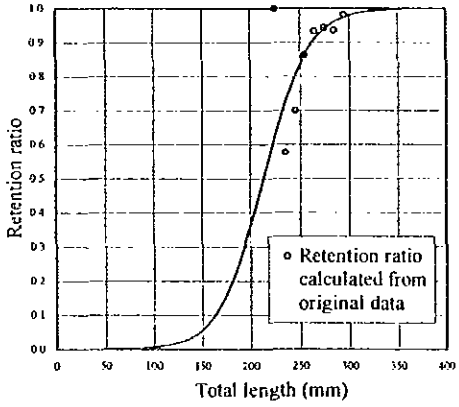


Figure 4.1 Selectivity curves for Senegalese hake *Merluccius senegalensis*.

(2) Benguela hake *Merluccius polli*

Although not one of the target species in this survey, the Benguela hake is referred to here because its distribution of overlaps with that of the target species Senegalese hake *Merluccius senegalensis*. Fifteen trawls with the 70 mm mesh cod-end could be analyzed individually. Selectivity parameter ranges were: L_{50}, 125 – 227 mm; SP, 44 – 233 mm, revealing quite a confused picture (Appendix Table 4.3, 1/6).

Figure 4.2 shows the selectivity curve for this species considering the minimum value of AIC as 27.610. Comparing the values of L_{50} = 184 mm and SP = 65 mm for *Merluccius polli* with those of L_{50} = 213 mm and SP = 49 mm for the congener and morphologically similar *M. senegalensis*, one notices the former parameter was lower and the later was higher for the Benguela hake. One expects that additional selectivity tests performed for each of these species would lead to more coherent values of L_{50} and SP.

A. 62.3mm cod-end

Survey season	Phase 2, warm season
Trawl number	To-64
Mesh size of cod-end	70 mm
Mesh size of covernet	20 mm
Catch numbers in cod-end	63
Catch numbers in covernet	17
Sample numbers in cod-end	63
Sample numbers in covernet	17
Range of total length in cod-end	180 – 340 mm
Range of total length in covernet	160 – 260 mm
Mean total length in cod-end	237 mm
Mean total length in covernet	213 mm
L_{50}	184 mm
SP (L_{75}-L_{25})	65 mm
AIC (Akaike's Information Criterion)	27.610

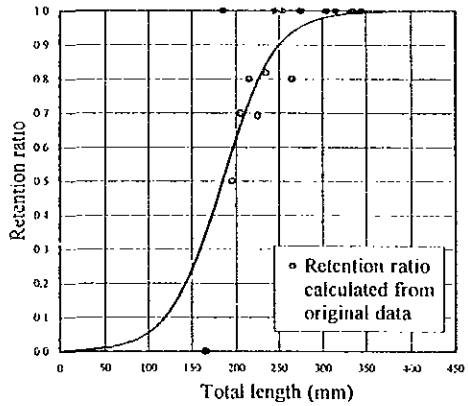


Figure 4.2 Selectivity curve for Benguela hake *Merluccius polli*.

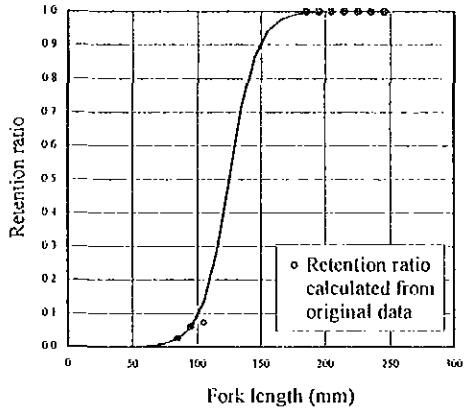
(3) Cunene horse mackerel *Trachurus trecae*

Individual analysis was conduted on seven, eight and two trawls with the cod-ends of 45 mm, 70 mm and 100 mm respectively. There was high variation between L_{50} and SP values at mesh sizes 45 mm and 70 mm, that of the cod-end with 70 mm mesh being particularly accentuated (Appendix Table 4.3, 1 – 2/6).

Figure 4.3 shows the selectivity curves as established by the AIC for the three different cod-ends. L_{50} values for the smallest to the largest mesh were 125 mm, 181 mm and 198 mm respectively, and the corresponding values of SP were 24 mm, 61 mm and 60 mm. However, as shown in the graph, data are not distributed along the entire selection range, thus any further data gathering and analysis will require checking the reliability of the above-mentioned estimated values of L_{50} and SP.

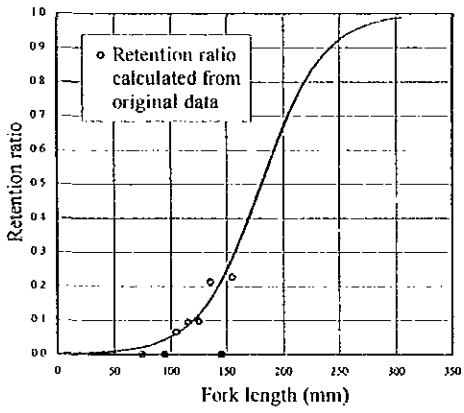
A. 39.2mm cod-end

Survey season	Phase 1, warm season
Trawl number	To−23
Mesh size of cod-end	45 mm
Mesh size of covernet	*20 mm*
Catch numbers in cod-end	507
Catch numbers in covernet	2,182
Sample numbers in cod-end	100
Sample numbers in covernet	100
Range of fork length in cod-end	80 – 240 mm
Range of fork length in covernet	80 – 100 mm
Mean fork length in cod-end	176 mm
Mean fork length in covernet	94 mm
L_{50}	125 mm
SP (L_{75}-L_{25})	24 mm
AIC (Akaike's Information Criterion)	15.246



B. 62.3mm cod-end

Survey season	Phase 2, warm season
Trawl number	To-60
Mesh size of cod-end	70 mm
Mesh size of covernet	20 mm
Catch numbers in cod-end	39
Catch numbers in covernet	337
Sample numbers in cod-end	39
Sample numbers in covernet	99
Range of fork length in cod-end	100 – 150 mm
Range of fork length in covernet	70 – 150 mm
Mean fork length in cod-end	123 mm
Mean fork length in covernet	119 mm
L_{50}	181 mm
SP (L_{75}-L_{25})	61 mm
AIC (Akaike's Information Criterion)	26.402



C. 92.8mm cod-end

Survey season	Phase 2, warm season
Trawl number	To-45
Mesh size of cod-end	100 mm
Mesh size of covernet	20 mm
Catch numbers in cod-end	925
Catch numbers in covernet	9,316
Sample numbers in cod-end	97
Sample numbers in covernet	99
Range of fork length in cod-end	80 – 170 mm
Range of fork length in covernet	80 – 160 mm
Mean fork length in cod-end	141 mm
Mean fork length in covernet	129 mm
L_{50}	198 mm
SP (L_{75}-L_{25})	60 mm
AIC (Akaike's Information Criterion)	81.038

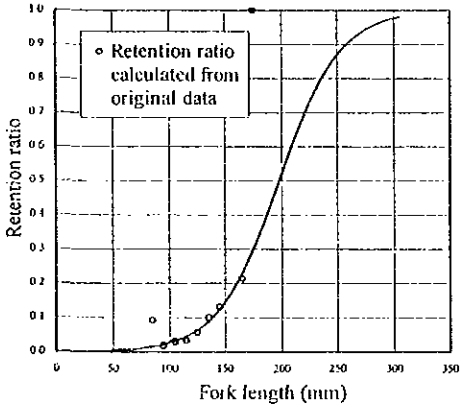


Figure 4.3 Selectivity curves for Cunene horse mackerel *Trachurus trecae*.

(4) Meagre *Argyrosomus regius*

Only one trawl with the cod-end of 70 mm mesh could be analyzed individually (Appendix Table 4.3, 2/6). AIC was a comparatively suitable value of 19.417. L_{50} and SP were 170 mm and 25 mm respectively (Figure 4.4).

A. 62.0mm cod-end

Survey season	Phase 2, cold season
Trawl number	Tc-22
Mesh size of cod-end	70 mm
Mesh size of covernet	20 mm
Catch numbers in cod-end	46
Catch numbers in covernet	18
Sample numbers in cod-end	46
Sample numbers in covernet	18
Range of total length in cod-end	150 – 460 mm
Range of total length in covernet	80 – 200 mm
Mean total length in cod-end	239 mm
Mean total length in covernet	156 mm
L_{50}	170 mm
SP (L_{75}-L_{25})	25 mm
AIC (Akaike's Information Criterion)	19.417

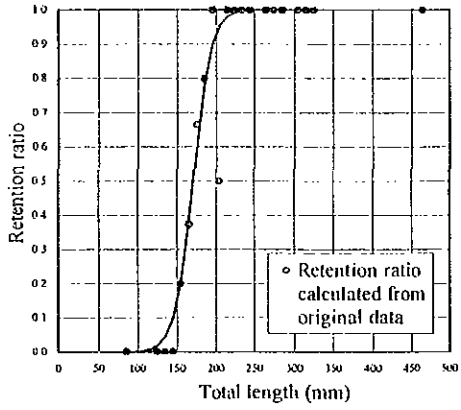


Figure 4.4 Selectivity curve for meagre *Argyrosomus regius*.

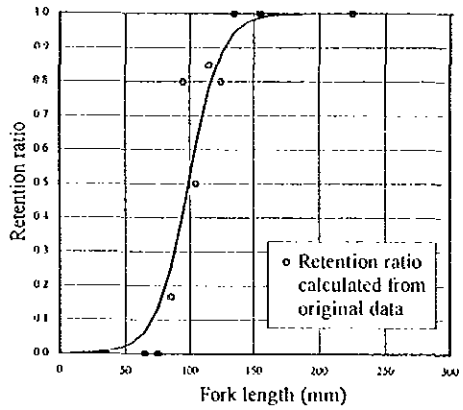
(5) West African goatfish *Pseudupeneus prayensis*

Ten trawls with the 45 mm mesh cod-end, seventeen with the 70 mm mesh cod-end, and three with the 100 mm mesh cod-end, were all individually analyzed. For those three different cod-ends, from the smallest to the largest mesh, the following value ranges were obtained: L_{50}, 88 –136 mm, 103 – 247 mm and 220 – 528 mm; SP, 16 – 30 mm, 10 – 366 mm and 101 – 316 mm, respectively, evidencing a situation of much fluctuation (Appendix Table 4.3, 2 – 3/6).

Figure 4.5 shows the selectivity curves determind by the AIC for the 45 and 70 mm mesh cod-ends. The selectivity curve related to the 100 mm mdesh cod-end was not established because estimation of L_{100} was not possible. L_{50} and SP for the 45 mm mesh were 99 mm and 28 mm respectively, and for the 70 mm mesh were 182 mm and 10 mm respectively. Because the selectivity curve based on the 70 mm mesh was deducted by only one datum between L_0 and L_{100}, it stands to reason that the above-mentioned values of L_{50} and SP should be combined with new data and the results reevaluated.

A. 39.0mm cod-end

Survey season	Phase 1, warm season
Trawl number	Tc-11
Mesh size of cod-end	45 mm
Mesh size of covernet	20 mm
Catch numbers in cod-end	82
Catch numbers in covernet	31
Sample numbers in cod-end	82
Sample numbers in covernet	31
Range of fork length in cod-end	80 – 220 mm
Range of fork length in covernet	60 – 120 mm
Mean fork length in cod-end	118 mm
Mean fork length in covernet	104 mm
L_{50}	99 mm
SP (L_{75}-L_{25})	28 mm
AIC (Akaike's Information Criterion)	26.570



B. 63.8mm cod-end

Survey season	Phase 2, warm season
Trawl number	To-02
Mesh size of cod-end	70 mm
Mesh size of covernet	20 mm
Catch numbers in cod-end	6
Catch numbers in covernet	55
Sample numbers in cod-end	6
Sample numbers in covernet	55
Range of fork length in cod-end	180 – 220 mm
Range of fork length in covernet	60 – 180 mm
Mean fork length in cod-end	205 mm
Mean fork length in covernet	82 mm
L_{50}	182 mm
SP (L_{75}-L_{25})	10 mm
AIC (Akaike's Information Criterion)	5.641

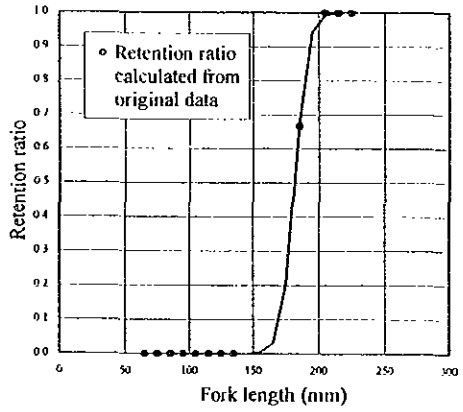


Figure 4.5 Selectivity curves for West African goatfish *Pseudupeneus prayensis*.

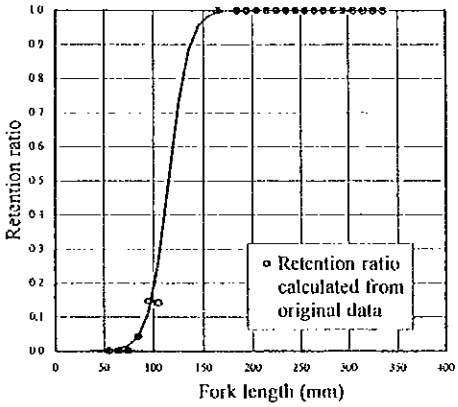
(6) Bluespotted seabream *Pagrus caeruleostictus*

Seven trawls with the 70 mm mesh cod-end and two trawls with the 100 mm mesh cod-end could be analyzed individually. L_{50} and SP for the 70 mm mesh cod-end did not fluctuate much in comparison to those of other species, and except for 2 or 3 examples, they were in the 110 – 130 mm and 20 – 40 mm ranges, respectively (Appendix Table 4.3, 3/6).

Figure 4.6 illustrates the selectivity curves determind by the AIC for the two types of cod-end. L_{50} for 70 mm and 100 mm mesh cod-ends was, respectively, 115 mm and 204 mm; SP was 22 mm and 20 mm respectively. Because there are data blanks in the 100 – 150 mm fork length range of the selectivity curve for the 70 mm mesh, further data gathering will be needed for an accurate reestimation of L_{50} and SP.

A. 63.8mm cod-end

Survey season	Phase 2, warm season
Trawl number	Tc-13
Mesh size of cod-end	70 mm
Mesh size of covernet	20 mm
Catch numbers in cod-end	59
Catch numbers in covernet	90
Sample numbers in cod-end	59
Sample numbers in covernet	90
Range of fork length in cod-end	80 – 330 mm
Range of fork length in covernet	50 – 100 mm
Mean fork length in cod-end	220 mm
Mean fork length in covernet	83 mm
L_{50}	115 mm
SP (L_{75}-L_{25})	22 mm
AIC (Akaike's Information Criterion)	12.685



B. 97.7mm cod-end

Survey season	Phase 2, warm season
Trawl number	Tc-18
Mesh size of cod-end	100 mm
Mesh size of covernet	20 mm
Catch numbers in cod-end	36
Catch numbers in covernet	9
Sample numbers in cod-end	36
Sample numbers in covernet	9
Range of fork length in cod-end	190 – 260 mm
Range of fork length in covernet	190 – 220 mm
Mean fork length in cod-end	226 mm
Mean fork length in covernet	208 mm
L_{50}	204 mm
SP (L_{75}-L_{25})	20 mm
AIC (Akaike's Information Criterion)	14.989

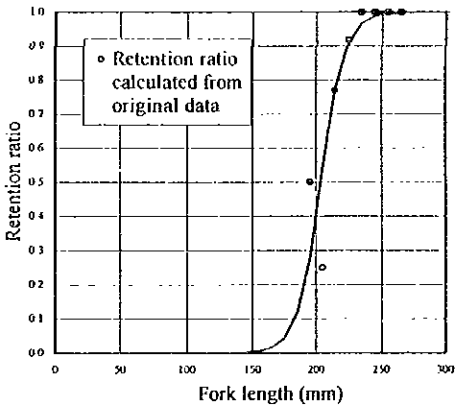


Figure 4.6 Selectivity curves for bluespotted seabream *Pagrus caeruleostictus*.

(7) Canary dentex *Dentex canariensis*

Three trawls with the 70 mm mesh cod-end had data suitable for individual analysis. The resulting selectivity parameters, with the exception of a single SP value of 101 mm, had very close values to each other (Appendix Table 4.3, 3/6).

Figure 4.7 shows the selectivity curve determined by the AIC. L_{50} and SP were 148 mm and 19 mm respectively.

A. 62.5mm cod-end

Survey season	Phase 2, cold season
Trawl number	Tc-30
Mesh size of cod-end	70 mm
Mesh size of covernet	20 mm
Catch numbers in cod-end	116
Catch numbers in covernet	21
Sample numbers in cod-end	100
Sample numbers in covernet	21
Range of fork length in cod-end	140 – 220 mm
Range of fork length in covernet	130 – 170 mm
Mean fork length in cod-end	169 mm
Mean fork length in covernet	158 mm
L_{50}	148 mm
SP (L_{75}-L_{25})	19 mm
AIC (Akaike's Information Criterion)	18.725

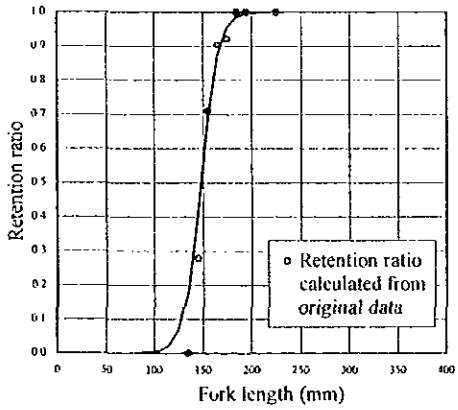


Figure 4.7 Selectivity curve for Canary dentex *Dentex canariensis*.

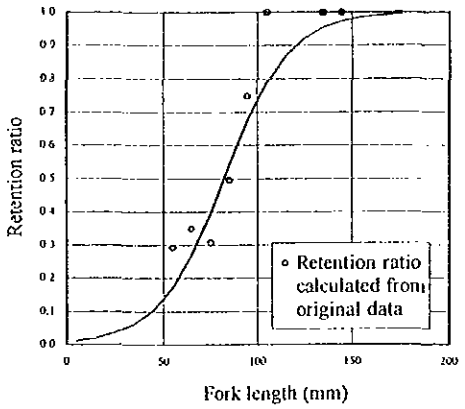
(8) Red pandora *Pagellus bellottii*

This species did indeed yield a considerable amout of data. Fourteen trawls with the 45 mm mesh cod-end, forty-two trawls with the 70 mm mesh cod-end, and five trawls with the 100 mm mesh cod-end could be analyzed individually. L_{50} value ranges for those three types of cod-end, from the smallest to the largest mesh, were 52 – 108 mm, 92 – 241 mm and 233 – 331 mm, respectively; similarly, SP value ranges were 14 – 47 mm, 17 – 268 mm and 53 – 159 mm, respectively. The values of both parameters for the data-rich 70 mm mesh cod-end presented a very confused picture (Appendix Table 4.3, 4 – 5/6).

Figure 4.8 illustrates the selectivity curves based on the AIC for the 45 mm and 70mm mesh cod-ends. The curve corresponding to the 100 mm mesh cod-end was not established because L_{100} cannot be determined by the model (Tokai, 1997). L_{50} and SP values were respectively 82 mm and 38 mm for the 45 mm mesh, and 156 mm and 20 mm for the 70 mm mesh.

A. 39.6mm cod-end

Survey season	Phase 1, cold season
Trawl number	To-35
Mesh size of cod-end	45 mm
Mesh size of covernet	20 mm
Catch numbers in cod-end	196
Catch numbers in covernet	239
Sample numbers in cod-end	99
Sample numbers in covernet	99
Range of fork length in cod-end	50 – 150 mm
Range of fork length in covernet	50 – 100 mm
Mean fork length in cod-end	83 mm
Mean fork length in covernet	75 mm
L_{50}	82 mm
SP (L_{75}-L_{25})	38 mm
AIC (Akaike's Information Criterion)	20.339



B. 62.0mm cod-end

Survey season	Phase 2, cold season
Trawl number	Tc-13
Mesh size of cod-end	70 mm
Mesh size of covernet	20 mm
Catch numbers in cod-end	36
Catch numbers in covernet	216
Sample numbers in cod-end	36
Sample numbers in covernet	100
Range of fork length in cod-end	140 – 240 mm
Range of fork length in covernet	40 – 170 mm
Mean fork length in cod-end	193 mm
Mean fork length in covernet	67 mm
L_{50}	156 mm
SP (L_{75}-L_{25})	20 mm
AIC (Akaike's Information Criterion)	14.218

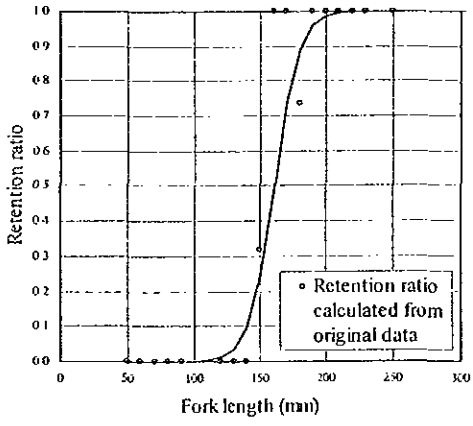


Figure 4.8 Selectivity curves for red pandora *Pagellus bellottii*.

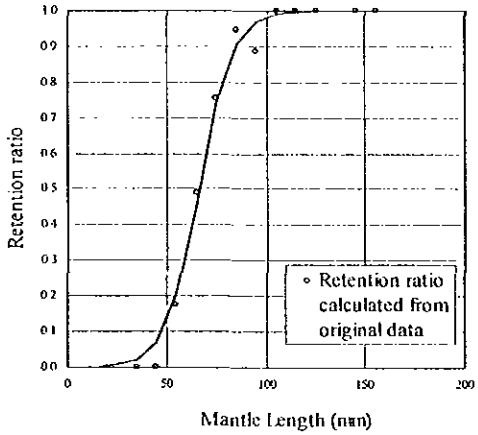
(9) European squid *Loligo vulgaris*

One trawl with the 45 mm mesh cod-end and eight trawls with the 70 mm mesh cod-end could be analyzed individually (Appendix Table 4.3, 6/6). According to Uozumi *et al.* (1984), because the long-finned squid *Loligo reynaudii* seldom escape through the cod-end meshes, the control of mesh size would not be an effective tool in the management of squid stocks; however, the present results show one cannot be categorical with respect to squids.

Figure 4.9 shows the selectivity curves based on the AIC for the 45 mm and 70mm mesh cod-ends. L_{50} and SP values were, respectively, 66 mm and 18 mm for the 45 mm mesh and 84 mm and 46 mm for the 70 mm mesh.

A. 39.9mm cod-end

Survey season	Phase 1, warm season
Trawl number	To-63
Mesh size of cod-end	45 mm
Mesh size of covernet	20 mm
Catch numbers in cod-end	147
Catch numbers in covernet	87
Sample numbers in cod-end	100
Sample numbers in covernet	87
Range of mantle length in cod-end	50 – 150 mm
Range of mantle length in covernet	30 – 90 mm
Mean mantle length in cod-end	83 mm
Mean mantle length in covernet	61 mm
L_{50}	66 mm
SP (L_{75}-L_{25})	18 mm
AIC (Akaike's Information Criterion)	30.746



B. 62.3mm cod-end

Survey season	Phase 2, warm season
Trawl number	To-35
Mesh size of cod-end	70 mm
Mesh size of covernet	20 mm
Catch numbers in cod-end	48
Catch numbers in covernet	18
Sample numbers in cod-end	48
Sample numbers in covernet	18
Range of mantle length in cod-end	70 – 150 mm
Range of mantle length in covernet	80 – 130 mm
Mean mantle length in cod-end	109 mm
Mean mantle length in covernet	100 mm
L_{50}	84 mm
SP (L_{75}-L_{25})	46 mm
AIC (Akaike's Information Criterion)	26.006

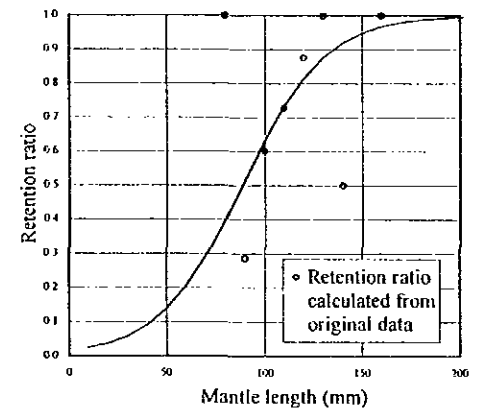


Figure 4.9 Selectivity curves for European squid *Loligo vulgaris*.

(10) Deep-water pink shrimp *Parapenaeus longirostris*

One trawl with the 45 mm mesh cod-end could be analyzed individually (Appendix Figure 4.3, 6/6). Its selectivity curve is illustrated in Figure 4.10. L_{50} was 95 mm and SP was 15 mm.

A. 39.9mm cod-end

Survey season	Phase 1, cold season
Trawl number	To-12
Mesh size of cod-end	45 mm
Mesh size of covernet	20 mm
Catch numbers in cod-end	354
Catch numbers in covernet	444
Sample numbers in cod-end	102
Sample numbers in covernet	93
Range of total length in cod-end	80 – 130 mm
Range of total length in covernet	50 – 110 mm
Mean total length in cod-end	100 mm
Mean total length in covernet	83 mm
L_{50}	95 mm
SP (L_{75}-L_{25})	15 mm
AIC (Akaike's Information Criterion)	50.452

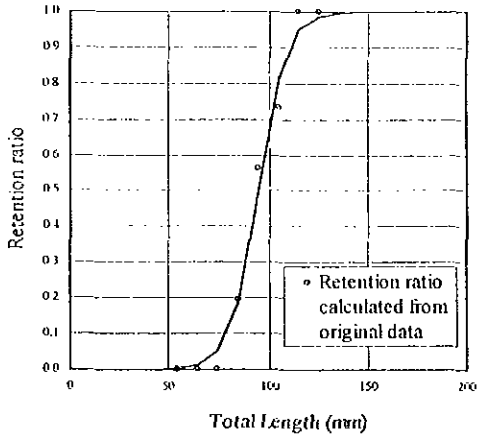


Figure 4.10 Selectivity curve for deep-water pink shrimp *Parapenaeus longirostris*.

4.3.2 Effectiveness of mesh size regulation

The management of fishery resources comprises three general principles: (1) overfishing should be prevented; (2) juveniles and youngs should be protected; and (3) spawning and spawners should be protected. Mesh size regulation is aimed at fulfulling principle (2) above, and a size limitation for fish to be harvested is a common method to do so.

The goal is to provide protection for small size fish – defined as individuals smaller than the biological minimum size (length at first maturity) of the species. For an effective or rational mesh regulation, a minimum mesh size should be adopted considering a L_{50} larger or equal to the biological minimum size of the target species. For this, a bottom trawl net with a minimum mesh size restricted to 70 mm and a bottom trawl shrimp net with a minimum mesh size restricted to 50 mm were tested for both effectiveness and rationality. Based on results of mesh selectivity studies, information on biological minimum sizes of nine of the species previously mentioned (*Merluccius polli* is excepted) was summarized in Table 4.2, and was utilized together with the data on Table 4.1.

Table 4.2 Biological minimum size for 9 target species with results of mesh selectivity studies.

Species	Biological minimum size* in mm	Sources
Senegalese hake	a. TL 280 (♀)	a. 3.4.6 in this report
Merluccius senegalensis	b. 240 (♂)	b. Maurin, 1954
	c. 297 (♀)	c. CNROP, 1991
Cunene horse mackerel	a. FL 220 (♀)	a. 3.4.6 in this report
Trachurus trecae	b. FL 240 <	b. CNROP, 1991
Meagre	a. (TL 210: at semi-mature)	a. (3.4.6 in this report)
Argyrosomus regius	b. 820 (♀), 720 (♂)	b. Tixerant, 1974
West African goatfish	a. FL 110 (♀)	a. 3.4.6 in this report
Pseudupeneus prayensis	b. 170	b. CNROP, 1991
Bluespotted seabream	a. FL 190 (♀)	a. 3.4.6 in this report
Pagrus caeruleostictus	b. FL 230 – 270	b. CNROP, 1991
Canary dentex	a. FL 210 (♀)	a. 3.4.6 in this report
Dentex canariensis	b. TL 219 (♀), TL 223 (♂)	b. Fish Base / http://www.fishbase.org
Red pandora	a. FL 110 (♀)	a. 3.4.6 in this report
Pagellus bellottii	b. 190 – 250	b. Domain, 1980
	c. 100 – 170	c. Franqueville, 1979
European squid	a. ML 120 (♀), ML 120 (♂)	a. 3.4.6 in this report
Loligo vulgaris	b. ML 160 (♀), ML 130 (♂)	b. CNROP, 1991
Deep-water pink shrimp *Parapenaeus longirostris*	a. TL 65	a. Burukovsky *et al.*, 1989

* Length at first maturity.

(1) Regulation of minimum mesh size 70 mm for bottom trawl net

Effectiveness was tested for eight species (the deep-water pink shrimp was excluded from the analysis because it yielded no data for the cod-end with a mesh of this size). The L_{50} values for six species (West African goatfish and red pandora excepted) with respect to the 70 mm mesh (actual measured inner diameter, 62.0 – 63.8 mm) are smaller than their respective minimum biological size. On the other hand, the L_{50} values for the West African goatfish and the red pandora are larger than their respective minimum biological size. So the 70 mm mesh regulation is effective in protecting small individuals of these two species, but for the other six, particularly for the meagre (which reaches a very large minimum size at first maturity), it can be thought to cause a growth overfishing.

(2) Regulation of minimum mesh size 50 mm for bottom shrimp trawl net

The L_{50} value of 95 mm for the deep-water pink shrimp for the mesh size of 45 mm (actual inner diameter measurement, 38.8 – 39.4 mm) is 30 mm larger than the biological minimum size of 65 mm for that species. The L_{50} value for the southern pink shrimp *Penaeus notialis*, one of important shrimp stocks, cannot be determined because of the very small catch. But supposing that the L_{50} value for the latter is near 95 mm of the former, its value is roughly equivalent to biological minimum size of 92 – 107 mm (Burukovsky *et al.*, 1989). In this context, a mesh size restriction to 50 mm can be considered highly effective in protecting small individuals of shrimp stocks. (Lobsters are excepted). However, for the fish captured as a bycatch by this bottom trawl shrimp net, they can be subjected to more growth overfishing than that of the 70 mm mesh size. For this reason, management methods such as the gear improvement of

bottom trawl shrimp nets (for example, banning the use of wing nets, fixing the height of net mouth at lower level, introducing selective grid) or the prohibition of the use of bottom trawl nets and their replacement by shrimp baskets, are desirable.

Also, because the Cunene horse mackerel is target species for the floating trawl fishery as well as for the bottom trawl fishery, the risk of growth overfishing is pointed out for this species caught by the former fishery (minimum mesh size regulation of 40 mm). The L_{50} value for the 45 mm mesh size cod-end for the Cunene horse mackerel is 125 mm, while its biological minimum size is 220 mm.

(3) Preliminary experiments on the effective and rational mesh size of bottom trawl net

It is suggested here that a bottom trawl net with a minimum mesh size regulation, in its aim to capture demersal fishes, cannot accomplish the objective of protecting small individuals (juveniles and youngs) for most of the target species under survey.

A preliminary approach to the relationship between mesh size and L_{50} for the aforementioned six target species, based on the results of mesh selectivity study for more than two kinds of cod-end, is illustrated in Figure 4.11. Expressed in a linear equation, this relationship would be indicated as follows:

Senegalese hake	$L_{50} = 5.4585\ M - 128.16$
Cunene horse mackerel	$L_{50} = 1.3201\ M + 82.504$
West African goatfish	$L_{50} = 3.3468\ M - 31.524$
Bluespotted seabream	$L_{50} = 2.6254\ M - 52.499$
Red pandora	$L_{50} = 3.3036\ M - 48.821$
European squid	$L_{50} = 0.8036\ M + 33.938$

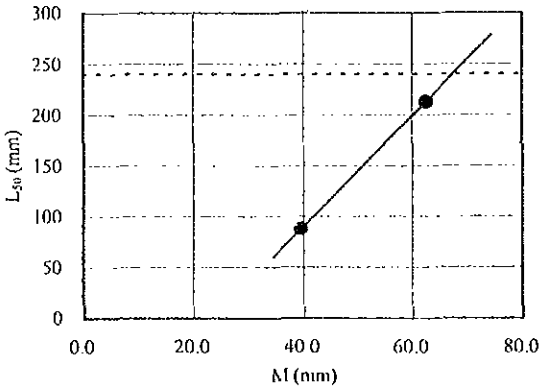
where M: the mesh inner diameter, and L_{50} and M: expressed in millimeters.

From this relationship, the mesh size in cases where the biological minimum size for each species (shown as broken lines in Figure 4.11) is equal to L_{50} was calculated and listed in Table 4.3. These results should be regarded as effective or rational mesh size references for resource preservation, not as a categorical final word. It is suggested that the results of these preliminary experiments should be combined with those of future follow-ups and their details and limitations be analyzed.

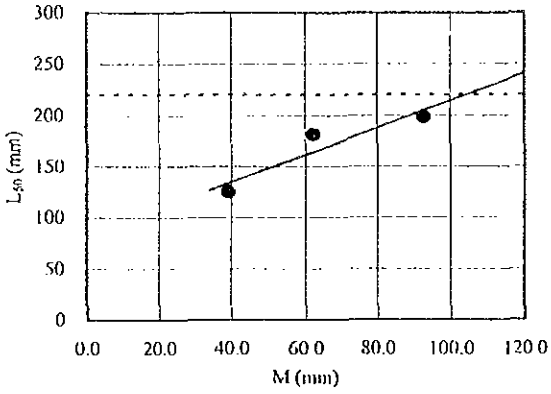
Table 4.3 Effective mesh size for the target species, based on the results of preliminary experiments.

Species	Biological minimum size in mm (from Tab. 4.2)	Effective mesh size in mm
Merluccius senegalensis	240	≧ 67
Trachurus trecae	220	≧ 104
Pseudupeneus prayensis	110	≧ 42
Pagrus caeruleostictus	190	≧ 92
Pagellus bellottii	110	≧ 48
Loligo vulgaris	120	≧ 107

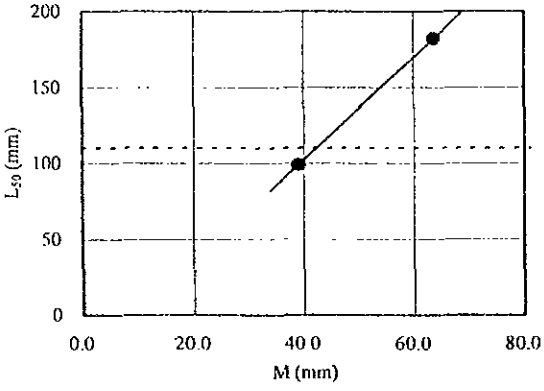
Senegalese hake
Merluccius senegalensis



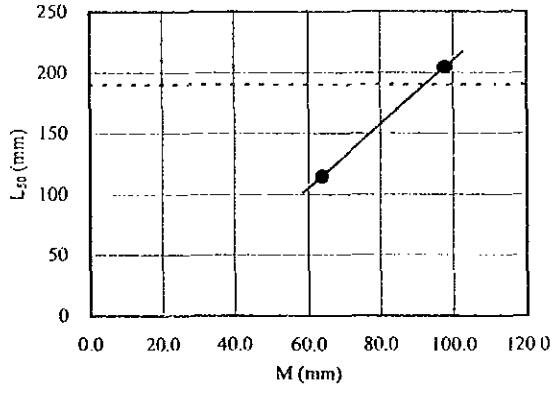
Cunene horse mackerel
Trachurus trecae



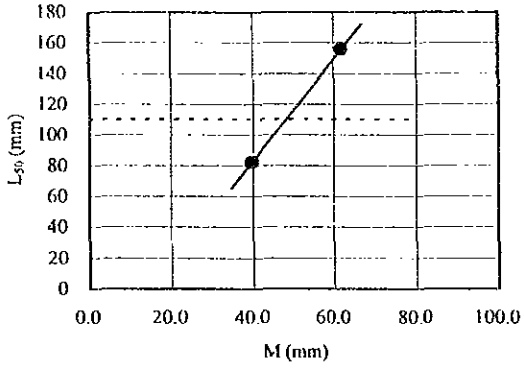
West African goatfish
Pseudupeneus prayensis



Bluespotted seabream
Pagrus caeruleostictus



Red pandora
Pagellus bellottii



European squid
Loligo vulgaris

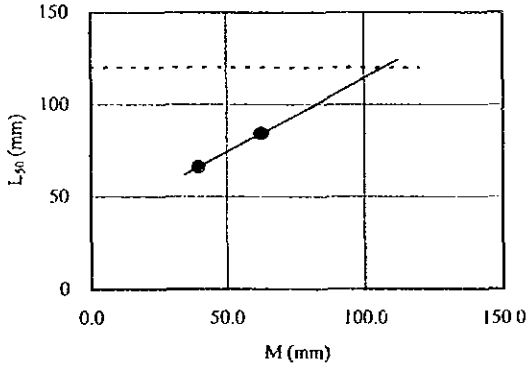


Figure 4.11 Relationship between mesh inner diameter (M) and L_{50}.

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Appendix Table 4.1 Results of mesh measurements of cod-end and covernet.

Research Vessel : *Al-Awam*

Nominated mesh size of cod-end 45mm

Date	12 April 2000				20 April 2000				12 Sept 2000				25 Sept. 2000				09 Oct. 2000			
Place	at Sea				at Sea				at Sea				at Sea				at Sea			
Status of net	wet				wet				wet				wet				wet			
Material of ne	nylon				nylon				nylon				nylon				nylon			
Type of gauge	slide caliper				slide caliper				slide caliper				slide caliper				slide caliper			
Net type	Cod end		Covernet		Cod end		Covernet		Cod end		Covernet		Cod end		Covernet		Cod end		Covernet	
	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right
1	37.2	37.5	17.5	18.6	37.4	37.3	19.3	20.5	36.0	38.0	22 0	22 0	37.5	36.2	20 2	20.6	41.0	40.8	22.7	22 3
2	37.3	39.1	19.3	18 5	37.0	37.5	17.8	19.0	39.0	39.0	19.0	23.0	39.0	38 0	20.2	20.9	38.9	39.8	21.0	22 7
3	37.0	37.2	20.5	18.4	38 9	40.3	18 9	19 5	37 0	41 0	20.0	21.0	39.6	38.1	20,4	20.8	38.8	42.1	20.8	22 7
4	37.3	37.4	20.8	19.0	39.5	37.8	19.8	19.5	38.0	39.0	19.0	20.0	39.0	37 3	20.5	20.7	38.2	39.6	22.5	21.8
5	37 2	39.7	20.2	19 1	38.1	37.7	18.7	19.5	39.0	37.0	22.0	23.0	39.0	40.5	20 4	20.9	39.1	38 8	22.6	21.7
6	39 4	38 9	20 5	20 0	38.2	38.5	19.9	18.9	37.0	41.0	22.0	21 0	39.4	37.7	20.6	20.5	37.6	41.9	20.5	20.5
7	39.2	40 0	20.0	19.0	39.1	38.9	18.8	20.6	38.0	40 0	22.0	21 0	37.8	40.0	19 3	21.4	39.2	39.2	22.7	22.7
8	38.4	41.1	20 3	19.4	38.1	38.4	18.4	18.7	40.0	38.0	23 0	21 0	39 3	39 3	20.3	21.1	38.9	40.0	22.6	23.0
9	39.7	39.7	20.9	19.4	40.0	39.6	19.2	18 8	39.0	41.0	22.0	23.0	39.5	39.5	20.3	20 5	38 0	39.7	22.8	21.1
10	40.2	41.0	20.0	20 5	37.9	38.5	18 8	19.2	38 0	40.0	22 0	22.0	38 3	36.6	20.8	21.1	40.3	39.6	22.5	22.2
11	40.9	40.1	20.3	19.1	39.3	38.5	19.7	18.6	39.0	39.0	24.0	25.0	38.2	39.4	20.0	20.4	38.3	40.2	22.6	23.0
12	40.8	40.7	20.6	19.8	39.9	39.8	18.4	19.8	38.0	40.0	22.0	23.0	38.5	38.7	21.0	20.3	39.7	39.3	23.5	22 0
13	39.9	41.0	18.9	19.5	39.7	37.5	19.4	20.3	39.0	41.0	22.0	24.0	39.1	38 2	20.2	20.6	38.4	37.2	22.5	21.7
14	41.2	40.1	19.5	18.9	38.2	40.7	19.2	19.0	40.0	40.0	21.0	23.0	40 2	39.6	20.7	20.8	39.8	38.0	20.7	21.9
15	40.1	41.3	20.2	19.4	41.1	40.5	19.2	18.8	41.0	39.0	22 0	23.0	39.7	41.8	20.6	20.7	38 0	40.3	21.4	21 2
16	40.0	37.5	20.2	19.1	40 2	39.8	19.1	20.0	40.0	41.0	26.0	22.0	39.3	39.6	20.1	21.0	40.6	39.1	22.0	22 5
17	40.0	40 8	19.2	18.6	38 5	39.5	19.3	19.4	41.0	38.0	22.0	23.0	40.9	40.0	20.5	19.2	39.0	40.0	21.4	20 0
18	39.7	39.7	19.0	19.5	40.1	39.9	19.5	22.4	41.0	39.0	22.0	23.0	41.0	39 0	20.8	20.4	40.2	38.3	21.9	20.4
19	42 6	41 0	20.2	18.4	40.2	40.1	19.7	20.2	38.0	39.0	21.0	23.0	38.5	38.0	20.3	20.0	39 7	39 2	21.0	20.4
20	40 2	40.4	20 5	19.4	40.2	38.4	19.5	19.1	38.0	42 0	20.0	24.0	37.7	40.0	20.4	19 7	38 3	38 6	21 0	21.0
Mean	39.4	39.7	19.9	19 2	39.1	39.0	19.1	19.6	38.8	39.6	21.8	22.5	39.1	38.9	20.4	20.6	39.1	39.6	21.9	21.7
	39.6		19.6		39.0		19 4		39.2		22.1		39.0		20.5		39.3		21.8	

Nominated mesh size of cod-end: 70mm

Date	13 April 2001				27 April 2001				08 May 2001				14 Sept. 2001				29 Sept. 2001			
Place	at Sea				at Sea				at Sea				at Sea				at Sea			
Status of net	wet				wet				wet				wet				wet			
Material of ne	nylon				nylon				nylon				nylon				nylon			
Type of gauge	slide caliper				slide caliper				slide caliper				slide caliper				slide caliper			
Net type	Cod end		Covernet		Cod end		Covernet		Cod end		Covernet		Cod end		Covernet		Cod end		Covernet	
	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right
1	61.0	57.5	21.0	20 0	62 0	65.0	21.0	21.0	59.6	54 6	19.0	23 6	61.5	65.6	20.3	21.2	63.8	61.1	20.3	19.4
2	60 8	60 3	20 0	21.0	62.0	62.0	21.0	21.0	64.8	55.5	20.6	23.0	57.9	62.7	21 0	21.5	66.8	60.1	20.0	21 2
3	59 7	62.0	20.5	20.0	63.0	66.0	21.0	21.0	61 2	61.0	19.4	21.5	63 3	63.8	21.6	21.2	63.7	62 7	20.5	20.4
4	65.7	63.4	21.0	20.0	63.0	67.0	21.0	19.0	56 9	64.4	20.1	20.5	64.6	64 5	21.1	21 5	60.4	61.5	20 9	21 3
5	62 1	63.5	21.0	19.5	65.0	62.0	21 0	20.0	64 5	65 3	20 5	21.7	63.6	61.2	21.6	22.1	62.4	59.0	20.1	19.7
6	65.0	67.2	20 5	20.0	62 0	66.0	20.0	20.0	64.0	64.0	19.4	22.0	63.8	65.3	22 5	21.9	64.0	61 3	20.6	20 3
7	63.4	62.2	20.5	20.0	62.0	61.0	19.0	21.0	58.0	64 0	20.3	21 1	63.1	66.8	21.3	20.2	60.1	63 0	21.6	21.2
8	65 0	64 7	20 0	20 0	61.0	65.0	19.0	21 0	62.0	64.3	20.0	21.3	63.4	62 6	21.6	21.5	63.6	59.9	21.3	20.7
9	63.8	63.0	20.0	21.0	60.0	61.0	19 0	20 0	89.4	62.6	21.1	20 8	64.0	63.2	20.0	21.1	63.1	63.7	21.5	20.2
10	64.1	63.8	20.0	20 0	62.0	59.0	20 0	21.0	62.6	55.3	21.2	20.7	63.3	61.1	20.3	21 3	60.2	63.3	21 2	19 5
11	66.0	64.6	21.0	20.5	61.0	62.0	20.0	20.0	67.0	58.8	20.5	20 0	65 1	64.9	21.7	20.3	64.3	62.0	20.8	19.4
12	61.7	54 7	19.5	21.0	63.0	59.0	19 0	20 0	64.4	63.1	19.0	19.8	62 7	65.5	21 0	22.9	62.4	65 7	20.9	18 2
13	64.0	55 6	20 5	20.0	60.0	62 0	20.0	19.0	63 8	63.0	19.4	19.0	64.2	64.3	21.0	20.1	63.6	63.6	20.9	20.1
14	65.0	63.2	20.0	20 0	62 0	60.0	21 0	20.0	62.4	58.6	20.5	20.0	64.5	61.4	20.5	21.8	61.6	62.1	20.2	20 1
15	63.5	63.0	21.5	20.5	59.0	61.0	21.0	21.0	64 4	60.8	21 0	20.6	61 9	62 2	21.0	19.9	63.8	60 3	19.7	18.8
16	62.6	60.6	20.5	21.0	61 0	63.0	20.0	18.0	61.9	60.3	20 5	20 3	65.2	66.4	21.8	20.0	58.4	61 4	20 6	20 2
17	61 4	62 1	19.0	21 5	62.0	62.0	21 0	21.0	61.8	62.5	20.2	19.1	66 8	62.4	21.1	20 2	62 3	61.0	20 7	19.7
18	62 1	64.0	21.5	21.0	62 0	61.0	20.0	20.0	61.1	63.3	21.0	20.1	64 2	65.7	21.1	19.9	61.0	64.2	21.0	20.3
19	65.0	62.2	20.0	20.0	62 0	59.0	20.0	19.0	64.1	63.3	19.2	20.9	64.7	65.4	22.5	19.9	61.7	63.5	19.9	19.8
20	64.3	64.3	20.0	21 0	61.0	61.0	20.0	20.0	58.4	63.3	22.0	21.8	63.9	65.4	21.5	20.0	63.0	64.0	22.0	20.0
Mean	63.5	62 1	20.4	20.4	61 8	62 2	20.2	20 2	63.6	61 4	20.2	20.9	63 6	64.0	21 2	20 9	62 5	62.2	20.7	20.0
	62 8		20.4		62 0		20 2		62 5		20.6		63.8		21.1		62.3		20.4	

Remark: Mesh size means 2 legs and 1 knot.

Appendix Table 4.1(cont.) Results of mesh measurements of cod-end and covernet.

Research Vessel : *Al-Awam*

Nominated mesh size of cod-end: 100mm

Date	19 Sept 2001				1 Oct. 2001			
Place	at Sea				at Sea			
Status of net	wet				wet			
Material of net	nylon				nylon			
Type of gauge	slide caliper				slide caliper			
Net type	Cod end		Covernet		Cod end		Covernet	
	Left	Right	Left	Right	Left	Right	Left	Right
1	98.7	99.2	24.3	29.1	94.0	93.4	21.9	21.4
2	95.0	98.2	26.7	26.2	90.4	95.0	22.0	24.7
3	97.7	97.8	26.9	27.0	89.1	95.1	23.5	24.9
4	94.9	97.2	26.2	27.5	91.3	91.7	23.5	24.4
5	99.0	100.0	28.1	27.8	90.1	94.2	23.8	26.0
6	97.1	95.4	26.5	28.1	93.0	95.5	22.3	22.2
7	97.3	99.0	28.5	27.1	93.6	90.7	22.2	23.2
8	94.8	98.1	26.4	28.1	93.1	91.1	20.8	22.0
9	98.0	97.7	27.2	27.2	91.1	92.5	22.3	22.0
10	96.9	97.9	27.4	27.9	92.0	90.2	21.7	21.1
11	99.0	97.2	27.5	28.0	90.0	93.8	23.0	22.7
12	99.6	101.3	27.9	27.2	96.4	93.2	23.6	24.0
13	96.8	98.1	27.9	28.4	93.5	97.2	23.0	23.8
14	97.0	96.0	30.4	27.3	92.2	92.1	24.5	23.9
15	98.7	95.6	27.7	26.3	91.5	91.6	23.5	23.9
16	100.4	95.9	28.1	28.6	92.2	92.9	24.0	25.5
17	97.9	97.7	27.7	27.1	92.7	90.0	24.0	24.2
18	98.2	96.3	27.7	27.0	89.0	93.7	24.6	23.1
19	98.8	100.8	26.8	29.3	91.9	94.2	22.2	22.6
20	97.4	96.5	26.4	26.2	94.2	98.1	21.1	24.2
Mean	97.7	97.8	27.3	27.6	92.2	93.3	22.9	23.5
	97.7		27.4		92.8		23.2	

Research Vessel : *Amrigue*

Nominated mesh size: 20mm

Date	06 May 2000		19 Oct. 2000		19 Oct. 2000		22 Oct. 2000		15 May 2001	
Place	at Sea		at Sea		at Sea		at Sea		at Sea	
Status of net	wet		wet		wet		wet		wet	
Material of net	nylon		nylon		nylon		nylon		nylon	
Type of gauge	slide caliper		slide caliper		slide caliper		slide caliper		slide caliper	
No. of meshs	Cod end		Cod end		Cod end		Cod end		Cod end	
measured	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right
1	20.5	20.0	23.1	22.8	23.3	22.9	26.2	23.2	20.0	23.2
2	20.2	20.5	25.2	22.4	23.7	22.8	24.0	23.2	19.5	23.2
3	20.0	20.2	25.0	23.0	23.3	23.8	22.9	23.7	20.6	23.7
4	20.0	19.8	23.6	24.2	26.1	23.2	23.1	23.0	20.2	23.0
5	20.0	19.5	24.2	23.7	23.5	23.3	23.8	22.6	20.8	22.6
6	19.8	19.8	24.7	24.1	23.7	23.7	22.3	22.6	21.4	22.6
7	20.5	20.0	23.0	24.0	24.0	23.8	23.2	21.9	20.5	21.9
8	20.0	19.9	23.7	23.6	23.3	23.4	22.9	22.6	20.2	22.6
9	19.5	19.8	24.6	24.0	23.7	23.3	24.2	22.5	20.3	22.5
10	20.0	20.0	24.7	25.0	22.8	23.6	24.4	22.4	20.0	22.4
11	20.0	20.0	24.1	24.7	23.7	23.4	22.9	23.6	21.9	23.6
12	20.2	20.0	24.8	25.8	22.8	23.6	23.5	24.0	20.8	24.0
13	20.0	19.4	22.6	25.3	22.6	25.3	24.3	24.0	21.5	24.0
14	20.5	19.8	25.1	25.7	22.4	24.2	23.3	23.9	20.7	23.9
15	20.5	20.0	24.3	26.8	23.0	22.9	23.6	23.4	21.2	23.4
16	20.1	20.3	24.6	25.6	23.7	23.4	24.4	23.5	22.1	23.5
17	20.0	19.8	24.7	25.2	23.8	25.8	23.9	24.0	21.5	24.0
18	20.8	20.0	25.5	26.1	24.5	23.0	22.8	24.0	21.2	24.0
19	20.2	20.4	23.5	25.5	23.1	23.2	23.6	23.9	22.1	23.9
20	19.8	19.5	23.3	25.1	25.1	23.2	23.9	24.5	20.9	24.5
Mean	20.1	19.9	24.2	24.6	23.6	23.6	23.7	23.3	20.9	20.3
	20.1		24.4		23.6		23.5		20.6	

Remark: Mesh size means 2 legs and 1 knot.

Appendix Table 4.2 Catch composition and trawl data on mesh selectivity study.

(1/3)

Phase	Season	Trawl No.	Depth (m)	Mesh size (mm)	Target species		Bycatch in codend		Total catch in codend	
					name	catch in codend (kg)	No. of spp.	kg	No. of spp.	kg
1	Cold	To-12	118	45	*Parapenaeus longirostris*	2.1	28	265.7	29	267.8
		To-14	85	45	*Merluccius senegalensis*	5.5	30	395.6	31	401.1
		To-35	22	45	*Pagellus bellottii*	2.2	17	18.7	18	20.9
		To-45	21	45	*Pagellus bellottii*	28.9	33	145.6	34	174.5
		To-56	32	45	*Pagellus bellottii*	50.9	28	304.2	29	355.1
		To-62	33	45	*Pagellus bellottii*	17.2	31	49.6	32	66.8
	Warm	Tc-06	15	45	*Pseudupeneus prayensis*	12.9	26	91.7	27	104.5
		Tc-11	14	45	*Pseudupeneus prayensis*	2.5	37	68.2	38	70.7
		Tc-13	16	45	*Pseudupeneus prayensis*	15.8	52	166.2	53	182.0
		Tc-18	10	45	*Pseudupeneus prayensis*	27.4	58	292.3	59	319.8
		To-01	56	45	*Pseudupeneus prayensis*	3.9	56	62.6	57	66.4
		To-01	58	45	*Trachurus trecae*	11.3	51	239.8	52	251.1
		To-05	44	45	*Pagellus bellottii*	21.5	47	152.7	48	174.2
					Pseudupeneus prayensis	5.5	47	168.6	48	174.2
		To-08	66	45	*Pagellus bellottii*	17.3	35	98.4	36	115.8
		To-09	50	45	*Pseudupeneus prayensis*	38.7	47	516.7	48	555.4
		To-10	43	45	*Pseudupeneus prayensis*	49.8	31	371.8	32	421.6
		To-11	99	45	*Loligo vulgaris*	33.4	36	44.1	37	77.5
		To-22	63	45	*Trachurus trecae*	90.8	26	305.0	27	395.8
		To-23	53	45	*Pagellus bellottii*	207.6	33	623.6	34	831.2
					Trachurus trecae	36.6	33	794.7	34	831.2
		To-26	94	45	*Trachurus trecae*	22.2	35	78.1	36	100.3
		To-32	66	45	*Pagellus bellottii*	192.7	30	92.3	31	285.0
		To-36	33	45	*Pagellus bellottii*	164.2	42	164.2	43	328.4
					Pseudupeneus prayensis	43.6	42	284.8	43	328.4
		To-40	45	45	*Pagellus bellottii*	107.9	36	106.1	37	214.0
		To-42	41	45	*Pagellus bellottii*	282.4	33	281.5	34	563.8
		To-43	36	45	*Pagellus bellottii*	116.1	33	208.1	34	324.2
		To-46	24	45	*Pseudupeneus prayensis*	19.5	43	456.4	44	475.9
		To-47	35	45	*Pagellus bellottii*	60.6	48	138.5	49	199.1
					Pseudupeneus prayensis	18.9	48	180.2	49	199.1
		To-48	58	45	*Loligo vulgaris*	8.8	23	43.5	24	52.2
		To-49	60	45	*Loligo vulgaris*	12.5	25	31.5	26	44.0
		To-50	111	45	*Trachurus trecae*	58.6	37	76.1	38	134.7
		To-52	34	45	*Pagellus bellottii*	6.3	24	17.0	25	23.2
		To-55	103	45	*Trachurus trecae*	202.7	22	674.5	23	877.1
		To-63	23	45	*Loligo vulgaris*	4.4	20	90.7	21	95.2
		To-64	37	45	*Pagellus bellottii*	56.6	36	196.9	37	253.4
		To-65	42	45	*Loligo vulgaris*	21.4	36	61.0	37	82.4
		To-66	58	45	*Trachurus trecae*	88.5	49	83.8	50	172.3
		To-67	81	45	*Trachurus trecae*	272.8	43	88.6	44	361.3
		To-73	38	45	*Loligo vulgaris*	37.3	40	240.0	41	277.3
					Pagellus bellottii	62.7	40	214.6	41	277.3
		To-74	39	45	*Loligo vulgaris*	6.7	43	227.6	44	234.3
2	Cold	Tc-12	14	70	*Pagellus bellottii*	90.5	22	202.3	23	292.8
		Tc-13	16	70	*Pagellus bellottii*	5.9	29	122.8	30	128.6
		Tc-14	17	70	*Pagellus bellottii*	12.2	20	130.9	21	143.1
		Tc-21	17	70	*Pagellus bellottii*	47.0	34	243.7	35	290.7
		Tc-22	13	70	*Argyrosomus regius*	8.6	43	157.0	44	165.6
		Tc-29	13	70	*Dentex canariensis*	13.4	22	230.0	23	243.5
		Tc-30	13	70	*Dentex canariensis*	13.1	18	313.9	19	327.1
		To-04	21	70	*Pagellus bellottii*	4.5	15	123.0	16	127.5
		To-05	53	70	*Pagellus bellottii*	3.6	26	86.8	27	90.4
		To-15	63	70	*Pagellus bellottii*	25.8	27	145.1	28	170.9
		To-18	26	70	*Pagellus bellottii*	2.2	26	46.0	27	48.2
		To-19	37	70	*Pagellus bellottii*	57.8	21	103.4	22	161.1

Appendix Table 4.2(cont.) Catch composition and trawl data on mesh selectivity study.

(2/3)

Phase	Season	Trawl No.	Depth (m)	Mesh size (mm)	Target species		Bycatch in codend		Total catch in codend	
					name	catch in codend (kg)	No. of spp.	kg	No. of spp.	kg
(cont.)		To-24	33	70	*Pagellus bellottii*	142.1	25	122.1	26	264.2
		To-25	63	70	*Pagellus bellottii*	41.7	33	68.5	34	110.2
		To-32	24	70	*Pagellus bellottii*	8.5	26	114.5	27	123.0
		To-36	23	70	*Pagellus bellottii*	3.8	27	66.2	28	70.0
		To-49	36	70	*Pagellus bellottii*	8.3	23	279.2	24	287.4
		To-57	22	70	*Pagellus bellottii*	12.7	34	152.2	35	164.9
		To-61	46	70	*Merluccius senegalensis*	57.2	33	194.8	34	251.9
		To-63	23	70	*Loligo vulgaris*	2.1	17	11.6	18	13.7
		To-68	27	70	*Loligo vulgaris*	4.1	18	70.1	19	74.2
		To-71	87	70	*Merluccius senegalensis*	120.3	26	299.1	27	419.4
	Warm	Tc-03	15	70	*Pseudupeneus prayensis*	5.1	37	230.3	38	235.4
		Tc-11	9	70	*Pagrus caeruleostictus*	9.7	34	115.6	35	125.4
		Tc-13	14	70	*Pagrus caeruleostictus*	18.2	23	134.9	24	153.1
					Pseudupeneus prayensis	2.0	23	151.1	24	153.1
		Tc-14	15	70	*Pagellus bellottii*	3.9	28	325.9	29	329.8
					Pseudupeneus prayensis	3.2	28	326.6	29	329.8
		Tc-15	12	70	*Pagrus caeruleostictus*	17.4	36	261.9	37	279.3
					Pseudupeneus prayensis	17.0	36	262.3	37	279.3
		Tc-16	10	70	*Pagrus caeruleostictus*	13.2	34	208.0	35	221.3
					Pseudupeneus prayensis	19.9	34	201.4	35	221.3
		Tc-17	10	70	*Pagellus bellottii*	2.3	27	101.4	28	103.7
					Pagrus caeruleostictus	2.7	27	101.0	28	103.7
					Pseudupeneus prayensis	1.0	27	102.8	28	103.7
		Tc-18	17	100	*Pagrus caeruleostictus*	10.5	28	158.4	29	169.0
		Tc-19	15	100	*Pagrus caeruleostictus*	22.3	37	75.5	38	97.8
					Pseudupeneus prayensis	3.0	37	94.8	38	97.8
		Tc-22	16	70	*Pagrus caeruleostictus*	89.2	22	548.1	23	637.3
					Pseudupeneus prayensis	15.6	22	621.7	23	637.3
		Tc-23	18	70	*Pagrus caeruleostictus*	20.0	25	163.7	26	183.8
					Pseudupeneus prayensis	18.6	25	165.2	26	183.8
		Tc-27	12	70	*Dentex canariensis*	11.3	20	486.5	21	497.8
					Pagellus bellottii	7.9	20	489.9	21	497.8
					Pagrus caeruleostictus	79.9	20	417.9	21	497.8
		To-02	55	70	*Pseudupeneus prayensis*	0.8	38	90.7	39	91.5
		To-03	73	70	*Trachurus trecae*	2.0	28	273.0	29	275.0
		To-05	57	70	*Pagellus bellottii*	20.9	39	213.2	40	234.0
		To-08	28	70	*Pagellus bellottii*	6.2	25	133.4	26	139.6
					Pseudupeneus prayensis	32.5	25	107.0	26	139.6
		To-09	276	70	*Merluccius polli*	100.6	18	212.9	19	313.5
		To-10	275	70	*Merluccius polli*	134.4	20	267.2	21	401.6
		To-11	43	70	*Pagellus bellottii*	3.8	27	40.2	28	44.0
		To-12	40	70	*Pagellus bellottii*	39.1	27	349.0	28	388.2
			40	70	*Pseudupeneus prayensis*	14.6	27	373.5	28	388.2
		To-13	48	70	*Pagellus bellottii*	26.7	32	125.8	33	152.5
		To-14	73	70	*Loligo vulgaris*	10.1	21	101.5	22	111.6
					Trachurus trecae	7.8	21	103.8	22	111.6
		To-15	22	70	*Pagellus bellottii*	11.9	15	64.0	16	75.9
					Pseudupeneus prayensis	1.1	15	74.8	16	75.9
		To-16	37	70	*Pagellus bellottii*	40.1	18	95.6	19	135.7
					Pseudupeneus prayensis	4.9	18	130.8	19	135.7
		To-17	46	70	*Pagellus bellottii*	0.8	15	23.1	16	23.9
		To-18	22	70	*Pagellus bellottii*	3.0	32	77.0	33	79.9
					Pseudupeneus prayensis	1.3	32	78.7	33	79.9
		To-21	37	100	*Pagellus bellottii*	34.1	37	205.3	38	239.4
					Pseudupeneus prayensis	0.4	37	239.0	38	239.4
		To-22	57	100	*Pagellus bellottii*	7.9	27	169.3	28	177.2

Appendix Table 4.2(cont.) Catch composition and trawl data on mesh selectivity study.

(3/3)

Phase	Season	Trawl No.	Depth (m)	Mesh size (mm)	Target species		Bycatch in codend		Total catch in codend	
					name	catch in codend (kg)	No. of spp.	kg	No. of spp.	kg
(cont.)		To-23	53	100	*Pagellus bellottii*	63.3	31	495.4	32	558.7
		To-24	27	100	*Pseudupeneus prayensis*	7.2	35	344.5	36	351.7
		To-26	66	70	*Pagellus bellottii*	5.9	28	46.7	29	52.5
		To-27	107	70	*Merluccius polli*	1.9	30	162.9	31	164.7
					Trachurus trecae	46.0	30	118.8	31	164.7
		To-28	324	70	*Merluccius polli*	478.0	23	952.5	24	1,430.5
		To-29	93	70	*Merluccius polli*	1.4	30	67.0	31	68.3
					Trachurus trecae	0.7	30	67.7	31	68.3
		To-30	129	70	*Merluccius polli*	4.5	27	85.8	28	90.3
		To-31	133	70	*Merluccius polli*	8.6	28	175.0	29	183.7
		To-32	172	70	*Merluccius polli*	17.0	27	292.3	28	309.3
		To-33	23	70	*Pseudupeneus prayensis*	26.7	40	509.2	41	536.0
		To-34	45	70	*Pagellus bellottii*	3.0	21	24.4	22	27.4
		To-35	101	70	*Loligo vulgaris*	2.8	35	57.5	36	60.3
					Merluccius polli	12.2	35	48.1	36	60.3
		To-36	256	70	*Merluccius polli*	78.2	33	952.5	34	1,030.6
		To-37	48	70	*Pagellus bellottii*	113.3	19	169.7	20	283.0
		To-38	53	70	*Pagellus bellottii*	53.4	17	248.4	18	301.8
		To-39	60	70	*Pagellus bellottii*	3.5	23	30.1	24	33.6
		To-40	62	70	*Pagellus bellottii*	7.4	18	60.1	19	67.5
					Trachurus trecae	0.7	18	66.8	19	67.5
		To-41	330	70	*Merluccius polli*	119.8	27	242.5	28	362.3
		To-42	264	70	*Merluccius polli*	330.8	22	1,283.0	23	1,613.8
		To-43	152	70	*Merluccius polli*	63.5	24	1,452.9	25	1,516.5
		To-44	23	100	*Pagellus bellottii*	3.3	23	131.6	24	134.9
					Pseudupeneus prayensis	2.7	23	132.2	24	134.9
		To-45	69	100	*Pagellus bellottii*	2.5	27	754.7	28	757.2
					Trachurus trecae	32.0	27	725.2	28	757.2
		To-47	287	100	*Merluccius polli*	32.7	23	992.0	24	1,024.6
		To-49	101	100	*Trachurus trecae*	14.6	23	334.8	24	349.5
		To-50	23	100	*Pagellus bellottii*	2.4	32	186.8	33	189.3
					Pseudupeneus prayensis	0.7	32	188.5	33	189.3
		To-52	34	70	*Pagellus bellottii*	25.8	42	277.2	43	303.0
		To-53	31	70	*Pagellus bellottii*	40.8	39	163.5	40	204.2
		To-54	34	70	*Pagellus bellottii*	176.0	31	1,203.3	32	1,379.2
					Pseudupeneus prayensis	6.1	31	1,373.2	32	1,379.2
		To-55	22	70	*Mustelus mustelus*	361.6	19	105.5	20	467.1
					Pagellus bellottii	7.8	19	459.2	20	467.1
		To-56	37	70	*Loligo vulgaris*	4.3	39	777.9	40	782.2
					Pagellus bellottii	72.6	39	709.7	40	782.2
					Pseudupeneus prayensis	7.4	39	774.9	40	782.2
					Trachurus trecae	6.6	39	775.6	40	782.2
		To-58	24	70	*Mustelus mustelus*	62.6	33	229.1	34	291.7
					Pagellus bellottii	39.2	33	252.4	34	291.7
		To-59	33	70	*Loligo vulgaris*	5.4	23	370.9	24	376.2
					Pagellus bellottii	20.2	23	356.1	24	376.2
					Trachurus trecae	6.1	23	370.1	24	376.2
		To-60	42	70	*Loligo vulgaris*	6.4	23	187.2	24	193.6
					Pagellus bellottii	6.3	23	187.3	24	193.6
					Trachurus trecae	2.7	23	190.9	24	193.6
		To-61	48	70	*Pagellus bellottii*	22.9	23	162.7	24	185.6
		To-62	36	70	*Loligo vulgaris*	3.8	23	388.6	24	392.4
					Pagellus bellottii	35.9	23	356.5	24	392.4
		To-63	291	70	*Merluccius polli*	13.3	32	398.3	33	411.6
		To-64	317	70	*Merluccius polli*	7.3	32	201.0	33	208.2

Appendix Table 4.3 Mesh selectivity parameters of the ten target species.

Senegalese hake *Merluccius senegalensis* (1/6)

Mesh size (mm)	Phase	Season	Trawl No.	Catch in No.		Speciemens in No.		Range of body length (TL:mm)		Mean length (mm)		L_{50} (mm)	SP (L_{75}-L_{25}: mm)	AIC
				Cod end	Covernet	Cod end	Covernet	Cod end	Covernet	Cod end	Covernet			
45	1	Cold	To-14	289	47	100	47	70 - 350	70 - 150	126	102	88	30	43.645
70	2	Cold	To-61	404	149	99	99	200 - 310	200 - 280	257	248	219	74	55.277
			To-71	747	81	100	81	220 - 290	230 - 290	268	257	213	46	55.143

Benguela hake *Merluccius polli*

Mesh size (mm)	*Phase*	*Season*	*Trawl* No.	*Catch in No.*		*Speciemens in No.*		*Range of body length (TL:mm)*		Mean length (mm)		L_{50} (mm)	SP (L_{75}-L_{25}: mm)	AIC
				Cod end	Covernet	Cod end	Covernet	Cod end	Covernet	Cod end	Covernet			
70	2	Warm	To-09	1,324	559	99	99	160 - 310	150 - 230	206	191	177	52	113.002
			To-10	1,807	879	99	100	160 - 290	160 - 230	203	193	172	78	145.731
			To-27	34	61	34	61	130 - 220	120 - 220	179	171	216	155	35.250
			To-28	4,640	2,575	99	99	180 - 320	180 - 270	231	221	197	108	69.149
			To-29	34	81	34	81	130 - 220	120 - 210	169	162	207	105	29.233
			To-30	72	72	72	63	130 - 320	130 - 230	191	171	179	78	50.063
			To-31	160	158	99	101	130 - 240	130 - 240	181	176	177	233	68.860
			To-32	248	100	100	100	130 - 270	130 - 270	194	183	125	153	75.098
			To-35	171	96	171	96	140 - 240	130 - 240	199	190	164	117	46.327
			To-36	1,126	215	101	101	160 - 330	160 - 250	221	194	172	44	77.977
			To-41	1,243	940	101	99	180 - 350	160 - 350	237	215	214	81	256.389
			To-42	3,013	2,023	100	99	180 - 320	150 - 280	235	220	208	106	508.851
			To-43	684	984	99	99	150 - 350	150 - 260	219	202	227	100	187.835
			To-63	120	31	106	31	200 - 360	190 - 270	245	224	198	56	36.022
			To-64	63	17	63	17	180 - 340	160 - 260	237	213	184	65	27.610
100	2	Warm	To-47	241	1,803	100	100	150 - 350	180 - 340	246	247	-	-	-

Cunene horse mackerel *Trachurus trecae*

Mesh size (mm)	Phase	Season	Trawl No.	Catch in No.		Speciemens in No.		Range of body length (FL:mm)		Mean length (mm)		L_{50} (mm)	SP (L_{75}-L_{25}: mm)	AIC
				Cod end	Covernet	Cod end	Covernet	Cod end	Covernet	Cod end	Covernet			
45	1	Warm	To-04	711	1,282	100	100	80 - 200	80 - 100	107	92	108	44	18.440
			To-22	966	436	100	100	100 - 210	80 - 100	191	98	-	-	-
			To-23	507	2,182	100	100	80 - 240	80 - 100	176	94	125	24	15.246
			To-26	1,070	733	100	100	80 - 140	90 - 130	116	108	107	27	111.900
			To-50	2,636	1,885	100	100	100 - 170	100 - 140	123	115	115	23	31.189
			To-55	12,512	21,939	100	96	100 - 150	100 - 120	114	113	129	60	29.542
			To-66	7,641	945	100	100	100 - 150	90 - 130	115	112	57	59	49.985
			To-67	7,619	409	100	100	100 - 170	100 - 180	140	121	88	30	35.057

Appendix Table 4.3(cont.) Mesh selectivity parameters of the ten target species.

Cunene horse mackerel *Trachurus trecae* (cont.) (2/6)

Mesh size (mm)	Phase	Season	Trawl No.	Catch in No.		Speciemens in No.		Range of body length (FL:mm)		Mean length (mm)		L_{50} (mm)	SP (L_{75}-L_{25}: mm)	AIC
				Cod end	Covernet	Cod end	Covernet	Cod end	Covernet	Cod end	Covernet			
70	2	Warm	To-03	96	822	96	96	80 - 200	80 - 200	106	98	392	297	40.136
			To-14	63	100	42	100	130 - 240	130 - 230	201	195	283	405	49.848
			To-27	207	330	10	9.9	100 - 150	90 - 140	121	120	158	176	60.430
			To-29	54	666	54	98	80 - 120	70 - 150	98	98	1365	1,110	24.521
			To-40	15	134	15	97	100 - 230	90 - 220	149	148	1534	1,390	30.289
			To-56	246	5,569	98	98	100 - 210	70 - 250	133	121	547	296	1500.219
			To-59	127	639	98	98	70 - 180	60 - 190	145	144	1519	1,869	123.385
			To-60	39	337	39	99	100 - 150	70 - 150	123	119	181	61	26.402
100	2	Warm	To-45	925	9,316	97	99	80 - 170	80 - 160	141	129	198	60	81.038
			To-49	85	1,824	10	9.7	80 - 330	90 - 190	110	108	766	471	83.636

Meagre *Argyrosomus regius*

Mesh size (mm)	Phase	Season	Trawl No.	Catch in No.		Speciemens in No.		Range of body length (TL:mm)		Mean length (mm)		L_{50} (mm)	SP (L_{75}-L_{25}: mm)	AIC
				Cod end	Covernet	Cod end	Covernet	Cod end	Covernet	Cod end	Covernet			
70	2	Cold	Tc-22	26	18	24	18	140 - 460	80 - 200	239	156	170	25	19.417

West African goatfish *Pseudupeneus prayensis*

Mesh size (mm)	Phase	Season	Trawl No.	Catch in No.		Speciemens in No.		Range of body length (FL:mm)		Mean length (mm)		L_{50} (mm)	SP (L_{75}-L_{25}: mm)	AIC
				Cod end	Covernet	Cod end	Covernet	Cod end	Covernet	Cod end	Covernet			
45	1	Warm	Tc-06	188	49	100	49	90 - 240	90 - 150	147	114	108	30	40.542
			Tc-11	82	31	82	31	80 - 220	60 - 120	118	104	99	28	26.570
			Tc-13	384	134	100	100	80 - 220	60 - 150	131	94	102	22	52.081
			Tc-18	903	696	100	100	70 - 160	60 - 110	116	86	98	18	80.491
			To-01	80	19	80	19	60 - 240	70 - 230	133	93	88	28	28.580
			To-05	230	567	100	77	80 - 220	50 - 120	109	85	101	17	36.318
			To-09	379	315	102	35	120 - 270	90 - 160	185	115	136	22	117.377
			To-10	1,368	2,233	100	100	90 - 250	80 - 200	123	110	-	-	-
			To-36	852	525	100	100	90 - 200	60 - 150	138	103	112	25	88.170
			To-46	496	661	98	99	80 - 230	60 - 130	127	93	111	24	70.916
			To-47	452	527	100	100	70 - 220	50 - 120	125	89	104	16	81.196
70	2	Warm	Tc-03	40	38	40	38	150 - 210	160 - 220	188	183	184	82	26.822
			Tc-13	21	41	21	41	80 - 230	60 - 180	159	128	172	96	47.626
			Tc-14	60	103	60	103	100 - 200	100 - 180	141	128	149	64	35.243
			Tc-15	141	186	98	99	90 - 250	80 - 220	192	133	170	59	84.368
			Tc-16	190	531	100	99	100 - 250	70 - 200	172	120	169	54	105.957
			Tc-17	27	57	27	57	100 - 190	90 - 190	124	122	247	366	26.207
			Tc-22	145	391	100	99	90 - 240	70 - 210	183	135	181	50	93.430

Appendix Table 4.3(cont.) Mesh selectivity parameters of the ten target species.

West African goatfish *Pseudupeneus prayensis* (cont.) (3/6)

Mesh size (mm)	Phase	Season	Trawl No.	Catch in No.		Speciemens in No.		Range of body length (FL:mm)		Mean length (mm)		L_{50} (mm)	SP (L_{75}-L_{25}: mm)	AIC
				Cod end	Covernet	Cod end	Covernet	Cod end	Covernet	Cod end	Covernet			
(cont.)			Tc-22	145	391	100	99	90 - 240	70 - 210	183	135	181	50	93.430
			Tc-23	233	523	100	98	100 - 230	90 - 190	157	132	166	63	110.985
			Tc-02	6	55	6	55	180 - 220	60 - 180	205	82	182	10	5.641
			Tc-08	301	230	99	98	80 - 220	140 - 200	183	179	167	114	70.428
			Tc-12	110	27	100	27	160 - 220	140 - 210	197	184	165	39	28.063
			Tc-15	211	143	24	98	100 - 180	80 - 200	133	126	103	148	84.990
			Tc-16	42	15	42	15	170 - 210	130 - 190	186	174	168	26	22.713
			Tc-18	32	70	42	15	70 - 220	90 - 170	122	112	151	98	27.496
			Tc-33	205	179	99	100	130 - 230	120 - 210	193	180	185	39	61.628
			Tc-54	40	69	33	14	150 - 220	100 - 200	191	170	198	61	44.264
			Tc-56	40	23	40	23	100 - 240	100 - 230	212	159	166	89	24.777
100	2	Warm	Tc-19	22	29	22	29	150 - 240	150 - 240	193	189	220	232	28.274
			Tc-21	4	115	4	98	110 - 200	90 - 220	155	170	-	-	-
			Tc-24	60	217	60	98	150 - 220	100 - 210	186	180	242	101	39.669
			Tc-44	42	179	42	98	100 - 200	90 - 200	145	148	-	-	-
			Tc-50	10	144	10	96	100 - 220	70 - 210	149	141	528	316	38.257

Bluespotted seabream *Pagrus caeruleostictus*

Mesh size (mm)	Phase	Season	Trawl No.	Catch in No.		Speciemens in No.		Range of body length (FL:mm)		Mean length (mm)		L_{50} (mm)	SP (L_{75}-L_{25}: mm)	AIC
				Cod end	Covernet	Cod end	Covernet	Cod end	Covernet	Cod end	Covernet			
70	2	Warm	Tc-11	45	28	45	28	100 - 270	40 - 110	194	95	118	22	13.830
			Tc-13	59	30	59	30	80 - 330	50 - 100	220	83	115	22	12.685
			Tc-15	81	141	81	96	70 - 320	50 - 230	195	100	157	49	51.418
			Tc-16	152	645	98	99	40 - 280	50 - 100	153	80	123	36	71.213
			Tc-17	23	22	23	22	70 - 200	60 - 100	161	83	111	36	16.976
			Tc-22	256	42	98	22	190 - 300	70 - 110	237	92	-	-	-
			Tc-23	70	147	70	40	70 - 290	50 - 110	215	84	133	30	18.906
			Tc-27	335	54	100	54	180 - 280	180 - 220	209	206	173	40	25.725
100	2	Warm	Tc-18	26	9	26	9	190 - 280	180 - 220	226	208	204	20	14.989
			Tc-19	88	27	88	27	180 - 280	180 - 220	220	200	194	29	25.033

Canary dentex *Dentex canariensis*

Mesh size (mm)	Phase	Season	Trawl No.	Catch in No.		Speciemens in No.		Range of body length (FL:mm)		Mean length (mm)		L_{50} (mm)	SP (L_{75}-L_{25}: mm)	AIC
				Cod end	Covernet	Cod end	Covernet	Cod end	Covernet	Cod end	Covernet			
70	2	Cold	Tc-29	113	40	99	40	140 - 220	130 - 180	173	154	152	21	24.644
			Tc-30	130	31	100	31	140 - 220	130 - 170	169	158	148	19	18.725
		Warm	Tc-27	62	28	62	28	170 - 270	170 - 250	199	194	159	101	29.275

Appendix Table 4.3(cont.) Mesh selectivity parameters of the ten target species.

Red pandora *Pagellus bellottii* (4/6)

Mesh size (mm)	Phase	Season	Trawl No.	Catch in No.		Speciemens in No.		Range of body length (FL:mm)		Mean length (mm)		L_{50} (mm)	SP (L_{75}-L_{25}: mm)	AIC
				Cod end	Covernet	Cod end	Covernet	Cod end	Covernet	Cod end	Covernet			
45	1	Cold	To-35	196	29	[illegible]					75	[illegible]	38	20.339
			To-45	1,955	2,064	100	100	70 - 140	50 - 100	93	85	89	18	29.245
			To-56	3,026	1,631	100	100	60 - 240	50 - 100	96	84	78	47	44.827
			To-62	420	45	100	45	80 - 150	40 - 130	124	88	90	19	40.167
		Warm	To-05	1,294	6,941	100	100	50 - 100	50 - 170	91	66	90	21	56.484
			To-08	636	276	100	68	70 - 150	50 - 140	111	84	87	26	106.637
			To-23	2,039	3,182	100	100	90 - 220	50 - 100	164	78	-	-	-
			To-32	4,722	359	100	100	70 - 200	60 - 190	121	95	52	47	241.588
			To-36	2,067	1,448	100	100	70 - 210	50 - 140	153	85	103	23	125.232
			To-40	1,835	287	100	100	70 - 210	60 - 200	137	104	85	39	108.199
			To-42	4,719	209	100	100	80 - 210	50 - 190	142	115	68	42	136.511
			To-43	1,803	113	100	100	70 - 210	60 - 150	142	101	77	33	70.908
			To-47	1,161	594	100	100	70 - 240	60 - 130	132	85	96	26	56.651
			To-52	203	43	100	43	80 - 170	70 - 150	113	106	-	-	-
			To-64	702	105	93	105	80 - 180	40 - 170	157	82	108	25	38.720
			To-73	4,353	70	100	70	80 - 170	40 - 150	155	69	79	14	65.005
70	2	Cold	Tc-12	510	29	98	29	160 - 230	130 - 200	196	164	161	17	28.069
			Tc-13	36	3	[illegible]					67	156	20	14.218
			Tc-14	175	142	100	100	80 - 200	60 - 160	152	120	135	33	57.208
			Tc-21	346	156	100	90	130 - 280	70 - 170	191	116	149	19	38.635
			To-04	44	510	32	111	120 - 210	40 - 150	163	80	156	18	44.218
			To-05	56	180	56	99	110 - 180	50 - 160	146	124	153	30	37.120
			To-15	220	150	100	82	90 - 250	50 - 180	172	100	132	32	53.409
			To-15	355	152	100	100	90 - 250	50 - 180	195	115	-	-	-
			To-18	28	108	28	99	110 - 210	40 - 170	152	106	150	34	26.760
			To-19	379	169	99	100	130 - 260	60 - 180	186	137	147	23	50.772
			To-24	740	141	100	98	120 - 250	80 - 180	208	151	158	25	89.595
			To-25	363	478	99	100	130 - 240	60 - 170	177	111	153	20	50.823
			To-32	130	221	100	100	60 - 220	60 - 170	146	124	151	64	72.646
			To-36	100	366	43	97	70 - 240	50 - 160	146	124	172	62	62.270
			To-49	274	4,266	100	100	70 - 220	50 - 170	109	81	163	58	169.153
			To-57	164	238	98	99	70 - 200	70 - 150	148	123	143	47	85.345

Appendix Table 4.3(cont.) Mesh selectivity parameters of the ten target species.

Red panrora *Pagellus bellottii* (cont.) (5/6)

Mesh size (mm)	Phase	Season	Trawl No.	Catch in No.		Speciemens in No.		Range of body length (FL:mm)		Mean length (mm)		L_{50} (mm)	SP (L_{75}-L_{25}: mm)	AIC
				Cod end	Covernet	Cod end	Covernet	Cod end	Covernet	Cod end	Covernet			
70	2	Warm	Tc-14	69	72	69	72	80 - 180	70 - 150	140	123	133	58	33.414
			Tc-17	65	42	65	42	80 - 220	70 - 140	114	96	92	54	28.415
			Tc-27	58	22	58	22	150 - 210	150 - 190	182	171	164	28	18.179
			To-05	174	65	99	65	110 - 210	50 - 230	181	99	137	26	42.091
			To-08	50	12	50	12	110 - 210	110 - 180	180	158	142	43	25.480
			To-11	92	320	92	99	80 - 170	70 - 160	123	119	235	200	50.678
			To-12	298	81	98	81	120 - 230	90 - 230	186	143	149	30	58.830
			To-13	212	147	100	100	110 - 230	70 - 190	167	145	150	44	43.798
			To-15	492	1,557	98	98	60 - 200	60 - 160	100	96	238	268	184.582
			To-16	446	183	97	101	120 - 200	80 - 180	163	152	133	61	60.705
			To-17	37	623	37	99	60 - 160	50 - 160	103	90	215	92	42.315
			To-18	30	30	30	30	70 - 220	70 - 190	162	121	143	65	27.309
			To-26	133	342	98	100	70 - 170	70 - 160	130	115	141	45	55.442
			To-34	43	77	43	77	90 - 210	60 - 190	144	110	142	66	41.296
			To-37	1,339	4,247	103	101	80 - 200	80 - 170	155	124	164	44	346.640
			To-38	913	7,123	98	99	80 - 170	70 - 170	139	118	180	55	204.735
			To-39	92	625	92	100	70 - 160	60 - 150	121	107	165	58	53.284
			To-40	142	449	96	95	90 - 240	70 - 160	136	121	153	49	73.312
			To-52	137	29	99	29	100 - 290	50 - 220	206	116	129	52	44.984
			To-53	338	836	99	99	50 - 220	50 - 230	174	102	160	52	228.619
			To-54	902	1,128	97	99	160 - 270	50 - 260	217	124	187	54	337.828
			To-55	338	1,083	99	100	60 - 210	60 - 100	89	81	127	82	106.682
			To-56	512	9,260	99	100	150 - 270	80 - 170	205	127	183	17	258.832
			To-58	474	1,109	99	99	80 - 210	70 - 160	156	119	155	37	170.052
			To-59	1,096	6,784	97	97	70 - 180	60 - 160	94	91	241	179	63.239
			To-60	200	5,153	98	96	70 - 210	50 - 160	108	85	174	55	154.390
			To-61	112	24	112	24	60 - 190	60 - 220	110	177	-	-	-
			To-62	372	310	100	100	100 - 200	60 - 190	167	136	154	35	71.520
100	2	Warm	To-21	151	370	99	101	170 - 260	160 - 230	218	205	233	53	58.917
			To-22	60	477	60	98	120 - 260	70 - 210	184	178	331	159	53.556
			To-23	346	1,785	98	100	160 - 240	160 - 240	203	197	287	116	125.132
			To-44	60	315	60	99	60 - 210	70 - 220	120	144	-	-	-
			To-45	13	161	13	100	80 - 280	90 - 230	204	171	258	61	43.853
			To-50	20	240	20	98	70 - 290	60 - 220	164	116	242	93	47.768

Appendix Table 4.3(cont.) Mesh selectivity parameters of the ten target species.

European squid *Loligo vulgaris* (6/6)

Mesh size (mm)	Phase	Season	Trawl No.	Catch in No.		Speciemens in No.		Range of body length (ML:mm)		Mean length (mm)		L_{50} (mm)	SP (L_{75}-L_{25}: mm)	AIC
				Cod end	Covernet	Cod end	Covernet	Cod end	Covernet	Cod end	Covernet			
45	1	Warm	To-11	686	132	102	26	60 - 140	60 - 130	97	95	-	-	-
			To-48	199	94	100	94	50 - 200	10 - 30	90	28	-	-	-
			To-49	176	48	100	48	100 - 260	20 - 90	159	33	-	-	-
			To-63	147	87	100	87	50 - 150	30 - 90	83	61	66	18	30.746
			To-65	582	176	100	100	40 - 380	20 - 160	122	50	-	-	-
			To-73	259	102	100	100	80 - 340	20 - 170	164	50	-	-	-
			To-74	121	396	66	100	40 - 290	10 - 60	112	42	-	-	-
70	2	Cold	To-63	24	181	24	100	60 - 200	60 - 130	119	84	125	32	33.841
			To-68	40	136	40	100	40 - 380	20 - 130	118	76	120	49	45.861
		Warm	To-14	113	124	100	99	80 - 190	70 - 160	131	115	124	52	50.672
			To-55	43	18	43	18	70 - 150	80 - 130	109	100	84	46	26.006
			To-56	100	1,394	100	99	50 - 170	50 - 110	94	83	124	30	38.943
			To-59	128	850	98	100	50 - 130	40 - 100	100	74	102	18	67.998
			To-60	108	405	98	99	30 - 150	50 - 120	91	85	179	152	63.641
			To-62	81	929	81	100	50 - 170	50 - 130	91	72	138	52	63.482

Deep-water pink shrimp *Parapenaeus longirostris*

Mesh size (mm)	Phase	Season	Trawl No.	Catch in No.		Speciemens in No.		Range of body length (TL:mm)		Mean length (mm)		L_{50} (mm)	SP (L_{75}-L_{25}: mm)	AIC
				Cod end	Covernet	Cod end	Covernet	Cod end	Covernet	Cod end	Covernet			
45	1	Cold	To-12	354	444	102	95	80 - 130	50 - 110	100	83	95	15	50.452