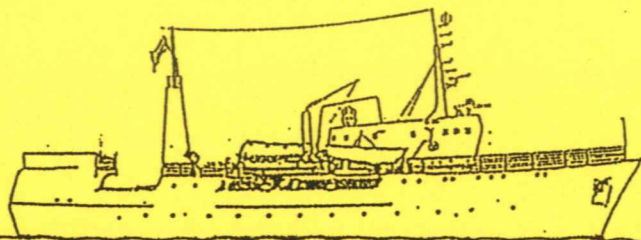


Reports on Surveys with the  
R/V Dr. Fridtjof Nansen



UNDP/FAO PROGRAMME GLO 001/82


CECAF COOPERATIVE SURVEY 1986

Interime Cruise Report "Dr. Fridtjof Nansen"

Surveys of the shelf between Agadir and Cape Juby  
September–November 1986

Institute of Marine Research, Bergen

April 1987



Institute of Marine Research, Bergen

1. INTRODUCTION

In accordance with the plans for the CECAF Cooperative Survey 1986 agreed at the meeting at Tenerife 7-9 April 1986 the R/V "Dr. Fridtjof Nansen" was programmed to work in September and again in November-December on the Moroccan coast from Agadir southwards.

The following coverages were made:

I 22 September-5 October; Agadir-Cape Juby. Repeated surveys.

II 6-12 November; Agadir-Cape Juby. Full survey.

The findings of each survey will be briefly described in the following and the results then discussed with reference to the total area.

2. Survey I - Agadir-Cape Juby 22 September to 5 October

In accordance with the survey plan a main acoustical coverage of the shelf from Agadir to Cape Juby was first to be made to localize the aggregations of small pelagic fish, mainly sardines. Then effort was to be concentrated on these aggregations with detailed studies on biomass estimation, target strength and fish behaviour.

Scientific staff:

From Morocco: Mostafa Idrissi Chbani  
Mbarek Zouiri

The vessels own scientific staff:

Tore Strømme, cruise leader  
Alvaro Abella  
Kjell Strømsnes  
Terje Haugland  
Erling Molvær

The shelf between Agadir and Cape Juby was first covered to the 200 m depth contour in the period 23-27 September. The survey tracks with trawl stations are shown in Figure 1. The main biomass of small pelagic fish was found within the 60 m depth contour between Cape Juby and about latitude N 29°20'. This area was then covered twice with acoustic transects and additional trawl stations in the period 27 September to 1 October, as shown in Figure 2. Finally a course track of about 110 nm was selected from the detailed coverage and this track was sailed four times with two coverages during daylight and two during night. The selected path was sailed during the days 2-4 October with a new moon and complete darkness during night hours.

A total of 2000 nm was sailed on the shelf and 44 trawl stations were worked.

Figure 3 shows the sea temperature recorded at 4 m below surface with a thermograph. The pattern of the isolines indicate upwelling in the region from Cape Juby to about latitude 29°30' with a center where the detailed work was carried out.

Records of the fishing stations worked in this area nos. 153 through 192 are shown in Appendix I. The main species caught were Sardina pilchardus, Scomber japonicus and Trachurus trachurus. Other small pelagic and demersal fish were found only in small quantities and will not be dealt with in this report. In general the vertical distribution of the fish did not constitute a major problem for acoustic assessment of the biomass. A few times the fish was located at or close to the surface, but as this was a diurnal behaviour at some locations only, it is assumed that this undersampling can be compensated by including density figures from the repeated coverages when the fish was distributed below the surface layer.

The distributions of sardine during the main coverage and the two detailed coverages are shown in Figures 4, 5 and 6 respectively. The unit of the index is  $0.1 \times m^2$  per  $nm^2$ . (energy reflected per unit area). The highest densities are found in the nearshore waters and the first main coverage does not sample these areas optimally.

The mackerel was mainly found together with the sardine and then usually only as small fractions of the total catch, except in an area northeast of Cape Juby where it constituted the main part of the biomass. Distribution during the main coverage is shown in Figure 7 and during the two detailed coverages combined in Figure 8.

The horse mackerel was generally found on the bottom and tended to have a more offshore distribution than the sardine and mackerel, except south of Tan Tan where it could be found in the more shallow waters, but then only in small quantities. Distributions based on the main and the detailed coverages are shown in Figures 9 and 10 respectively.

First provisional estimates of fish biomass are as follows: (thousand tonnes)

	<u>Sardines</u>	<u>Mackerel</u>	<u>Horse mackerel</u>
Main coverage	700	90	120
First detailed coverage	870		
Second detailed coverage	1040		
Detailed coverage combined	960	70	20

As shown the estimate of sardines for the whole shelf is less than for the nearshore areas. This is due to undersampling in the dense areas during the main coverage. All coverages combined give an estimate of 1040 thousand tonnes of sardine for the shelf between Agadir and Cape Juby.

Figure 11 shows the length compositions of the pooled samples from the trawl catches.

### 3. Survey II, Agadir-Cape Juby 6-12 November

#### Scientific staff:

From Morocco: Mostafa Idrissi Chbani

The vessels own scientific staff:

- I. Svellingen, cruise leader
- A. Abella, FAO
- O. Alvheim, chief technician
- Ø. Torgersen, instrument chief
- T. Mørk, instrument technician

Figure 12 shows the cruise tracks and stations between Agadir and Cape Juby. Its design was largely based on the experience of fish distribution from the September survey.

The observations of sea surface temperature Figure 13, shows effects of upwelling very similar to those found in September (see Figure 4). The main species caught were as previously Sardina pilchardus, Scomber japonicus and Trachurus trachurus with a large predominance of the sardine. Their distributions are shown in Figures 14 through 16.

The records of the fishing stations worked nos. 197 through 217 are shown in Appendix I.

The distribution of the sardine down to Cape Juby, was found to be very similar to that observed in September covering the inner part of the shelf from about latitude 29°30' southwards. Also the behaviour was similar with predominantly mid-water schools during the day and layers and looser schools during night.

The acoustic system combined with the sampling provided the following estimates of biomass: (thousand tonnes)

Sardine	990
Mackerel	160
Horse mackerel	80

These estimates are seen to be very similar to those obtained during Survey I.

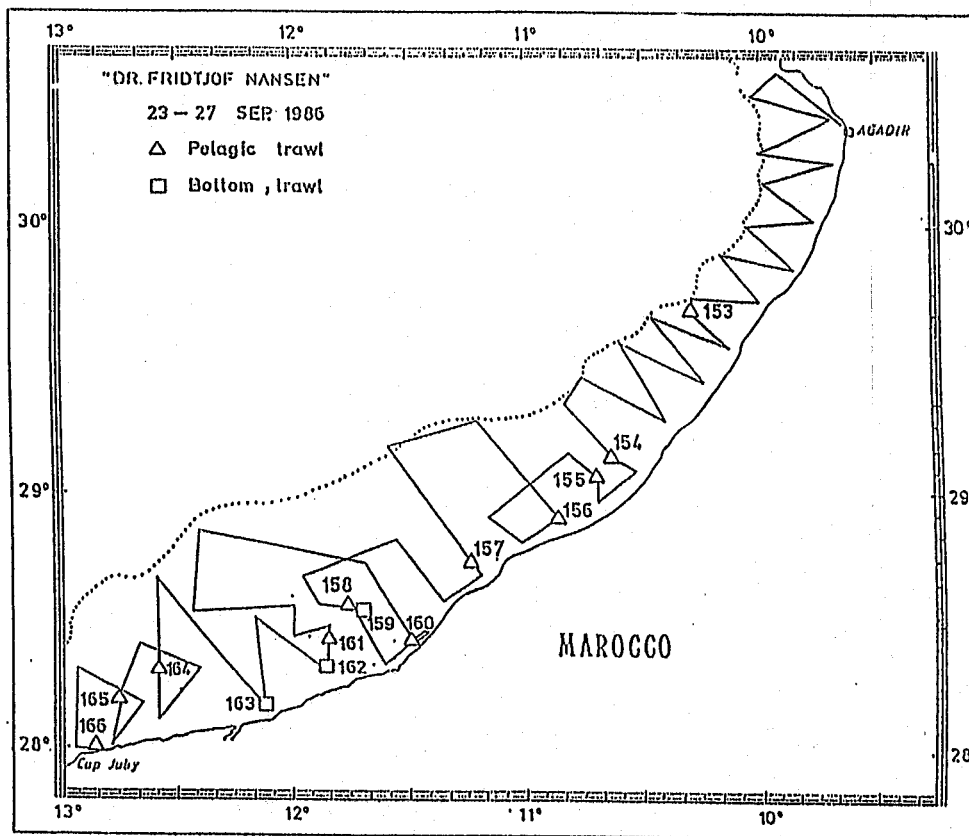


Figure 1. Cruise track and fishing stations, main coverage, Survey I.

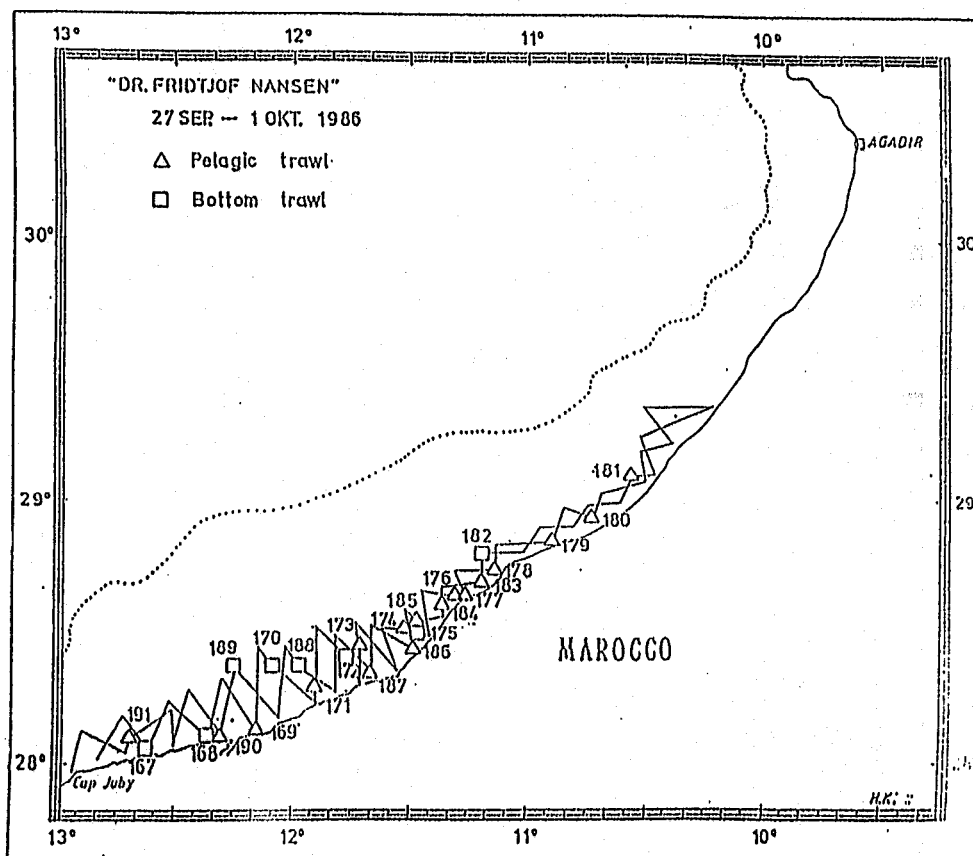


Figure 2. Cruise track and fishing stations, detailed coverages, Survey I.

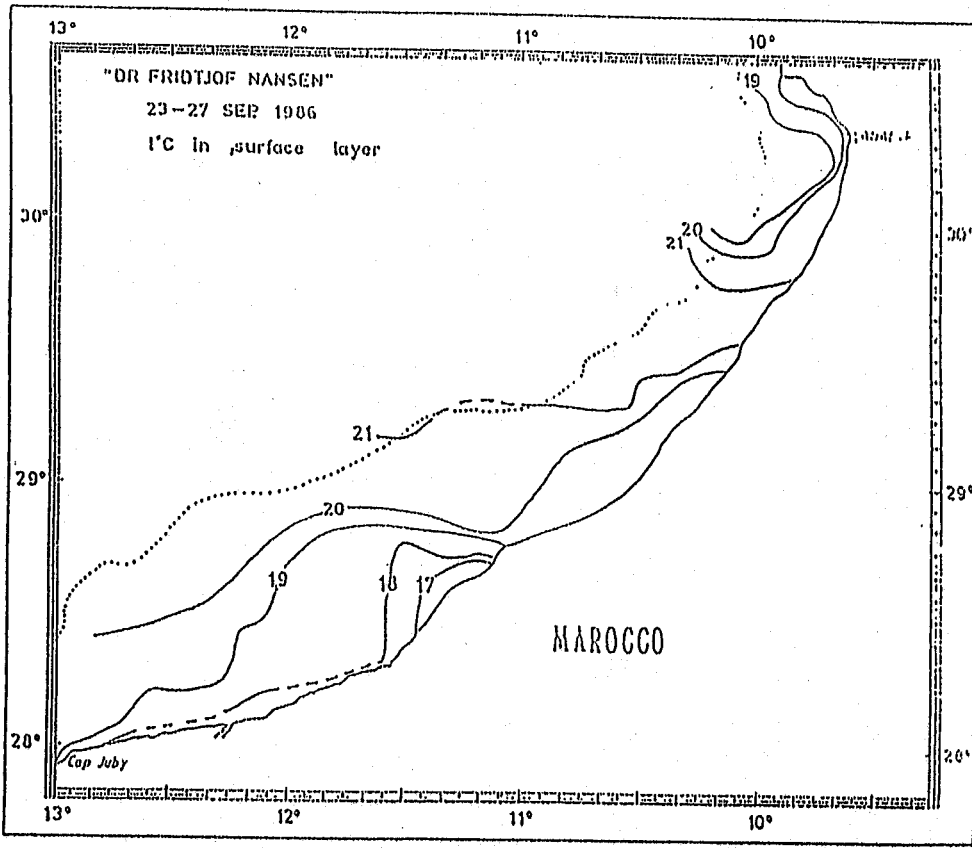


Figure 3. Sea surface temperature, Survey I.

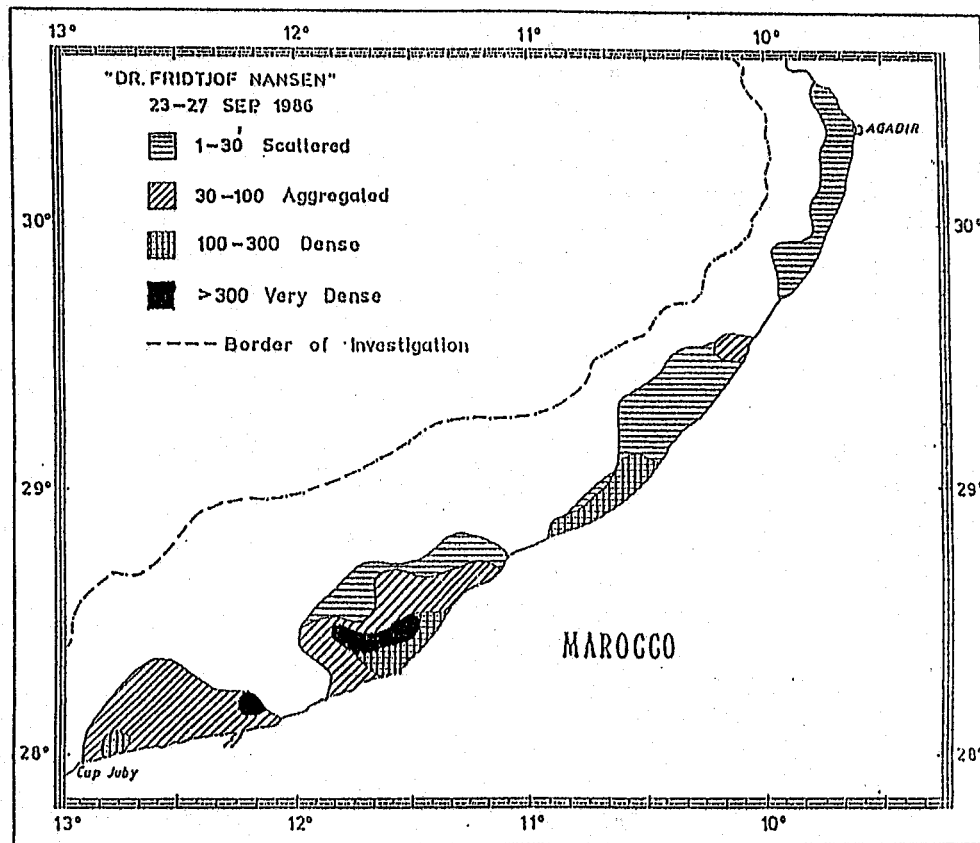


Figure 4. Distribution of sardine, main coverage, Survey I.

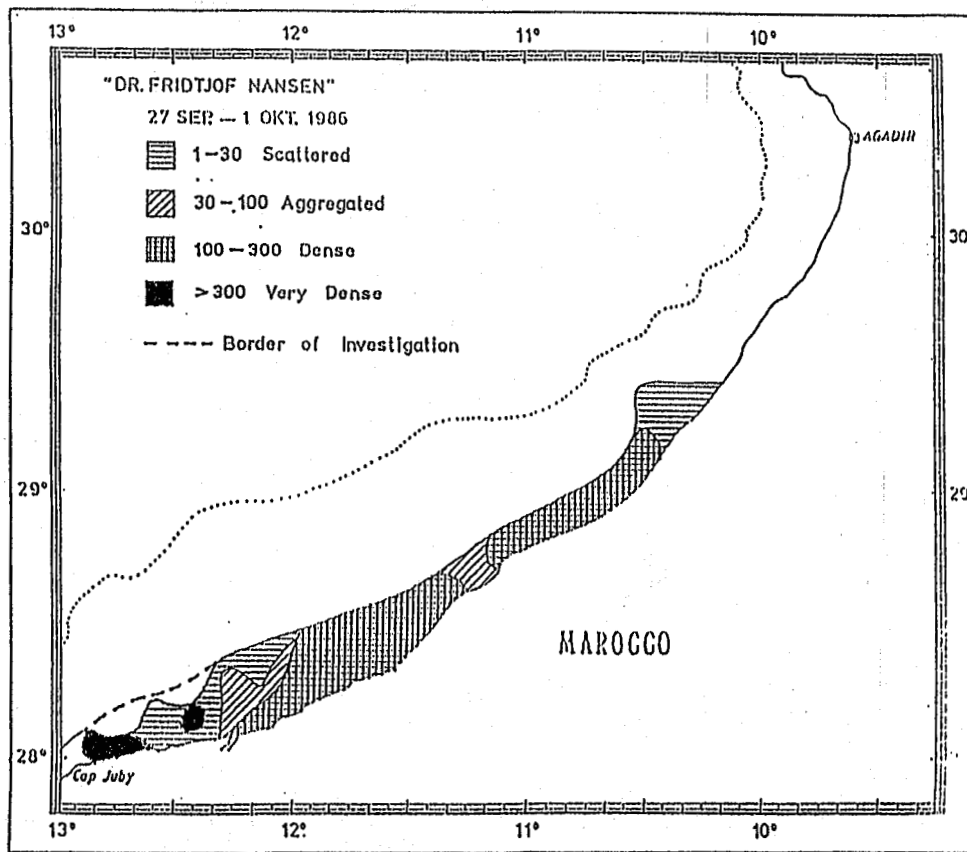


Figure 5. Distribution of sardine, 1st detailed coverage, Survey I.

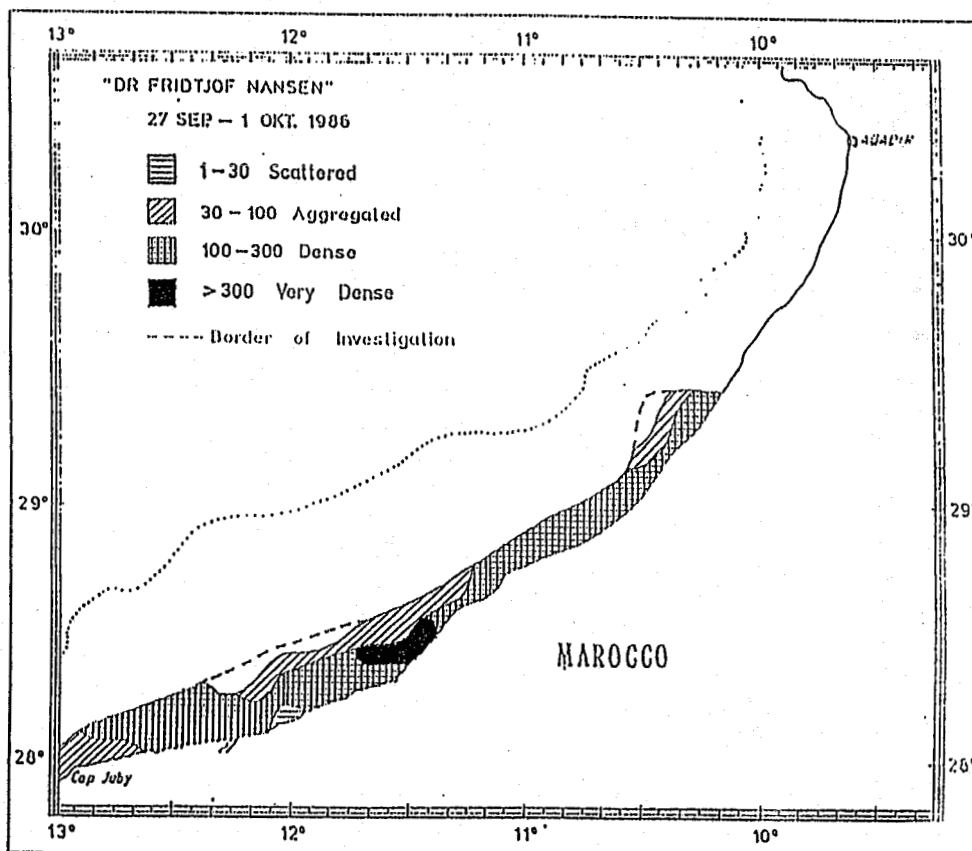


Figure 6. Distribution of sardine, 2nd detailed coverage, Survey I.



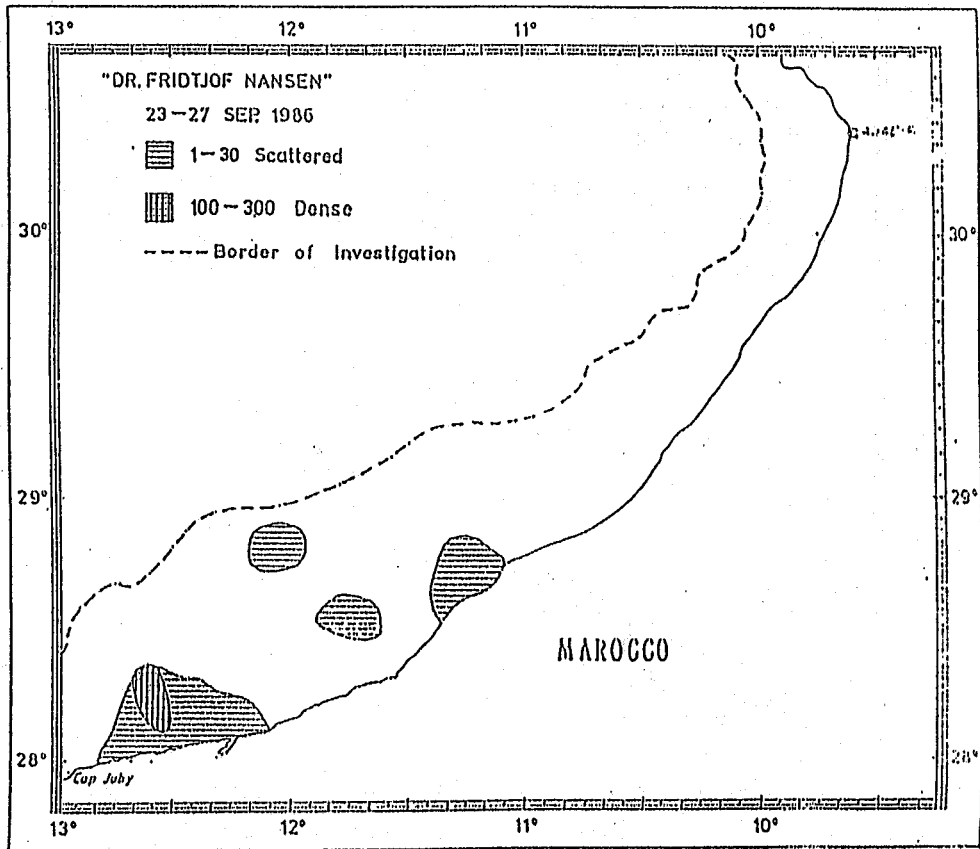


Figure 7. Distribution of mackerel, main coverage, Survey I.

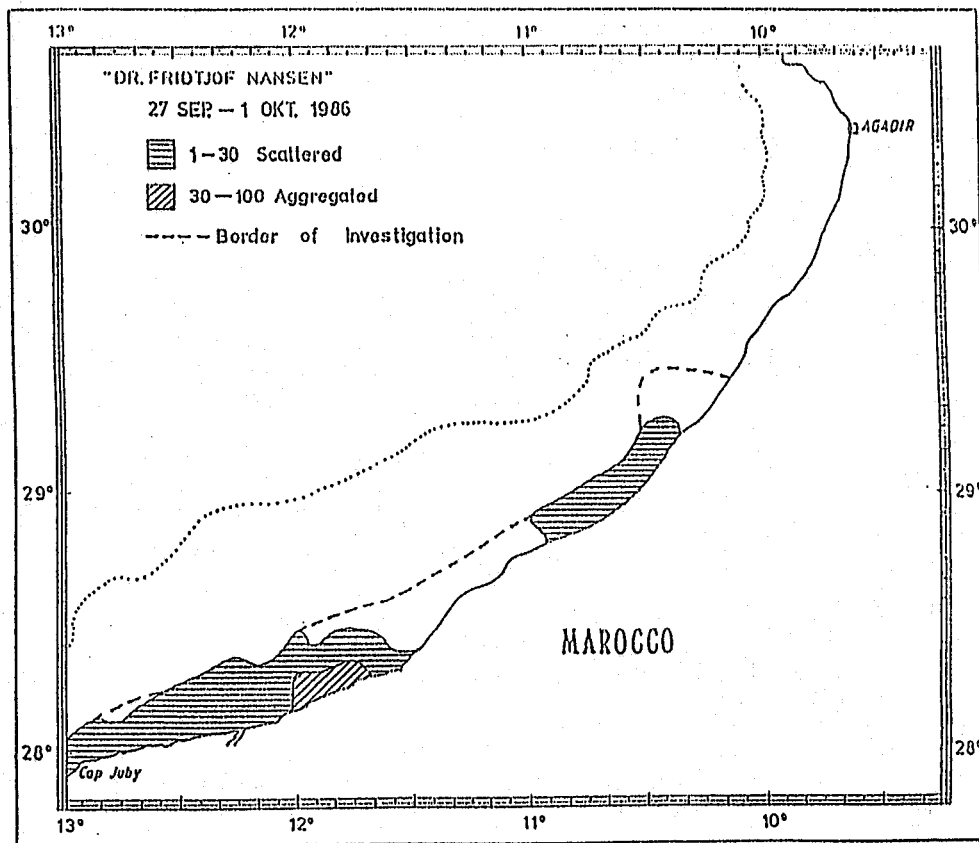


Figure 8. Distribution of mackerel, detailed coverages, Survey I.

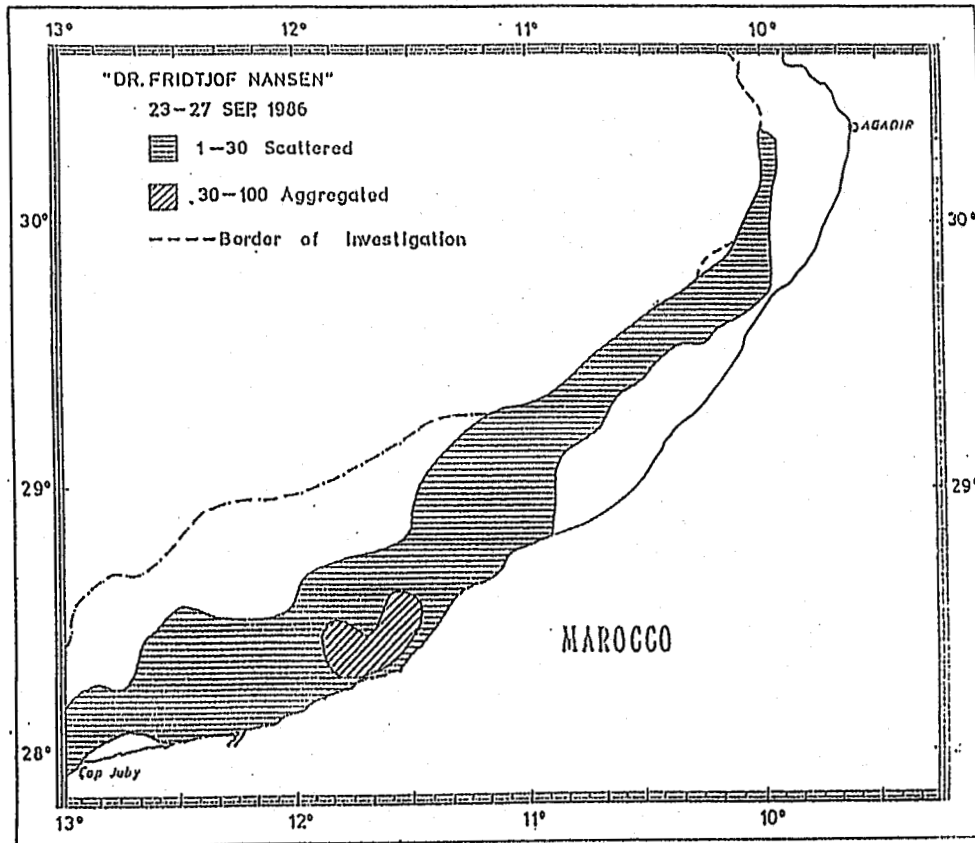


Figure 9. Distribution of horse mackerel, main coverage. Survey I.

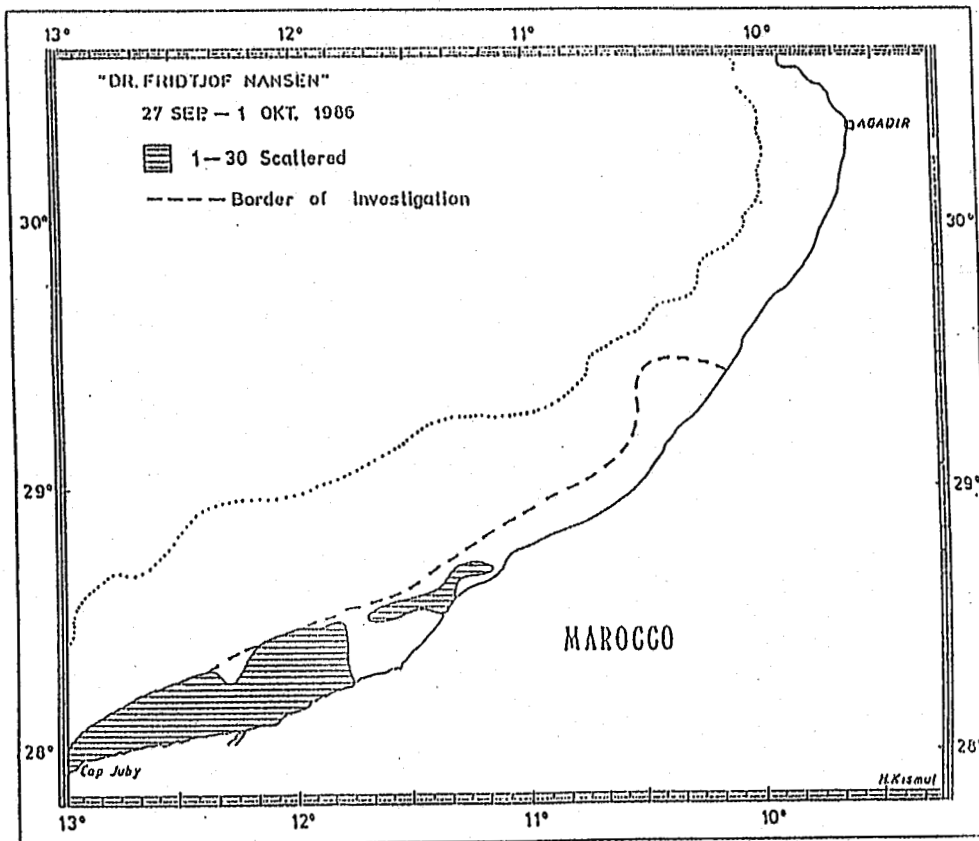
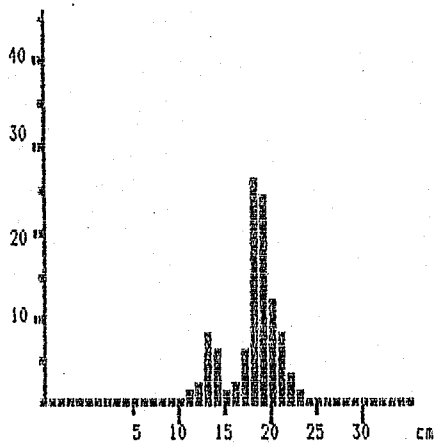


Figure 10. Distribution of horse mackerel, detailed coverages, Survey I.



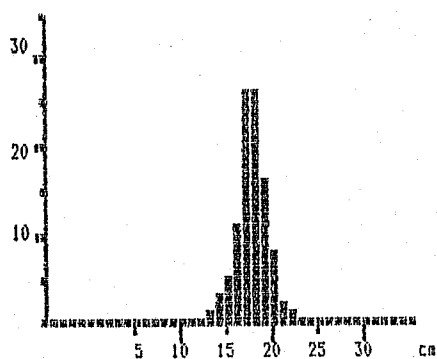
*Sardina pilchardus* (pooled data)

Morocco Sep. 1986

MEAN LENGTH = 17,8cm N= 3019

MODES : , 13cm, 18cm

NUMBER OF SUBSAMPLES : 32



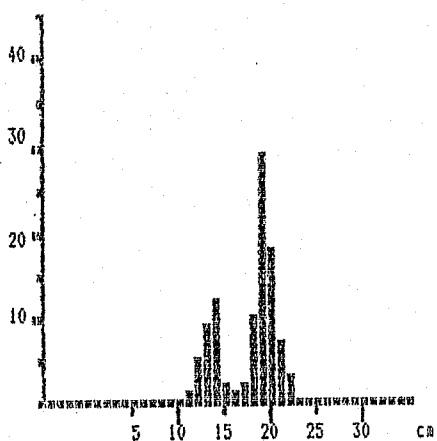
*Scomber japonicus* (pooled data)

Morocco Sep. 1986

MEAN LENGTH = 17,6cm N= 1456

MODES : , 10cm

NUMBER OF SUBSAMPLES : 24



*Trachurus trachurus* (pooled data)

Morocco Sep. 1986

MEAN LENGTH = 17,6cm N= 640

MODES : , 14cm, 19cm

NUMBER OF SUBSAMPLES : 10

Figure 11. Length composition of samples of sardine, mackerel and horse mackerel, Survey I.

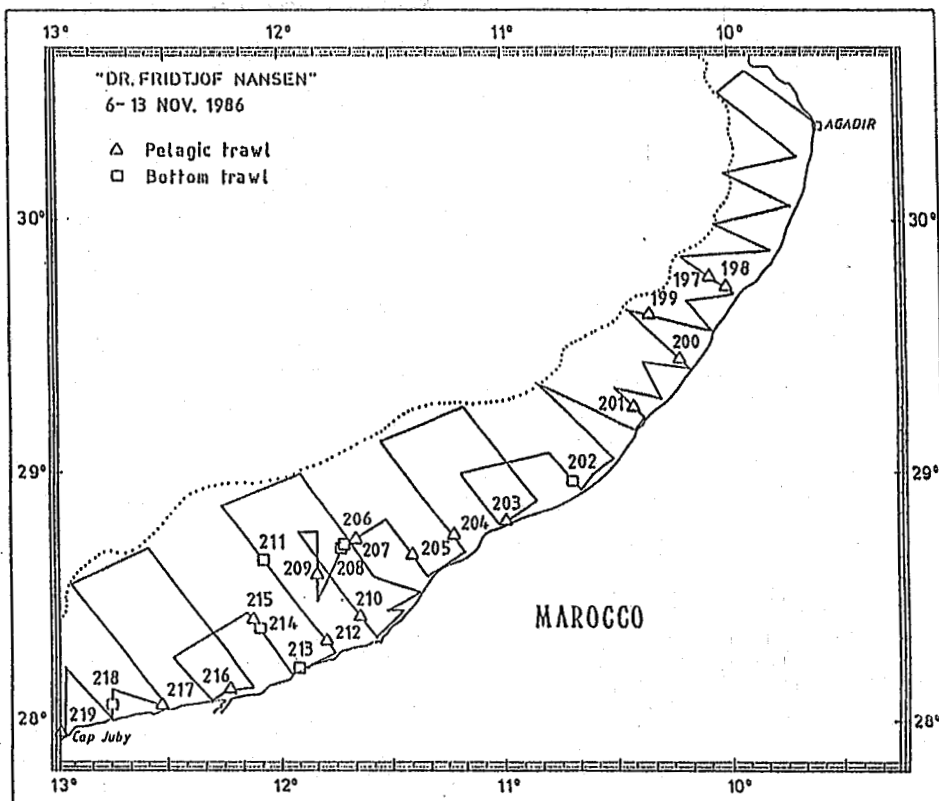


Figure 12. Cruise track and fishing stations. Agadir to Cape Juby, Survey II.

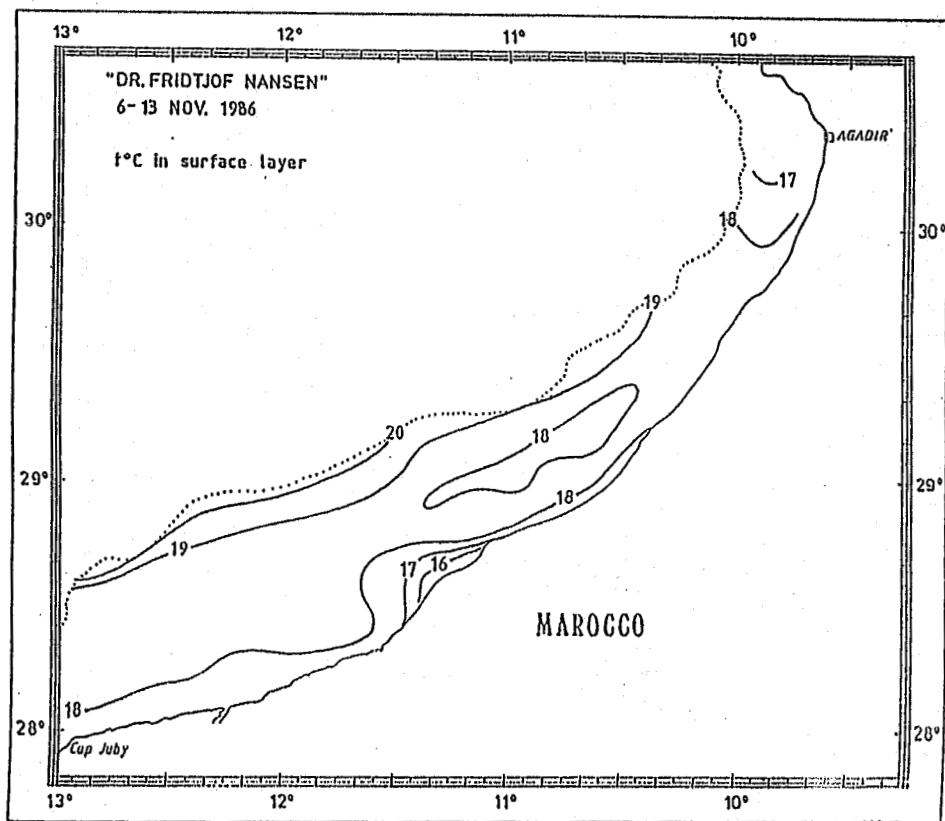


Figure 13. Sea surface temperature Agadir to Cape Juby, Survey II.

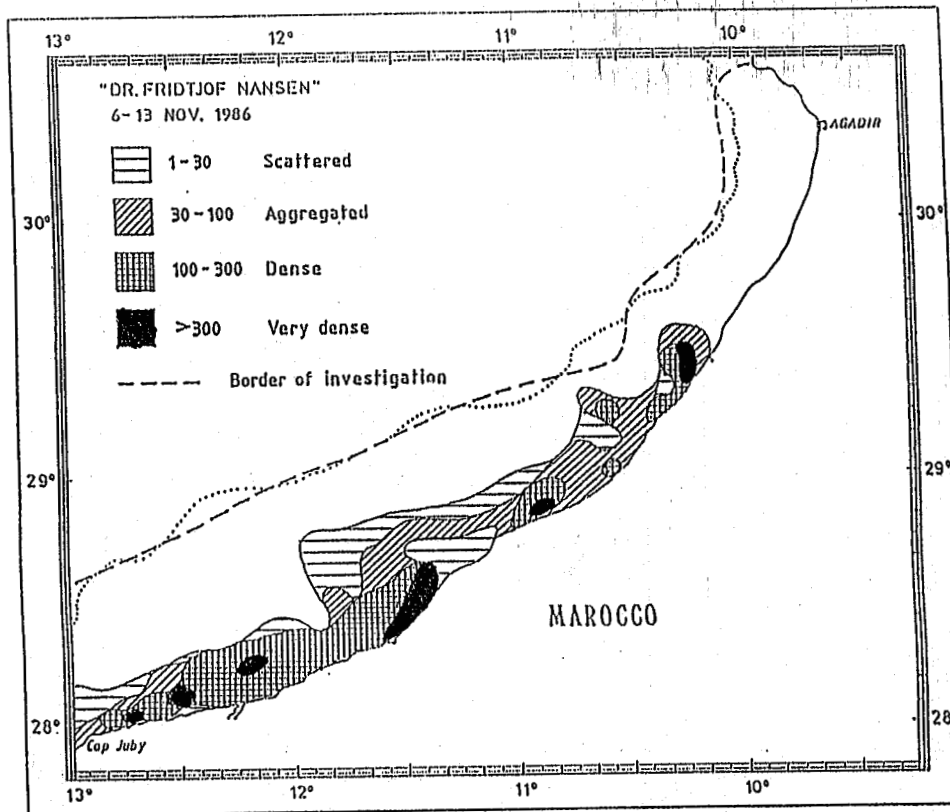


Figure 14. Distribution of sardine, Agadir to Cape Juby, Survey II.

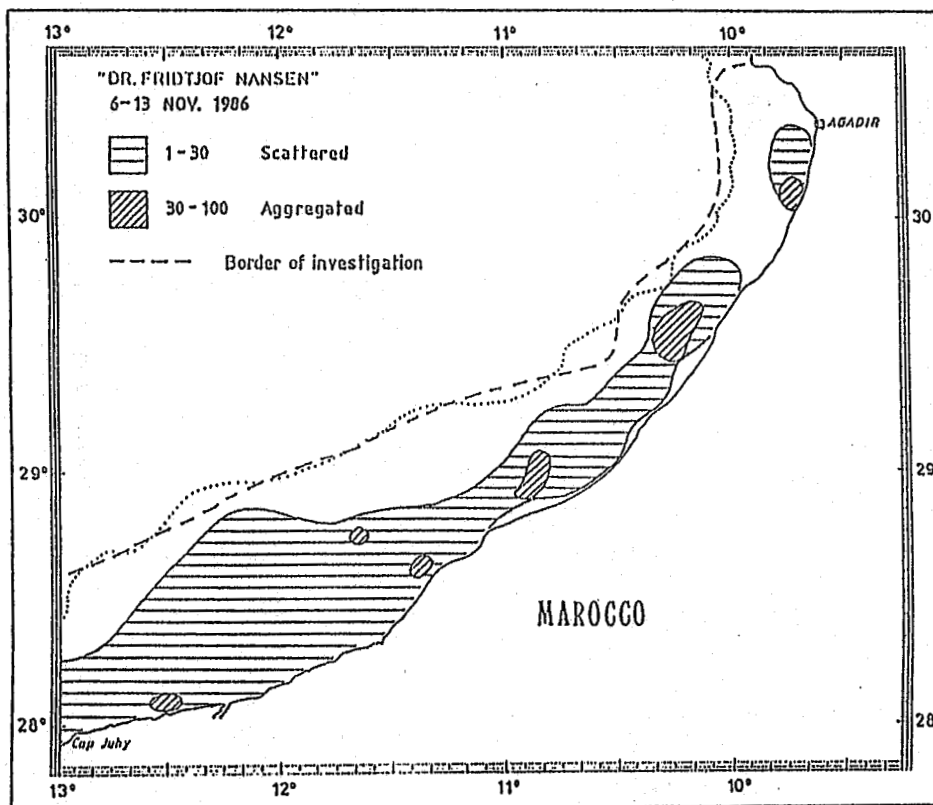


Figure 15. Distribution of mackerel Agadir to Cape Juby, Survey II.

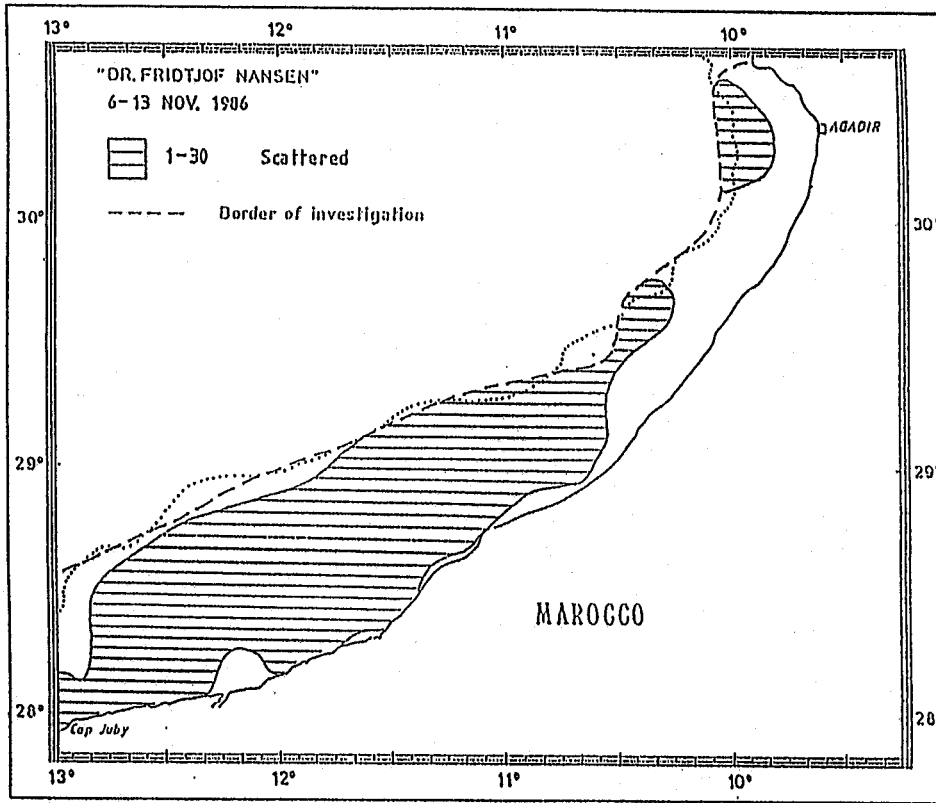
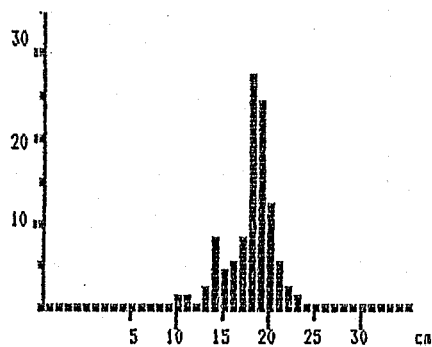


Figure 16. Distribution of horse mackerel, Agadir to Cape Juby, Survey II.



*Sardina pilchardus* (pooled data)

Agadir-C. Juby Nov. 1986

MEAN LENGTH = 17,7cm N= 1440

MODES : , 11cm, 14cm, 18cm

NUMBER OF SUBSAMPLES : 17

Figure 17. Length compositions of samples of sardines Survey II.

## Appendix I Abbreviated records of fishing stations.

DATE	TIME START	STN No.	GEAR TYPE	DEPTH (M)		POSITION		CATCH (KG)		DOMINANT SPECIES	WEIGHT (KG)	
				BOTTOM	GEAR	LATIT.	LONGIT.	TOTAL	PR HR		PR HR	%
24.09	1340	153	PT	105	100	N29 41'	W010 17'	3,3	6,6	Trachurus trachurus Anthias anthias	5,00 1,60	75,7 24,2
25.09	0425	154	PT	50	1	N29 08'	W010 37'	19,3	38,6	Sardina pilchardus Sphyrna zygaena Scomber japonicus Prionace glaucus	28,00 5,00 4,60 1,20	72,5 12,9 11,9 3,1
25.09	0805	155	PT	60	15	N29 04'	W010 42'	,0	,0	NO CATCH	,00	,0
25.09	1420	156	PT	53	15	N28 54'	W010 52'	,0	,0	NO CATCH	,00	,0
25.09	2345	157	PT	64	1	N28 45'	W011 14'	111,3	222,6	Sardina pilchardus Scomber japonicus	175,00 47,60	78,6 21,3
26.09	0845	158	PT	57	20	N28 34'	W011 44'	,0	,0	NO CATCH	,00	,0
26.09	0945	159	BT	55	55	N28 34'	W011 45'	476,1	952,2	Scomber japonicus Trachinus sp Trachurus trachurus Sardina pilchardus	471,00 216,00 69,00 63,00	49,4 22,6 7,2 6,6
26.09	1430	160	PT	35	1	N28 26'	W011 29'	1590,8	3817,9	Sardina pilchardus	3816,00	99,9
27.09	0635	161	PT	49	1	N28 28'	W011 51'	,0	,0	NO CATCH	,00	,0
27.09	0830	162	BT	40	40	N28 19'	W011 52'	525,3	1050,6	Scomber japonicus Sardina pilchardus Conger conger Trachurus trachurus	298,20 254,80 168,00 98,00	28,3 24,2 15,9 9,3
27.09	1340	163	BT	34	34	N28 10'	W012 08'	4800,0	9600,0	Sardina pilchardus Scomber japonicus Diplodus vulgaris Merluccius senegalensis	8946,00 375,80 135,40 105,20	93,1 3,9 1,4 1,0
27.09	2155	164	PT	54	1	N28 18'	W012 35'	160,7	321,4	Scomber japonicus Sardina pilchardus	190,00 127,00	59,1 39,5
28.09	0450	165	PT	60	10	N28 12'	W012 45'	12,0	24,0	Scomber japonicus Sardina pilchardus	22,00 2,00	91,6 8,3
28.09	1255	166	PT	38	10	N28 01'	W012 50'	9000,0	18000,0	Sardina pilchardus Scomber japonicus	17420,00 580,60	96,7 3,2

DATE	TIME START	STN No.	GEAR TYPE	DEPTH (M)		POSITION		CATCH (KG)		DOMINANT SPECIES	WEIGHT (KG)	
				BOTTOM	GEAR	LATIT.	LONGIT.	TOTAL	PR HR		PR HR	%
28.09	1610	167	BT	34	34	N28 02'	W012 37'	,3	,6	Scomber japonicus Sardina pilchardus	,60 ,10	100,0 16,6
28.09	1940	168	BT	29	29	N28 05'	W012 21'	107,7	215,4	Solea sp. Merluccius senegalensis Trisopterus minutus Torpedo marmorata	61,80 55,20 13,20 13,20	28,6 25,6 6,1 6,1
28.09	2300	169	PT	25	15	N28 07'	W012 09'	476,0	952,0	Sardina pilchardus Scomber japonicus Pagellus acarne Trachurus trachurus	764,40 84,00 64,40 22,40	80,2 9,8 6,7 2,3
29.09	0150	170	BT	47	47	N28 22'	W012 05'	434,4	868,8	Trachurus trachurus Pagellus acarne Plectorhynchus mediterraneus Pagellus erythrinus	221,00 210,80 87,80 76,60	25,4 24,2 10,1 8,8
29.09	0445	171	PT	34	10	N28 16'	W011 54'	806,0	3224,0	Sardina pilchardus Scomber japonicus	3109,60 114,40	96,4 3,5
29.09	0805	172	BT	43	43	N28 23'	W011 47'	795,8	1591,6	Scomber japonicus Sardina pilchardus Trachurus trachurus Trachinus sp	1150,00 232,60 102,60 67,60	72,2 14,6 6,4 4,2
29.09	1055	173	PT	48	30	N28 26'	W011 44'	1405,0	16860,0	Sardina pilchardus	16860,00	100,0
29.09	1500	174	PT	53	30	N28 31'	W011 32'	995,1	1990,2	Sardina pilchardus	1984,00	99,6
29.09	1615	175	BT	41	41	N28 29'	W011 28'	412,1	1648,4	Sardina pilchardus Scomber japonicus Solea sp. Merluccius senegalensis	1352,00 182,00 34,40 31,20	82,0 11,0 2,2 1,8
29.09	1925	176	PT	31	15	N28 38'	W011 17'	96,4	289,2	Sardina pilchardus Scomber japonicus Octopus vulgaris	248,40 36,00 3,60	85,8 12,4 1,2
29.09	2025	177	PT	31	1	N28 38'	W011 17'	31,2	93,6	Sardina pilchardus Scomber japonicus Scomber scombrus	78,00 12,60 2,10	83,3 13,4 2,2
29.09	2250	178	PT	25	1	N28 44'	W011 07'	446,9	893,8	Sardina pilchardus Diplodus bellottii	868,00 23,10	97,1 2,5



DATE	TIME START	STN No.	GEAR TYPE	DEPTH (M)		POSITION		CATCH (KG)		DOMINANT SPECIES	WEIGHT (KG)	
				BOTTOM	GEAR	LATIT.	LONGIT.	TOTAL	PR HR		PR HR	%
30.09	0130	179	PT	35	1	N28 51'	W011 54'	124,4	248,8	Sardina pilchardus Scomber japonicus	232,00 16,80	93,2 6,7
30.09	0345	180	PT	35	1	N28 57'	W010 43'	53,2	106,4	Sardina pilchardus Scomber japonicus	67,50 39,00	63,4 36,6
30.09	1330	181	PT	39	10	N29 05'	W010 34'	3000,0	9000,0	Sardina pilchardus Scomber japonicus	8727,30 272,70	96,9 3,0
30.09	1845	182	BT	68	68	N28 47'	W011 11'	222,1	444,2	Trachurus trachurus Trisopterus minutus Dentex macrophthalmus Pagellus acarne	259,20 53,60 23,20 20,00	58,3 12,0 5,2 4,5
30.09	2025	183	PT	37	1	N28 42'	W011 10'	65,6	131,2	Sardina pilchardus Trachurus trachurus Scomber japonicus	117,20 10,80 2,80	89,3 8,2 2,1
30.09	2310	184	PT	49	1	N28 37'	W011 22'	25,1	50,2	Sardina pilchardus Scomber japonicus Trachurus trachurus	47,00 1,80 1,20	93,6 3,5 2,3
01.10	0125	185	PT	55	40	N28 32'	W011 29'	2000,0	12000,0	Sardina pilchardus	12000,00	100,0
01.10	0340	186	PT	30	1	N28 25'	W011 29'	161,5	323,0	Sardina pilchardus	320,00	99,0
01.10	0650	187	PT	37	20	N28 20'	W011 40'	1010,4	4041,6	Sardina pilchardus	4032,00	99,7
01.10	1130	188	BT	46	46	N28 21'	W011 58'	570,1	1140,2	Scomber japonicus Sardina pilchardus Trachurus trachurus Trachinus sp	659,40 239,40 91,20 60,80	57,8 20,9 7,9 5,3
01.10	1650	189	BT	51	51	N28 21'	W012 15'	535,5	1606,5	Scomber japonicus Sardina pilchardus Pagellus erythrinus Sparus auriga	513,00 405,00 199,80 164,70	31,9 25,2 12,4 10,2
01.10	1930	190	PT	16	1	N28 04'	W012 18'	790,0	1896,0	Sardina pilchardus Diplodus bellottii Diplodus vulgaris Scomber japonicus	1620,00 90,00 54,00 48,00	85,4 4,7 2,8 2,5
02.10	0040	191	PT	49	10	N28 05'	W012 42'	52,8	105,6	Sardina pilchardus Scomber japonicus	88,00 17,60	83,3 16,6
02.10	0835	192	BT	31	31	N28 09'	W012 09'	3000,0	6000,0	Sardina pilchardus Scomber japonicus	5387,00 590,60	89,7 9,8

DATE	TIME START	STN No.	GEAR TYPE	DEPTH (M)		POSITION		CATCH (KG)		DOMINANT SPECIES	WEIGHT (KG)	
				BOTTOM	GEAR	LATIT.	LONGIT.	TOTAL	PR HR		PR HR	%
07.11	0950	197	PT	105	27	N29 47'	W010 06'	,0	,0	NO CATCH	,00	,0
07.11	1137	198	PT	45	15	N29 44'	W010 02'	,1	,1	<i>Scomber japonicus</i>	,10	100,0
07.11	1744	199	PT	104	80	N29 38'	W010 21'	30,1	60,2	<i>Scomber japonicus</i>	60,00	99,6
07.11	2100	200	PT	45	23	N29 27'	W010 14'	46,6	93,2	<i>Sardina pilchardus</i> <i>Scomber japonicus</i> <i>Oicentrarchus labrax</i> <i>Pagellus acarne</i>	69,00 13,00 9,00 1,20	74,0 13,9 9,6 1,2
08.11	0225	201	PT	39	13	N29 15'	W010 26'	225,0	612,0	<i>Sardina pilchardus</i> <i>Scomber japonicus</i>	601,66 7,61	98,3 1,2
08.11	1037	202	BT	37	37	N28 57'	W010 42'	103,9	367,8	<i>Scomber japonicus</i> <i>Trachurus trachurus</i> <i>Lepidotrigla carolae</i> <i>Sardina pilchardus</i>	162,00 82,80 32,40 25,20	44,0 22,5 8,8 6,6
08.11	1605	203	PT	25	10	N28 48'	W011 00'	3000,0	5610,0	<i>Sardina pilchardus</i>	5606,26	99,9
09.11	0125	204	PT	65	10	N28 44'	W011 14'	140,0	280,0	<i>Sardina pilchardus</i> <i>Scomber japonicus</i>	207,20 72,80	74,0 26,0
09.11	0446	205	PT	64	14	N28 40'	W011 24'	70,0	190,4	<i>Sardina pilchardus</i> <i>Scomber japonicus</i>	176,25 14,14	92,5 7,4
09.11	0736	206	PT	75	10	N28 44'	W011 39'	2,8	5,6	<i>Trachinus draco</i> <i>Sardina pilchardus</i>	5,20 ,40	92,8 7,1
09.11	0910	207	BT	66	66	N28 42'	W011 43'	14,2	426,0	<i>Dentex macrophthalmus</i> <i>Pagellus erythrinus</i> <i>Dentex gibbosus</i> <i>Loligo vulgaris</i>	360,00 21,00 12,00 9,00	84,5 4,7 2,8 2,1
09.11	0940	208	BT	67	67	N28 42'	W011 42'	2500,0	5000,0	<i>Scomber japonicus</i> <i>Trachurus trachurus</i> <i>Pagellus acarne</i> <i>Dentex macrophthalmus</i>	1597,00 1486,60 900,40 450,20	31,9 29,7 18,0 9,0
11.11	2001	209	PT	59	40	N28 35'	W011 51'	51,5	103,0	<i>Diplodus vulgaris</i> <i>Pagellus bellottii</i> <i>Sardina pilchardus</i> <i>Dasyatis sp.</i>	50,00 22,00 15,00 5,60	48,5 21,3 14,5 5,4

DATE	TIME	STN No.	GEAR TYPE	DEPTH (M)		POSITION		CATCH (KG)		DOMINANT SPECIES	WEIGHT (KG)	
				BOTTOM	GEAR	LATIT.	LONGIT.	TOTAL	PR HR		PR HR	%
12.11	0025	210	PT	44	10	N28 25'	W011 10'	245,0	490,0	Sardina pilchardus Scomber japonicus	485,10 4,90	99,0 1,0
12.11	1205	211	BT	100	100	N28 38'	W012 05'	48,3	413,9	Scomber japonicus Trachurus trachurus Pagellus acarne	385,65 12,85 11,99	93,1 3,1 2,8
12.11	1505	212	PT	38	20	N29 19'	W011 48'	313,0	626,0	Sardina pilchardus Scomber japonicus Trachurus trachurus Pagellus acarne	500,00 76,00 28,00 20,00	79,8 12,1 4,4 3,1
12.11	1721	213	BT	19	19	N28 12'	W011 55'	89,6	179,2	Diplodus bellottii Trachurus trachurus Merluccius merluccius Scomber scombrus	120,00 22,80 15,00 6,60	66,9 12,7 8,3 3,6
12.11	1952	214	BT	48	48	N28 22'	W012 06'	90,8	181,6	Pagellus acarne Dentex macrophthalmus Trachurus trachurus Sepia sp	33,90 27,00 20,40 19,20	18,6 14,8 11,2 10,5
12.11	2120	215	PT	50	1	N28 24'	W012 08'	261,0	522,0	Scomber japonicus Sardina pilchardus	516,60 5,40	98,9 1,0
13.11	0213	216	PT	36	10	N28 08'	W012 14'	1750,0	3500,0	Sardina pilchardus Scomber japonicus	3410,00 80,00	97,4 2,2
13.11	1223	217	PT	34	10	N28 04'	W012 32'	2500,0	5000,0	Sardina pilchardus Scomber japonicus	4864,20 135,80	97,2 2,7
13.11	1545	218	BT	46	46	N28 04'	W012 44'	464,8	929,6	Sardina pilchardus Scomber japonicus Pagellus acarne Trachurus trachurus	496,00 192,00 73,60 70,40	53,3 20,6 7,9 7,5