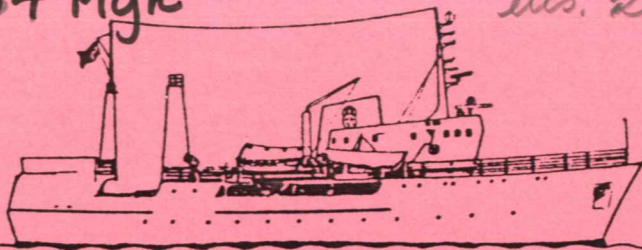


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( Reports on Surveys with the  
R/V Dr Fridtjof Nansen )

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A PELAGIC FISH SURVEY  
IN THE EEZ OF THE  
REPUBLIC OF DJIBOUTI

Sigmund Myklevoll

Institute of Marine Research, Bergen

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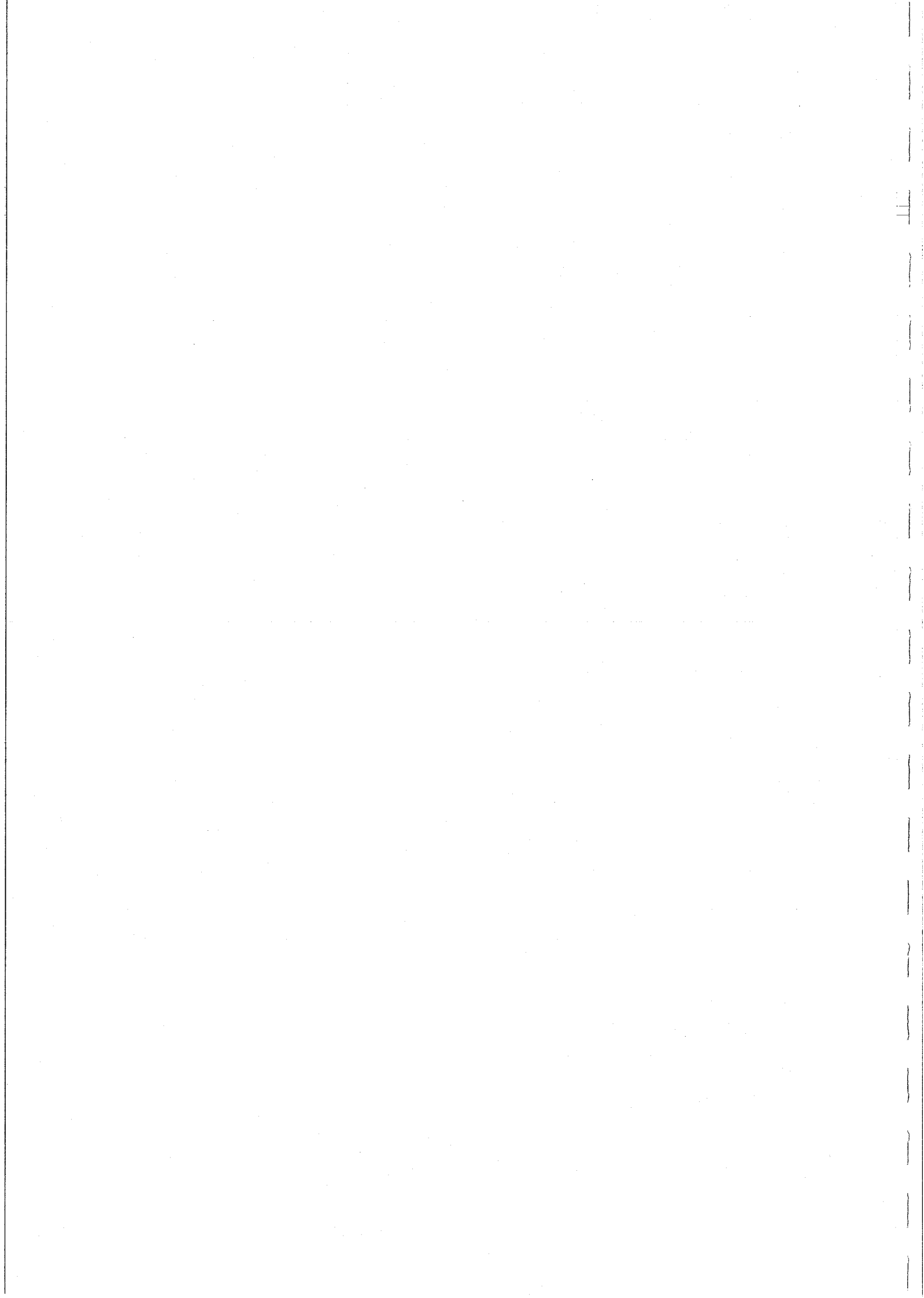
Bergen, May 1982

### "Dr Fridtjof Nansen"

The fishery research vessel "Dr Fridtjof Nansen" belongs to the Norwegian Agency for International Development (NORAD). It was designed and built for scientific and exploratory investigations of fishery resources of developing countries, under a joint plan with the Fisheries Department of FAO based on a funding of operation to be shared by FAO and Norway.

## CONTENTS

	Page
1. INTRODUCTION	1
2. EQUIPMENT AND METHODS	2
2.1 Vessel and equipment	2
2.2 Operation of the acoustic instruments	2
2.3 Sampling and processing of acoustic data	3
2.4 Sampling and processing of biological data	3
3. RESULTS	3
3.1 Cruise narrative	3
3.2 Hydrography	4
3.3 Bottom conditions	4
3.4 Pelagic fish	4
3.5 Demersal fish	5
3.6 Shrimp	5
3.7 Mesopelagic fish, plankton, swimming crab, cephalopods	6
4. SUMMARY AND CONCLUSIONS	6
5. REFERENCES	6
Figures	7
Tables	12
ANNEX The trawls used during the cruise	15



## 1. INTRODUCTION

The fishery research vessel "Dr Fridtjof Nansen" called at Djibouti for supplies and change of personnel on 27 February 1981, enroute from meso-pelagic fish surveys in the Gulf of Oman and Gulf of Aden to new research missions in the Red Sea and the Mediterranean.

On arrival the cruise leader was approached by Government representatives with a request for a pelagic fish survey of the Exclusive Economic Zone (EEZ) of the Republic of Djibouti.

On the 1 March 1981 a meeting was held onboard the vessel. The participants were:

### Government of Djibouti:

Mohammed Moussa Chehen, Chef du Service de l'Elvage et des Pesches  
Dini Ibrahim, Directeur de la Peche  
René Tello, Conseiller Peche

### UNDP office, Aden:

Bouhled Mahmoud

### Institute of Marine Research, Bergen:

Sigmund Myklevoll, Cruise leader  
Roald Vindenes, Captain of R/V "Dr Fridtjof Nansen"

### Interpreter:

Mohamed Reda Mahmoud Hegazy, Egypt

A survey of Djibouti waters was strongly recommended by the UNDP representative Bouhled Mahmoud. It was pointed out that the vessel's programme had been planned already up to 18 September, and that the first part particularly had a very strict timetable. It was, however, agreed to apply for a 2-3 days survey, and the Institute of Marine Research, Bergen was contacted.

Permission was granted the same evening, and the Government of Djibouti was informed the next morning. Licence to operate in Djibouti waters was issued immediately, and two representatives of the fisheries authorities joined the vessel.

The short time available did not permit a thorough investigation of the area. It was decided to concentrate upon small pelagic fish species (Carangidae, Clupeidae, Engraulidae) which migrate to these waters at this time of the year.

A cruise track suggested by Mr. Bouhled Mahmoud and slightly modified to cover the interests of the Djibouti personell was approved.

### The research staff were:

Youssef Ali Youssef and René Tello (Djibouti),  
Mohammed Reda Mahmoud Hegazy (Egypt),  
Bjørn Bakken, Walter Løtvedt and Sigmund Myklevoll (Institute  
of Marine Research, Bergen, Norway).

## 2. EQUIPMENT AND METHODS

### 2.1 Vessel and equipment

"Dr Fridtjof Nansen" is a 150 ft stern trawler with a main engine of 1500 hp. The cruising speed is 10-11 knots. The vessel is equipped for acoustic surveying, bottom and pelagic trawling, hydrography and plankton observations.

The acoustic equipment comprise two echo sounders, 38 and 120 kHz, two echo integrators, a 50 kHz net sonde, and a 24 kHz searchlight sonar. All instruments are manufactured by Simrad.

Three trawls, one bottom trawl and two pelagic trawls are ready for use at any time. The bottom trawl is placed on deck and the pelagic trawls are on drums above deck. The same set of otter boards is used with all trawls.

The bottom trawl is a modified high opening shrimp trawl 1800 meshes in circumference, 40 mm mesh size, with a group rope of 63 ft and headrope of 96 ft length. The ground rope is equipped with 0.5 m rubber bobbins. The bridles are 40 m long, the distance between the wings is 20 m and the vertical opening about 6 m.

The pelagic trawls are one capelin ("Harstad") trawl, 30x30 m, and one "Krill" trawl, 25.5x25.5 m opening.

The cod ends of all trawls are lined with fine-meshed net of 1 cm mesh size.

The hydrographic instruments used during the cruise were a Brown bathythermograph, depth range 0-140 m, and a Negretti & Zambra continuous temperature recorder at 5 m depth. The vessel also carries Nansen bottles and instruments for salinity and oxygen determinations.

### 2.2 Operation of the acoustic instruments

The echo integrators were connected, one to each echo sounder. The instruments had the following settings and performance:

Frequency	38 kHz	120 kHz
Depth range (m)	0-100 + 100-200	0-100
Transducer (ceramic)	8 <sup>o</sup> x 8 <sup>o</sup> 30 x 30 cm	10 <sup>o</sup> circular
Transmitter output	External 2500 W	1/1 355 W
SL + VR	138 dB	102 dB
Bandwidth and pulse length	3 kHz, 0.6 m sec	3 kHz, 0.6 m sec
TVG and gain	20 log R+2αR -20 dB	20 log R+2αR 0 dB
Recorder gain	7	4
Integrator threshold	1	1
Integrator gain	20 x 10	20 x 10
Depth intervals (m)	4-50 / 50-200	4-50 / 50-100

### 2.3 Sampling and processing of acoustic data

The acoustic instruments were watched continuously. Integrator outputs were read per nautical mile and averaged over five miles intervals. Trawl hauls were made to identify the various types of echo traces.

The 38 kHz sounder was chosen as the main instrument. By comparing the values from the two sounders one had a means of separating fish and plankton echoes.

The integrated values were divided into three categories: pelagic fish, demersal fish, and plankton/mesopelagic fish/swimming crabs according to the echo traces and trawl catch composition.

The integrated values were plotted along the course-line, and charts of density distribution were drawn.

### 2.4 Sampling and processing of biological data

Trawling time was recorded from the moment the trawl was at the selected fishing depth until hauling in started. Normal towing time was 30 minutes.

Catches were sorted into species, weighed and counted. Some species were measured to length (LT).

Samples from the catches were frozen or preserved in formalin and taken to Djibouti and Bergen, Norway for identification and further examination.

We are indebted to Dr Jean Michel Rose, Aquarium Tropical de Djibouti, and Dr Jakob Gjørseter, University of Bergen for their help in identification of several species.

Fish names are, as far as possible in accordance with FAO Species Identification Sheets for Fishery Purposes (FISCHER and WHITEHEAD 1974).

## 3. RESULTS

### 3.1 Cruise narrative

The cruise commenced on the 2 March 1981 at 1920 hours. The inner part of the Gulf of Tadjura was surveyed during the night. Three pelagic trawl hauls were made here, and a bathythermograph station was taken in the centre of the gulf.

At daybreak on the 3 March, the vessel entered the plateau between Djibouti harbour and Musha Islands. A bottom trawl haul was made here, mainly to look for large shrimp.

The entrance to the Gulf of Tadjura was searched until midday. The rest of the day and the 4 March until dusk was spent surveying the shelf and the deeps between Ras Bir and the country's northern border. One bottom trawl and six pelagic trawl hauls were made in this area. A bathythermograph station was made off Ras Bir.

The eastern triangle of the EEZ to the east of Ras Bir was not surveyed.



North of Ras Si-Ane fishing was restricted to the coastal plateau, as it was not advisable to trawl in the heavily trafficked ships' lanes in the Straits of Bab-el-Mandeb.

For comparison with the daylight trawl haul on the plateau off Djibouti, another haul was made here around midnight.

The vessel anchored in the roads off Djibouti at 0115 on the 5 March. The local participants disembarked in the morning.

The weather conditions were favourable with calm in the Gulf of Tadjura and southeasterly winds up to force 4 in the northern region.

The survey courses and stations are shown in Figure 1.

### 3.2 Hydrography

Temperature was recorded continuously at 5 m depth. Temperatures varied between 26.5 and 27.5°C in the whole area.

Two bathythermograph stations were made to determine the thermocline. In the Gulf of Tadjura a distinct thermocline was found at 60 m. The upper layer held about 26.5°C, temperature falling to about 22.5°C between 60 and 110 m. Off Ras Bir the temperature fell more evenly from 26.7°C at the surface to about 24.8°C at 85 m, rising slightly and falling again from 95 m to 24°C at 130 m (Figure 5).

### 3.3 Bottom conditions

Most of the shelf area that was covered, off Djibouti and between Ras Bir and the northern border (see Figure 1) had bottom suitable for demersal trawling.

Depths in the inner part of the Gulf of Tadjura are uncertain, and the charts cannot be trusted. Bottom topography has changed in recent years because of volcanic activity.

### 3.4 Pelagic fish

The main objective of the survey was to find whether migratory small pelagic fish species (Carangidae, Clupeidae, Engraulidae and Scombridae) had arrived in Djibouti waters. Therefore the instruments were set to record the upper 200 m.

No significant schools were recorded, and the trawl catches were poor. As the survey was made rather early in the season, this was no surprise.

Complete details of fishing stations are given in Tables 1 and 2, and density distribution chart is given in Figure 2. Some of the sought for small pelagic species are mentioned below:

#### Decapterus macrosoma (Lajang scad)

One specimen only (TP 112), over the shelf north of Ras Bir.

Decapterus maruadsi (Round scad)

A few specimen caught in bottom trawl (TB 116) on the plateau off Djibouti harbour.

Selar crumenophthalmus (Bigeye scad)

Present in small number in catches over the shelf from Tadjura towards Ras Si-Ane (TP 107, TP 109, TP 112). About 15 kg caught in bottom trawl off Djibouti harbour (TB 116). Length frequency distributions presented in Table 3.

Dussumieria acuta (Rainbow sardine)

Caught in small number in the two bottom hauls (TB 108, TB 116) off Djibouti harbour.

Sardinella sp.

Present in bottom trawl catches (TB 108, TB 116) on the plateau off Djibouti harbour. Also two specimens caught at TP 105 at the head of the Gulf of Tadjura. The species probably S. gibbosa.

Stolephorus sp.

One specimen only (TP 107).

Rastrelliger kanagurta (Indian mackerel)

Three specimens caught at TB 116 off Djibouti harbour.

### 3.5 Demersal fish

The two bottom trawl hauls (TB 108, TB 116) on the plateau off Djibouti harbour yielded a rich variety of species (Table 2). Areas where demersal fish were recorded are shown in Figure 3.

The Leiognathidae, which may be labelled "semi-pelagic" species, constituted 80% of the catch at TB 108 and 13% of TB 116. Other species that were fairly numerous were Japanese threadfin bream (Nemipterus japonicus), Great lizardfish (Saurida tumbil) and Therapon perches (Therapon jarbua, T. theraps).

In the north, recordings at the bottom were poor.

### 3.6 Shrimp

The bottom trawl hauls on the plateau off Djibouti harbour were made primarily to look for large shrimp.

A naval exercise with several moored installations over the plateau permitted trawling only in a very narrow area where one day and one night haul were made.

The two fishing stations confirmed the presence of commercially valuable large shrimp (Penaeus sp.), but only a few specimens were caught. The two hauls were made at the same position.

### 3.7 Mesopelagic fish, plankton, swimming crab, cephalopods

Most of the integrated echo intensities were ascribed to mesopelagic fish and plankton. The contribution from swimming crabs is somewhat uncertain. The density distribution of these organisms plus squid is shown in Figure 4.

The most abundant mesopelagic species were Myctophids, mainly Benthosema pterotum, and also Lampanyctus macropterus. Other mesopelagic species that were taken in numbers, but at fewer stations were Stomias affinis and Lestrolepis intermedia.

Eel larvae were not taken in the inner part of the Gulf of Tadjura, but were quite numerous outside from Ras Bir northwards.

Small squids and swimming crabs were present in most pelagic hauls, and cuttlefish were caught in the bottom trawl off Djibouti.

No plankton hauls were made, and the planktonic organisms caught by the trawl were not identified ("krill").

Samples of mesopelagic fish were preserved and taken to the University of Bergen, Norway for further study. The results will be presented in a separate publication.

## 4. SUMMARY AND CONCLUSIONS

The survey was carried out during 54 hours, 2-5 March 1981. Except for the easternmost triangle, east of Ras Bir, the Djibouti EEZ was covered. A denser grid over the shelf would, of course, have been preferable.

The primary purpose of the survey was to find whether small pelagic fish species that migrate to these waters at this time of the year had arrived in quantity already.

No schools were recorded by echo sounder in the upper 200 m, and no surface schools were observed. Only a few specimens of the sought for species (Carangidae, Clupeidae, Engraulidae, Scombridae) were present in the catches.

According to the local participants, the cruise was run at the very beginning of the season, therefore the absence of larger concentrations was no surprise.

The presence of large shrimp (Penaeus sp.) on the plateau off Djibouti was confirmed, but access to the whole plateau and more fishing stations are necessary to find whether a commercially exploitable stock exists.

## 5. REFERENCES

- FISCHER, W. and P.J.P. WHITEHEAD (eds). 1974. FAO Species identification sheets for fishery purposes, Eastern Indian Ocean (Fishing area 57) and Western Central Pacific (Fishing area 71). Vols I-IV (pag.var.). FAO, Rome.

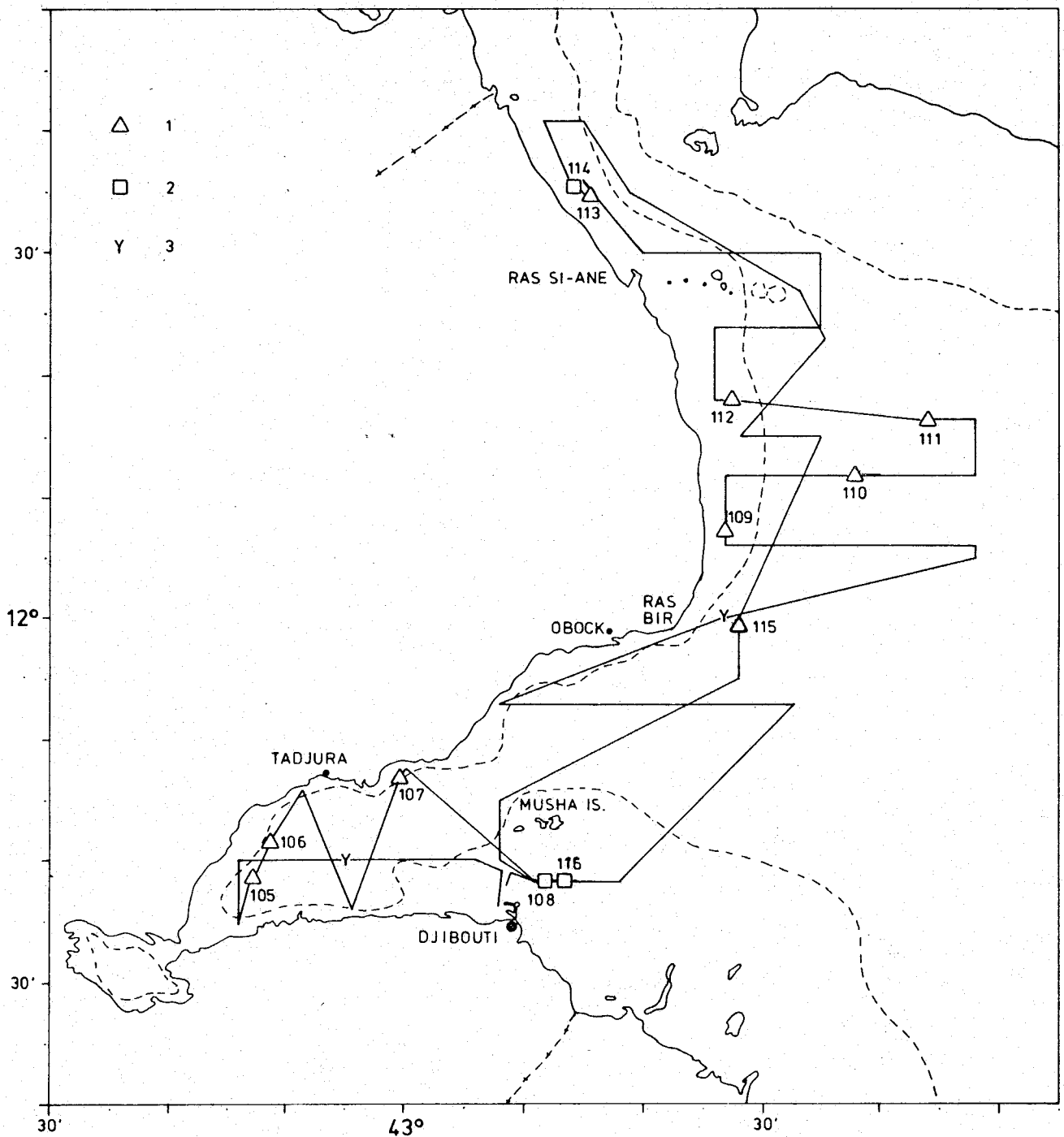


Fig. 1. Survey courses and stations. R/V "Dr Fridtjof Nansen", Pelagic fish survey in Djibouti EEZ, 2-5 March 1981. Legend: 1) Pelagic trawl, 2) Bottom trawl, 3) Bathythermograph.

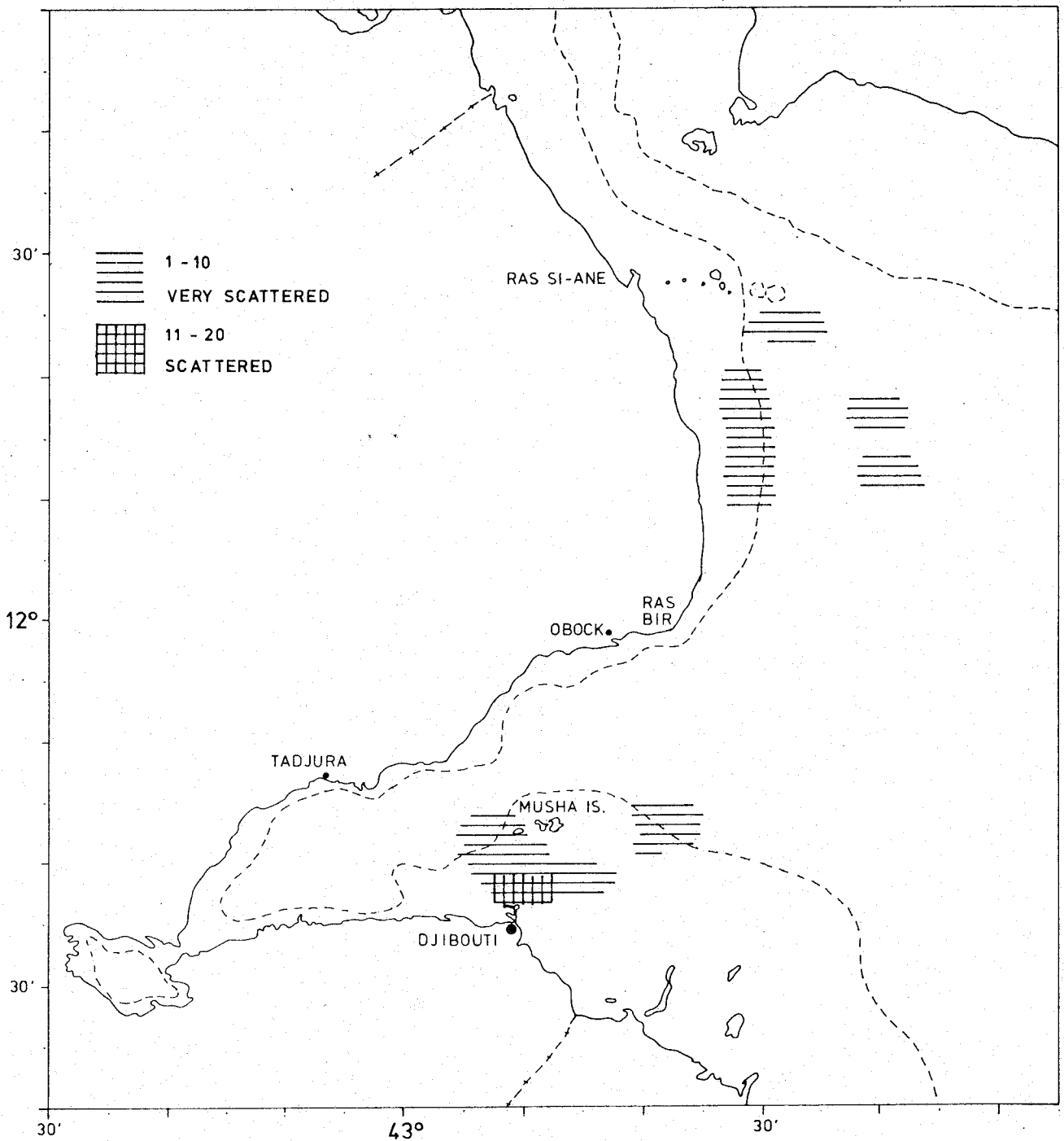


Fig. 2. Integrated echo intensities (mm per nautical mile) classified as pelagic fish.

R/V "Dr Fridtjof Nansen", 2 - 5 March 1981.

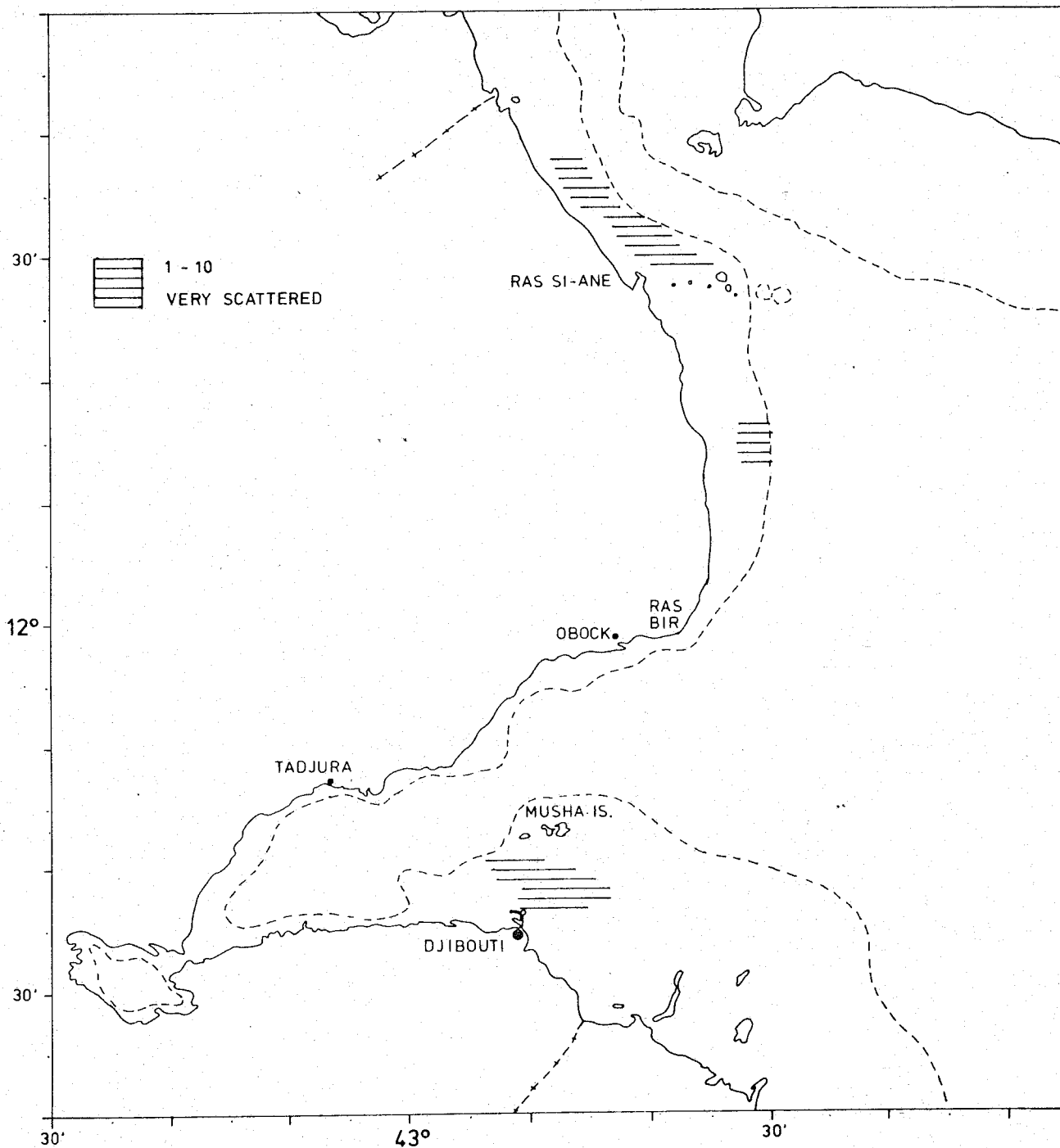


Fig. 3. Integrated echo intensities (mm per nautical mile) classified as demersal fish.  
 R/V "Dr Fridtjof Nansen", 2 - 5 March 1981.

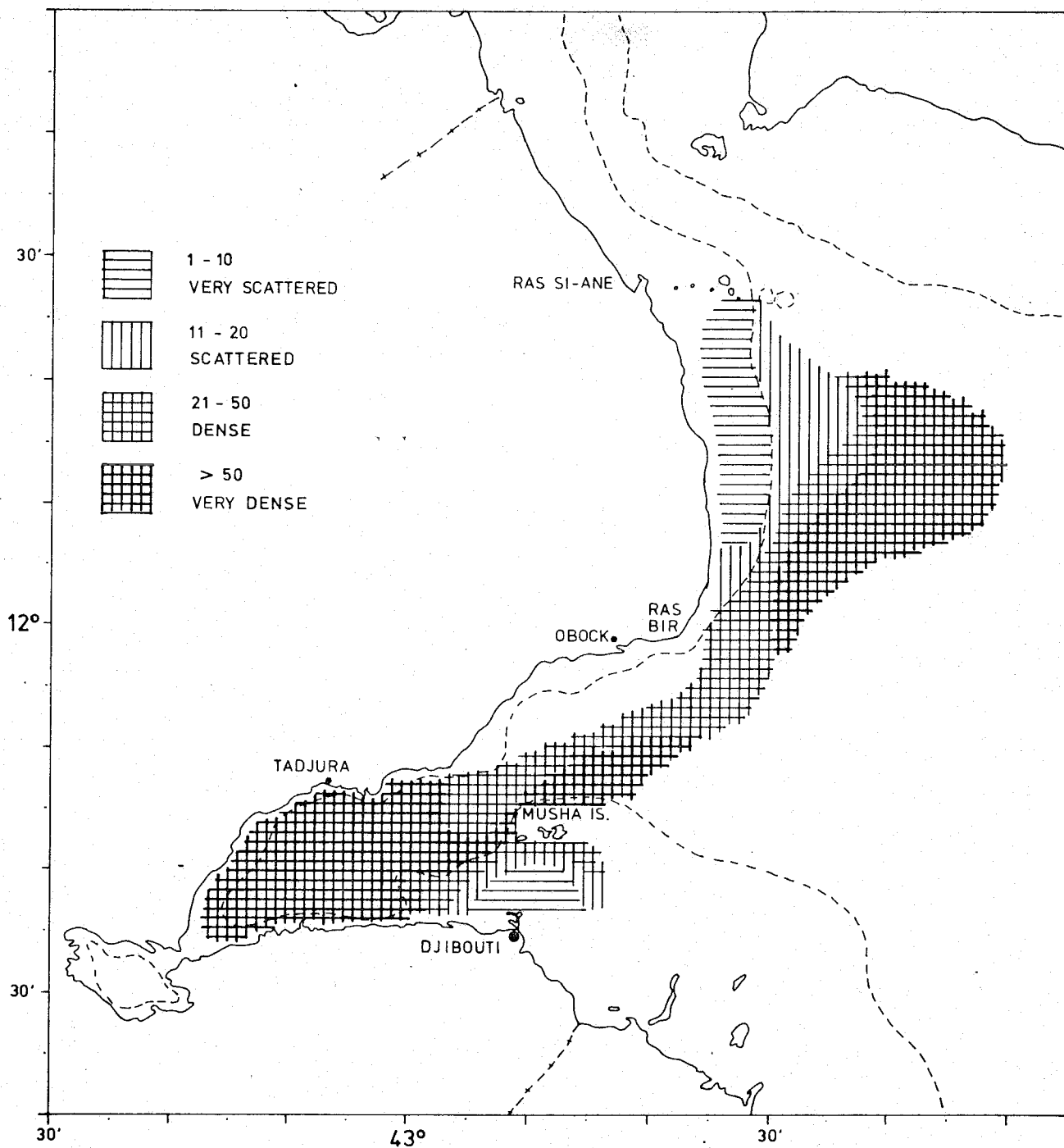


Fig. 4. Integrated echo intensities (mm per nautical mile) classified as mesopelagic fish, plankton and swimming crab. Night recordings only.  
R/V "Dr Fridtjof Nansen", 2 - 5 March 1981.

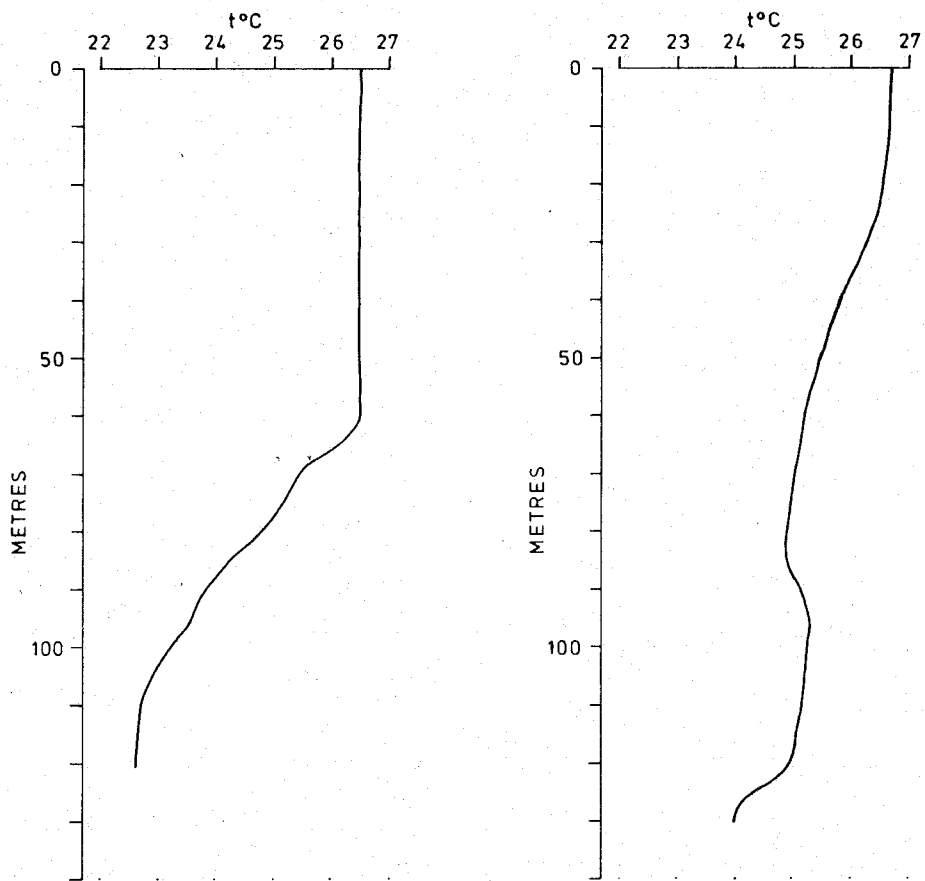


Fig. 5. Vertical temperature recordings  
by bathythermograph.  
R/V "Dr Fridtjof Nansen",  
2 - 3 March 1981.



Table 1. Pelagic trawl catches. R/V "Dr Fridtjof Nansen", Pelagic fish survey in the Republic of Djibouti EEZ, March 1981.

Station Number (trawl type)	105(H)	106(K)	107(H)	109(H)	110(K)	111(K)	112(K)	113(K)	115(K)
Date	2.3	3.3	3.3	3.3	3.3	4.3	4.3	4.3	4.3
Hour start	2345	0110	0440	2005	2300	0125	0350	1035	1845
Towing time (minutes)	30	30	30	30	30	30	40	15	30
Position N	11°38'	11°48'	11°46'	12°08'	12°12'	12°16'	12°18'	12°35'	11°59'
E	42°47'	42°49'	42°59'	43°27'	43°39'	43°45'	43°27'	43°16'	43°28'
Gear depth (headrope) (m)	0	50	0	0	25	30	25	25	30
Bottom depth (m)	225	?	50-166	28-78	360	312	39	43	?
Catch per hour (kg)	3.2	76.0	6.0	0.2	34.0	22.4	3.15	24.4	97.0
Total catch (kg)	1.6	38.0	3.0	0.1	17.0	11.2	2.1	6.1	48.5
Anguilliformes (larvae)				+		+	0.30	0.10	0.20
APOGONIDAE Apogon sp.							+		
ASTRONESTHIDAE Astronesthes martensi		+							
BREGMACEROTIDAE Bregmaceros arabicus		+							
CAESIOTIDAE Dipterygonotus balteatus				+			0.50		
CARANGIDAE Decapterus macrosoma							0.05		
Selar crumenophthalmus			0.10		0.60		0.20		
Seriolina nigrofasciata					+		+		+
CHAMPSODONTIDAE Champsodon sp.									0.05
CLUPEIDAE Sardinella sp.	0.05								
ENGRAULIDAE Stolephorus sp.			0.02						
GEMPYLIDAE Epinnula orientalis		+							
MYCTOPHIDAE Benthosema pterotum	+	} 36.50			3.90	4.00			} 36.80
Lampanyctus macropterus									
NOMEIDAE -			0.03						
PARALEPIDIDAE Lestrolepis intermedia	+	0.45							2.20
Pleuronectiformes (juveniles)					+				
SPHYRAENIDAE Sphyraena jello			1.20						
Sphyraena obtusata					2.60				
STOMIATIDAE Stomias affinis		0.25							
TRICHIURIDAE Trichiurus lepturus									0.30
XENOCONGRIDAE Kaupichthys sp.		+							
Fish larvae and juveniles, various spp.				+				+	
Cephalopoda (squid)		0.05	0.05	+	3.90	2.50	0.70	0.10	2.35
PORTUNIDAE (Crustacea) Charybdis edwardsii	1.55	0.75	1.60		6.00	4.70	0.35		6.60
"Krill"				+					
"Jellyfish"				+				5.90	

Table 2. Bottom trawl catches. R/V "Dr Fridtjof Nansen", Pelagic fish survey in the Republic of Djibouti EEZ, March 1981.

Station Number	108	114	116
Date	3.3	4.3	4.3
Hour start (30 minutes hauls)	0735	1020	2305
Position N	11°38'	12°35'	11°38'
E	43°13'	43°15'	43°14'
Depth (m)	29	41	29
Catch per hour (kg)	1030	180	428
Total catch (kg)	515	90	214
ARIIDAE	Arius (thalassinus)		2.00
BALISTIDAE	Abalistes stellatus	+	0.80
CARANGIDAE	Decapterus maruadsi (russelli)		0.40
	Scomberoides lysan	1.00	
	Selar crumenophthalmus		14.80
CLUPEIDAE	Dussumieria acuta	1.00	1.00
	Sardinella (gibbosa)	1.00	0.80
ECHENEIDAE	Echeneis naucrates		0.20
FISTULARIIDAE	Fistularia villosa	+	
GERREIDAE	Gerres filamentosus	3.00	0.20
LEIOGNATHIDAE	Gazza minuta	90.00	26.40
	Leiognathus equulus	325.00	1.60
	Leiognathus (leuciscus)	1.00	0.20
MULLIDAE	Upeneus sulphureus	2.50	
NEMIPTERIDAE	Nemipterus japonicus	12.00	20.80
PLATYCEPHALIDAE	Platycephalus sp.	+	0.40
PSETTODIDAE	Psettodes erumei	5.00	0.30
SCOMBRIDAE	Rastrelliger kanagurta		0.40
	Scomberomorus commerson	1.00	
SPHYRAENIDAE	Sphyraena jello	+	1.40
	Sphyraena obtusata	+	0.40
	Sphyraena putnamiae	+	
SYNODONTIDAE	Saurida tumbil	5.00	30.00
TETRAODONTIDAE	Gastrophysus lunaris	3.00	1.80
THERAPONIDAE	Therapon jarbua	} 10.00	0.20
	Therapon theraps		13.00
TRICHIURIDAE	Trichiurus lepturus	3.50	1.80
CARCHARHINIDAE	Carcharhinus albimarginatus		90.00
	Carcharhinus limbatus (unidentified juveniles)	2.00	13.10
			0.20
SPHYRNIDAE	Sphyrna sp.	8.00	
MYLIOBATIDAE	-	40.00	80.00
Cephalopoda	(cuttlefish)		0.30
Crustacea	Penaeus sp.	1.00	1.75
	Thenus orientalis		0.20

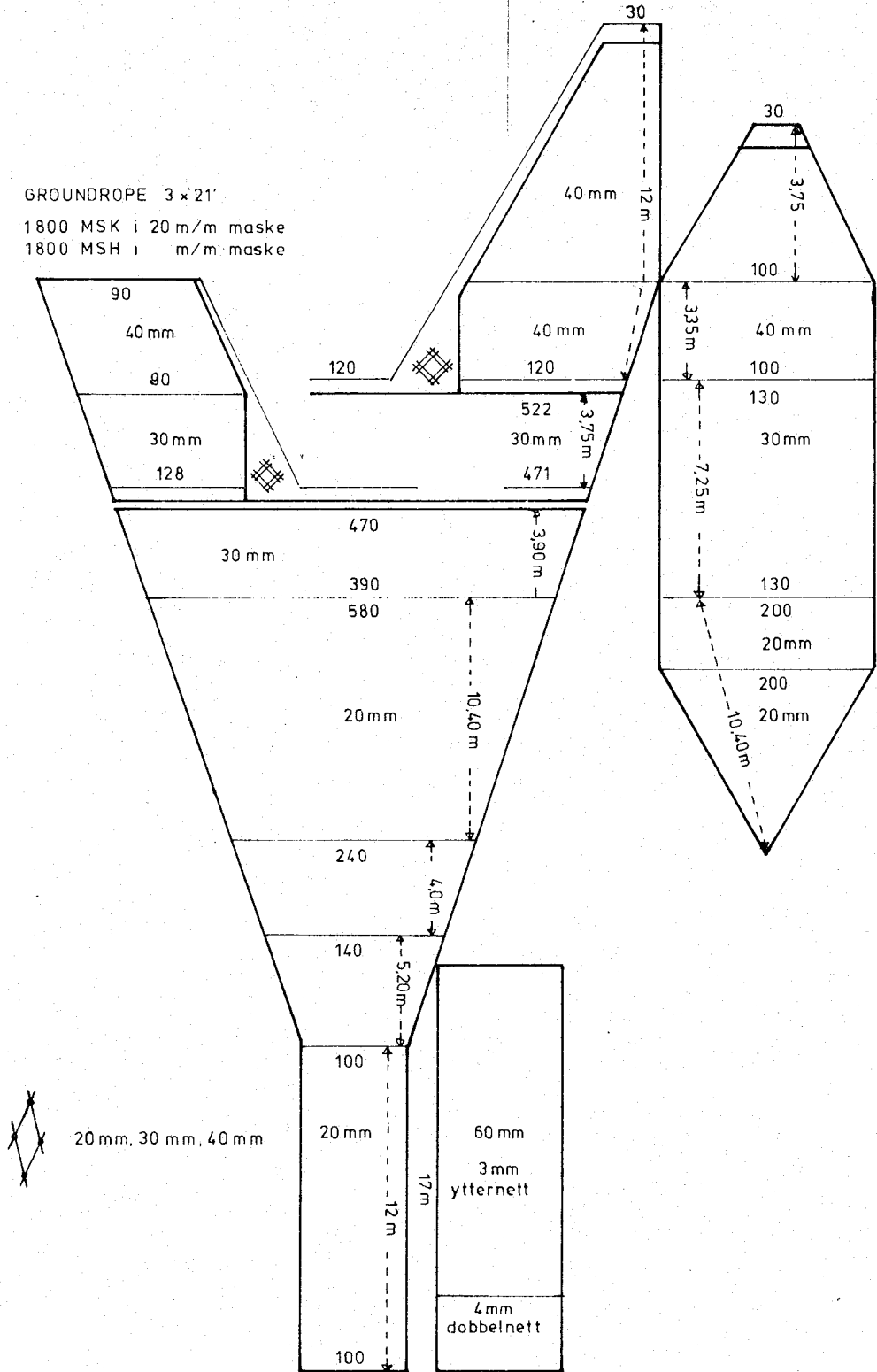
Table 3. Length frequency distributions, 1 cm units. R/V "Dr Fridtjof Nansen", Pelagic fish survey in the Republic of Djibouti EEZ, March 1981.

FAMILY	Stn																	
Species	No.	N	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
CARANGIDAE																		
Selar	110	9							4	5								
crumenophthalmus	116	58					2	2	15	29	9	1						
LEIOGNATHIDAE																		
Gazza minuta	116	23	6	16	1													
SPHYRAENIDAE																		
Sphyraena obtusata	110	37										2	1	16	14	2	2	

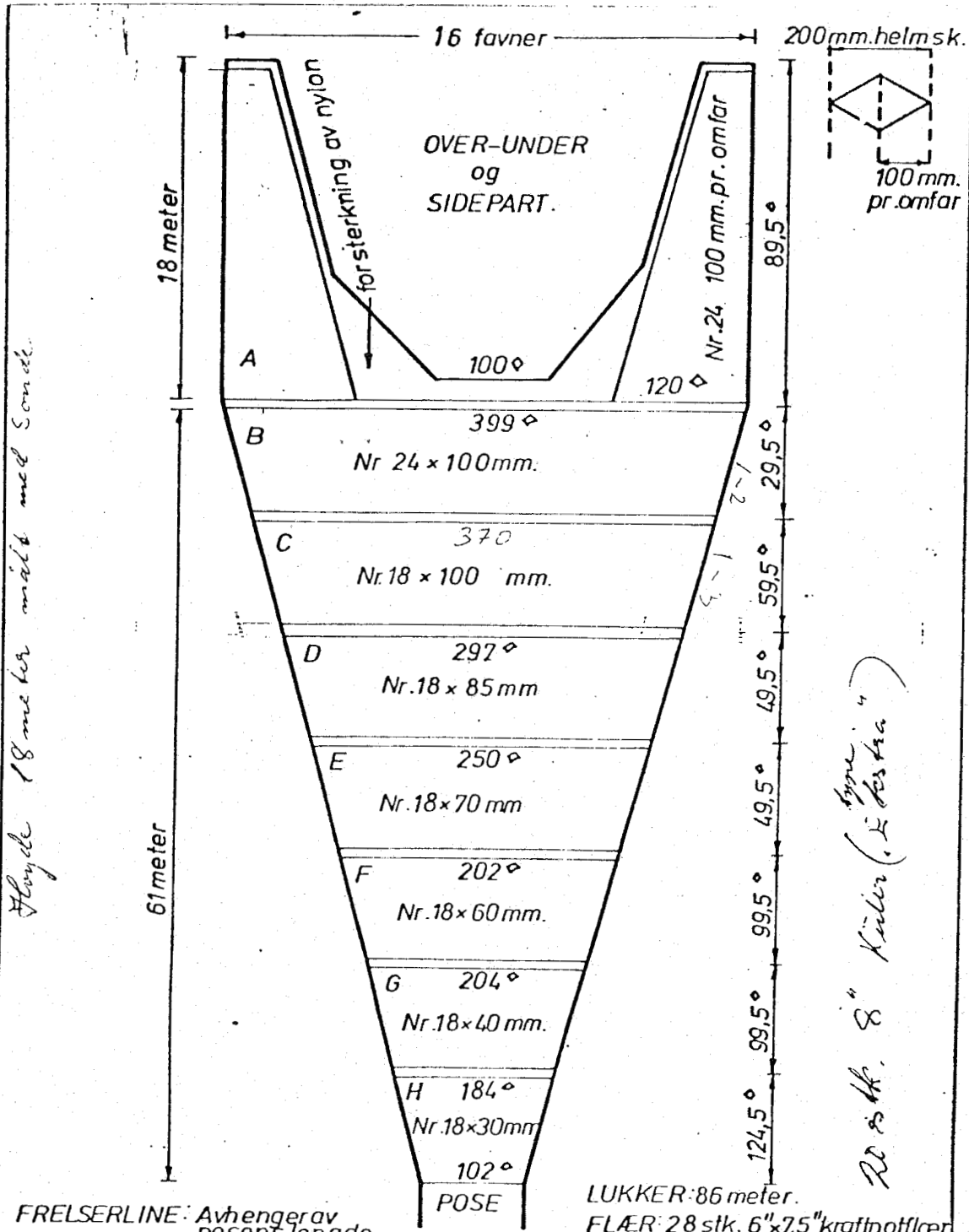
ANNEX

Drawings of the trawls used during the cruise.

GROUNDROPE 3 x 21'  
 1800 MSK i 20 m/m maske  
 1800 MSH i m/m maske



The bottom trawl.



FRELSELINE: Avhengerav  
posens lengde.

LUKKER: 86 meter.  
FLÆR: 28 stk. 6" x 7,5" kraftnetflær

Avd./Serie	Dept./Series	Type
Ref.	Ref.	LODDETRÅL 16x16 fvn.
Nr.	No	omkrets 1600 masker =
Erelatter	Replaces	320 meter.
Erel av	Repl. by	Skala
		Scale
		Konstr.
		Constr
		Godkj.
		Godk.



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The Capelin pelagic trawl.