Fishing village	AGADIR		PNBA		Position	N	20:36:61
Population	70					W	16:26:91
Fishermen	24	Imraguen					
No. of boats	7						
Type of boat	Lanche						
Length of boat	8.5	m					
No. of fishers/boat	4						

2001 Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Main fishig methods	C	C	C	C	C	C	L	L	I	I	I	C
Length in m	150	150	150	150	150	150			60	60	60	150
Net depth in m	5	5	5	5	5	5			1	1	1	5
Mesh size in cm	16	16	16	16	16	16			11	11	11	16
Target Species Water depth in m	3	3	3	3	3	3	5	5	2	2	2	3
1 Mugil cephalus	■								■	■	■	■
2 Mugil capurrii	■								■			
3 Liza aurata	■								■	■	■	■
4 Argyrosomus regius	■	■	■		■							■
5 Solea senegalensis				■	■							
6 Pagrus caeruleostictus												
7 Mustelus mustelus		■	■	■	■	■	■					
8 Pagellus bellottii												
9 Zeus faber												
10 Pseudupeneus prayensis												
11 Dentex canariensis												
12 Dentex angolensis												
13 Epinephelus aeneus					■	■	■	■				
14 Merluccius senegalensis												
15 Octopus vulgaris												
16 Sepia officinalis												
17 Loligo vulgaris												
18 Palnulirus regius												
19 Palinurus mauritanicus												
20 Penaeus notialis												
21 Parapenaeus longirostris												
22 Geryon (Chaceon) maritae												
23 Arius sp.												
24 Cynoglossus sp.					■							
25 Psettodes belcheri					■							
26 Ethmalosa fimbriata												
27 Sardinella aurita												
28 Paragaleus pectoralis												
29 Rhizoprionodon acutus		■	■	■	■	■						
30 Sphyrna lewini		■	■	■	■	■						
31 Rhinoptera marginata												
32 Rhinobatos cemiculus												
33 Dasyatis pastinaca												
34 Dasyatis marmorata												
35 Sparus aurata										■	■	
36 Diplodus sargus												
37 Other Sparidae												
38 Caranx rhonchus												
39 Plectorhinchus mediterraneus												
40 Sarotherodon melanotheron												
41 Pseudotolithus brachygnathus	■	■									■	■

Remark. C: Corbin net, L: Line, I: Imraguen net, S: Solea net

Fishing village	**TEN-ALLOUL** **PNBA** Position N 19:58:18
Population	**70** W 16:13:50
Fishermen	**30** **Imraguen**
No. of boats	**9**
Type of boat	**Lanche**
Length of boat	**9** **m**
No. of fishers/boat	**4**

2001 Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Main fishig methods	L	C	C	C	C	C	S	S	I	I	I	L
Length in m		400	400	400	400	400	100	100	60	60	60	
Net depth in m		2	2	2	2	2	1.5	1.5	1	1	1	
Mesh size in cm		20	20	20	20	20	8	8	11	11	11	
Target Species Water depth in m	7	6	7	7	6	6	7	7	2	2	2	7
1 Mugil cephalus									■	■	■	
2 Mugil capurrii			■	■	■							
3 Liza aurata												
4 Argyrosomus regius												
5 Solea senegalensis							■	■				
6 Pagrus caeruleostictus	■										■	■
7 Mustelus mustelus		■	■	■								
8 Pagellus bellottii												
9 Zeus faber												
10 Pseudupeneus prayensis												
11 Dentex canariensis	■										■	■
12 Dentex angolensis	■										■	■
13 Epinephelus aeneus	■										■	■
14 Merluccius senegalensis												
15 Octopus vulgaris												
16 Sepia officinalis												
17 Loligo vulgaris												
18 Palnulirus regius												
19 Palinurus mauritanicus												
20 Penaeus notialis												
21 Parapenaeus longirostris												
22 Geryon (Chaceon) maritae												
23 Arius sp.			■	■	■							
24 Cynoglossus sp.												
25 Psettodes belcheri												
26 Ethmalosa fimbriata												
27 Sardinella aurita												
28 Paragaleus pectoralis		■	■	■								
29 Rhizoprionodon acutus		■	■	■								
30 Sphyrna lewini		■	■	■								
31 Rhinoptera marginata												
32 Rhinobatos cemiculus												
33 Dasyatis pastinaca												
34 Dasyatis marmorata												
35 Sparus aurata												
36 Diplodus sargus												
37 Other Sparidae												
38 Caranx rhonchus												
39 Plectorhinchus mediterraneus												
40 Sarotherodon melanotheron												

Remark. C: Corbin net, L: Line, I: Imraguen net, S: Solea net

Fishing village	IWIK		PNBA	Position	N	19:53:02
Population	200				W	16:17:42
Fishermen	40	Imraguen				
No. of boats	16					
Type of boat	Lanche					
Length of boat	9	m				
No. of fishers/boat	4					

2001 Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Main fishig methods	C/L	C	C	C	C	C	C	C	M	M	M	C/L
Length in m	400	400	400	400	400	400	400	400	200	200	200	400
Net depth in m	2	2	2	2	2	2	2	2	6	6	6	2
Mesh size in cm	20	20	20	20	20	20	20	20	11	11	11	20
Target Species — Water depth in m	5	5	5	5	5	5	5	5	6	6	6	5
1 Mugil cephalus									■	■	■	
2 Mugil capurrii												
3 Liza aurata												
4 Argyrosomus regius	■											■
5 Solea senegalensis												
6 Pagrus caeruleostictus	■											■
7 Mustelus mustelus	■	■	■									
8 Pagellus bellottii												
9 Zeus faber												
10 Pseudupeneus prayensis												
11 Dentex canariensis												
12 Dentex angolensis	■											■
13 Epinephelus aeneus												■
14 Merluccius senegalensis												
15 Octopus vulgaris												
16 Sepia officinalis												
17 Loligo vulgaris												
18 Palinurus regius												
19 Palinurus mauritanicus												
20 Penaeus notialis												
21 Parapenaeus longirostris												
22 Geryon (Chaceon) maritae												
23 Arius sp.	■	■	■									■
24 Cynoglossus sp.												
25 Psettodes belcheri												
26 Ethmalosa fimbriata												
27 Sardinella aurita												
28 Paragaleus pectoralis												
29 Rhizoprionodon acutus	■	■	■									■
30 Sphyrna lewini	■	■	■									
31 Rhinoptera marginata	■	■	■									■
32 Rhinobatos cemiculus	■	■	■									■
33 Dasyatis pastinaca	■	■	■									
34 Dasyatis marmorata	■	■	■									
35 Sparus aurata	■	■	■								■	
36 Diplodus sargus	■	■	■									■
37 Other Sparidae	■	■	■									
38 Caranx rhonchus												
39 Plectorhinchus mediterraneus												
40 Sarotherodon melanotheron												

Remark. C: Corbin net, L: Line, I: Imraguen net, S: Solea net

Fishing village	**TEICHOTT**	**PNBA**	Position N 19:32:32
Population	**120**		W 16:24:78
Fishermen	**40** **Imraguen**		
No. of boats	**25**		
Type of boat	**Lanche**		
Length of boat	**8.5 m**		
No. of fishers/boat	**4**		

2001 Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Main fishig methods	C	C	C	C	C	C	C	S	S	I/L	I/L	I/L
Length in m	200	200	200	200	200	200	200	140	140	5	5	5
Net depth in m	2	2	2	2	2	2	2	2	2	1	1	1
Mesh size in cm	20	20	20	20	20	20	20	10	10	11	11	11
Target Species Water depth in m	10	10	10	10	10	10	10	5	5	2	2	2
1 Mugil cephalus										■	■	■
2 Mugil capurrii												
3 Liza aurata												
4 Argyrosomus regius												
5 Solea senegalensis												
6 Pagrus caeruleostictus											■	■
7 Mustlelus mustelus					■	■						
8 Pagellus bellottii												
9 Zeus faber												
10 Pseudupeneus prayensis												
11 Dentex canariensis												
12 Dentex angolensis												
13 Epinephelus aeneus												
14 Merluccius senegalensis												
15 Octopus vulgaris												
16 Sepia officinalis												
17 Loligo vulgaris												
18 Palnulirus regius												
19 Palinurus mauritanicus												
20 Penaeus notialis												
21 Parapenaeus longirostris												
22 Geryon (Chaceon) maritae												
23 Arius sp.			■	■	■	■						
24 Cynoglossus sp.								■	■			
25 Psettodes belcheri												
26 Ethmalosa fimbriata												
27 Sardinella aurita												
28 Paragaleus pectoralis				■	■	■						
29 Rhizoprionodon acutus				■	■	■						
30 Sphyrna lewini												
31 Rhinoptera marginata		■	■									
32 Rhinobatos cemiculus		■	■	■								
33 Dasyatis pastinaca		■	■									
34 Dasyatis marmorata	■	■										
35 Sparus aurata	■									■	■	■
36 Diplodus sargus	■									■	■	■
37 Other Sparidae	■									■	■	■
38 Caranx rhonchus												
39 Plectorhinchus mediterraneus												
40 Sarotherodon melanotheron										■	■	■

Remark. C: Corbin net, L: Line, I: Imraguen net, S: Solea net

Fishing village	R'GUEIBA	PNBA	Position	N	19:25:08
Population	51			W	16:28:01
Fishermen	12	Imraguen			
No. of boats	22				
Type of boat	Lanche				
Length of boat	8.5 m				
No. of fishers/boat	4				

2001 Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Main fishig methods	C	C	C	C	C	I	I	I	I	I	I	I
Length in m	200	200	200	200	200	6	6	6	6	6	6	6
Net depth in m	2	2	2	2	2	1	1	1	1	1	1	1
Mesh size in cm	20	20	20	20	20	11	11	11	11	11	11	11
Target Species Water depth in m	5	5	5	5	5	1	1	1	1	1	1	1
1 Mugil cephalus						■	■	■	■	■	■	■
2 Mugil capurrii												
3 Liza aurata												
4 Argyrosomus regius												
5 Solea senegalensis												
6 Pagrus caeruleostictus												
7 Mustlelus mustelus			■	■	■							
8 Pagellus bellottii												
9 Zeus faber												
10 Pseudupeneus prayensis												
11 Dentex canariensis												
12 Dentex angolensis												
13 Epinephelus aeneus												
14 Merluccius senegalensis												
15 Octopus vulgaris												
16 Sepia officinalis												
17 Loligo vulgaris												
18 Palnulirus regius												
19 Palinurus mauritanicus												
20 Penaeus notialis												
21 Parapenaeus longirostris												
22 Geryon (Chaceon) maritae												
23 Arius sp.	■	■	■	■	■							
24 Cynoglossus sp.												
25 Psettodes belcheri												
26 Ethmalosa fimbriata												
27 Sardinella aurita												
28 Paragaleus pectoralis				■	■							
29 Rhizoprionodon acutus				■	■							
30 Sphyrna lewini				■	■							
31 Rhinoptera marginata	■	■		■	■							
32 Rhinobatos cemiculus	■	■		■	■							
33 Dasyatis pastinaca				■	■							
34 Dasyatis marmorata				■	■							
35 Sparus aurata										■	■	■
36 Diplodus sargus										■	■	■
37 Other Sparidae										■	■	■
38 Caranx rhonchus												
39 Plectorhinchus mediterraneus												
40 Sarotherodon melanotheron						■	■	■	■	■	■	■

Remark. C: Corbin net, L: Line, I: Imraguen net, S: Solea net

Fishing village	**AWGEJ**		**PNBA**	Position	**N**	**19:23:34**
Population	**70**				**W**	**16:25:03**
Fishermen	**24**	**Imraguen**				
No. of boats	**6**					
Type of boat	**Lanche**					
Length of boat	**8.5**	**m**				
No. of fishers/boat	**4**					

2001 Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Main fishig methods	C	C	C			C	C	I	I	I	I	I
Length in m	200	200	200			200	200	200	200	200	200	200
Net depth in m	5	5	5			5	5	I	I	I	I	I
Mesh size in cm	16	16	16			16	16	11	11	11	11	11
Target Species Water depth in m	5	5	5			5	5	I	I	I	I	I
1 Mugil cephalus										█	█	█
2 Mugil capurrii												
3 Liza aurata												
4 Argyrosomus regius												
5 Solea senegalensis												
6 Pagrus caeruleostictus												
7 Mustlelus mustelus		█	█									
8 Pagellus bellottii												
9 Zeus faber												
10 Pseudupeneus prayensis												
11 Dentex canariensis												
12 Dentex angolensis												
13 Epinephelus aeneus												
14 Merluccius senegalensis												
15 Octopus vulgaris												
16 Sepia officinalis												
17 Loligo vulgaris												
18 Palinlirus regius												
19 Palinurus mauritanicus												
20 Penaeus notialis												
21 Parapenaeus longirostris												
22 Geryon (Chaceon) maritae												
23 Arius sp.	█	█	█									
24 Cynoglossus sp.												
25 Pseltodes belcheri												
26 Ethmalosa fimbriata												
27 Sardinella aurita												
28 Paragaleus pectoralis		█										
29 Rhizoprionodon acutus		█	█									
30 Sphyrna lewini		█	█									
31 Rhinoptera marginata												
32 Rhinobatos cemiculus												
33 Dasyatis pastinaca												
34 Dasyatis marmorata												
35 Sparus aurata	█	█	█									
36 Diplodus sargus	█	█	█									
37 Other Sparidae	█	█	█									
38 Caranx rhonchus												
39 Plectorhinchus mediterraneus												
40 Sarotherodon melanotheron						█	█	█				
41 Pseudutolithus brachygnathus	█	█										█

Remark. C: Corbin net, L: Line, I: Imraguen net, S: Solea net

Fishing village	MAMGHAR PNBA - NKC	Position	N	19:21:46
Population	500		W	16:30:54
Fishermen	105 Imraguen			
No. of boats	18			
Type of boat	FRP pirogue	40HP		
Length of boat	13 m			
No. of fishers/boat	3			

2001 Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Main fishig methods	C/M	C	C	C	C	C	C	C	C	C	C/M	C/M
Length in m	200	200	200	200	200	200	200	200	200	200	200	200
Net depth in m	6	6	6	6	6	6	6	6	6	6	6	6
Mesh size in cm	16	16	16	16	16	16	16	16	16	16	16	16
Target Species / Water depth in m	5	5	5	5	5	5	5	5	5	5	5	5
1 Mugil cephalus	■										■	■
2 Mugil capurrii												
3 Liza aurata												
4 Argyrosomus regius		■	■	■	■	■	■	■	■			
5 Solea senegalensis												
6 Pagrus caeruleostictus												
7 Mustelus mustelus		■	■	■	■	■	■	■	■			
8 Pagellus bellottii												
9 Zeus faber												
10 Pseudupeneus prayensis												
11 Dentex canariensis												
12 Dentex angolensis												
13 Epinephelus aeneus												
14 Merluccius senegalensis												
15 Octopus vulgaris												
16 Sepia officinalis												
17 Loligo vulgaris												
18 Palmulirus regius												
19 Palinurus mauritanicus												
20 Penaeus notialis												
21 Parapenaeus longirostris												
22 Geryon (Chaceon) maritae												
23 Arius sp.		■	■	■	■	■	■	■	■			
24 Cynoglossus sp.												
25 Psettodes belcheri												
26 Ethmalosa fimbriata												
27 Sardinella aurita				■	■							
28 Paragaleus pectoralis												
29 Rhizoprionodon acutus		■	■	■	■	■	■	■				
30 Sphyrna lewini		■	■	■	■	■	■	■				
31 Rhinoptera marginata			■	■	■	■						
32 Rhinobatos cemiculus			■	■	■	■						
33 Dasyatis pastinaca												
34 Dasyatis marmorata												
35 Sparus aurata												
36 Diplodus sargus				■	■							
37 Other Sparidae				■	■							
38 Caranx rhonchus												
39 Plectorhinchus mediterraneus												
40 Sarotherodon melanotheron												
41 Pseudotolithus brachygnathus	■	■	■								■	■

Remark. C: Corbin net, L: Line, I: Imraguen net, S: Solea net

Fishing village	**JREIF**	**PNBA - NKC**	Position	N	**19:16:12**
Population	**80**			W	**16:28:45**
Fishermen	**70**	**Senegalese fishermen**			
No. of boats	**42**				
Type of boat	**Wooden pirogue**		**40HP**		
Length of boat	**8.5 m**				
No. of fishers/boat	**2**				

2001 Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Main fishig methods	L	L	L	L	L	L	L	L	L	L	L	L
Length in m												
Net depth in m												
Mesh size in cm												
Target Species Water depth in m	10	10	10	10	10	10	10	10	10	10	10	10
1 Mugil cephalus												
2 Mugil capurrii												
3 Liza aurata												
4 Argyrosomus regius			■	■								
5 Solea senegalensis												
6 Pagrus caeruleostictus	■	■	■	■	■	■	■					■
7 Mustelus mustelus			■	■	■	■						
8 Pagellus bellottii												
9 Zeus faber												
10 Pseudupeneus prayensis												
11 Dentex canariensis	■	■	■	■								■
12 Dentex angolensis												
13 Epinephelus aeneus	■	■	■	■							■	■
14 Merluccius senegalensis												
15 Octopus vulgaris												
16 Sepia officinalis												
17 Loligo vulgaris												
18 Palnulirus regius												
19 Palinurus mauritanicus												
20 Penaeus notialis												
21 Parapenaeus longirostris												
22 Geryon (Chaceon) maritae												
23 Arius sp.	■	■	■	■	■	■	■	■	■	■	■	■
24 Cynoglossus sp.												
25 Psettodes belcheri												
26 Ethmalosa fimbriata	■	■	■	■							■	■
27 Sardinella aurita												
28 Paragaleus pectoralis												
29 Rhizoprionodon acutus			■	■	■	■						
30 Sphyrna lewini			■	■	■	■						
31 Rhinoptera marginata												
32 Rhinobatos cemiculus												
33 Dasyatis pastinaca												
34 Dasyatis marmorata												
35 Sparus aurata												
36 Diplodus sargus	■	■	■	■							■	■
37 Other Sparidae	■	■	■	■							■	■
38 Caranx rhonchus												
39 Plectorhinchus mediterraneus	■	■	■	■	■	■	■	■	■	■	■	■
40 Sarotherodon melanotheron												

Remark. C: Corbin net, L: Line, I: Imraguen net, S: Solea net

Fishing village	**MHAJARAT** **PNBA – NKC**	Position N	19:01:46
Population	**400**	W	16:13:56
Fishermen	**60** **Imraguen**		
No. of boats	**22**		
Type of boat	**FRP pirogue**	**40HP**	
Length of boat	**12** **m**		
No. of fishers/boat	**3**		

2001 Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Main fishig methods	M	M	C	C	C	T	T	C	C	M	M	M
Length in m	200	200	200	200	200	180	180	200	200	200	200	200
Net depth in m	2	2	5	5	5			5	5	2	2	2
Mesh size in cm	11	11	22	22	22			22	22	11	11	11
Target Species Water depth in m	5	5	5	5	5	10	10	5	5	5	5	5
1 Mugil cephalus	█	█	█	█						█	█	█
2 Mugil capurrii												
3 Liza aurata												
4 Argyrosomus regius			█	█	█							
5 Solea senegalensis				█	█	█						
6 Pagrus caeruleostictus												
7 Mustelus mustelus	█	█										█
8 Pagellus bellottii												
9 Zeus faber												
10 Pseudupeneus prayensis												
11 Dentex canariensis												
12 Dentex angolensis												
13 Epinephelus aeneus												
14 Merluccius senegalensis												
15 Octopus vulgaris						█	█	█			█	
16 Sepia officinalis												
17 Loligo vulgaris												
18 Palinulirus regius	█										█	█
19 Palinurus mauritanicus												
20 Penaeus notialis												
21 Parapenaeus longirostris												
22 Geryon (Chaceon) maritae												
23 Arius sp.		█	█	█		█		█	█	█		
24 Cynoglossus sp.				█	█	█						
25 Psettodes belcheri				█	█	█						
26 Ethmalosa fimbriata												
27 Sardinella aurita												
28 Paragaleus pectoralis												
29 Rhizoprionodon acutus	█	█									█	█
30 Sphyrna lewini	█	█									█	█
31 Rhinoptera marginata	█	█									█	█
32 Rhinobatos cemiculus	█	█									█	█
33 Dasyatis pastinaca												
34 Dasyatis marmorata												
35 Sparus aurata												
36 Diplodus sargus												
37 Other Sparidae												
38 Caranx rhonchus												
39 Plectorhinchus mediterraneus												
40 Sarotherodon melanotheron												

Remark. C: Corbin net, L: Line, I: Imraguen net, S: Solea net

Fishing village	**TIWILIT**	**PNBA - NKC**	Position N 18:52:36
Population	**100**		W 16:10:53
Fishermen	**30**	**Imraguen**	
No. of boats	**14**		
Type of boat	**FRP pirogue**		**40HP**
Length of boat	**12** m		
No. of fishers/boat	**4**		

2001 Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Main fishig methods	L	C	C	S	S	S	T/L	T/L	C	C	M	M
Length in m		200	200	60	60	60			200	200	200	200
Net depth in m		6	6	1	1	1			6	6	5	5
Mesh size in cm		20	20	10	10	10			20	20	12	12
Target Species Water depth in m	20	10	10	5	5	5	20	20	10	10	10	10
1 Mugil cephalus												
2 Mugil capurrii												
3 Liza aurata												
4 Argyrosomus regius												
5 Solea senegalensis												
6 Pagrus caeruleostictus												
7 Mustlelus mustelus												
8 Pagellus bellottii												
9 Zeus faber												
10 Pseudupeneus prayensis												
11 Dentex canariensis												
12 Dentex angolensis												
13 Epinephelus aeneus												
14 Merluccius senegalensis												
15 Octopus vulgaris												
16 Sepia officinalis												
17 Loligo vulgaris												
18 Palnulirus regius												
19 Palinurus mauritanicus												
20 Penaeus notialis												
21 Parapenaeus longirostris												
22 Geryon (Chaceon) maritae												
23 Arius sp.												
24 Cynoglossus sp.												
25 Psettodes belcheri												
26 Ethmalosa fimbriata												
27 Sardinella aurita												
28 Paragaleus pectoralis												
29 Rhizoprionodon acutus												
30 Sphyrna lewini												
31 Rhinoptera marginata												
32 Rhinobatos cemiculus												
33 Dasyatis pastinaca												
34 Dasyatis marmorata												
35 Sparus aurata												
36 Diplodus sargus												
37 Other Sparidae												
38 Caranx rhonchus												
39 Plectorhinchus mediterraneus												
40 Sarotherodon melanotheron												

Remark. C: Corbin net, L: Line, I: Imraguen net, S: Solea net

Fishing village	LEMCID	PNBA – NKC	Position N	18:41:19
Population	210		W	16:08:24
Fishermen	65	Imraguen		
No. of boats	12			
Type of boat	FRP pirogue		40HP	
Length of boat	12 m			
No. of fishers/boat	4			

2001 Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Main fishig methods	M	M	C	C	C/L	C/L	C	C	C	C	C	M
Length in m	200	200	200	200	200	200	200	200	200	200	200	200
Net depth in m	5	5	4	4	4	4	4	4	4	4	4	5
Mesh size in cm	11	11	12	12	12	12	12	12	12	12	12	11
Target Species Water depth in m	5	5	10	10	10	10	10	10	10	10	10	5
1 Mugil cephalus	■	■										■
2 Mugil capurrii												
3 Liza aurata												
4 Argyrosomus regius			■	■	■							
5 Solea senegalensis			■		■							
6 Pagrus caeruleostictus				■	■	■						
7 Mustelus mustelus				■	■	■						
8 Pagellus bellottii												
9 Zeus faber												
10 Pseudupeneus prayensis												
11 Dentex canariensis			■	■	■						■	■
12 Dentex angolensis												
13 Epinephelus aeneus											■	■
14 Merluccius senegalensis												
15 Octopus vulgaris						■	■				■	■
16 Sepia officinalis			■	■	■							
17 Loligo vulgaris												
18 Palnulirus regius	■										■	■
19 Palinurus mauritanicus												
20 Penaeus notialis												
21 Parapenaeus longirostris												
22 Geryon (Chaceon) maritae												
23 Arius sp.	■	■	■	■	■						■	■
24 Cynoglossus sp.			■	■	■							
25 Psettodes belcheri		■	■									
26 Ethmalosa fimbriata												
27 Sardinella aurita												
28 Paragaleus pectoralis				■	■	■						
29 Rhizoprionodon acutus				■	■	■						
30 Sphyrna lewini				■	■							
31 Rhinoptera marginata												
32 Rhinobatos cemiculus												
33 Dasyatis pastinaca												
34 Dasyatis marmorata												
35 Sparus aurata												
36 Diplodus sargus												
37 Other Sparidae												
38 Caranx rhonchus												
39 Plectorhinchus mediterraneus	■	■	■	■	■	■					■	■
40 Sarotherodon melanotheron												

Remark. C: Corbin net, L: Line, I: Imraguen net, S: Solea net

Fishing village	BLEWAKH PNBA - NKC	Position N 18:31:05
Population	400	W 16:04:20
Fishermen	90 Imraguen	
No. of boats	30	
Type of boat	FRP pirogue 40HP	
Length of boat	11 m	
No. of fishers/boat	4	

2001 Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Main fishig methods	C	C	C	C	C/L	C/L	L	L	C	C	C	C
Length in m	200	200	200	200	200	200			200	200	200	200
Net depth in m	2	2	2	2	2	2			2	2	2	2
Mesh size in cm	18	18	18	18	18	18			18	18	18	18
Target Species Water depth in m	6	6	6	6	6	6	15	15	6	6	6	6
1 Mugil cephalus	■										■	■
2 Mugil capurrii												
3 Liza aurata												
4 Argyrosomus regius		■	■	■	■							
5 Solea senegalensis		■		■								
6 Pagrus caeruleostictus		■	■	■	■	■	■	■				
7 Mustelus mustelus												
8 Pagellus bellottii												
9 Zeus faber												
10 Pseudupeneus prayensis												
11 Dentex canariensis		■	■	■	■	■	■	■				
12 Dentex angolensis												
13 Epinephelus aeneus		■	■	■	■	■	■	■				
14 Merluccius senegalensis												
15 Octopus vulgaris	■	■			■	■	■	■			■	■
16 Sepia officinalis					■	■	■	■				
17 Loligo vulgaris												
18 Palinurus regius	■										■	■
19 Palinurus mauritanicus												
20 Penaeus notialis												
21 Parapenaeus longirostris												
22 Geryon (Chaceon) maritae												
23 Arius sp.		■	■	■	■	■	■	■				
24 Cynoglossus sp.				■	■							
25 Psettodes belcheri												
26 Ethmalosa fimbriata												
27 Sardinella aurita												
28 Paragaleus pectoralis												
29 Rhizoprionodon acutus									■	■	■	
30 Sphyrna lewini									■	■	■	
31 Rhinoptera marginata												
32 Rhinobatos cemiculus												
33 Dasyatis pastinaca												
34 Dasyatis marmorata												
35 Sparus aurata												
36 Diplodus sargus												
37 Other Sparidae												
38 Caranx rhonchus												
39 Plectorhinchus mediterraneus												
40 Sarotherodon melanotheron												

Remark. C: Corbin net, L: Line, I: Imraguen net, S: Solea net

Fishing village	TARFAYA	MOVING CAMP	Position	N	18:50:29
Population	40			W	16:10:14
Fishermen	40	Mainly Mauritanian fishermen			
No. of boats	17				
Type of boat	wooden pirogue		40HP		
Length of boat	9 m				
No. of fishers/boat	5				

2001 Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Main fishig methods	S	S	S	S	S	T	T	T	S			
Length in m	20	20	20	20	20				20			
Net depth in m	15	15	15	15	15				15			
Mesh size in cm	12	12	12	12	12				12			
Target Species Water depth in m	10	10	10	10	10	20	20	20	10			
1 Mugil cephalus												
2 Mugil capurrii												
3 Liza aurata												
4 Argyrosomus regius												
5 Solea senegalensis	▓	▓	▓	▓	▓							
6 Pagrus caeruleostictus	▓	▓	▓	▓	▓							
7 Mustelus mustelus												
8 Pagellus bellottii												
9 Zeus faber												
10 Pseudupeneus prayensis												
11 Dentex canariensis												
12 Dentex angolensis												
13 Epinephelus aeneus												
14 Merluccius senegalensis												
15 Octopus vulgaris						▓	▓	▓				
16 Sepia officinalis		▓	▓									
17 Loligo vulgaris												
18 Palinulirus regius	▓	▓	▓	▓	▓							
19 Palinurus mauritanicus												
20 Penaeus notialis												
21 Parapenaeus longirostris												
22 Geryon (Chaceon) maritae												
23 Arius sp.	▓	▓	▓	▓	▓							
24 Cynoglossus sp.	▓	▓	▓	▓	▓							
25 Pseltodes belcheri	▓	▓	▓	▓	▓							
26 Ethmalosa fimbriata												
27 Sardinella aurita												
28 Paragaleus pectoralis												
29 Rhizoprionodon acutus												
30 Sphyrna lewini												
31 Rhinoptera marginata												
32 Rhinobatos cemiculus												
33 Dasyatis pastinaca												
34 Dasyatis marmorata												
35 Sparus aurata												
36 Diplodus sargus												
37 Other Sparidae												
38 Caranx rhonchus												
39 Plectorhinchus mediterraneus												
40 Sarotherodon melanotheron	▓	▓	▓	▓	▓							

Remark. C: Corbin net, L: Line, I: Imraguen net, S: Solea net

Fishing village	TAINITT	MOVING CAMP	Position N	18:35:03
Population	115		W	16:05:48
Fishermen	110	Mauritanian fishermen		
No. of boats	20			
Type of boat	FRP pirogue		40HP	
Length of boat	8 m			
No. of fishers/boat	4			

2001 Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Main fishig methods	S	S	S	S	S	S	S	S	T	T	T	S
Length in m	100	100	100	100	100	100	100	100				100
Net depth in m	5	5	5	5	5	5	5	5				5
Mesh size in cm	8	8	8	8	8	8	8	8				8
Target Species Water depth in m	8	8	8	8	8	8	8	8	10	10	10	8
1 Mugil cephalus												
2 Mugil capurrii												
3 Liza aurata												
4 Argyrosomus regius												
5 Solea senegalensis			■	■	■							
6 Pagrus caeruleostictus												
7 Mustelus mustelus				■	■							
8 Pagellus bellottii												
9 Zeus faber												
10 Pseudupeneus prayensis												
11 Dentex canariensis												
12 Dentex angolensis												
13 Epinephelus aeneus												
14 Merluccius senegalensis												
15 Octopus vulgaris						■	■	■	■	■	■	
16 Sepia officinalis				■	■							
17 Loligo vulgaris												
18 Palinurus regius												
19 Palinurus mauritanicus												
20 Penaeus notialis												
21 Parapenaeus longirostris												
22 Geryon (Chaceon) maritae												
23 Arius sp.	■	■	■	■	■	■	■	■				■
24 Cynoglossus sp.			■	■	■	■	■					
25 Psettodes belcheri					■	■						
26 Ethmalosa fimbriata												
27 Sardinella aurita												
28 Paragaleus pectoralis												
29 Rhizoprionodon acutus				■	■	■	■					
30 Sphyrna lewini												
31 Rhinoptera marginata												
32 Rhinobatos cemiculus												
33 Dasyatis pastinaca												
34 Dasyatis marmorata												
35 Sparus aurata												
36 Diplodus sargus												
37 Other Sparidae												
38 Caranx rhonchus												
39 Plectorhinchus mediterraneus	■	■	■	■	■	■	■					■
40 Sarotherodon melanotheron												

Remark. C: Corbin net, L: Line, I: Imraguen net, S: Solea net

Fishing village	**PK-28**	**MOVING CAMP**	Position N	**17:45:94**
Population	**160**	**Mauritanian fishermen**	W	**16:02:64**
Fishermen	**150**			
No. of boats	**50**			
Type of boat	**wooden pirogue**	**40HP**		
Length of boat	**8.5 m**			
No. of fishers/boat	**4**			

2001 Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Main fishig methods	S	S	S	S	S	S	S	L	L	L	S	S
Length in m	150	150	150	150	150	150	150				200	200
Net depth in m	1.5	1.5	1.5	1.5	1.5	1.5	1.5				5	5
Mesh size in cm	8	8	8	8	8	8	8				11	11
Target Species Water depth in m	10	10	10	10	10	10	10	20	20	20	10	10
1 Mugil cephalus	■										■	■
2 Mugil capurrii												
3 Liza aurata												
4 Argyrosomus regius								■	■	■		
5 Solea senegalensis					■	■						
6 Pagrus caeruleostictus					■	■						
7 Mustlelus mustelus	■	■	■								■	■
8 Pagellus bellottii												
9 Zeus faber												
10 Pseudupeneus prayensis												
11 Dentex canariensis					■	■						
12 Dentex angolensis					■	■						
13 Epinephelus aeneus					■	■						
14 Merluccius senegalensis												
15 Octopus vulgaris												
16 Sepia officinalis			■	■	■							
17 Loligo vulgaris												
18 Palnulirus regius	■	■	■	■							■	■
19 Palinurus mauritanicus												
20 Penaeus notialis												
21 Parapenaeus longirostris												
22 Geryon (Chaceon) maritae												
23 Arius sp.	■	■	■	■	■			■	■	■	■	■
24 Cynoglossus sp.					■	■						
25 Psettodes belcheri												
26 Ethmalosa fimbriata												
27 Sardinella aurita						■	■					
28 Paragaleus pectoralis												
29 Rhizoprionodon acutus	■	■	■								■	■
30 Sphyrna lewini	■	■	■								■	■
31 Rhinoptera marginata												
32 Rhinobatos cemiculus												
33 Dasyatis pastinaca												
34 Dasyatis marmorata												
35 Sparus aurata												
36 Diplodus sargus												
37 Other Sparidae					■	■						
38 Caranx rhonchus												
39 Plectorhinchus mediterraneus	■	■	■									
40 Sarotherodon melanotheron												
41 Cymbium sp.	■	■	■								■	■

Remark. C: Corbin net, L: Line, I: Imraguen net, S: Solea net

Fishing village	**PK-42**	**MOVING CAMP**	Position N	**17:41:04**
Population	**200**	**Senegalese fishermen**	W	**16:03:00**
Fishermen	**190**			
No. of boats	**46**			
Type of boat	**wooden pirogue**	**40HP**		
Length of boat	**8.5 m**			
No. of fishers/boat	**3**			

2001 Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Main fishig methods	S	S	S	S	S	S	S	S	S	L	L	L
Length in m	100	100	100	100	100	100	100	100	100			
Net depth in m	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5			
Mesh size in cm	10	10	10	10	10	10	10	10	10			
Target Species Water depth in m	25	25	10	10	10	10	10	10	10	25	25	25
1 Mugil cephalus	■	■									■	■
2 Mugil capurii												
3 Liza aurata												
4 Argyrosomus regius												
5 Solea senegalensis				■	■	■						
6 Sparus coeruleostictus			■	■					■	■		
7 Mustelus mustelus										■	■	
8 Pagellus ballotti												
9 Zeus faber												
10 Pseudupeneus prayensis												
11 Dentex canariensis									■	■		
12 Dentex angolensis												
13 Epinephelus aeneus										■	■	
14 Merluccius senegalensis												
15 Octopus vulgaris												
16 Sepia officinalis					■						■	■
17 Loligo vulgaris												
18 Palinurus regius			■	■						■	■	
19 Palinurus mauritanicus												
20 Penaeus notiaris												
21 Parapenaeus longirostris												
22 Gerryon maritae												
23 Arius sp.	■	■	■			■						
24 Cynoglossus sp.			■	■	■	■						
25 Psettodas belcheri												
26 Ethmalosa fimbriata												
27 Sardinella aurita				■	■	■	■					
28 Paragaleus pectoralis												
29 Rhizoprionodon acutus			■	■	■	■						
30 Sphyrina lewini			■	■	■							
31 Rhinoptera marginata												
32 Rhinobatos cemiculus												
33 Dasyatis pastinaca												
34 Dasyatis marmorata												
35 Sparus aurata												
36 Diplodus sargus												
37 Autres Sparidae									■	■		
38 Caranx rhonchus					■	■	■	■	■	■		
39 Plectorhynchus mediterraneus												
40 Sarotherodon melanotheron												
41 Cymbium sp.	■	■	■	■	■	■						

Remark. C: Corbin net, L: Line, I: Imraguen net, S: Solea net

Fishing village	PK-65	MOVING CAMP	Position	N	17:31:12
Population	60	Fishermen mainry from D'Niago		W	16:04:52
Fishermen	55				
No. of boats	13				
Type of boat	wooden pirogue	40HP			
Length of boat	10 m				
No. of fishers/boat	4				

2001 Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Main fishig methods	C	C	C	C/L	C/L	C/L	C	C	S	S	S	S
Length in m	100	100	100	100	100	100	100	100	60	60	60	60
Net depth in m	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	1.5	1.5	1.5	1.5
Mesh size in cm	8	8	8	8	8	8	8	8	10	10	10	10
Target Species / Water depth in m	20	20	20	20	20	20	20	20	20	20	20	20
1 Mugil cephalus												
2 Mugil capurrii												
3 Liza aurata												
4 Argyrosomus regius												
5 Solea senegalensis									▓	▓	▓	▓
6 Pagrus caeruleostictus				▓	▓	▓						
7 Mustelus mustelus				▓	▓							
8 Pagellus bellottii												
9 Zeus faber												
10 Pseudupeneus prayensis												
11 Dentex canariensis				▓	▓	▓						
12 Dentex angolensis				▓								
13 Epinephelus aeneus				▓	▓	▓						
14 Merluccius senegalensis												
15 Octopus vulgaris												
16 Sepia officinalis												
17 Loligo vulgaris												
18 Palnulirus regius											▓	▓
19 Palinurus mauritanicus												
20 Penaeus notialis												
21 Parapenaeus longirostris												
22 Geryon (Chaceon) maritae												
23 Arius sp.	▓	▓							▓	▓	▓	▓
24 Cynoglossus sp.									▓	▓	▓	▓
25 Psettodes belcheri										▓	▓	▓
26 Ethmalosa fimbriata												
27 Sardinella aurita				▓	▓	▓	▓	▓				
28 Paragaleus pectoralis												
29 Rhizoprionodon acutus	▓	▓	▓	▓	▓	▓			▓	▓	▓	▓
30 Sphyrna lewini		▓	▓	▓	▓	▓	▓					
31 Rhinoptera marginata												
32 Rhinobatos cemiculus												
33 Dasyatis pastinaca												
34 Dasyatis marmorata												
35 Sparus aurata												
36 Diplodus sargus												
37 Other Sparidae			▓	▓	▓	▓	▓					
38 Caranx rhonchus				▓	▓	▓						
39 Plectorhinchus mediterraneus	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓	▓
40 Sarotherodon melanotheron												
41 Cymbium sp.	▓	▓						▓	▓	▓	▓	▓

Remark. C: Corbin net, L: Line, I: Imraguen net, S: Solea net

Fishing village	**PK-93**	**MOVING CAMP** Position N	17:10:44
Population	**250**	*Senegalese fishermen* W	16:12:50
Fishermen	**240**		
No. of boats	**65**		
Type of boat	**wooden pirogue**	*40HP*	
Length of boat	**10** m		
No. of fishers/boat	**4**		

2001 Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Main fishig methods	S	S	S	S	S	S	S	S	S			
Length in m	100	100	100	100	100	100	100	100	100			
Net depth in m	5	5	5	5	5	5	5	5	5			
Mesh size in cm	8	8	8	8	8	8	8	8	8			
Target Species — Water depth in m	25	25	25	25	25	25	25	25	25			
1 *Mugil cephalus*												
2 *Mugil capurrii*												
3 *Liza aurata*												
4 *Argyrosomus regius*					■	■						
5 *Solea senegalensis*		■	■	■	■	■	■					
6 *Pagrus caeruleostictus*												
7 *Mustlelus mustelus*					■	■						
8 *Pagellus bellottii*												
9 *Zeus faber*												
10 *Pseudupeneus prayensis*												
11 *Dentex canariensis*												
12 *Dentex angolensis*												
13 *Epinephelus aeneus*												
14 *Merluccius senegalensis*												
15 *Octopus vulgaris*												
16 *Sepia officinalis*					■	■						
17 *Loligo vulgaris*												
18 *Palnulirus regius*					■	■						
19 *Palinurus mauritanicus*												
20 *Penaeus notialis*												
21 *Parapenaeus longirostris*												
22 *Geryon (Chaceon) maritae*												
23 *Arius sp.*	■	■	■	■	■	■	■	■				
24 *Cynoglossus sp.*		■	■	■	■	■	■	■				
25 *Psettodes belcheri*												
26 *Ethmalosa fimbriata*												
27 *Sardinella aurita*				■	■	■	■					
28 *Paragaleus pectoralis*												
29 *Rhizoprionodon acutus*				■	■	■						
30 *Sphyrna lewini*												
31 *Rhinoptera marginata*												
32 *Rhinobatos cemiculus*												
33 *Dasyatis pastinaca*												
34 *Dasyatis marmorata*												
35 *Sparus aurata*												
36 *Diplodus sargus*												
37 Other Sparidae												
38 *Caranx rhonchus*				■	■	■	■					
39 *Plectorhinchus mediterraneus*			■	■	■	■	■					
40 *Sarotherodon melanotheron*												
41 *Cymbium sp.*	■	■	■	■	■	■	■	■				

Remark. C: Corbin net, L: Line, I: Imraguen net, S: Solea net

Fishing village	PK-140	MOVING CAMP	Position	N	16:58:21
Population	80	Senegalese fishermen		W	16:18:03
Fishermen	80				
No. of boats	30				
Type of boat	wooden pirogue	40HP			
Length of boat	10 m				
No. of fishers/boat	4				

2001 Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Main fishig methods	M	S	L	L	L	L	S	S	S	S	M	M
Length in m	80	100					100	100	100	100	80	80
Net depth in m	2	1.4					1.4	1.4	1.4	1.4	2	2
Mesh size in cm	10	9					9	9	9	9	10	10
Target Species — Water depth in m	20	20	25	25	25	25	20	20	20	20	20	20
1 Mugil cephalus	■										■	■
2 Mugil capurrii												
3 Liza aurata												
4 Argyrosomus regius			■	■	■	■						
5 Solea senegalensis			■	■		■						
6 Pagrus caeruleostictus				■	■	■						
7 Mustelus mustelus			■			■						
8 Pagellus bellottii												
9 Zeus faber												
10 Pseudupeneus prayensis				■								
11 Dentex canariensis			■	■								
12 Dentex angolensis												
13 Epinephelus aeneus	■	■	■	■	■	■	■	■	■	■	■	■
14 Merluccius senegalensis												
15 Octopus vulgaris												
16 Sepia officinalis			■	■								
17 Loligo vulgaris												
18 Palnulirus regius							■	■	■	■		
19 Palinurus mauritanicus												
20 Penaeus notialis												
21 Parapenaeus longirostris												
22 Geryon (Chaceon) maritae												
23 Arius sp.	■	■	■	■	■	■	■	■	■	■	■	■
24 Cynoglossus sp.			■	■								
25 Psettodes belcheri												
26 Ethmalosa fimbriata												
27 Sardinella aurita												
28 Paragaleus pectoralis												
29 Rhizoprionodon acutus			■	■	■							
30 Sphyrna lewini				■	■							
31 Rhinoptera marginata			■	■	■							
32 Rhinobatos cemiculus												
33 Dasyatis pastinaca												
34 Dasyatis marmorata												
35 Sparus aurata												
36 Diplodus sargus												
37 Other Sparidae												
38 Caranx rhonchus			■	■	■							
39 Plectorhinchus mediterraneus	■	■	■	■	■	■	■	■	■	■	■	■
40 Sarotherodon melanotheron	■						■	■	■	■	■	■
41 Cymbium sp.	■	■					■	■	■	■	■	■

Remark. C: Corbin net, L: Line, I: Imraguen net, S: Solea net

Fishing village	**NOUADHIBOU**	Position N 20:54:78
Population	-	W 17:02:51
Fishermen	**3,500** Fishermen mainly from N'Diago	
No. of boats	**1,200**	
Type of boat	**pirogue** 40HP	
Length of boat	**9** m	
No. of fishers/boat	**4**	

2001 Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Main fishig methods	T	C	C	C	C	C	T	T	S	S	T	T
Length in m		200	200	200	200	200			20	20		
Net depth in m		5	5	5	5	5			15	15		
Mesh size in cm		20	20	20	20	20			12	12		
Target Species — Water depth in m	20	10	10	10	10	10	20	20	20	20	20	20
1 Mugil cephalus	■	■									■	■
2 Mugil capurrii	■	■									■	■
3 Liza aurata												
4 Argyrosomus regius		■	■	■	■							
5 Solea senegalensis							■	■		■		
6 Pagrus caeruleostictus									■	■	■	
7 Mustelus mustelus						■	■	■	■			
8 Pagellus bellottii												
9 Zeus faber												
10 Pseudupeneus prayensis												
11 Dentex canariensis										■	■	
12 Dentex angolensis												
13 Epinephelus aeneus										■	■	
14 Merluccius senegalensis												
15 Octopus vulgaris	■						■	■			■	
16 Sepia officinalis												
17 Loligo vulgaris												
18 Palnulirus regius	■	■	■	■	■	■	■	■	■	■	■	■
19 Palinurus mauritanicus												
20 Penaeus notialis												
21 Parapenaeus longirostris												
22 Geryon (Chaceon) maritae												
23 Arius sp.								■	■			
24 Cynoglossus sp.								■	■			
25 Psettodes belcheri								■	■			
26 Ethmalosa fimbriata												
27 Sardinella aurita												
28 Paragaleus pectoralis							■	■	■	■		
29 Rhizoprionodon acutus							■	■	■			
30 Sphyrna lewini							■	■	■			
31 Rhinoptera marginata												
32 Rhinobatos cemiculus												
33 Dasyatis pastinaca												
34 Dasyatis marmorata												
35 Sparus aurata										■	■	■
36 Diplodus sargus									■	■	■	
37 Other Sparidae												
38 Caranx rhonchus												
39 Plectorhinchus mediterraneus								■	■	■	■	
40 Sarotherodon melanotheron												
41 Umbrina canariensis									■	■		
42 Sciaena umbra									■	■		

Remark. C: Corbin net, L: Line, I: Imraguen net, S: Solea net

Fishing village	**NOUAKCHOTT**	Position N	18:06:32
Population	-	W	16:01:37
Fishermen	3500	Fishermen from N'Diago and Senegal	
No. of boats	700		
Type of boat	**wooden pirogue**	**40-90 HP**	
Length of boat	9-18m		
No. of fishers/boat	3-12		

2001 Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Main fishig methods	M	C	L	L	L	P	P	P	P	M	M	M
Length in m	400	200				800	800	800	800	400	400	400
Net depth in m	4	5				4	4	4	4	4	4	4
Mesh size in cm	4	16				2.5	2.5	2.5	2.5	4	4	4
Target Species Water depth in m	15	10	25	25	25	20	20	20	20	15	15	15
1 Mugil cephalus	■									■	■	
2 Mugil capurrii		■	■	■								
3 Liza aurata												
4 Argyrosomus regius	■	■	■	■	■							
5 Solea senegalensis											■	■
6 Pagrus caeruleostictus			■	■	■	■	■	■	■	■		
7 Mustlelus mustelus												
8 Pagellus bellottii			■	■	■	■	■	■	■	■		
9 Zeus faber												
10 Pseudupeneus prayensis				■	■							
11 Dentex canariensis			■	■	■							
12 Dentex angolensis												
13 Epinephelus aeneus			■	■	■							
14 Merluccius senegalensis												
15 Octopus vulgaris							■	■			■	■
16 Sepia officinalis			■	■	■							
17 Loligo vulgaris												
18 Palnulirus regius											■	■
19 Palinurus mauritanicus												
20 Penaeus notialis												
21 Parapenaeus longirostris												
22 Geryon (Chaceon) maritae												
23 Arius sp.												
24 Cynoglossus sp.											■	■
25 Psettodes belcheri												
26 Ethmalosa fimbriata	■	■	■	■	■	■	■	■	■	■		
27 Sardinella aurita	■	■	■	■	■	■	■	■	■	■		
28 Paragaleus pectoralis												
29 Rhizoprionodon acutus												
30 Sphyrna lewini												
31 Rhinoptera marginata												
32 Rhinobatos cemiculus												
33 Dasyatis pastinaca												
34 Dasyatis marmorata												
35 Sparus aurata												
36 Diplodus sargus												
37 Other Sparidae			■	■	■	■						
38 Caranx rhonchus												
39 Plectorhinchus mediterraneus												
40 Sarotherodon melanotheron												
41 Pomatomus saltator						■	■	■				

Remark. C: Corbin net, L: Line, I: Imraguen net, S: Solea net

9. RECOMMENDATIONS FOR RESOURCES MANAGEMENT

With the proposal of recommendations for resources management as its final objective, this study conducted various surveys (see Chapters 2 - 8). Based on the results of these surveys, this chapter mainly considers and discusses about management of demersal fishery resources that allow sustainable development of fisheries, to be implemented from now on.

9.1 Background and reason of resources management

9.1.1 International background for resources management

Articles 61 (Conservation of living resources) and 62 (Utilization of living resources) of the United Nations Convention on the Law of the Sea call for the rational utilization of resources by coastal countries (UN, 1982).

Article 61 Conservation of the living resources

1. *The coastal State shall determine the allowable catch of the living resources in its exclusive economic zone.*

2. *The coastal State, taking into account the best scientific evidence available to it, shall ensure through proper conservation and management measures that the maintenance of the living resources in the exclusive economic zone is not endangered by over-exploitation. (continues)*

Article 62 Utilization of the living resources

1. *The coastal State shall promote the objective of optimum utilization of the living resources in the exclusive economic zone without prejudice to article 61.*

2. *The coastal State shall determine its capacity to harvest the living resources of the exclusive economic zone. (continues)*

The IRM works under the regime after declared a 200 miles Exclusive Economic Zone in 1978. The DEARH/MPEM of the IRM summoned fisheries personnel from both the governmental and private sectors to organize a discussion of the FAO "Code of Conduct for Responsible Fisheries" in the Capital city of NKC in March 2000. So the IRM is paying much attention to the international stances on resources management and recognizes the necessity of a rational utilization of its resources.

9.1.2 The need to reinforce resources management in the IRM

In the IRM, fisheries occupy a very high position in the domestic economy. In 1997, they represented 52% of all export and 27% of the National Treasury foreign exchange revenue, according to the "Strategy of Management and Development of the Fisheries and Maritime Economy Sectors" (MPEM, 1998). The value of fishery product exports in 2000 reached 35,442 million UMs. In this year, 26,500 tonnes of cephalopods and 15,500 tonnes of demersal fishes (in product weight) were exported. The principal export markets are Japan and EU countries. Counting the indirect jobs, the fisheries sector employs some 30,000

persons. Considering the dependency ratio, it can be concluded that over 80,000 people depend directly or indirectly on the fisheries sector for their subsistence (Chapter 8. 1). Also, there are great expectations on the fisheries industry as a sector that could generate employment, fight poverty and secure food provision for the population.

However high might be the national expectations on fisheries as mentioned above, the fluctuations in catch of high-value demersal species have in general pointed to a declining trend in recent years. According to officially published statistics (ONS, 2001), the production of industrial fishing vessels (both ice storage and freezer trawlers) registered in Mauritania, which claim most of the demersal fish catches, dropped from 61,900 tonnes in 1986 to 21,943 tonnes in 2000, a decrease of one-third. Of these, the important octopus catches have been dwindling in recent years, and the 4th Working Group of the CNROP attributes this decline in CPUE (Catch per Unit Effort) to the decrease in the octopus stock (Gascuel in FAO, 1999). Thus the decline of demersal fishery resources, particularly the octopus, is regarded as critical for such an important export item for the IRM.

In a donors' round-table meeting in the Capital of the IRM in June 1998, the MPEM launched its "Strategy of Management and Development of the Fisheries and Maritime Economy Sector". This document presented development plans and simultaneously explained the official measure on fisheries management, and various management policies have been implemented based on its guidelines. It also stated that fishing effort should be compatible with Allowable Biological Catch (ABC), and be subjected to periodical revision.

9.2 Diagnosis of the status of demersal species resources

In this study, a four-stage resources surveys with a bottom trawl were conducted, and the stock size of demersal species was assessed (see Chapter 3). To begin with, by utilizing a 20 mm mesh-size cover-net, which allowed the inclusion of small individuals normally not caught, the total stock size including the future recruitment was estimated. The estimated total stock size was 117,748 tonnes in the cold season and 199,783 tonnes in the warm season of 2000, and 352,567 tonnes in the cold season and 402,594 tonnes in the warm season of 2001 (Chapter 3, Table 3.20). After being converted to catchable stock size for industrial trawlers that utilize cod-end of 70 mm net, the respective values were 72,180 tonnes, 120,689 tonnes, 282,621 tonnes and 264,983 tonnes (Chapter 5, Table 5.4). The low values for the cold and warm seasons of 2000 can be explained mainly by the absence of shallow water surveys by the *Al-Awam*.

Realizing the importance of resources surveys in transitional period between seasons, the CNROP conducted three resources surveys on its own in the transitional periods in 2000 and 2001. Since the cold and warm seasons surveys and those transitional period surveys were compatible in terms of their basic methods, it was feasible to utilize the results of all seven series of surveys. In each series of survey, adjustments were made so as to standardize to a 45 mm mesh for cod-end, and it was possible to compute the stock size at 20 - 200 m strata. The total stock size thus estimated was, for each successive survey, respectively, 66,426 tonnes, 84,889 tonnes, 75,255 tonnes and 92,204 tonnes (all in 2000), then 43,327 tonnes, (no survey in July),

84,247 tonnes and 67,254 tonnes (all in 2001) (see Table 5.7). The coefficient of variation for total stock size in each of the seven surveys indicated those estimates to be of good accuracy.

The fishing rate, being regarded as the ratio of fisheries-caught quantities and the catchable stock size, was tentatively calculated. For this occasion, the fishing efficiency of the trawl gear used in the surveys was postulated as 1.0. Catch of industrial fisheries was taken from the official statistics. In the years 2000 and 2001, the fishing rate of industrial fisheries was at least 27% and 29% respectively. The value can be higher if the incidental catch by pelagic fisheries is included. Although some questions remained about the accuracy of catch estimation, it was concluded that, on the whole, the exploitation of demersal fishery resources by industrial fisheries has advanced to a high degree (Chapter 5).

At the 3 - 20 m stratum, thought to be the fishing zone of artisanal fisheries, the mean value of catchable stock size in the cold and warm seasons in 2001 was about 200,000 tonnes, about three times that of the offshore area. If the production of artisanal fisheries in 2001 is presumed to be the same as that in 2000, that is 20,000 tonnes, and that production was entirely made up of demersal species, the fishing rate of artisanal fishery over the demersal stock would be less than 10%, a very low value (Chapter 5).

It was impossible to obtain standardized fishing effort data of both industrial and artisanal fisheries. Then, the numbers of fishing vessels targeting demersal species (ice storage and freezer trawlers in the industrial fishery and boats in artisanal fishery) were used as indicators of the fishing effort exerted by the fishing fleet. Then so-called CPUEs were calculated using the catch amount and numbers of fishing vessels or boats. Those CPUE data from 1986 to 2000 pointed to a decrease (Chapter 5, Figure 5.13). Some of the figures on which those calculations were based may be questionable, but the fact that the CPUEs of both type of fisheries targeting demersal species stocks had exhibited a declining trend over time was confirmed. By means of a similar method, the Overseas Fisheries Cooperation Foundation (1998) also indicated a continuous, long-term trend of decline.

The CPUE of artisanal fisheries follows a long-term tendency toward decline (Chapter 5). In particular, artisanal fisheries aim at demersal species in the vicinity of large cities, that means big markets in the background, concentrate their small fishing boat fleet in nearby waters. The Fourth Working Group of CNROP recognized that those stocks are being either fully or excessively exploited (FAO, 1999). The recent decrease in the catch of major species groups in spite of the sharp increase of boats for artisanal fisheries was thought to support above observation. On the other hand, the fishing rate calculated from the results of the resources survey deemed low, which suggested that potential stock size in the coastal area was not small in all Mauritanian territorial waters (Chapter 5), but indicated the room for further exploitation.

The present resources survey indicates a decline of the estimated stock size of the common octopus in various areas (Table 9.1). The fishing efficiency of the trawl gear utilized in this survey was low in catching organisms that hide in the sea floor like the common octopus, as it was designed with the main objective of capturing demersal fin-fishes over the continental shelf in a balanced way. However, the same gear and methodology were adopted in all the tow in

this survey, and their relative stock size is meaningful. The one-year interval for comparison is short, but if this decrease is indeed a fairly accurate reflection of the decrease of the stock size of the octopus, then the stock is in a significant situation.

Table 9.1 Estimated stock size of the common octopus *Octopus vulgaris* by survey (in tonnes).

Sub area	Phase 1 (2000)		Phase 2 (2001)	
	Cold season	Warm season	Cold season	Warm season
North	1,415*	2,355*	607**	1,825
Central	3,777*	2,157	1,614	861
South	2,420*	1,761	1,132	804
TOTAL	7,612	6,274	3,352	3,521

Remarks.   *: Stock size at the 3 - 20 m stratum is not established.
            **: Stock size at the 200 - 400 m stratum is not established.

The trawl gear used in this survey was primarily destined for demersal fishes, and therefore its fishing efficiency in capturing octopus was low. Hence, the values above are relative and are underestimated.

Results of the research conducted by the CNROP Fourth Working Group on the long-term variation in octopus stock size have been published (FAO, 1999). According to those, at an early stage, the octopus stock size un-affected by fisheries pressure was estimated at 570,000 tonnes (confidence limits 500,000 - 800,000 tonnes), and the estimated stock size for 1998 was 90,000 tonnes. Even considering some eventual estimation errors, it is clear that the octopus stock suffered a heavy decline as it used to be quite abundant.

When the above results are added up, we must conclude that the stocks of cephalopods (particularly the common octopus) and demersal fish species are decreasing side by side and simultaneously. In particular, the decline of octopus stocks was so drastic one could infer a strong possibility of some degree of overexploitation. On the other hand, as for the stocks of demersal fishes in shallow waters targeted by artisanal fisheries, it is estimated that, except for the vicinities of large cities, there is still some room left for exploitation.

In this section, diagnoses of the status of demersal stocks were made utilizing the result of the survey and all available information. Estimated stock size by target species, the quantity of production, available biological information useful for the evaluation, and the management measures proposed for each species were compiled for important species (Table 9.2). The table also indicates under exploited species that could substitute the catch of regulated species.

Table 9.2 Synopsis of biology, status of stock and necessary management of target species (A) and a list of unutilized and unexploited species (B) as determined through the cold and warm seasons surveys by *Al-Awam* in 2001.

(A) Target species

Species	Survey season[1]	Horizontal[2] N	C	S	Vertical Depth (m)	Estimated stock size[3] (Catchable)	Annual production[4] (2000)	Important biological features	Current status of stocks	Recommendations	Remarks
Smooth-hound	2C	©	O	O	12 - 34	4,572	-	Reproduce in shallow waters of the north area in warm season. Shoreward migration in cold season.	unknown	-	lack of catch statistics
Mustelus mustelus	2W	©		O	12 - 97	17,947					
Senegalese hake	2C	©	O	O	27 - 333	2,350	11,766	Spawn in a long period including the cold season in the central-south area. Migrate deeper in warm season.	Probably under exploited	Control the effort awaiting more precise evaluations	Possibility of confusing two species; statistics by species is necessary
Merluccius senegalensis	2W	©	O	O	91 - 330	1,580					
Benguela hake	2C	O	©	O	37 - 333	3,493		Spawn in winter. Migrate deeper in warm season.			
Merluccius polli	2W	O	O	O	93 - 330	10,115					
John dory	2C	O	O	O	15 - 171	1,405	-	Spawn April-June in Mauritania[5], December-February and May in Senegal[6]. Migrate deeper in the warm season.	unknown	-	lack of catch and effort statistics by species
Zeus faber	2W	©	O	O	34 - 256	424					
White grouper	2C	O	©	O	9 - 22	156	-	North-south migrations. Smaller individuals found only in shallow waters in the south.	Over exploited locally	Disperse fishing effort not to concentrate	lack of catch and effort statistics by species
Epinephelus aeneus	2W	©	O	O	9 - 42	446					
Meagre	2C	O	O	O	10 - 33	1,193	-	Spawn in the north Mar.-June, migrate south for feeding[7]	unknown	-	lack of catch and effort statistics by species
Argyrosomus regius	2W	O	©	O	6 - 73	381					
West African goatfish	2C	O	©	O	6 - 84	2,369	-	Shoreward migration in the cold season.	unknown	-	lack of catch and effort statistics by species
Pseudupeneus prayensis	2W	O	©	O	8 - 91	1,395					
Bluespotted seabream	2C	O	O	O	6 - 84	6,237		Probably more than two spawning seasons a year. Found mostly in shallow waters.	unknown	-	lack of catch and effort statistics by species
Pagrus caeruleostictus	2W	©	O	O	6 - 39	28,853					
Angola dentex	2C			©	171	8		Spawning season long or has two peaks. Distribution sporadic.	unknown	-	lack of catch and effort statistics by species
Dentex angolensis	2W		©		141 - 152	8	1,368				
Canary dentex	2C	©	O	O	6 - 84	2,759		Mostly found in shallow waters in the north	unknown	-	lack of catch and effort statistics by species
Dentex canariensis	2W	©	O	O	8 - 69	982					
Red pandora	2C	O	O	©	6 - 93	5,531		Spawning season long or has two peaks. Seasonal migration[7].	unknown	-	lack of catch and effort statistics by species
Pagellus bellotti	2W	O	O	O	6 - 73	8,706					
Leaping African mullet	2C			©	11 - 91	45	-	-	unknown	-	Stock size under estimated
Mugil capurrii	2W				-						
Flathead grey mullet	2C		©	O	10 - 15	98	-	-	unknown	-	Stock size under estimated
Mugil cephalus	2W	©			34	19					
Senegalese sole	2C	©	O		7 - 27	70	-	Found only in shallow waters.	unknown	-	Stock size underestimated
Solea senegalensis	2W	©			6 - 37	8					
European squid	2C	O	O	O	6 - 84	908	3,338	Neritic distribution. Shoreward migration for spawning in the cold season[8].	Probably fully to over exploited	-	Biological studies needed
Loligo vulgaris	2W	©	O	O	12 - 134	586					
Common cuttlefish	2C	O	O	O	5 - 27	1,454	4,694	Occur in less than 80m deep. North-south migration.	Probably fully to over exploited	Control the effort	Biological studies needed
Sepia officinalis	2W	O	O	O	6 - 66	655					
Common octopus	2C	O	O	O	6 - 249	2,760	22,234	Three areas of heavy concentration observed. Presence of two hereditary independent cohorts suggested[9].	Over exploitation	Decrease the fishing effort and not increase the catch of the young	Stock size underestimated
Octopus vulgaris	2W	O	O	O	8 - 317	2,447					
Southern pink shrimp	2C	©	O	O	6 - 53	52	1,161	Occur in shallow waters less than 80m deep.	unknown	-	Stock size underestimated
Penaeus notialis	2W	©	O	O	6 - 53	16					
Deep-water pink shrimp	2C	O	O	©	71 - 333	60	1,630	Distributed 200-400 m deep mainly.	unknown	-	Stock size underestimated
Parapenaeus longirostris	2W	O	©	O	55 - 330	16					
Pink spiny lobster	2C			©	333	22	-	-	unknown	-	Stock size underestimated
Palinurus mauritanicus	2W	©			256 - 317	16					
Green spiny lobster	2C			©	19	2	4	-	unknown	-	Stock size underestimated
Panulirus regius	2W	©		O	14 - 15	99					

Remarks 1) 2C: phase 2 cold season, 2W: phase2 warm season, 2) N: Northern area, C: Central area, S: Southern area, 3) Estimated stock size in tonnes by 70 mm cod end
4) Production in tonnes (chapter 5, 5.3.3), 5) Josse and Garcia (1986), 6) Domain (1980), 7) Dan et al. (1991), 8) Diz and Inejih (1991), 9) Inejih (2001)
- : data not available, O: Occurred, ©: Occurrence of more than 50%.

Table 9.2 continued.

(B) Unutilized and unexploited species

Species	Survey season[1]	Distribution				Estimated stock size[3] (include recruitment)	Trend of fishery resources				
		Horizontal[2]			Vertical		Annual production[4] (2000)	Important biological features	Current status of stocks	Recommendations	Remarks
		N	C	S	Depth (m)						
Shortnose greeneye	2C	O	◎	O	72 - 333	8,176	Unknown; probably negligible among incidental catches and discarded	unknown	Neglected and unutilized	Encourage fishery to increase the catch Develop method to increase commercial value	Most species have potential of commercial value; need to try increasing local consumption
Chlorophthalmus agassizi	2W	O	O	O	91 - 330	7,199					
Blackbelly rosefish	2C	◎	◎	O	98 - 333	16,652					
Helicolenus dactylopterus dactylopterus	2W	O	◎	O	91 - 330	9,049					
Offshore rockfish	2C	O	◎	O	69 - 333	2,689					
Pontinus kuhlii	2W	O	O	◎	91 - 324	3,194					
Thinlip splitfin	2C	O	◎	O	26 - 333	8,149					
Synagrops microlepis	2W	O	◎	O	91 - 330	2,074					
Bigeye grunt	2C	O	O	◎	6 - 71	4,839					
Brachydeuterus auritus	2W	O	O	◎	6 - 93	4,689					
Rubberlip grunt	2C	◎	O	O	6 - 94	4,069					
Plectorhinchus mediterraneus	2W	O	O	O	8 - 69	75,394					
Senegal seabream	2C	◎	O	◎	6 - 27	101,262					
Diplodus bellottii	2W	◎	O	◎	6 - 37	96,882					
Lesser African threadfin	2C	O	◎	O	6 - 56	7,292					
Galeoides decadactylus	2W	O	O	O	6 - 66	7,406					
Largehead hairtail	2C	O	O	◎	10 - 333	10,081					
Trichiurus lepturus	2W	O	◎	O	10 - 330	1,834					

Remarks. 1) 2C: phase 2 cold season; 2W: phase2 warm season, 2) N: Northern area; C: Central area, S: Southern area, 3) Estimated stock size in tonnes by 70mm cod end,
4) Nominal catch in tonnes (chapter 5, 5.3.3), 5) Estimated stock size in tonnes by 20mm covernet.
-: data not available, O: Appeared, ◎: Appearance of more than 50%.

9.3 Goals and principles of resources management

(1) When planning the management of resources in the IRM, it is believed to be appropriate to give top priority to the recovery of the octopus stocks that is very important commercially and is in a critical situation. Bottom trawls, the major method utilized by industrial fisheries aimed at demersal species, are being operated for catching octopus, but also capture other bottom species in the process. Regulation of the excessive harvest of octopus by trawlers could lead to an increase in the effort for catching other species, although it is not easy to predict to what extent this shift in fishing effort may occur.

(2) The goals of resources management can be divided into: (i) the achievement of an ideal level of resources; (ii) the maintenance of the current stock situation; and (iii) the assurance of a minimum level of the resources to avoid a collapse of the stock. Here, with reference to the conclusions of the previous section, urgent countermeasures are thought to be necessary to prevent the depletion of octopus stocks, thus advocating item (iii) as the main objective of resources management.

(3) As for the effective utilization of specific sea area, its advantage should be taken into account for a full and practical use of the productivity. If a specific area is excessively exploited, the effort should be diffused to elsewhere, and if surplus production existes there, it should be utilized without waste.

(4) When regulations of catch or fishing effort are advocated, the reduction of the catch and fishing effort of trawlers becomes an important objective, from the standpoint of the power of the influence exerted upon the resources.

(5) When both industrial and artisanal fisheries exploit the same resource, a lack of reserve stock leads to a disagreement in the respective interest of each actor. It should be clear what is the order of priorities: whether it is the maintenance of fishing right fees, whose returns make up for some 25% of the National Treasury foreign exchange revenue, and the significant earnings in foreign currency from fishery exports by the industrial fisheries, or the employment generated by artisanal fisheries and social consequences therein (see Chapter 8.I).

9.4 Methodology of management

9.4.1 Resources management through the regulation of catch amount and its feasibility in the IRM

Resources management can be actualized through two major methods; the "output control" which regulates the amount of catch directly and the "input control" which regulates the effort.

. Mathematical models are the first to be sought for when output control is being tried to introduce. In the case, preliminary calculations are possible, but the calculation process admits too many hypotheses, it is difficult to be accurate enough to the degree of becoming the basis of resources management. Due to the current lack of accurate information of the catch of each species, as well as the lack of quick reporting system, it seems impractical to straightforwardly introduce such a management method. In addition, trawl is not a selective gear, therefore the

difficulty of the management by species should also be considered. In the IRM, as stated in Chapter 8.1, a number of management measures are already in force, such as restrictions of the purchase of fishing vessels, limitations to newcomers by not granting licenses, control of fishing effort by taxation, restrictions of fishing grounds, etc. All those are measures aimed at indirectly controlling fishing effort, but no restriction to the upper limit of catch size has ever been applied. This is a reflection of the present situation of the fisheries of IRM.

9.4.2 Socio-economic considerations related to resources management methods

The Mauritanian fisheries are primarily oriented towards exports (Chapter 8.1). A process of increased vertical integration is taking place and local exploitation patterns are greatly influenced by the demand in foreign markets. The sector employs some 30,000 persons – directly and indirectly – almost half of who are in jobs on land. Many fishers are migrating according to the fishing seasons and foreigners play an important role in the artisanal fishery. It should also be noted that there are important differences in the structure of the fisheries and of the marketing systems between different geographical regions.

Based on an analysis of existing fishery management measures, one could verify that in the IRM, from 1970 to the present day, their objective was threefold: protection of resources, optimization of revenues generated by the fisheries sector and creation of employment opportunities. Those goals were ambitious while having mutually contradictory aspects at the same time, so the need for clearly ranking them in order of priority was pointed out (see Chapter 8.1).

For a management measure to be effectively observed, it is necessary that the responsibility involved in the management be shared among the authorities, official agencies and related private parties in concern. In other words, from its very conception, this kind of partnership management must aim at the necessity of the various concerned parties accepting the project and being aware of their responsibility with regards to their own profits (see Chapter 8.1).

9.5 Proposals for resources management

The introduction of management measures that directly regulate catch size is thought to be premature. Instead, if regulations are the right route, methods for controlling fishing effort are believed to be more realistic. Historically, those have also been adopted in Japan. Management measures centered on regulating fishing effort are proposed below.

A proper choice of a procedure for resources management would include as many management methods previously adopted by the IRM as possible. Today, standing on the fact that the decline of resources is already clear, catch should be substantially decreased. And, for an efficient management to take place, the resources management currently in force should be redressed into a direction that strengthen the weak spots, indicating the aspects to be improved.

It is here proposed that a realistic resources management measure must from the very start not aim at perfection, but refer to the sustainable utilization of resources, shifting from a measure agreed upon by the related actors into practical action, monitoring its results and turning over in feedback to the creation of consensual form of the next management policy.

Eventually, an increase in resources could allow for a slight increase in fishing pressure, and a decrease in resources should lead to a corresponding decrease in pressure, so small adjustments should be properly reiterated.

9.5.1 Reduction of fishing effort in bottom trawl fisheries

The large catch size of trawl nets that are non-selective, and the continuous overfishing by it over many years are the main cause of the decline of octopus and other demersal resources. The first measure to curtail the decline of demersal fishery resources, especially octopus stocks, is to reduce the catch by trawl nets.

To reduce the catch of bottom trawlers, it is necessary to reduce fishing effort. Like in TAC (Total Allowable Catch), a control of catch by species does not fit in the present situation of the IRM. This study qualitatively indicated that the greatest problem affecting Mauritanian fisheries was the excessive fishing effort of bottom trawl, but its results were not sufficient to permit suggesting a specific rate of reduction in fishing effort. Particularly with respect to the common octopus, as the fishing efficiency of the gear used for the resources survey is quite low, the estimates for octopus stock size are not realistic. It has been previously stated by the CNROP Fourth Working Group that the fishing effort for octopus should be reduced by 25% (FAO, 1999). Since those results have been widely discussed in the country, it should be time to put them into practice.

As a method of curtailing effort of trawl fishery, a decrease in the number of licensed vessels, or of foreign vessels entering the area, or else the establishment of a closed fishing season, could be suggested.

9.5.2 Biological closure: extension of the period and/or an additional closure

This policy was implemented in the IRM in 1995 and had as its focus the most-important common octopus, and it seems to be a feasible, superior regulatory measure compared to other strategies.

During the period of closure (September to October), trawlers that harvest octopus are detained in the harbor and there is little need of actually patrolling the fishing grounds. Thus, control is relatively fair. If TAC is determined for each species, and in a strict form, it is possible to have unselective trawl fisheries induced to discard their catch of prohibited species.

The current two-month period for the biological closure has been useful for the adjustment of commercial circulation and maintaining the price of the common octopus (see Chapter 8.1). But, it has not in fact led to any substantial decrease in catch, because fishery operators utilize the period for a furlough, vessel repair, etc. in the year-round operational cycle. It is necessary to devise methods to extend and reorganize this closure period, with the objective of efficient decrease in the catch of demersal species including the common octopus. It is advisable to protect the common octopus in the most vulnerable period in its life cycle, particularly when it shifts toward a benthic life. According to the life history of the common octopus clarified by Inejih (2001), the recruitment of the cold season cohort happens in November-December, when small-sized individuals are heavily harvested. On the other hand, the recruitment of the warm

season cohort takes place in May-June. The period of November - December and/or May - June could be added to the current closure period. This procedure could be tentatively tried at first for three consecutive years, with a continuous monitoring of the status of octopus stocks and subsequent revision of its direction.

9.5.3 Regulation of minimum catchable size

This regulatory measure, together with mesh-size regulation, aims at the protection of immature individuals: with no change of fishing gear or methods, it forces all individuals smaller than the regulation size to be released if captured. For the target species in this study, the minimum catchable size and the biological minimum (the length at first maturity) obtained from the results of the resources survey are listed below (see Table 9.3).

Table 9.3 Minimum catchable sizes and biological minimums of target species.

Species	Minimum catchable size	Biological minimum (minimum size in each season)
Merluccius spp.	30cmTL	*Merluccius senegalensis*: ♀28cmTL
Pagrus spp.	18cmTL	*Pagrus caeruleostictus*: ♀19cmFL
Pagellus spp.	18cmTL	*Pagellus bellottii*: ♀11cmFL
Sepia spp.	13cmML	*Sepia officinalis*: ♀11cmML, ♂14cmML
Octopus spp.	500g	*Octopus vulgaris*: ♀8cmML, ♂6cmML

The biological minimum of 6 cm for the common octopus would correspond, according to the length - weight equations (Chapter 3, Figure 3.82), to a body weight of 180 - 260 g. The current minimum catchable size for the octopus was derived from the size at 50 % of individuals mature, and it is safer than the regulation based on biological minimum. Thus the current regulation including the common octopus is rational, and this should be continuously enforced.

In order to expand this regulation into other species, the results of the present survey are useful. Currently the regulation is not focused on species, but on species groups. Regulation should seriously consider the biological information pertaining to each species, and as much as possible be extended to the species level, so as not to lose its biological meaning.

9.5.4 Regulation of trawl net mesh-size

One of the objectives of mesh-size regulation is to prevent the capture of individuals yet to reach maturation length (that is, under the biological minimum), thus preventing a growth overfishing. Ideally, the mesh-size should be big enough not to capture immature individuals. The current mesh-size regulation enforced in the IRM establishes a cod-end mesh with a 70 mm for trawl nets, and a 50 mm mesh-size for shrimp trawl nets.

The results of the present survey, with $L_{50}/L_{75}-L_{25}$ values of the target species to a cod-end with nominal 45 mm and 70 mm mesh-sizes and respective biological minimum, are listed in Table 9.4. For species with unknown biological minimum, data from the literature were used. Here, L_{50} indicate the size at which 50% of the individuals that passed through the net mouth

was retained in the cod-end. Likewise, L_{75} - L_{25} correspond the size range of 75% and 25% retentions. The smaller the value of L_{75}- L_{25}, the more sharply inclined is the selectivity curve.

Table 9.4 Biological minimums and mesh selectivity parameters of target species.

Species	$L_{50}/L_{75}-L_{25}$(cm)		Biological minimum
	45mm cod-end	70mm cod-end	
Merluccius senegalensis	8.8/3.0	21.3/4.9	♂24cm, ♀28cm (Maurin,1954)
Trachurus trecae	12.5/2.4	18.1/6.1	♀22cmFL
Argyrosomus regius	-	17.0/2.5	♂72cm, ♀82cm (Tixerant,1974)
Pseudupeneus prayensis	9.9/2.8	18.2/1.0	♀11cmFL
Pagrus caeruleostictus	-	11.5/2.2	♀19cmFL
Dentex canariensis	-	14.8/1.9	♀21cmFL
Pagellus bellottii	8.2/3.8	15.6/2.0	♀11cmFL
Loligo vulgaris	6.6/1.8	8.4/4.6	♂12cmML, ♀12cmML
Parapenaeus longirostris	9.5/1.5	-	6.5cm TL (Burukovsky et al.,1989)

Based on Table 9.4, for five species among the seven fish species listed, except for the West African goatfish *Pseudupeneus prayensis* and the red pandora *Pagellus bellottii*, the 70 mm minimum mesh is evidently too small.

For the target species with the results of more than two kinds of cod-end, the mesh-size at which 50% of individuals of biological minimum to be retained was preliminarily determined and the effective mesh size was indicated (Chapter 4, Table 4.3 and Figure 4.11). This value can be considered the ideal mesh-size for the protection of the resource in question. According to the result, the mesh size which 50% of the individuals of biological minimum of three species — Cunene horse mackerel *Trachurus trecae*:104mm, blue-spotted seabream *Pagrus caeruleostictus*: 92mm and European squid *Loligo vulgaris*: 107mm — to be retained was larger than the regulation mesh-size of 70 mm. If the protection of those species' stocks has priority, it is necessary for the present regulation of 70 mm mesh to be enlarged.

As for the 50 mm mesh shrimp trawl, many immature fish were indeed caught before they have a chance to reproduce. If it is not possible to have the same mesh size regulation with bottom trawls for fish because of commercial aptness, a Canada type shrimp trawl net that selects shrimps from the catch, for instance, or another such device should be used (see Chapter 4).

9.5.5 Regulation and efficient utilization of specific area

Regulations on fishery operations in the EEZ of the IRM are based on many Government ordinances, and define the 19°21' N parallel as dividing the coast into the Northern Region and the Southern Region. Here, the efficiency of such regulations on demersal resources is tested in the light of the survey results, bringing out some points to consider. As related in 9.3,

productivity of the sea area should be fully utilized. If the sea area is excessively exploited, regulations should be conceived, and conversely, when the resources have some surplus, active exploitation should be considered. The new Government Order issued in July 2002 substantiating the law 2000-025 designates areal division that is different from the division shown in Fig.9.1.
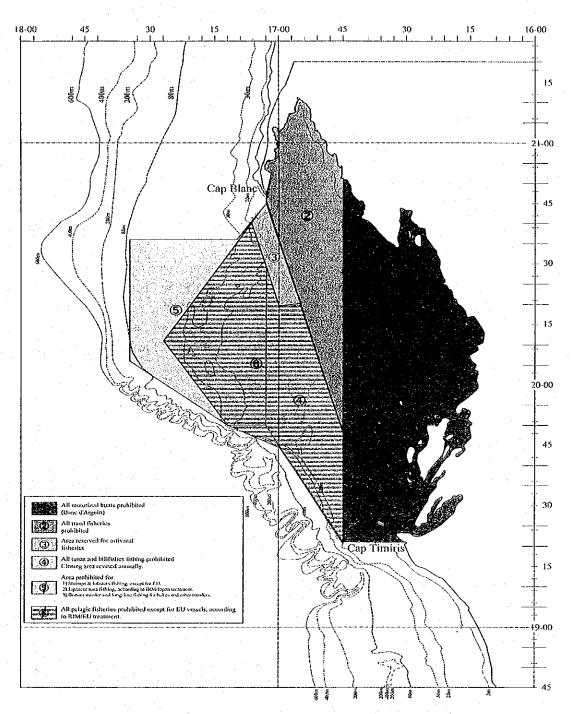
Figure 9.1   Operational area regulations on the Northern
Region of the EEZ of the IRM.

(1) Northern Region (north of 19°21'N) — Sub-regions 1 and 2

Sub-region 1 is a sea area in the Banc d'Arguin National Park (PNBA) and all fishing operations by motorized boats are prohibited there. In Sub-region 2 all trawl operations, cephalopod trawl fishing by EU vessels and fishing of cephalopod and demersal fish by non-EU vessels, are banned. These two sub-regions are included in the 3-20 m stratum in the "Northern coastal area" of the present survey. According to the Phase 2 cold and warm season surveys, the stock size in the Northern coastal area accounted for 52-63% of the total stock size in the entire area, and 76-97% of the stock size in the Northern area (see Chapter 3, Table 3.20). It is highly probable that Sub-regions 1 and 2 is an important source of supply of a given demersal species for the entire area. Particularly, the importance of the PNBA as a natural reproduction site is well known, and current restrictions should continue.

(2) Northern Region — Sub-regions 5 and 6 and regions within 3-20 miles from the coastline

These sub-regions are included in 20-400m strata in the Northern offshore area of the present survey. The stock size in the Northern offshore area was, in Phase 1, about 28,000 tonnes in the cold season and some 45,000 tonnes in the warm season; and, in Phase 2, about 7,200 tonnes in the cold season and some 66,000 tonnes in the warm season (Table 3.20). Among the target species, those important for both EU and non-EU fishing vessels are cephalopods, hakes, shrimps, lobsters - and the chronological change in the stock sizes of these species are shown in Table 9.5.

Table 9.5   Estimated stock sizes of main target species at the 20-400m strata in the Northern offshore area by survey (in tonnes).

Species	Phase 1		Phase 2	
	Cold season	Warm season	Cold season	Warm season
Hakes				
Merluccius spp. (*M. senegalensis* and *M. polli*)	2,547	1,287	2,236	1,496
Other target fishes				
Pagellus bellottii	2,012	3,483	458	7,474
Mustelus mustelus	73	2,174	80	8,086
Cephalopods				
Loligo vulgaris	644	2,490	331	1,138
Sepia officinalis	21	184	21	230
Octopus vulgaris	1,415	2,355	458	1,758
Crustaceans				
Penaeus notialis	1	6	+	4
Parapenaeus longirostris	5	56	9	43
Palinurus mauritanicus	4	6	0	19
Panulirus regius	0	0	0	0

Remark. +:less than 1 tonne.

In the Phase 2 cold season, the 200 -400 m stratum was not surveyed, and its stock size was not included. For this reason, the stock size of hakes *Merluccius senegalensis* and *M. polli*, deep-water pink shrimp *Parapenaeus longirostris* and pink spiny lobster *Palinurus mauritanicus* are underestimated. As previously mentioned, the fishing efficiency of the gear used was low in catching octopuses, shrimps and crabs, but as the survey was done with the same equipment, the relative stock size of these species was believed to be fairly stable. Results indicate that the stock size of the common octopus has evidently suffered a sharp decline. To prevent a collapse of octopus resources, in depths down to 200 m where the species is mainly distributed, it is desirable that fishing operations targeting the common octopus and the use of gear that has it as by-catch be, at the very least, regulated for some period.

(3) Southern Region (south of 19°21'N) – Sub-region 2 (within 6 miles from the coastline)

Most of this Sub-region is included in the Central and Southern coastal areas, as defined for this survey, that is, located at the 3 - 20 m stratum (a portion south of NKC includes the 20 - 30 m stratum). Trawl operations are prohibited in this Sub-region.

In the Phase 1 warm season and Phase 2 cold and warm seasons, at the 3-20 m stratum in the Central and Southern areas, the stock size of demersal species was, respectively for each season, 46,000 tonnes, 64,000 tonnes and 36,000 tonnes. The stock size at the 3-20m stratum occupied 30%, 52% and 28% of the total stock size in this area respectively (Table 3.20). The total stock sizes of main target species are listed in Table 9.6.

Table 9.6 Estimated stock sizes of main target species at the 3-20m stratum in the Central and Southern areas by survey (in tonnes).

Species	Phase 1	Phase 2	
	Warm season	Cold season	Warm season
Fishes			
Pagrus caeruleostictus	2,049	4,454	1,639
Pagellus bellottii	525	1,041	111
Pseudupeneus prayensis	973	2,374	929
Total other target species	4,229	809	336
Total fishes	45,007	62,959	35,918
Cephalopods			
Loligo vulgaris	0	272	0
Sepia officinalis	389	400	149
Octopus vulgaris	375	206	146
Crustaceans			
Penaeus notialis	28	68	4
Panulirus regius	5	2	8

Remark. This stratum was not surveyed in the Phase 1 cold season

To protect the resources of demersal fishes, common octopus *Octopus vulgaris* and green spiny lobster *Panulirus regius*, trawls in this Sub-region should continue to be banned.

(4) Southern Region – Sub-regions within 6, 12, 15, 20 and 30 miles from the coastline

These Sub-regions are included in the Central and Southern offshore areas of this survey (except the 400 - 600 m stratum). Estimated stock size of demersal species in this offshore area was about 89,000 tonnes, 106,000 tonnes, 59,000 tonnes and 93,000 tonnes respectively (see Table 3.20). The estimated stock sizes of main target species are listed in Table 9.7.

Table 9.7   Estimated stock sizes of main target species in the Central and Southern offshore areas by survey (in tonnes).

	Phase 1		Phase 2	
	Cold season	Warm season	Cold season	Warm season
Fishes				
Merluccius spp.	8,718	12,291	5,244	15,041
Zeus faber	2,699	281	1,260	233
Pagrus caeruleostictus	185	361	278	308
Pagellus bellottii	1,601	13,633	3,416	8,461
Pseudupeneus prayensis	729	2,304	261	1,164
Total other target fishes	1,584	1,051	152	610
Total fishes	82,640	99,039	54,739	90,576
Cephalopods				
Loligo vulgaris	90	1,474	88	444
Sepia officinalis	52	575	23	199
Octopus vulgaris	6,197	3,543	2,540	1,539
Crustaceans				
Penaeus notialis	7	4	6	17
Parapenaeus longirostris	346	175	350	162
Palinurus mauritanicus	0	0	22	0
Panulirus regius	0	0	0	0

Remark. 400-600 m stratum not included.

The stock sizes of many species undergo seasonal changes, but comparing the cold seasons of both Phases, there was a decrease in Phase 2. Remarkably, octopus stocks did not change with the season but declined over time.

Presently, trawl operations are banned within the 6 miles mark (the limit for shrimp trawls is 3 miles), and expanding the prohibition offshore is believed to be an overall effective way to protect not only the octopus but also all other demersal resources. Shifts in this direction need official support to give priority on the promotion of inshore artisanal fisheries.

(5) Development of artisanal fisheries in the Southern Region south of NKC

In the past, the efforts of artisanal fisheries in the IRM have been excessively concentrated in the Northern Region, but given the opportunity, diluting the fishing effort into the Southern Region south of NKC is preferable. Here, the characteristics of the resource (quantitative and qualitative) in the Southern area were analyzed, utilizing the results of the cold season survey in Phase 2, and the possibilities of development were discussed (Table 9.8). The Southern area as

defined by the resources survey (16° 04' - 17° 39' N) has a northern limit at about 52 km south of NKC (18° 07' N), and is somewhat discrepant from the area normally called Southern Region.

Table 9.8 Demersal resources components and their vertical distribution in the Southern area in the Phase 2 cold season.

Species	Fishery (Source: Fish Base)	Stock size in tonnes**	Vertical distribution of stock (m)			
			3-30	30-80	80-200	200-400
Plectorhinchus mediterraneus	Commercial	6,989	97%	2%	(0.1)%	0%
Brachydeuterus auritus	Commercial	3,947	100	(0.2)	0	0
Chlorophthalmus agassizi	Commercial	3,019	0	(0.1)	94	6
Galeoides decadactylus	Commercial: fresh, dried/salted or smoked	2,281	100	0	0	0
Pomadasys incisus	Minor commercial	2,136	96	4	0	0
*Pagellus bellottii**	Commercial: important food fish	2,128	6	94	(0.1)	0
*Pagrus caeruleostictus**	Commercial	1,737	97	1	0	0
Hoplostethus cadenati	Commercial	1,592	0	0	0	100
Trichiurus lepturus	Highly commercial: frozen or dried/ salted	1,371	50	38	10	2
Pontinus kuhlii	Commercial	1,335	0	1	97	2
*Octopus vulgaris**	(Highly commercial)	1,132	1	47	51	0
Merluccius polli(*)	Minor commercial: fresh, frozen, fish meal or oil	1,116	0	34	44	22
Synagrops microlepis	-	1,005	0	12	86	1
Dentex macrophthalmus	Commercial	966	0	51	48	(0.4)
*Zeus faber**	Commercial: excellent flesh	732	2	28	70	0
*Pseudupeneus prayensis**	Commercial	382	74	26	0	0
*Sepia officinalis**	(Highly commercial)	153	100	0	0	0
*Parapenaeus longirostris**	(Commercial)	286	0	3	43	54
Total		50,413	56	14	21	9

Remarks. *: target species, **: stock size including uncatchable small size individuals.

The stock size in the Southern area of 50,000 tonnes represents 14.3% of that of the entire survey area and cannot be said to be abundant. However, most of the high-ranking species are commercially important, and the possibilities of their exploitation should be high, particularly at the 3 - 30 m stratum that accounts for 56% of the stock size in this area. From the standpoint of the characteristics of these resources, this region is suited for the development of coastal artisanal fisheries.

Among the policies deemed necessary, it is believed that those concerning the improvement of productivity and the consolidation of fishing villages should be implemented in N'Diago area

as a priority. The reasons for this are:

1) Suitable geographic position. Following NDB and NKC southwards, the development and promotion of fisheries in N'Diago would create one base in each of the regions – Northern, Central and Southern –, providing a good geographical balance.

2) The economic expansion of an undeveloped area depends on the development of specific sites with very suitable conditions as a rule. N'Diago is the only village south of NKC with a history of fisheries, although there are few fishermen operating in the area at present. But, at the very least, it is endowed with technical resources conducive to its development.

3) The region at the mouth of the Senegal River is rich in productivity, and resources such as mullets *Mugil* spp., meagre *Argyrosomus regius*, Senegalese sole *Solea senegalensis* or southern pink shrimp *Penaeus notialis* are believed to exist there. In N'Diago, it is possible to expect inland water resources to be explored, particularly as the riverine region (which includes the river mouth) could be a site for development and promotion. Sixteen species of fishes have been reported, by a credible source, to be distributed in inland waters including artificial lakes and have capacity for exploitation (Chapter 8.II).

These 16 species are : Wahrindi *Synodontis schall*, North African catfish *Clarias gariepinus*, Nurse tetra *Brycinus nurse*, *Labeo senegalensis*, Niger barb *Barbus foureaui*, *Hyperopisus bebe*, *Petrocephalus bovei*, Semutundu *Bagrus docmak* (syn: *Porcus docmac*), Mango tilapia *Sarotherodon galileus*, Silversides *Alestes baremoze*, Nile tilapia *Oreochromis niloticus*, African carp *Labeo coubie*, Mormyrids *Mormyrus rume*, Elephant Fish *Pollimyrus isidori* , Bayad *Bagrus bajad* (syn: *Porcus bayadi*) , and African butter catfish *Schilbe mystus*.

(6) Development of industrial fisheries on the continental slope

The exploitation of resources needs they be first discovered and their worth evaluated for commercial utilization. Resources survey over the continental slope, in waters deeper than 200 m, could not be satisfactorily conducted due to various reasons. Through the analysis of the data from the Phase I warm season survey, the resources on the continental slope were qualitatively and quantitatively evaluated. Main species at the 200 - 400 m stratum are shown in Table 9.9, with their relative abundance by area.

Table 9.9   Demersal resources components on the continental slope (200 - 400 m stratum)

in the Phase 1 warm season.

Species	Fishery*	Stock size in tonnes**	Geographical distribution of stock		
			North	Central	South
Helicolenus dactylopterus	Commercial: fresh	28,086	32%	63%	5%
Merluccius senegalensis	Highly commercial	10,100	12	69	19
Chlorophthalmus agassizi	Commercial: fresh or fish meal	6,900	3	71	27
Synagrops microlepis	-	5,057	3	68	29
Caelorhinchus caelorhinchus	Minor commercial	3,448	52	36	11
Capros aper	Of no interest	2,860	98	2	0
Parapenaeus longirostris	(Commercial)	189	26	29	45
Others	-	8,688	32	47	21
Total		65,328	26	60	14

Remarks. *Source: Fish Base<http://www.fishbase.org/>, **stock size including uncatchable small size individuals.

Out of the stock size at the 200 - 400 m stratum, 65,328 tonnes, 58% were attributed to the two top-ranking species, and 86% to the six highest-ranking species in the table. Species considered to have commercial value are four: the three top-ranking ones - blackbelly rosefish *Helicolenus dactylopterus*, Senegalese hake *Merluccius senegalensis* (identification uncertain, may include *S. polli* as well) and shortnose greeneye *Chlorophthalmus agassizi* - and the comparatively less abundant deep-water pink shrimp *Parapenaeus longirostris*. The thinlip splitfin *Synagrops microlepis* is a small fish (maximum SL 16.5 cm, according to the Fish Base), but its biomass is quite large, and it is thought to support the production of piscivorous fishes.

Today, of these resources found on the continental slope, Senegalese hake is specifically caught with licensed EU vessels, and the species is presumed to be fully exploited. However, if the EU countries withdraw from this fishery, the species should be a new target for Mauritanian-registered fishing vessels.

Actually, a feasibility study is necessary even before fishing vessels start to operate. About 60% of the exploitable resources are distributed over the Central area (17° 39' - 19° 15' N), and it is necessary to establish a base around NKC for actual operations to be launched. The establishment of such a base in the region south of NKC is a priority matter for the IRM Government, and it also could be an effective foothold for the development of sea fisheries.

9.5.6   Consolidation of the system of resources management

For the smooth operation of resources management as a system, the coordinated action of three elements is necessary: (i) monitoring, (ii) control, and (iii) surveillance. Of those three items, some technical considerations on monitoring are proposed here.

(1) Periodic resources surveys with research vessels

For an appropriate resources management to be taken into effect, it is necessary to regularly conduct the monitoring of the status of resources, and revise the management guidelines upon its results. Particularly when there are no fishery statistics by species, surveys by research vessels are of great importance. Routine surveys should be conducted, and their results must be made public. Technical problems related to the surveys and considerations upon them are presented below, accompanied by the technical limit of the present survey.

1) Problems of the fishing gear (beam trawl) aboard the *Amrigue*

A comparative test with the two research vessels, the *Al-Awam* and the *Amrigue*, revealed a great difference in fishing capacity between them, and the relative fishing efficiency by species was impossible to determine (Chapter 3). The *Al-Awam* could not operate safely in inshore waters shallower than 8 m, particularly in the Lévrier Bay and Banc d'Arguin region, for which accurate stock size estimates are needed in the future. For that, instead of the beam trawl aboard the *Amrigue*, a more efficient bottom trawl net would be required, and comparative experiments of fishing efficiency could be conducted, finally determining the relative fishing efficiency by species.

2) Sampling limitations of the trawl gear aboard the *Al-Awam*

The bottom trawl net utilized in the survey had been designed to be used over the continental shelf, targeting mainly fin-fishes. The limits of operational capacity of the *Al-Awam* and limits of sampling ability of the aforementioned gear will be discussed in five aspects that follow. Some of the results strongly reflect those limitations (for some species, stock size could be underestimated), and possible countermeasures in the future are discussed below.

a) Operational difficulties on the continental slope of depths over 200 m (particularly, over 400 m)

Results: In the Phase 2 cold season survey, there were some unoccupied stations in a portion of the 200 - 400 m stratum, and no operation at the 400 - 600 m stratum. As a consequence, the stock sizes of three target species - Senegalese hake *Merluccius senegalensis* (in Phase 1 quite possibly mixed with *M. pollii*), deep-water pink shrimp *Parapenaeus longirostris* and pink spiny lobster *Palinurus mauritanicus* – were presumably underestimated, and the West African geryon *Chaceon maritae* did not appear at all. The missing operations at the 400 - 600 m stratum brought an information gap related to the development possibilities of unutilized and unexploited resources.

Suggestions: For depths over 200 m, particularly over 400 m, the survey should employ a bottom trawl net for the continental slope provided by JICA. Also, the relative fishing efficiency between two kinds of bottom trawl nets should be evaluated. The fishing efficiency of the bottom trawl net should be very low in the capture of the West African Geryon. Parallel operations with JICA-supplied crab traps could be conducted to test

relative abundance.

b) **Low fishing efficiency on demersal species particularly those closely associated with the bottom (shrimps, octopuses and flatfishes)**

Results: Due to the poor efficiency of the gear used, the stock size of species closely associated with the bottom such as southern pink shrimp *Penaeus notialis*, common octopus *Octopus vulgaris* and Senegalese sole *Solea senegalensis* was presumably underestimated.

Suggestions: The southern pink shrimp obviously, but also the previously mentioned deep-water pink shrimp *Parapenaeus longirostris* and the pink spiny lobster *Palinurus mauritanicus*, in addition to the Senegalese sole, could probably be better caught with a shrimp trawl net provided by JICA. The common octopus and Senegalese sole could be caught with a trawl net with a series of tickling chains along the ground rope, or with a net with rings attached. The catch of benthic species can be increased if they remove the bobbins and the balls from the ground rope. Then the relative efficiency with the net utilized in the present survey could be determined.

c) **Operational difficulties in rocky areas**

Results: Fishing was carried out over flat rocky areas, but no operation took place over sloped rocks to avoid gear damage. Of the species targeted by the survey, mainly the stock size of important reef species such as the pink spiny lobster *Palinurus mauritanicus* are most probably underestimated.

Suggestions: The lobsters in reef areas can be sampled with JICA-supplied lobster traps, if necessary, and distribution and relative abundance could also be investigated.

d) **Possible underestimates in inshore waters shallower than 8 m and the water column above the net mouth**

Results: The draft of the *Al-Awam* and her big otter boards do not allow her to operate in waters shallower than 8 m. Therefore, the stock size of the species which occur in habitats shallower than 8 m (comprised 3–20 m stratum) or utilize coastline as their migratory route – Senegalese sole *Solea senegalensis*, flathead mullet *Mugil cephalus*, narrowhead grey mullet *Mugil capurrii*, smooth-hound *Mustelus mustelus*, white grouper *Epinephelus aeneus*, meagre *Argyrosomus regius* (except for golden grey mullet *Liza aurata*, which was absent) – was most probably underestimated.

Also, fishes distributed in the water column above the net mouth (about 2 m) could not be evaluated correctly in this survey. Of the target species, benthopelagic species such as John dory *Zeus faber*, Cunene horse mackerel *Trachurus trecae*, bluespotted seabream *Pagrus caeruleostictus*, Canary dentex *Dentex canariensis*, meagre *Argyrosomus regius*, flathead mullet *Mugil cephalus*, narrowhead grey mullet *Mugil capurrii*, as well as common cuttlefish *Sepia officinalis* and European squid *Loligo vulgaris*, since they are distributed above the level of the net mouth, should also have had their stock size underestimated.

Suggestions: Areas shallower than 8 m can be surveyed with a small trawl designed for the *Amrigue*, as mentioned before. Distribution and relative abundance should be studied by using gill nets as well.

c) Trawl speed

Results: Among the target species, there is a strong likelihood of large individuals (old fish) that can swim faster than 3 knots (very much possible for the white grouper *Epinephelus aeneus* or the meagre *Argyrosomus regius*) have mostly escaped being caught. Therefore, their stock size was probably underestimated, and length composition may have been inaccurate.

Suggestions: The comparison between catches of both the trawl net used in the survey and a gill net would allow knowing the length composition in the nature.

3) Selection of survey period for the resources survey

The cooperative resources survey in 2000 and 2001 was carried out in the cold season (April - May) and in the warm season (September - October). However, for the proper monitoring of year-round change in the stock size, and also for obtaining complete biological information on target species, surveys should ideally be done four times a year (cold season, cold-warm transition, warm season, warm-cold transition). Fortunately, the CNROP conducted her own surveys in the transitional periods, overall allowing almost ideal results. In the future resources studies, it is desirable that four surveys per year be conducted.

4) Survey area selection: necessity of surveys covering a wide area

The geographical distribution of the species targeted in this survey is not always confined to the territorial waters of the IRM, but is straddling (see CPUA distribution map) in some cases. A survey over a much wider area could establish the distribution limits of a resource unit (population) and clarify the life history of target species. Such a survey will be possible through a bilateral or an international fisheries organization, with the participants working simultaneously and using identical methods.

(2) Establishment of data on age, body length and body weight

With a continuous measuring the body length of individuals caught and landed, the current status of the resource can be analyzed to a certain extent even if other information is unavailable. Information on body length and age is indispensable for a diagnosis of the status of resource or a quantitative evaluation of it. Body length measurement does not need expensive, high technology machinery or equipment: a single fish measuring board is sufficient for its realization. It is propopsed that the periodic surveys currently being conducted by the CNROP at landing sites should add body length measurement into the menu. The method could be the same card-punching method used in the present survey.

Although the goal was not achieved in this Study, the elucidation of the length/age relationship should have lead to establish age composition by cohort analysis of size composition. If surveys aboard research vessels are conducted every year and body length are continuously measured, recruitment of each year could be actually determined, allowing the

identification of the dominant year class.

(3) Consolidation of catch statistics

This question has been repeatedly pointed out. For an efficient utilization and a rational management of resource, it is essential to know the catch of each species. Because fishery statistics in the IRM have not been tabulated by species, it is not possible to trace catch size by species. In the future, it is definitely necessary to calculate the total allowable catch (TAC) for each species. In preparation for that, at the earliest opportunity possible, a reconstruction of the data gathering system is proposed, with information of monthly catch and fishing effort both by species and by type of fisheries. In addition, for both artisanal and industrial fisheries, it is desirable that discarded catch be recorded as well, by species.

Statistics related to the production and distribution of fisheries have been published by the CNROP, the DSPCM, the SMCP, the Customs Office and the Central Bank, in a way as to serve their respective purpose. These statistics are not compatible with each other, hence they lead to a confusion. As indicated by the Fourth Working Group of the CNROP, there is a need to centralize the system to consolidate all data (FAO, 1998). It is indispensable that information such as catch by EU fishing vessels, which are estimated to be large, be accurately recorded and made public. As the data on those catches collected through the observer system took too long for compilation and publication, their validity was not verified. EU vessels are not obliged to land their catch on Mauritanian soil, so the gathering of information by observers is considered vital hereafter. Any shortcomings in the system should be widely investigated.

Among the fishery statistics, information related to fishing sites is important. The unit fishing region in the statistic for artisanal fisheries - a square of 30 minutes latitude and longitude (unit fishing area) – is too large and does not meet its objectives. Considering the fishing gear, methods and operational scale, it is more appropriate to reduce the size of the present unit fishing area to a small square area of 10 minutes latitude and longitude.

(4) Construction of a fisheries information system

There are striking developments today in fisheries information processing techniques and communication technology, and the ODA (Official Development Assistance) of Japan has also made positive advances in introducing them and putting them into practical use. In the IRM, as clamorous voices ask for continuous utilization of fishery resources, it is urgent to be able to promptly grasp accurate catch and landing information on inshore and offshore fishing, and it is of utmost importance to build a fisheries information system (Evers, 2000). For this, a computer network linking the main landing sites with the CNROP and the MPEM – a system of data gathering and analysis – should be constructed, so that information necessary for fisheries management such as reports on catch and on the status of landing could be obtained in real time.

(5) Socio-economic research and monitoring

The importance of economic, social and institutional aspects, within the framework of fisheries management plans, has been mentioned on several occasions (Chapter 8.I). The main findings of the socio-economic studies carried out under the present project as well as the suggestions made with regard to the continuation of this work are summarized below:

1) The marketing system

Findings: The study gives a description of the marketing and distribution systems in different geographical regions and makes a first analysis of the financial relations existing between the different operators. It is noted that a process towards increased vertical integration is taking place. There are close ties between the fishers and the exporting companies which are in turn closely associated with the foreign importers and the sector is moving with its downward vector.

Suggestions: In addition to consolidating and adding more detail to the general results of the study, there are several subjects on which in-depth studies would be useful. For example, an analysis of the value-added created by the different segments of the sector could be considered. Such an analysis should be made both "horizontally", i.e., comparing different fishing methods, and "vertically" to identify where in the distribution and marketing chain profits are created and who benefits from them.

2) Employment and labor structure

Findings: Through the work on employment aspects, a methodology for estimating the number of job opportunities created by the sector was developed and the main professional groups of the sector were defined. An analysis of some of the socio-demographic aspects of the main groups of operators was also carried out. It could be noted that the sector employs some 30,000 people; that there is a high level of mobility within this workforce, and that foreigners play an important role, particularly in artisanal fisheries. It is also noteworthy that almost half of the total number of jobs created is on land.

Suggestions: Basic information on employment related issues are socio-economic indicators that should be monitored on a regular basis. The data collected so far constitute an information base that – with additions as necessary – can be used for more detailed analyses on, for example, the possible impact of management measures on employment within different professional groups or in different geographical regions.

3) Review of management measures

Findings: The study carried out was basically a review of already existing literature on management measures and no in-depth analysis was made. Nevertheless, it could be noted that the management measures most likely to be effective include limitations of fishing effort and complete closures of fisheries. Incentive measures and taxation should also be considered. Moreover, it would appear important to reflect on the overall objectives assigned to the fisheries sector since they appear to some extent contradictory.

Suggestions: A more in-depth review is possible by analyzing respective management measure in more detail. In order to better appreciate the available options with regard to objectives and priorities, it would be important to assess the economic and social contributions by different sub-sectors. A review of the perception of the industry with regard to the state of resources could also be considered together with an analysis of how the industry adjusts its strategies and behavior according to this perception.

4) Monitoring of indicators and a socio-economic database

Findings: The work on a socio-economic database was limited to discussions on the subject and to reconfirming the urgent need to organize the collection and compilation of this type of data in a systematic way.

Suggestions: Basic socio-economic aspects have to be monitored in a structured way and on a regular basis and a computerized socio-economic database needs to be developed. The various aspects to cover would include, among other things, employment, macroeconomic aggregates, prices, export volumes, and fish consumption. It is also suggested that a socio-economic statistical bulletin is published.

5) Participatory approaches

Findings: The new Fisheries Law anticipates more importance to be given to management in partnership and this approach should be encouraged. The importance of management in partnership and of participatory approaches is thus noted but the time and means available did not allow for any further work on these issues.

Suggestions: With regard to research, there is first of all a need to strengthen the capacities of LASE and to improve the knowledge by its researchers of the local environment by establishing more regular contacts between LASE and the operators in the sector. It is also desirable that participatory approaches are used in field works and there is thus a need to train field workers and researchers in participatory research techniques (e.g., PRA).

6) Costs and earnings analysis

Findings: Based on the information collected, exploratory profit and loss accounts were developed for a selected number of fishing methods. By calculating different scenarios, estimates of minimum catches in the artisanal demersal fishery were arrived at. For a canoe targeting octopus to be profitable, it was estimated that the annual production had to be between 3,800 and 5,600 kg. The artisanal demersal fishery as a whole has to catch at least between 12,000 and 17,000 tonnes per year to be profitable.

Suggestions: A continuation and expansion of the work could include, among other things, the following:

- The collection of data from fishers during a longer time period, i.e., one year.
- A critical review of the profit and loss accounts established by the study and a verification of the proposed methods.
- A historical analysis of the development of the profitability of different fishing methods.

9.6   The promotion of artisanal fisheries

9.6.1   "The Law of the Promotion of Coastal Fisheries" of Japan as an example

The Government of the IRM has been giving serious consideration to the promotion of artisanal fisheries, and founded new landing facilities and harbors in NKC and NDB.   For proper development of limited resources in limited fishing grounds, the Japanese experience could serve as a reference.

The Government of Japan issued in 1963 its " the Law of the Promotion of Coastal Fisheries" (Anon.,

1963). This legislation was conceived as a policy for increasing the production of coastal fisheries through modernization and rationalization, and to promote the welfare of the actors involved in those fisheries. Its objective was to plan the expansion of coastal fisheries and the improvement of the status of the actors concerned. According to the law, the Government is requested to take various measures for the promotion of coastal fisheries, namely:

(1) **Enhance the fishery resources, by means of:**

    a. Proper utilization of fishery resources

    b. Propagation of aquatic animals and plants

    c. Prevent deterioration or loss of the use of fishing grounds, etc.

(2) **Increase production, by means of:**

    a. Consolidation of fishing ports

    b. Development and consolidation of fishing grounds

    c. Improvement of fishing techniques, etc.

(3) **Modernize management, by means of:**

    a. Enlargement of management scale

    b. Cooperation in the process of production

    c. Shift to more productive fisheries

    d. Elevation of capital and equipment, etc.

(4) **Rationalize the distribution of fishery products, promote processing industry and demand, stabilize prices by means of:**

    a. Improvement and development of sales conducted by fisheries cooperative associations

    b. Consolidation of facilities for storage and transportation of fishery products

    c. Modernization of transactions of fishery products

    d. Promotion of processing industries of fishery products

    e. Control of the production and distribution of fishery products, etc.

(5) **Promote exports, by means of:**

    a. Opening markets overseas

    b. Strengthening competitiveness of export-oriented fishery products

    c. Establishment of an order in the transactions of export, etc.

(6) **Stabilize management, by means of:**

    a. Control of imports if necessary, etc.

(7) **Rationalize production and distribution of fishery materials and stabilize price of them**

(8) **Train and maintain suitable personnel as actors of modern coastal fisheries, by means of:**

    a. Education

b. Research

c. Fulfillment of the project for improvement and diffusion, etc.

(9) **Improve labor structure, by means of:**
    a. Fulfillment of vocational training and projects for employment consultation, etc.

(10) **Promote well-being of personnel involved in fisheries, by means of:**
    a. Consolidation of the circumstances including transportation, health and culture

    b. Improvement of the quality of life

    c. Modernization of labor relations, etc.

9.6.2   Introduction of fishermen's cooperative unions

Consolidation and development plan of coastal fisheries in Japan by the government was explained briefly in the former section, but the background of fisheries of the IRM is different to a considerable extent. In Japan, fishery is a kind of family business and is inherited generation to generation, leaving few chances for new comers. This results in the aging of fishermen, and is highly contrasting with the high mobility in Mauritanian fisheries sectors. Japanese coastal fishermen have been given right to utilize their coastal fishing grounds almost exclusively and are protected with many other measures. But, in spite of these differences, some may be useful for the reference in the management of fisheries of the IRM. Among these, fishermen's cooperative unions that are common in Japan are thought worth considering introducing into Mauritanian soil.

The actors of artisanal fisheries in Mauritania appear to be left unorganized and this is quite different from the situation of Japanese coastal fishermen. In the coastal fisheries of Japan, fishermen's cooperatives play important roles in the economical unification of fishermen and their economical independence. The present survey revealed that some fishermen's cooperatives had been organized in the fishing villages of Imraguen and they function for the selling of production and purchasing fishing equipments on communal basis (see Chapter 8.1). The introduction of the system is highly recommendable in other areas of the IRM. The fishermen's cooperatives in Japan are centers of local fishing communities and have various functions as follows.

    - Circulate information necessary for the operation and utilization of their fishing ground, and act as a mediator for minor adjustments of their interests.

    - Provide space for selling production to provide chances for selling their production in better terms, purchase fuel and gears on cooperative's basis, help utilizing public financial credits and have function of banking.

    - Possess some productive means, run and manage them: ice-making facilities, fish markets.

    - Negotiate with other fishermen's organizations or governmental bodies as the representative.

Vertical integration among fishery sectors was discussed in details in Chapter 8.1. If fishermen's cooperative unions have enough power and influence, they will function effectively in reducing the financial control of big capitals through fish wholesalers.

9.7 References

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