CHAPTER 1 INTRODUCTION

1.1 GENERAL OBJECTIVES

Following an offer from NORAD extended through FAO and UNDP, an agreement was reached in Windhoek in January 1990 between the UNDP Resident Representative and Namibian authorities for the execution of a programme of surveys of the fish resources of the Namibian shelf waters during 1990 with the R/V "DR.FRIDTJOF NANSEN".

The purpose of the programme was agreed as follows:

The main objectives are descriptions of the distribution, composition and abundance of the most important resources of fish and shellfish (although little informations is expected to be obtained on lobster). The small pelagic fish, horse mackerel, pilchard and anchovy will be investigated by the acoustic integration method combined with sampling with mid-water and bottom trawls. A swept area trawl survey programme will be used for the demersal stocks. All catches will be sampled to species by weight and numbers and biological sampling will be made of the commercially important stocks.

Environmental studies will include recording of surface temperature on a continuous basis and occupation of hydrographic stations in a series of fixed profiles as well as studies of bottom type by grab samples and the ROXANN bottom discrimination system.

Possible taxonomic problems will be studied by sampling and examination by experts in cooperation with FAO's Fisheries Department.

1.2 SPECIFIC OBJECTIVES OF THE THIRD SURVEY

These are descriptions of the distribution, composition and abundance of the most important stocks of demersal fish. The acoustic system will be used to observe possible mid water occurrence of the hakes, but the observations of pelagic fish will not be processed. The swept area trawl survey programme will cover depths down to 500 m and deeper if necessary. The survey design will be based on a semi-random distribution of hauls designed to cover the depth ranges of the two hake species and with density of stations adapted to the expected fish densities. Biomass of Cape hake will be based on post-stratification by density areas. Some mid water sampling of horse mackerel will be made for observations of length compositions and growth.

A programme of testing of trawl dimensions with SCANMAR instruments will be conducted in accordance with a special plan.

1.3 PARTICIPATION

The scientific staff from Namibia were:

To September 25: Dr. Gert Cloete, Bruce Tomalin, Adriaan Beukes, Malakia Shimhanda, Quintin Hammond, Sielfried Gowaseb.

From September 25: Dr. David Boyer, Serubabel Kahiha, Johnny Gamatham, Alex Hendricks, Willem Nauiseb.

The staff from IMR were: G. Saetersdal, O. Alvheim, M. Dahl and R. Johannesen.

1.4 NARRATIVE

Figures 1 a-c show the course tracks with the positions of the fishing stations and the hydrographical stations occupied.

The vessel left Walvis Bay on September 11, called on Lüderitz on September 13 and work started off the Orange River on September 14. A heavy bobbins-gear was mounted on the trawl before working the slope which in this area includes parts with rough bottom. The profile off Panther Head was occupied on September 17.

Unfavourable weather over several days with winds up to force 8 delayed the work. Catch rates of hake in the deep slope beyond 400 m were low from Lüderitz northwards and the coverage at these depths were reduced. Cape hake was found to occur in some abundance down to 350 m and the most important depth range to sample was 180-350 m. This range was then covered during daylight hours with some complementary hauls at greater depths during nighttime. The hydrographic profile north of Hottentot Point was occupied on September 20. By September 21 the shelf up to 25°S had been covered with a total of 47 bottom trawl stations.

From Dolphins Head northwards heavy densities of Cape hake was found at intermediate depths, 200-300 m. The fish could often be identified by echo-traces near the bottom (on the ES 400, 40 log R sounder) and the observation indicated that lifting from the bottom into mid water at night time was irregular, some times it was observed and some times not. Sampling in this area was therefore at times made also during night time. Most of the fish was in a prespawning or spawning condition.

The coverage from 25°S northwards to Ambrose Bay is shown in Figure 1b. Bottom conditions on the offshore shelf for the demersal trawl improved in this region and the trawl could be used without bobbins gear. A hydrographical section was worked off Concepcion Bay on September 23. The zone of soft muddy bottom with dead shells some times reaching out to 150 m of depth was a problem for sampling as was heavy by-catches of jellyfish in hauls down to 200-250 m from 24°S to 23°S. In the February survey jellyfish occurred in high densities in mid water in this area, but not in the bottom hauls as now. The vessel called on Walvis Bay on September 25 for exchange of staff.

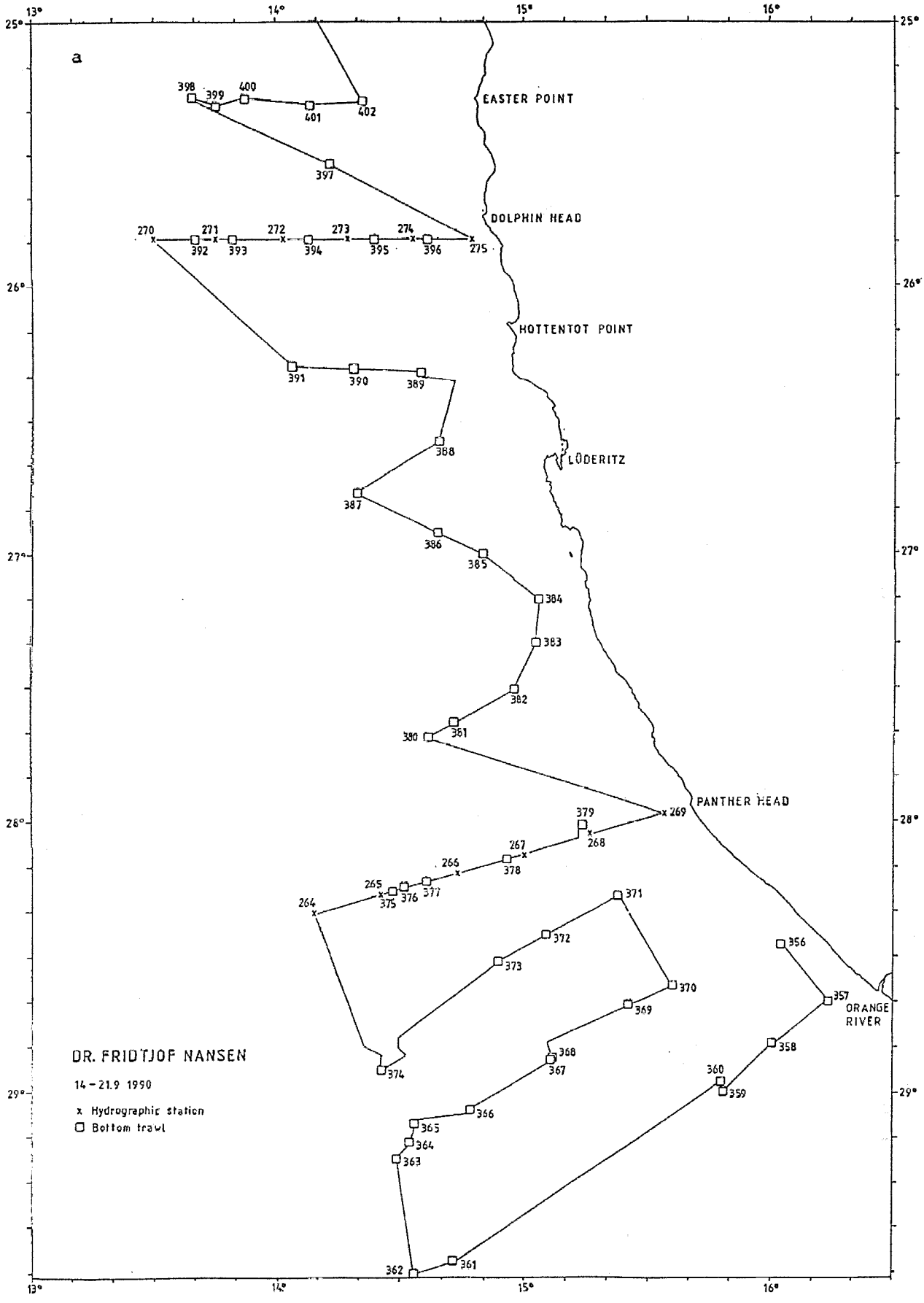
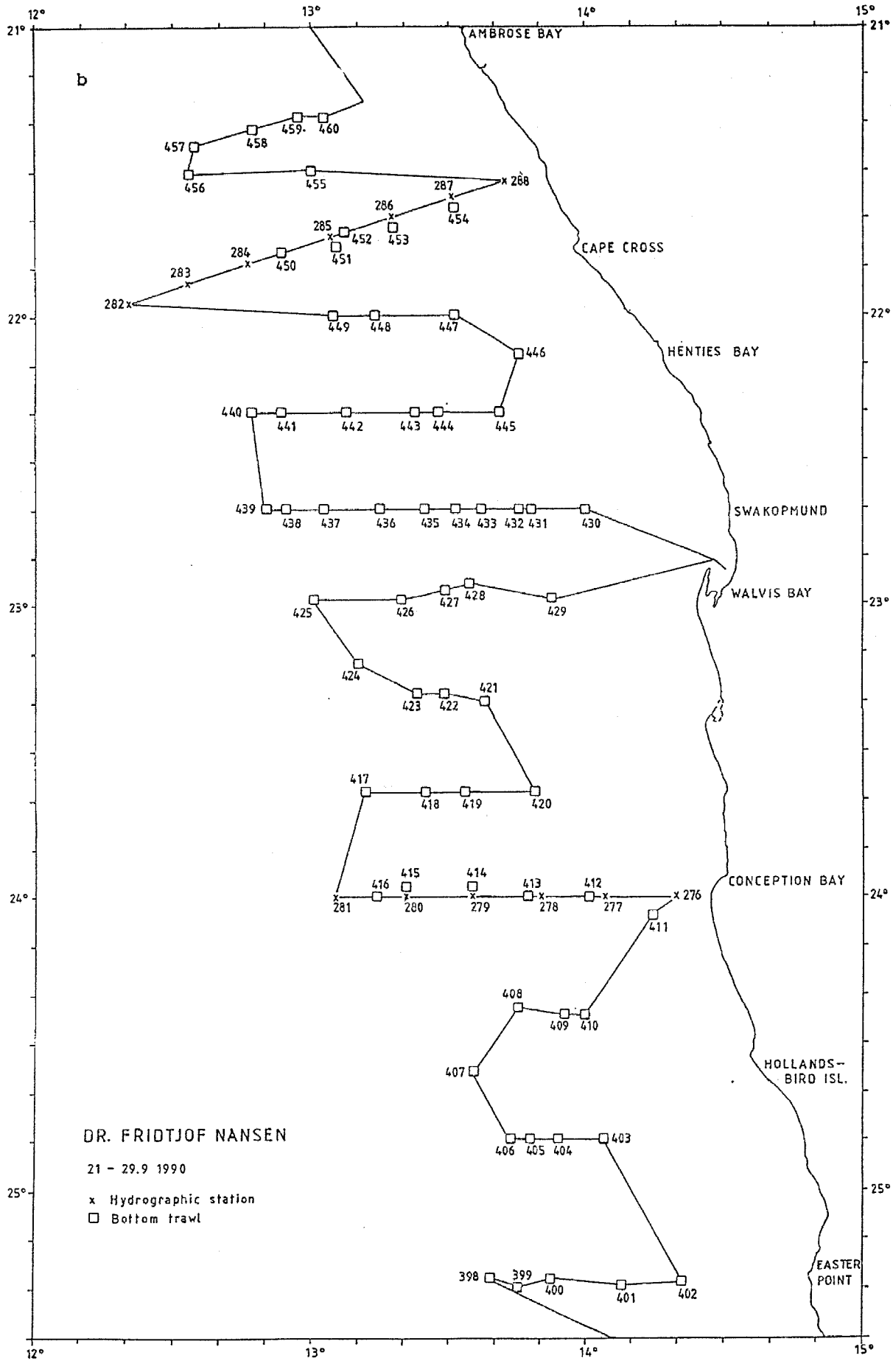


Figure 1. Course tracks with fishing stations and hydrographic profiles, a: Orange River to St. Francis Bay, b: St. Francis Bay to Ambrose Bay, c: Ambrose Bay to Cunene River.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b
AMBROSE BAY
CAPE CROSS
HENTIES BAY
SWAKOPMUND
WALVIS BAY
CONCEPTION BAY
HOLLANDS-
BIRD ISL.
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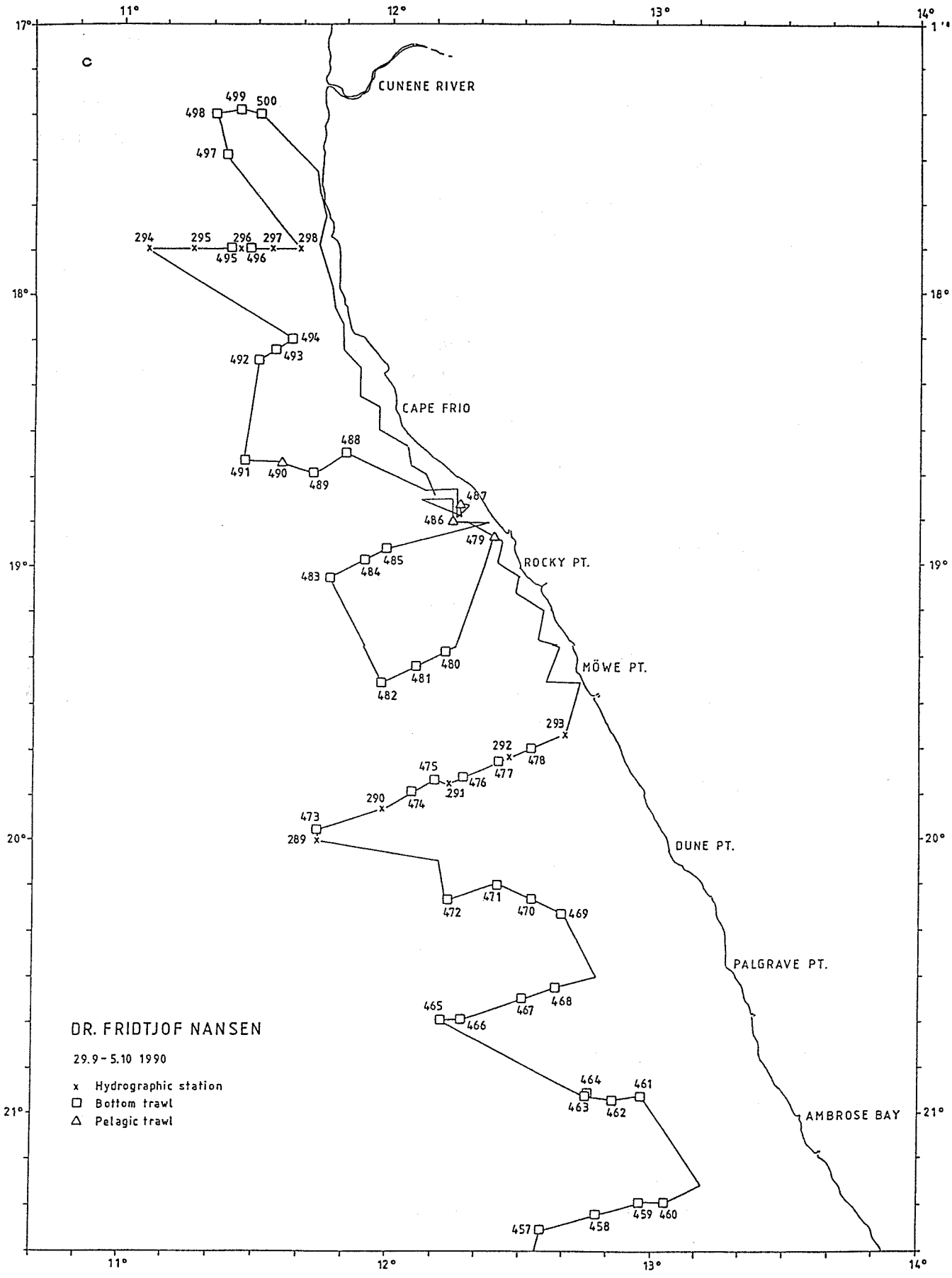
DR. FRIDTJOF NANSEN
21 - 29.9 1990
x Hydrographic station
□ Bottom trawl


c
CUNENE RIVER
CAPE FRIO
ROCKY PT.
MÖWE PT.
DUNE PT.
PALGRAVE PT.
AMBROSE BAY
DR. FRIDTJOF NANSEN
29.9 - 5.10 1990
x Hydrographic station
□ Bottom trawl
△ Pelagic trawl
11°
12°
13°
14°
17°
18°
19°
20°
21°

In the continued survey from Walvis Bay northwards from September 26 soft muddy bottom with shells complicated sampling above 150 m of depth and jellyfish was a problem from 180 to 250 m of depth giving some times several tonnes of by-catch in brief hauls. During daytime heavy catches of horse mackerel was taken together with hake at intermediate depths. The horse mackerel lifted off the bottom at night. The profile off Cape Cross was occupied on September 28. The survey was completed up to Ambrose Bay by September 29 with a total of 53 swept area trawl hauls. Abundant echo traces of hake were observed off the bottom, at intermediate depths, although closer to the bottom in daytime.

The course track between Ambrose Bay and Cunene is shown in Figure 3. Catches of deep water hake were very low in this area and sampling at 400 m and deeper was restricted. Acoustic observations showed that in this area hake was distributed in mid water both day and night and this was confirmed by pelagic trawling. Catches in bottom trawl would thus underestimate the biomass. The profiles off Dune Point and Cape Frio were worked on October 1 and 4 respectively. The nights to October 2 and 3 were spent surveying for pelagic fish inshore south of Cape Frio. The work was terminated on October 4 with 34 swept area and 4 pelagic trawl hauls in the northern area. Steaming inshore past Cape Frio during the first night the vessel docked in Walvis Bay at noon on October 6.

1.5 INSTRUMENTS AND FISHING GEAR, OBSERVATIONS ON TRAWL GEOMETRY

The acoustic instruments and their setting are shown in ANNEX III together with a description of the fishing gear used. Some observations were made with SCANMAR instrumentation on headline height and distance between wings of the type of bottom trawl used by the vessel in the Namibian surveys. This is a 31 m headline high opening shrimp and fish trawl. Table 1 shows the results.

Table 1. Observations of headline height and distance between wings during trawling. Means of 4-6 observations. m.

St. nr.	Depth	Distance	Hight
360	173	20.3	5.5
367	165	19.4	5.4
397	202	18.9	5.7
455	253	16.5	4.8
464	322	18.9	5.3
500	150	17.5	6.2

The position of the wing sensors were slightly more forward on stations 360 and 367 than in the following experiments. The experiments at stations 455-500 were with a different net of the same design. The low values obtained at station 455 may have been caused by a catch of jellyfish which is expected to result in heavy drag of the net due to clogging. The overall mean of the observations of distance is very close to the value used in the swept area estimates 1/100 nm, 18.6 m. The SCANMAR measurements indicate that in normal hauls the distance may be somewhat greater, but perhaps lower with by-catches of jellyfish. For the present survey there does not seem to be any need for an adjustment of the figure used.

CHAPTER 2 THE ENVIRONMENT

2.1 THE SHELF AND THE SLOPE

Table 2 shows the approximate extensions of the areas between the various depth ranges along the coast revised in accordance with new observations based on GPS navigation. For some incompletely covered areas depth observations from Spanish fishing charts have been used.

Table 2. Areal extension of shelf and slope by depth ranges, nm^2.

	100-250m	250-350m	350-450m	450-550m
Orange R.-25°	12 000	3 300	3 000	1 700
25° - 21°	8 300	3 700	1 700	700
21° -Cunene R.	5 100	2 700	1 600	800

2.2 HYDROGRAPHY

Figures 2a-c show the sea temperature at 4 m of depth as observed with the ships thermograph and Figures 3a-c show the distribution of temperature, salinity and oxygen in the 6 hydrographic transects worked. The position of the transects are shown in Figures 1a-c.

The surface temperature over the southern shelf is 2-4°C lower than observed in February with a shoreward decline typical for the coastal upwelling process. Off Lüderitz the surface isotherms follow the bottom configuration. The inclination of the isolines of the profiles demonstrate intensive upwelling. Both temperature and salinities indicate an origin of the upwelled water from 200-300 m of depth. The oxygen content of the bottom water layer is above 1 ml/l over the whole shelf.

As shown in Figure 2b the surface temperature over the shelf from St. Francis Bay to Ambrose Bay is 1 to 2°C higher than over the southern shelf. The profile off Cape Cross indicates a less vigorous process of upwelling than that off Concepcion, a probable effect of a period of calm weather after the call on Walvis Bay on September 25.

The surface temperature over the northern part of the shelf, see Figure 2c is again 1-2°C higher than over the St. Francis Bay to Ambrose Bay part of the shelf with the 15°C isoline approaching the coast near Cape Frio. The profiles off Mwe Point and to the north of Cape Frio, Figure 3 c show inclination of isolines indicating a reduced rate of upwelling northwards, which could be related to the preceding persistent period of calm weather.

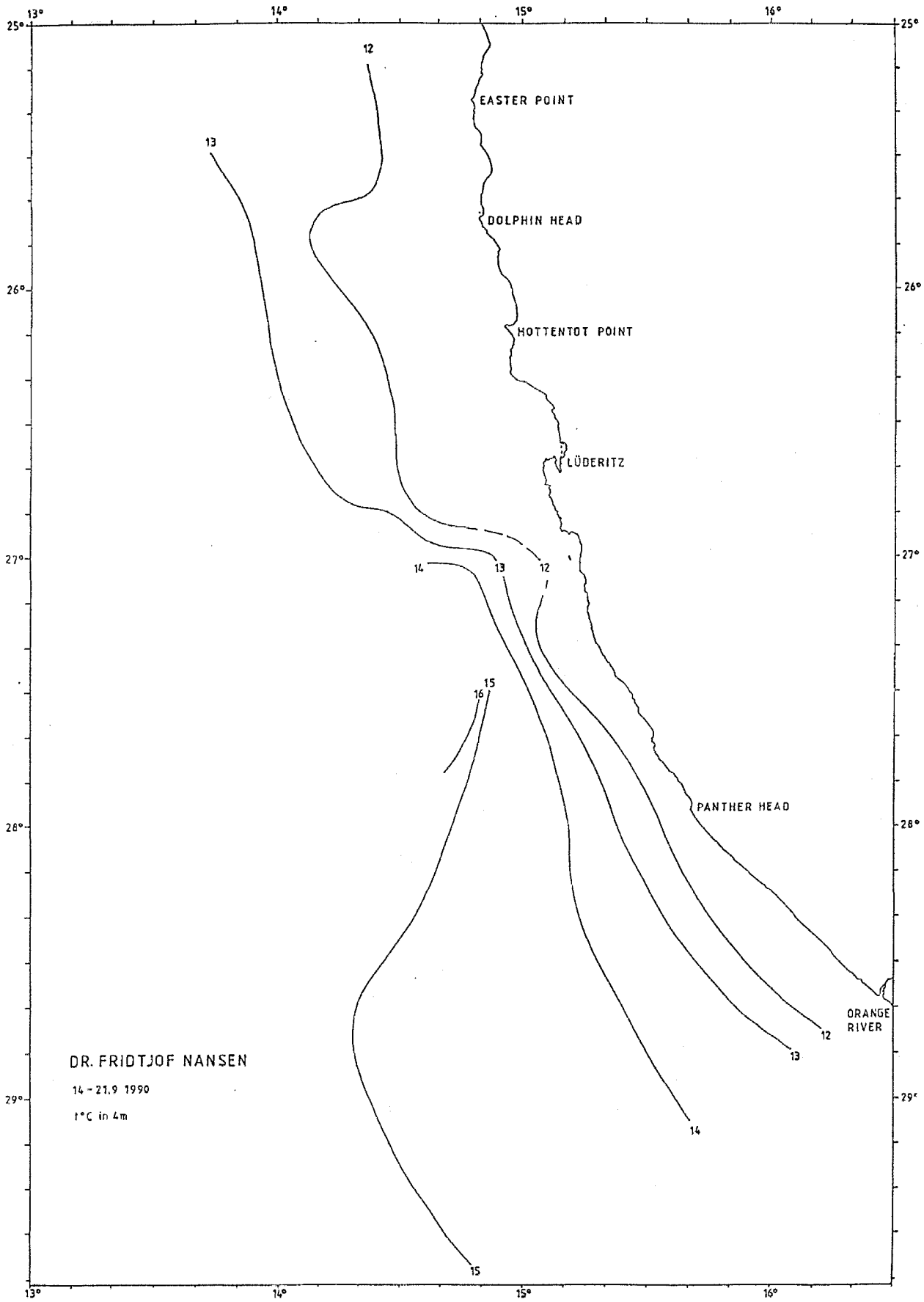
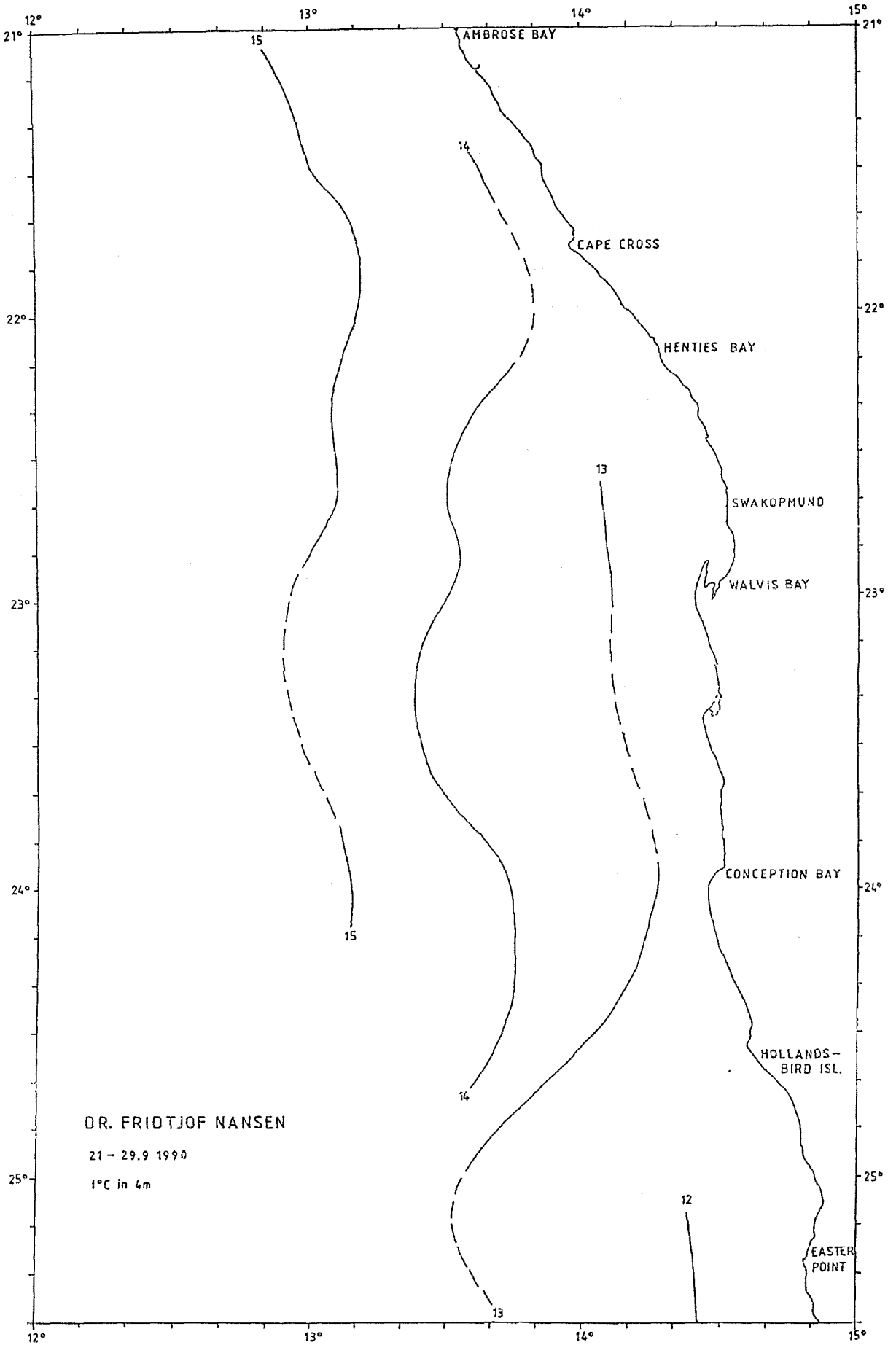


Figure 2. Temperature at sea surface : a: Orange River to St. Francis Bay, b: St. Francis Bay to Ambrose Bay, c: Ambrose Bay to Cunene River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AMBROSE BAY
CAPE CROSS
HENTIES BAY
SWAKOPMUND
WALVIS BAY
CONCEPTION BAY
HOLLANDS-
BIRD ISL.
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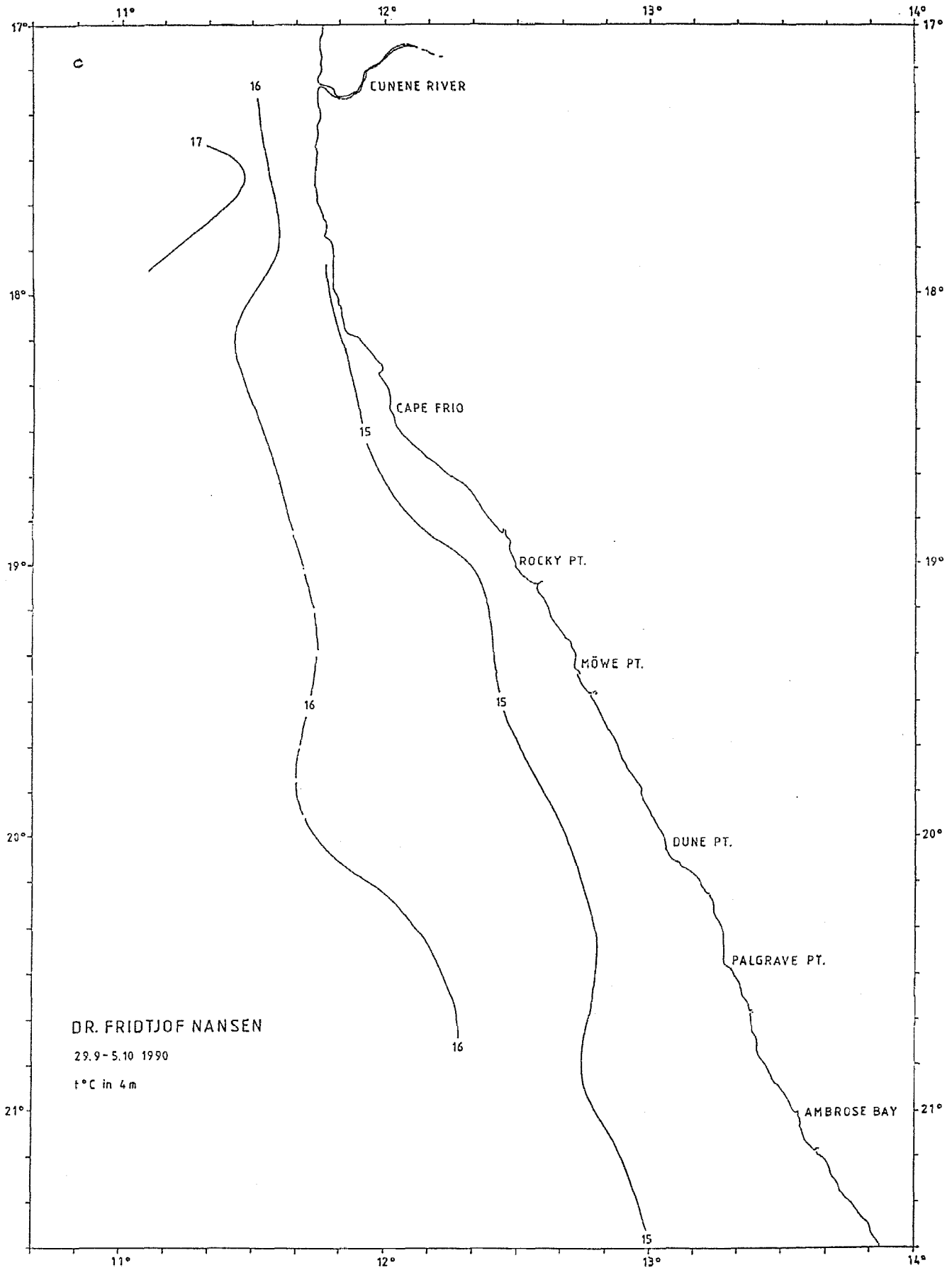
21 - 29.9 1990
1°C in 4m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DR. FRIDTJOF NANSEN
29.9 - 5.10 1990
t °C in 4 m

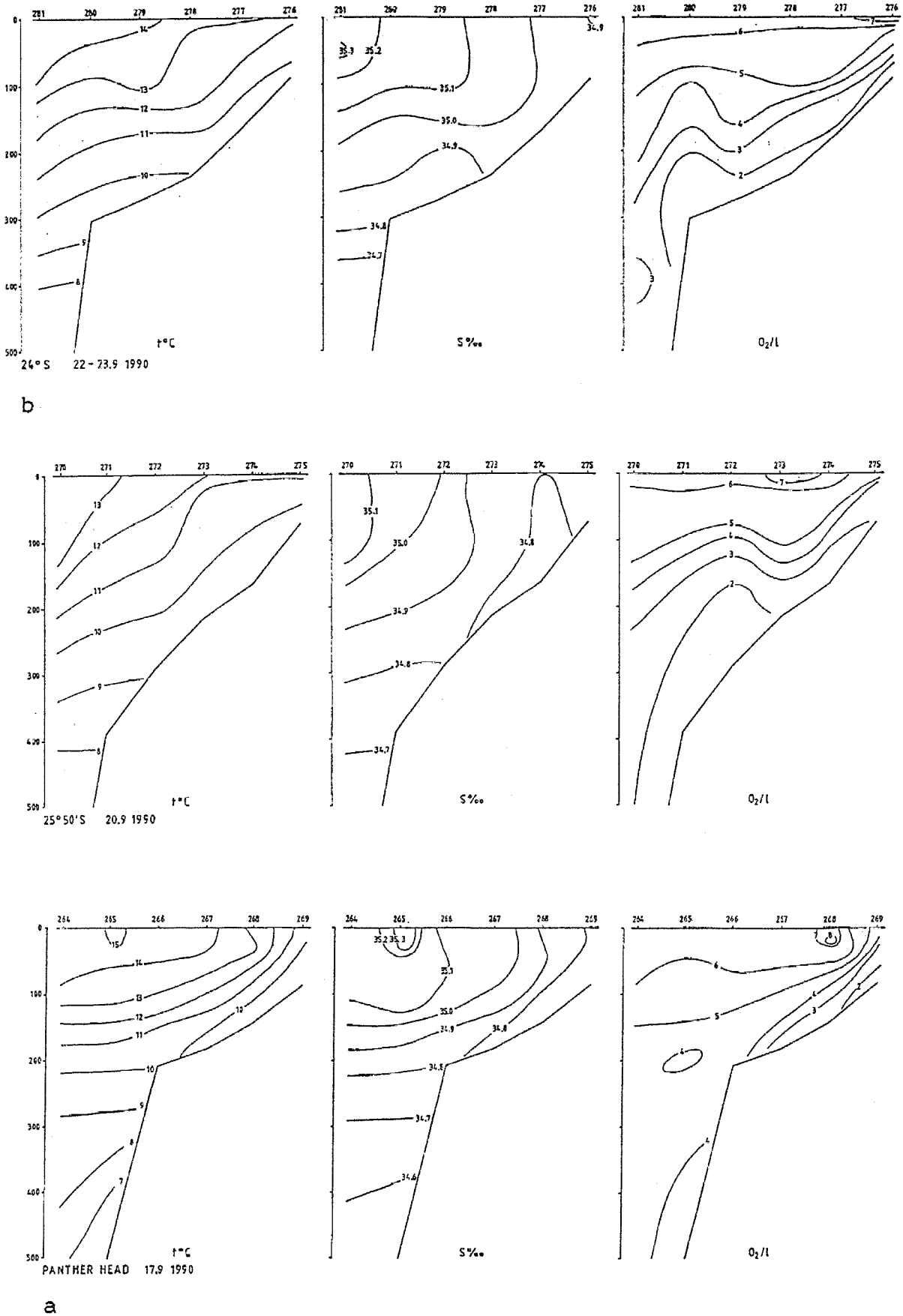
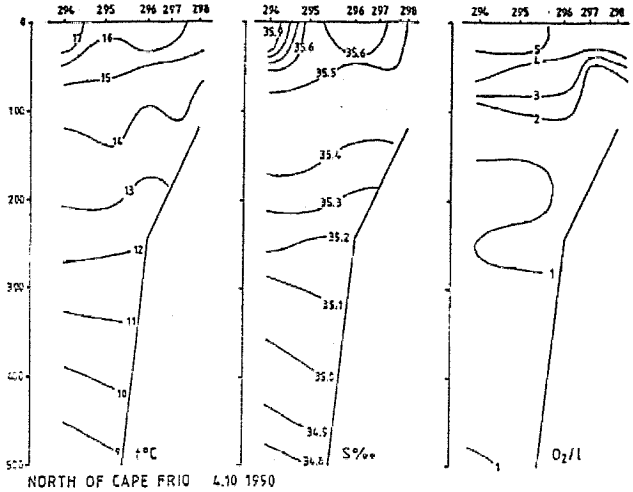
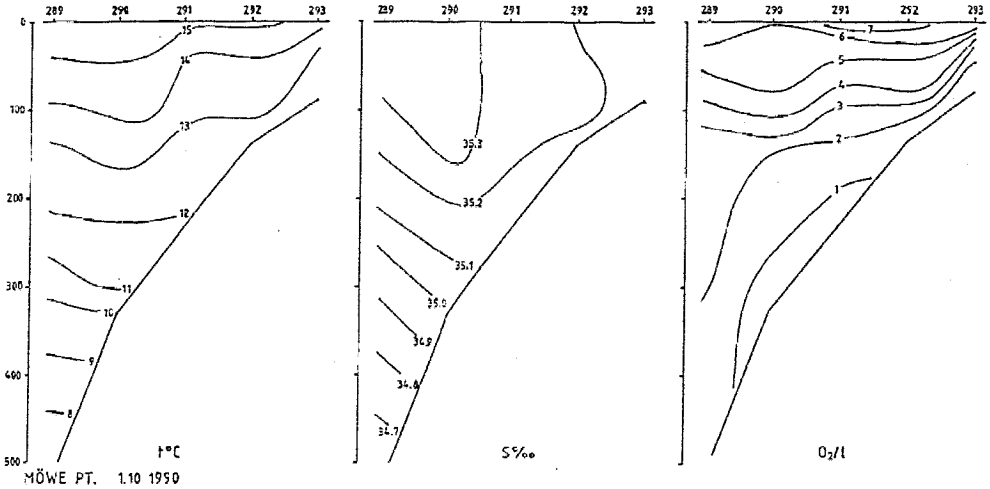


Figure 3. Hydrographic profiles. a: Orange River to St. Francis Bay, b: St. Francis Bay to Ambrose Bay, c: Ambrose Bay to Cunene River.



NORTH OF CAPE FRIO 4.10 1990



MÖWE PT. 1.10 1990

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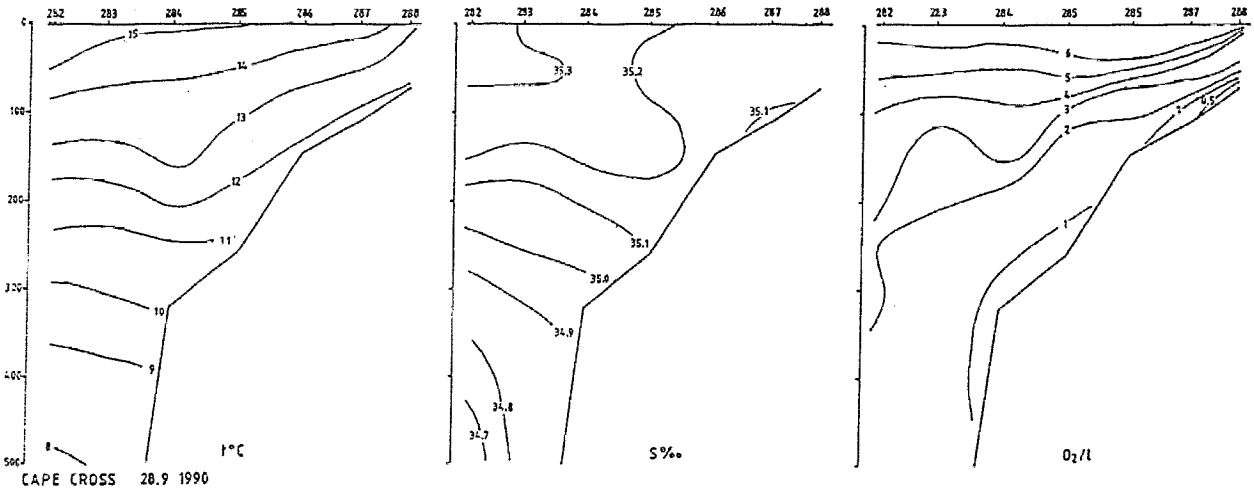

CAPE CROSS 28.9 1990