PART I

SURVEYS OF THE HAKE STOCKS
26 April - 31 May 1994

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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 with the RV 'Dr. Fridtjof Nansen'.

The main objectives were agreed as follows:

> To describe the distribution, composition and abundance of the most important fish resources. Small pelagic fish, including horse mackerel, pilchard and anchovy would be investigated by the acoustic integration method combined with sampling with mid-water and bottom trawls. A swept area trawl survey programme would be used for the demersal stocks. All catches would be sampled by species, weight and numbers, including biological sampling of the commercially important stocks.
>
> To carry out environmental studies including recording of surface temperature on a continuous basis and hydrographic sampling on a series of fixed profiles.

1.2 OBJECTIVES OF SURVEY 2/1994

The main objective was to continue the time series obtained with the old 'Dr. Fridtjof Nansen' of the demersal trawl surveys on the hake stocks. This vessel concluded her operations in Namibia in June 1993. As part of the survey program, the complete demersal fish community within the distribution range of the hake stocks would be studied. The less abundant, but commercially important species as monk, sole and kingklip would be given a special emphasis.

The acoustic system was used to observe possible mid-water occurrence of the hakes. The survey design for the swept-area trawl programme was based on a semi-random distribution of hauls along transects perpendicular to the coast. The transects were intended to cover the depth ranges

of the two hake species and with a density of stations adapted to the expected fish densities. Biomass estimates of hake were based on post stratification by depth and density aggregations.

1.3 PARTICIPATION

The scientific staff consisted of:

From Namibia:

Filimon Dauseb, Hashali Hamakuaya, Malakia Shimanda and Jamy Traut (26.4 - 31.5)
Michael Evenson, Anke Lehmensiek and Heinie Lesch (26.4 - 16.5)
Michael O'Toole (5.5-16.5)
Johnny Gamathan, Siegfred Gowaseb and Benny Ushona (18.5 - 31.5)

From Norway:

Oddgeir Alvheim, Terje Haugland and Erling Molvær (26.4 - 31.5)
Tore Strømme (5.5 - 16.5), Sigbjørn Mehl (18.5 - 31.5)

1.4 NARRATIVE

The course tracks with the positions of the fishing and hydrographic stations are shown in Figures 1 a-c.

The vessel left Walvis Bay on the evening of 26 April and steamed south for about 36 hours to the Orange River to commence the work. The trawl stations were randomly distributed along transects perpendicular to the coast, about 25NM apart. CTD-stations were taken on every trawl station, and additional CTD-stations were taken along standard hydrographic transects. On 5 May the vessel called on Lüderitz to pick up two members of the scientific staff, and continued to cover the Southern Region and the southern part of the Central Region. On 16 May 'Dr. Fridtjof Nansen' came to Walvis Bay to exchange personnel and celebrate the Norwegian Constitution Day on 17 May. The cruise continued on the morning of 18 May in the northern part of the Central Region and proceeded to the Northern Region. In order to avoid steaming during day time, 5 transects were passed to be taken on the way back to Walvis Bay. The northern point of the survey area (off the Cunene River) was reached on 25 May, and 'Dr. Fridtjof Nansen' headed for Walvis Bay, taking the 5 last transects on the way southward. The weather conditions were generally favourable except for a few days with gale, and the programme was completed according to the plans. 210 bottom trawl and 196 CTD-stations were sampled.

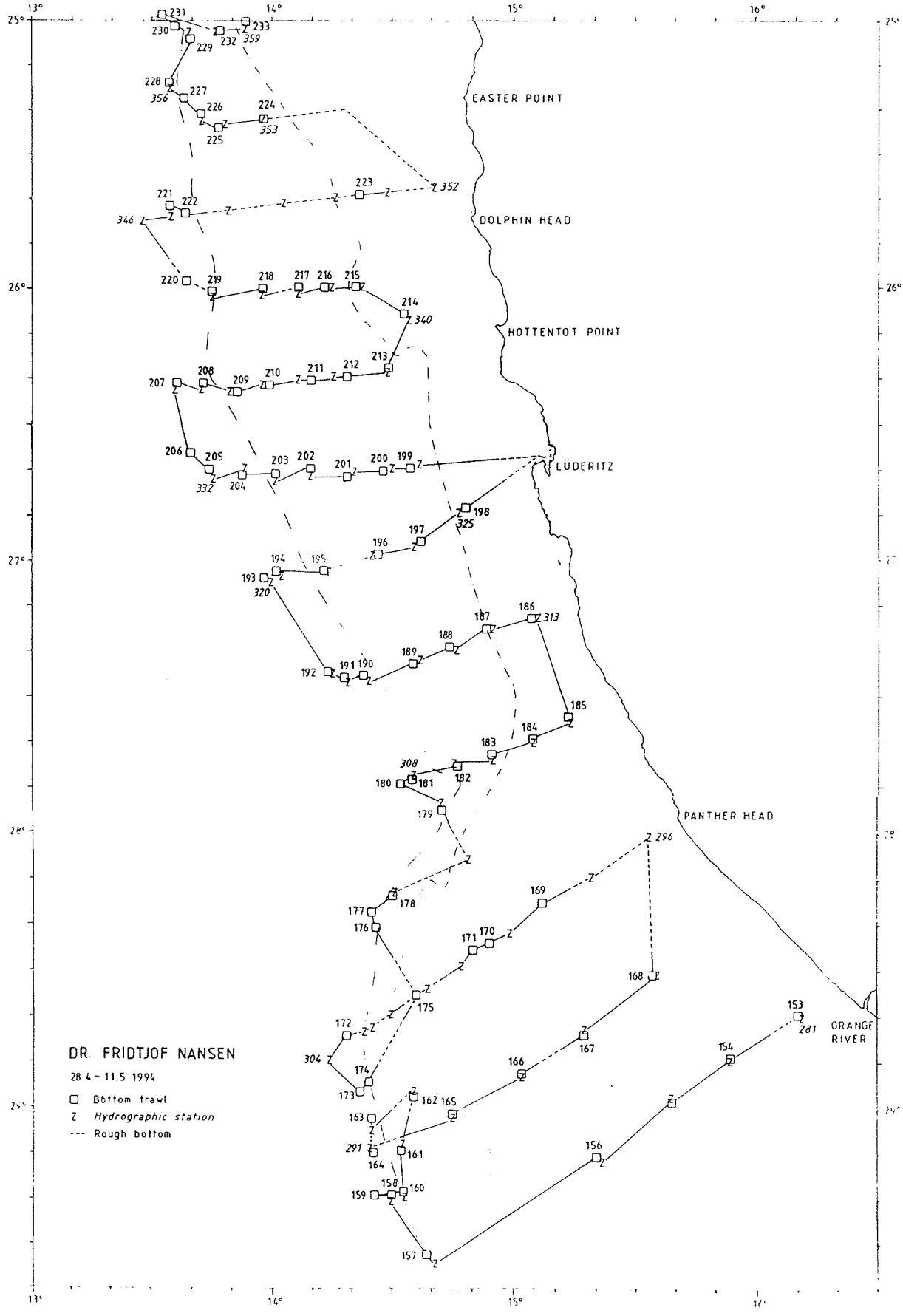

Figure 1a Southern Region (Orange River to St. Francis Bay). Course tracks, fishing stations and hydrographic stations.

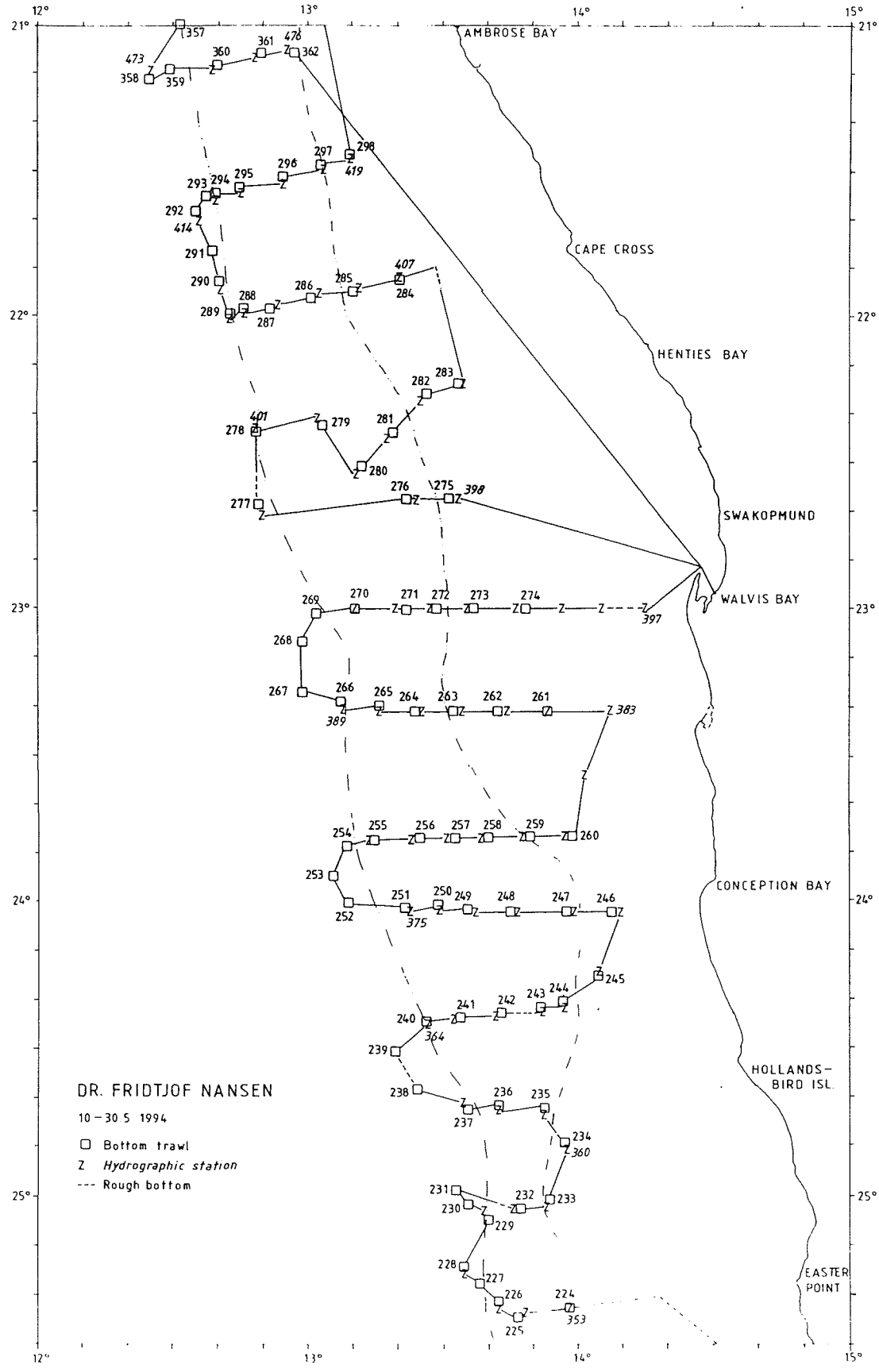

Figure 1b Central Region (St. Francis Bay to Ambrose Bay). Course tracks, fishing stations and hydrographic stations.

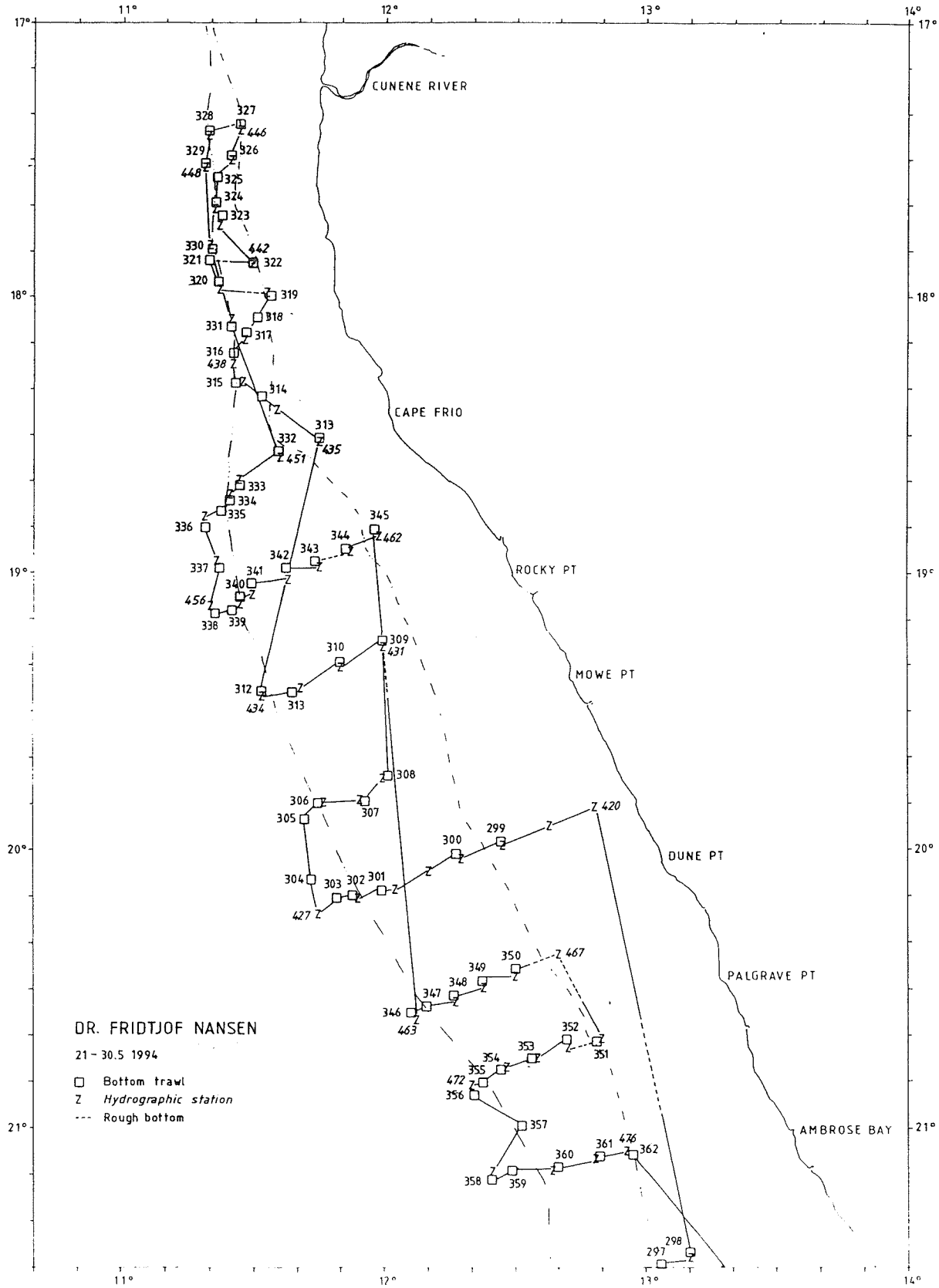

Figure 1c Northern Region (Ambrose Bay to Cunene River). Course tracks, fishing stations and hydrographic stations.

CHAPTER 2 HYDROGRAPHY

Surface sea temperature could not be collected during the survey, as a new data logging system was still under development.

Bottom temperature and oxygen were recorded at all fishing stations (Figures 2a-c and 3a-c). This was done in order to investigate the effect of these parameters on the distribution of the hake. Low oxygen conditions characterize the shelf environment until beyond 200 m bottom depth from Lüderitz and northwards and parts of the shallow waters until 100-150 m between Conception Bay and Rocky Point have values less than 0.25ml O_2/l.

The oxygen maps were overlaid with the distribution maps of the Cape hake in Figures 4a-c. They show that the main part of the hake stock is found between the oxyclines 0.25/0.5 and 1.0 ml/l, indicating that this species can easily tolerate such relatively low figures.

The vertical distribution of temperature, salinity and oxygen along four standard hydrographic transects, collected with a CTD and an attached rosette for water samples, are shown in Figures 5a-c.

In the southern region, off Panther Head, the surface waters are characterized by relatively warm water (16-18°C) with a narrow upwelling zone with colder (13-15°C) water close to the coast. Much of the shelf and coastal waters had high values of oxygen and the offshore water was relatively stable and defined by a strong thermocline at about 50 m depth. Further to the north, off Dolphin Head, upwelling was intense in the subsurface coastal waters. Oxygen deficient waters at the bottom had developed and the 0.5 ml oxycline was located approximately at the 200 m depth contour.

In the central region, the low oxygen conditions on the bottom prevail and there are indications of upwelling in the coastal surface waters.

In northern waters, upwelling was recorded off Dune Point, and the 0.5 ml oxycline was now located at 300 m bottom depth.

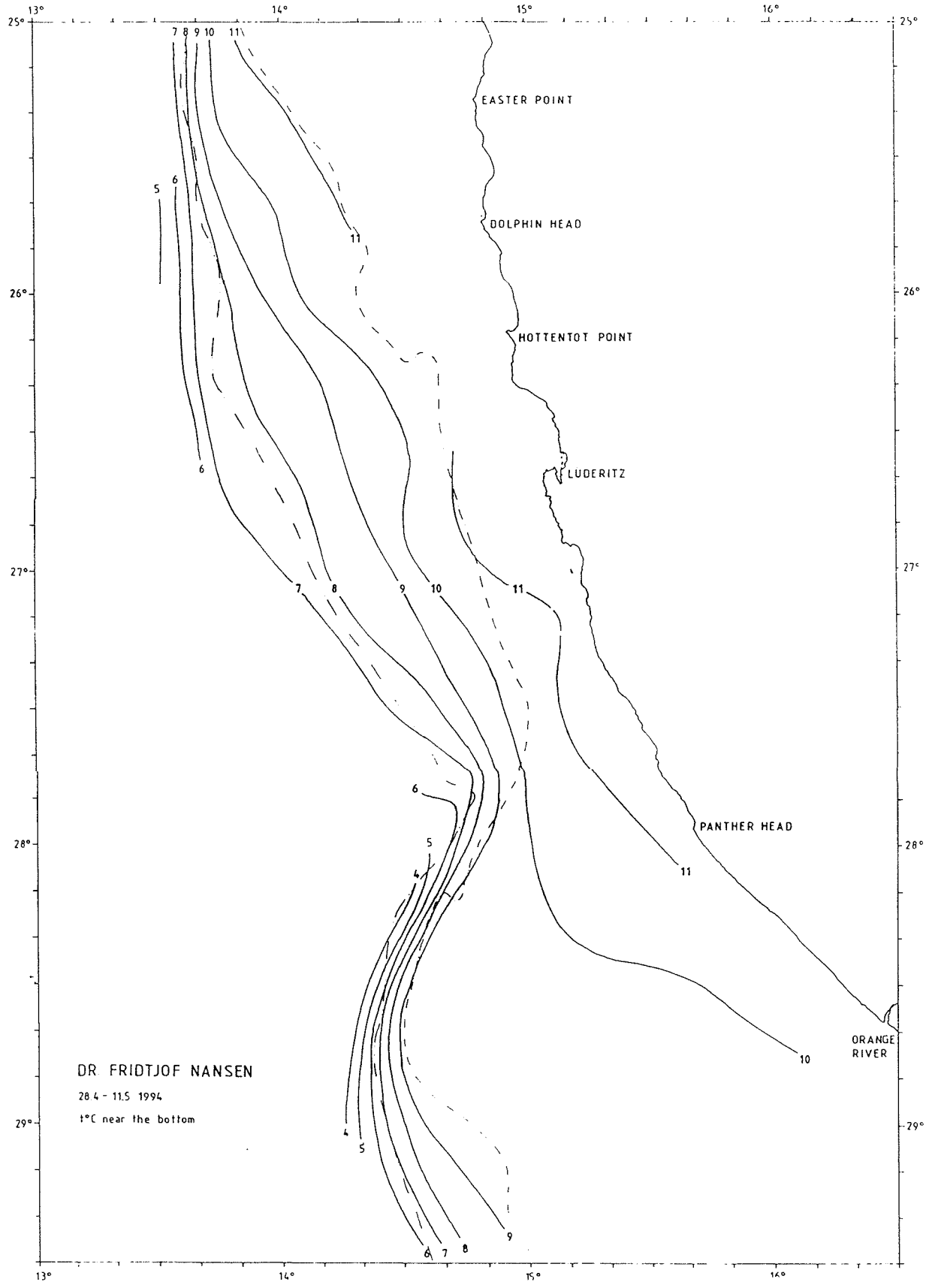

Figure 2a Orange River to St. Francis Bay. Distribution of sea temperature near the bottom.

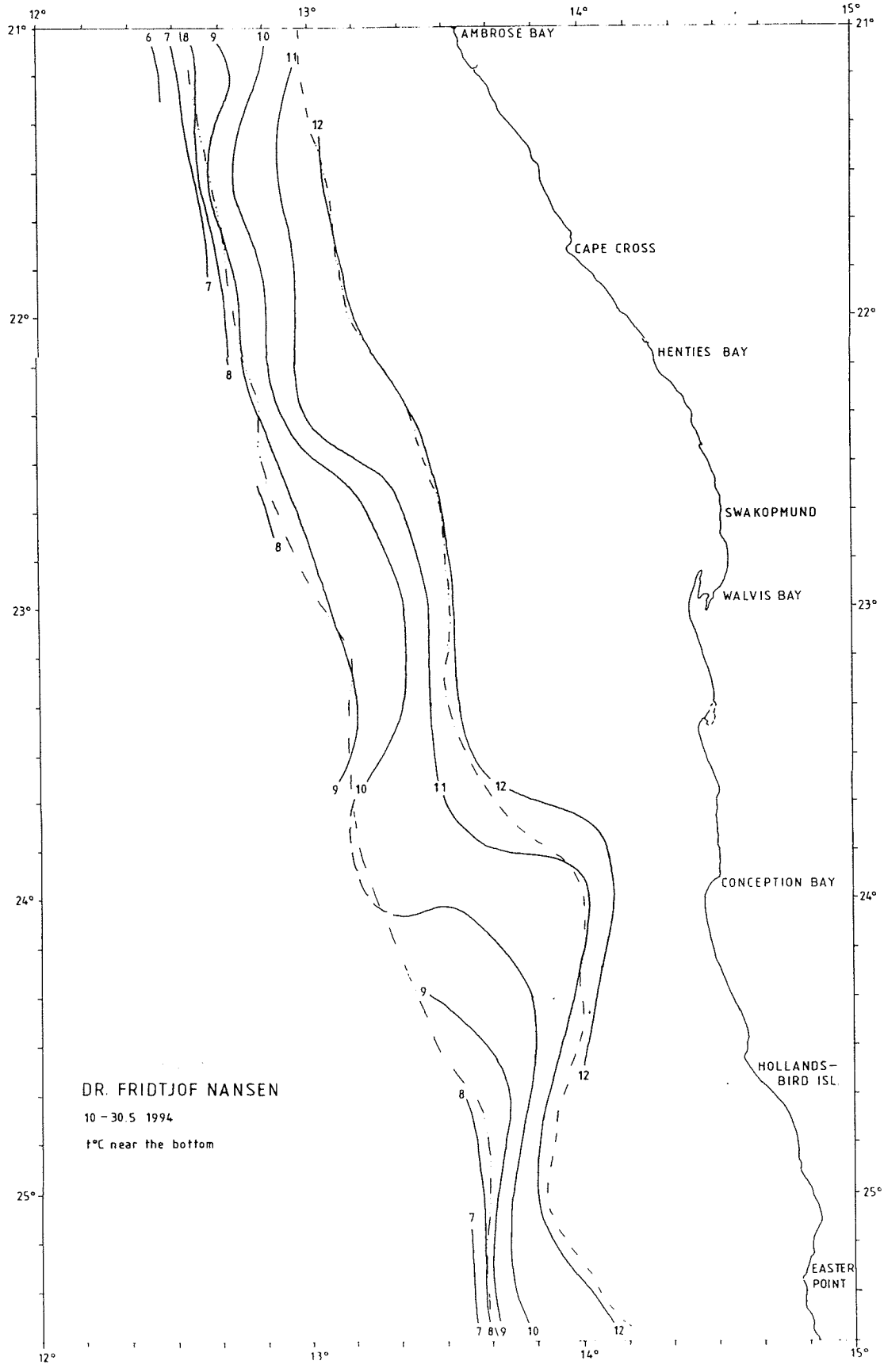

Figure 2b St. Francis Bay to Ambrose Bay. Distribution of sea temperature near the bottom.

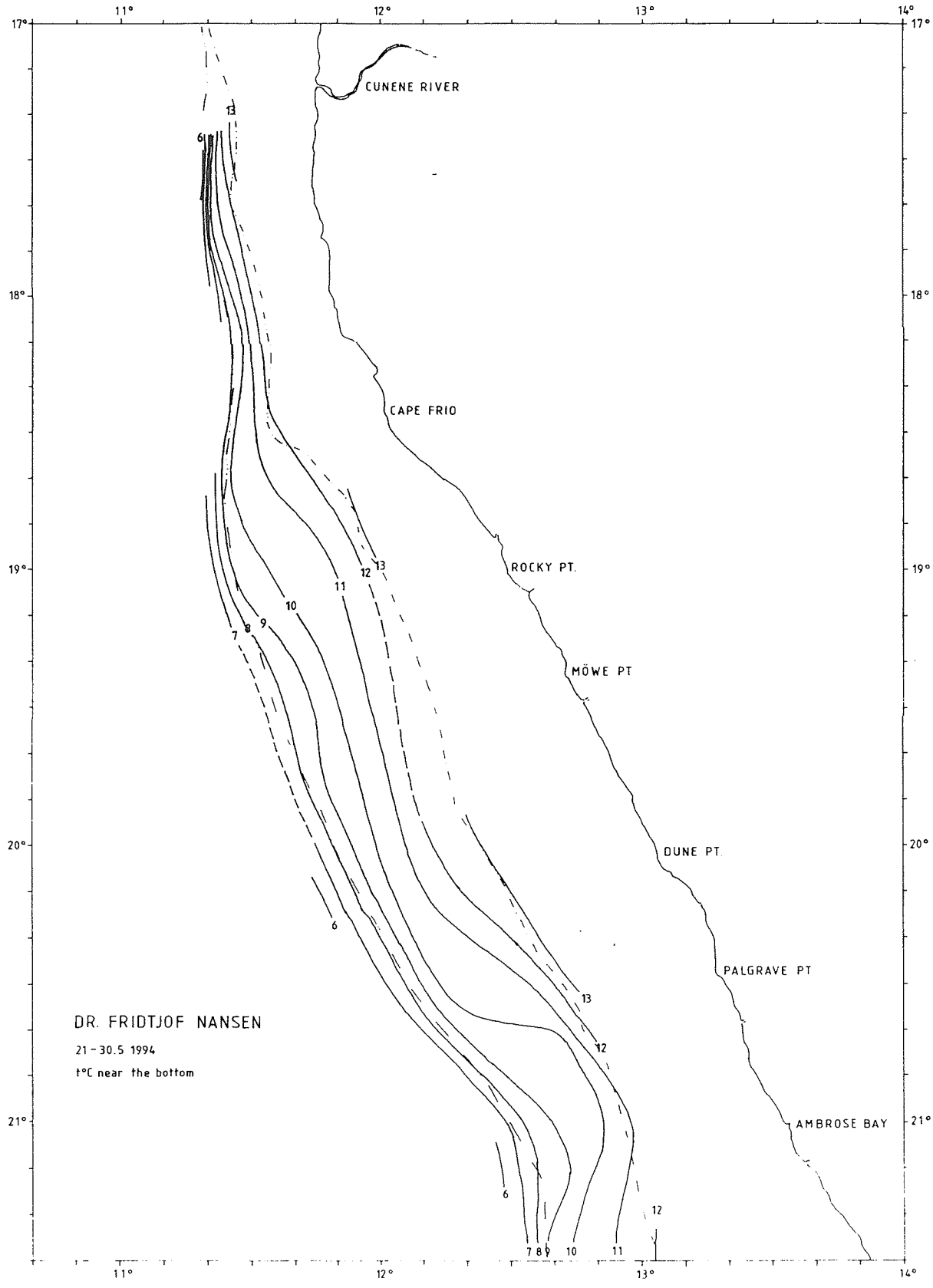

Figure 2c Ambrose Bay to Cunene River. Distribution of sea temperature near the bottom.

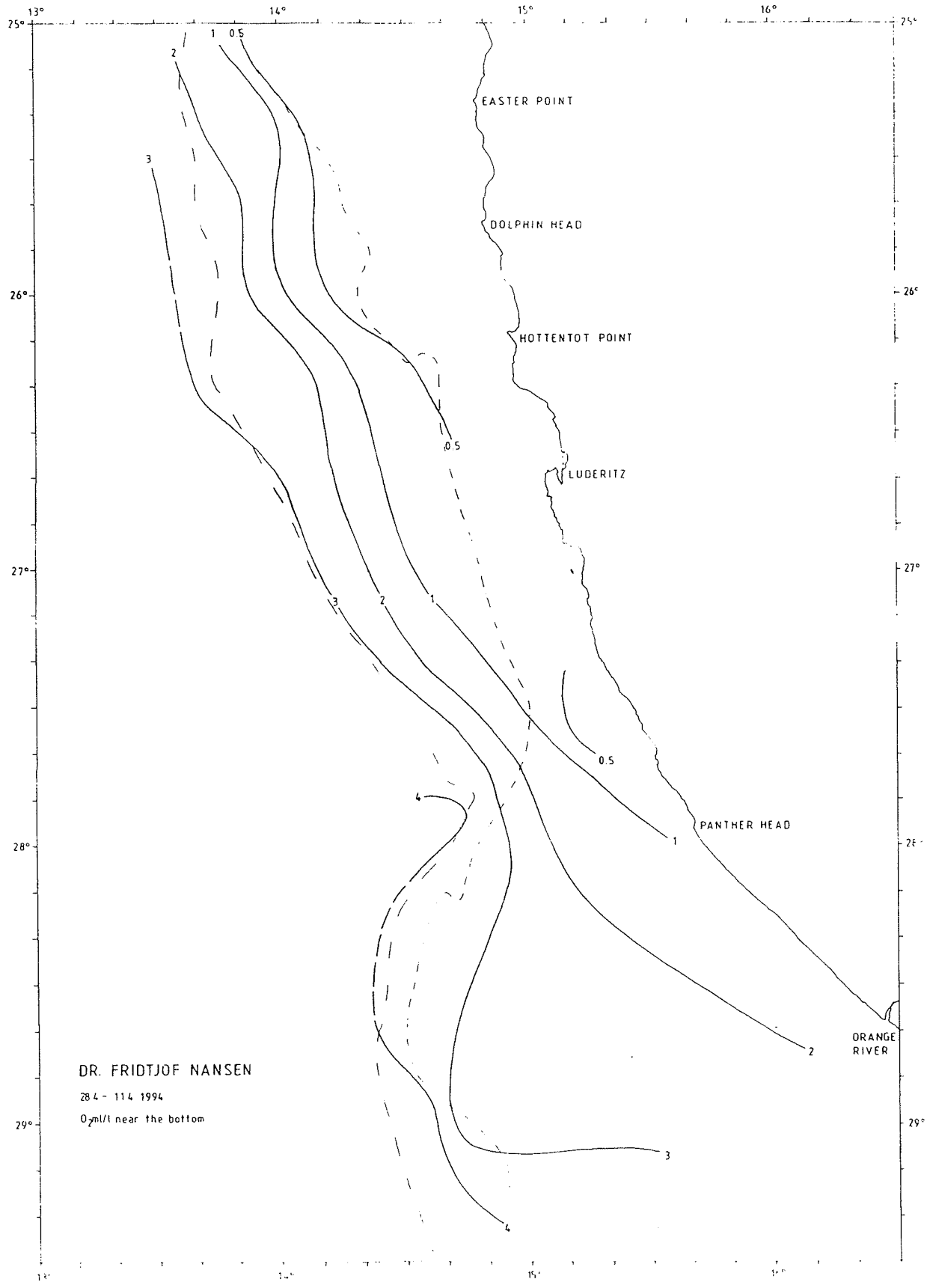

Figure 3a Orange River to St. Francis Bay. Distribution of oxygen (ml/l) near the bottom.

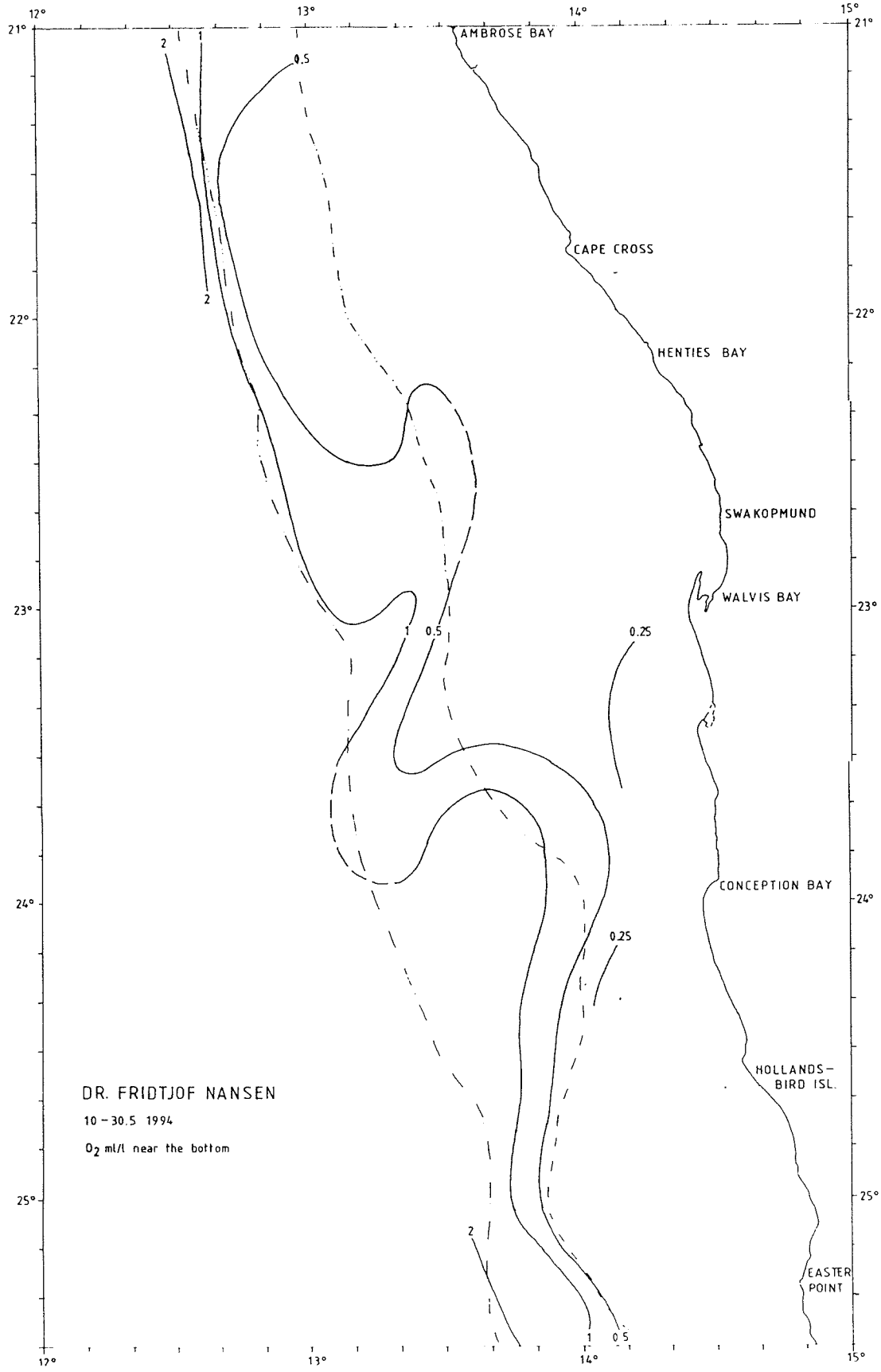

Figure 3b St. Francis Bay to Ambrose Bay. Distribution of oxygen (ml/l) near the bottom.

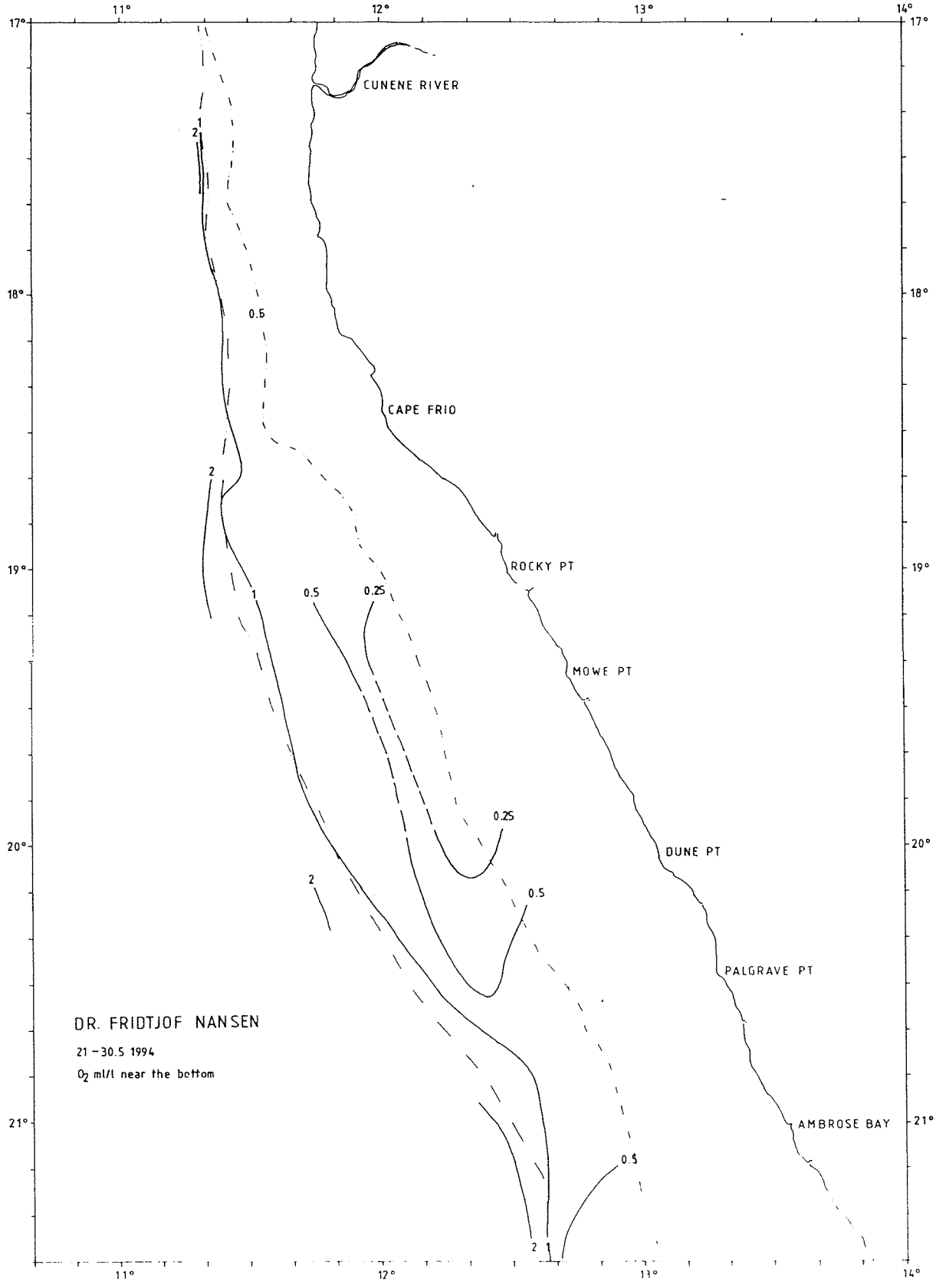

Figure 3c Ambrose Bay to Cunene River. Distribution of oxygen (ml/l) near the bottom.

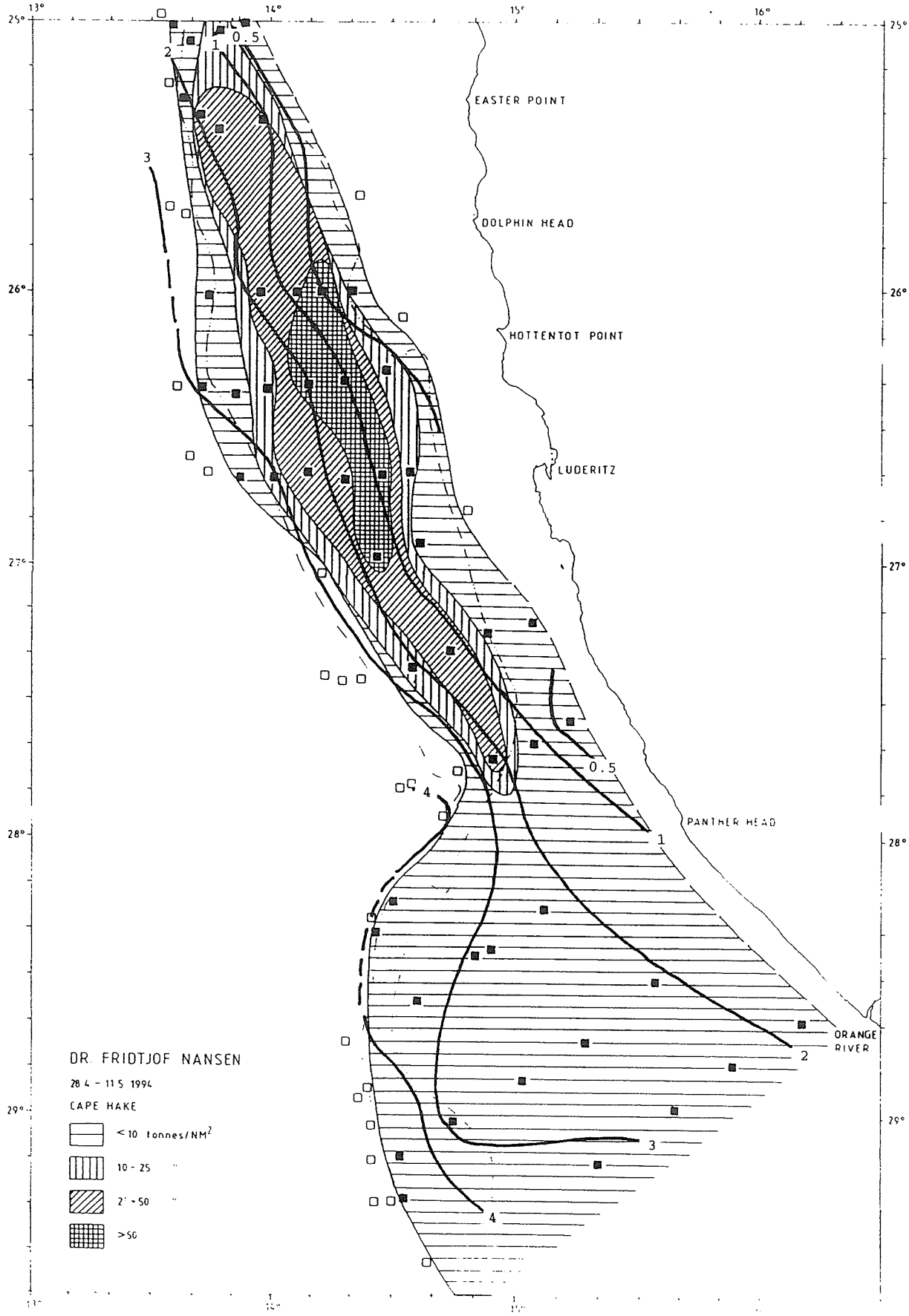

Figure 4a Orange River to St. Francis Bay. Distribution of Cape hake and oxygen (ml/l) near the bottom.

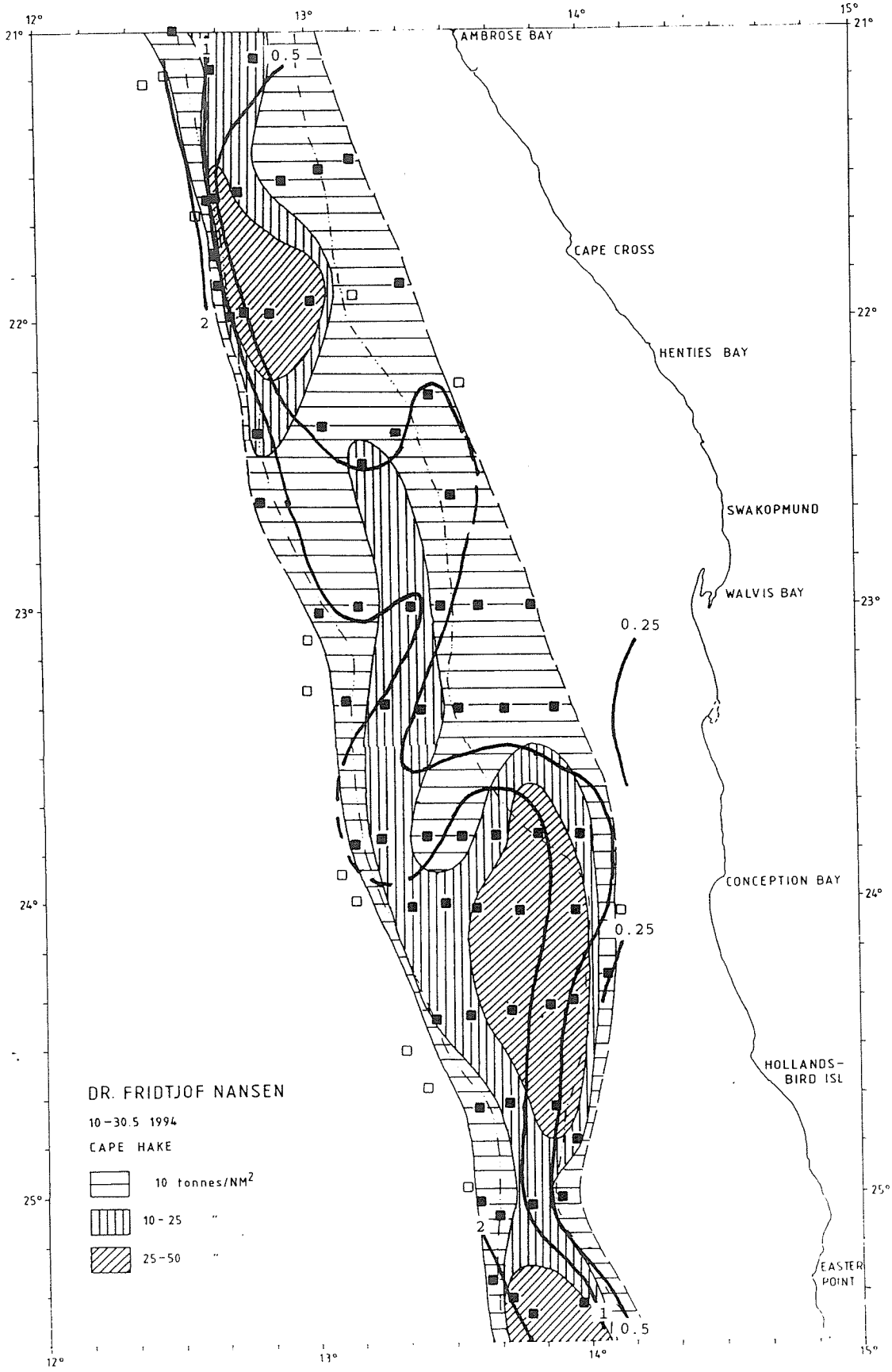

Figure 4b St. Francis Bay to Ambrose Bay. Distribution of Cape hake and oxygen (ml/l) near the bottom.

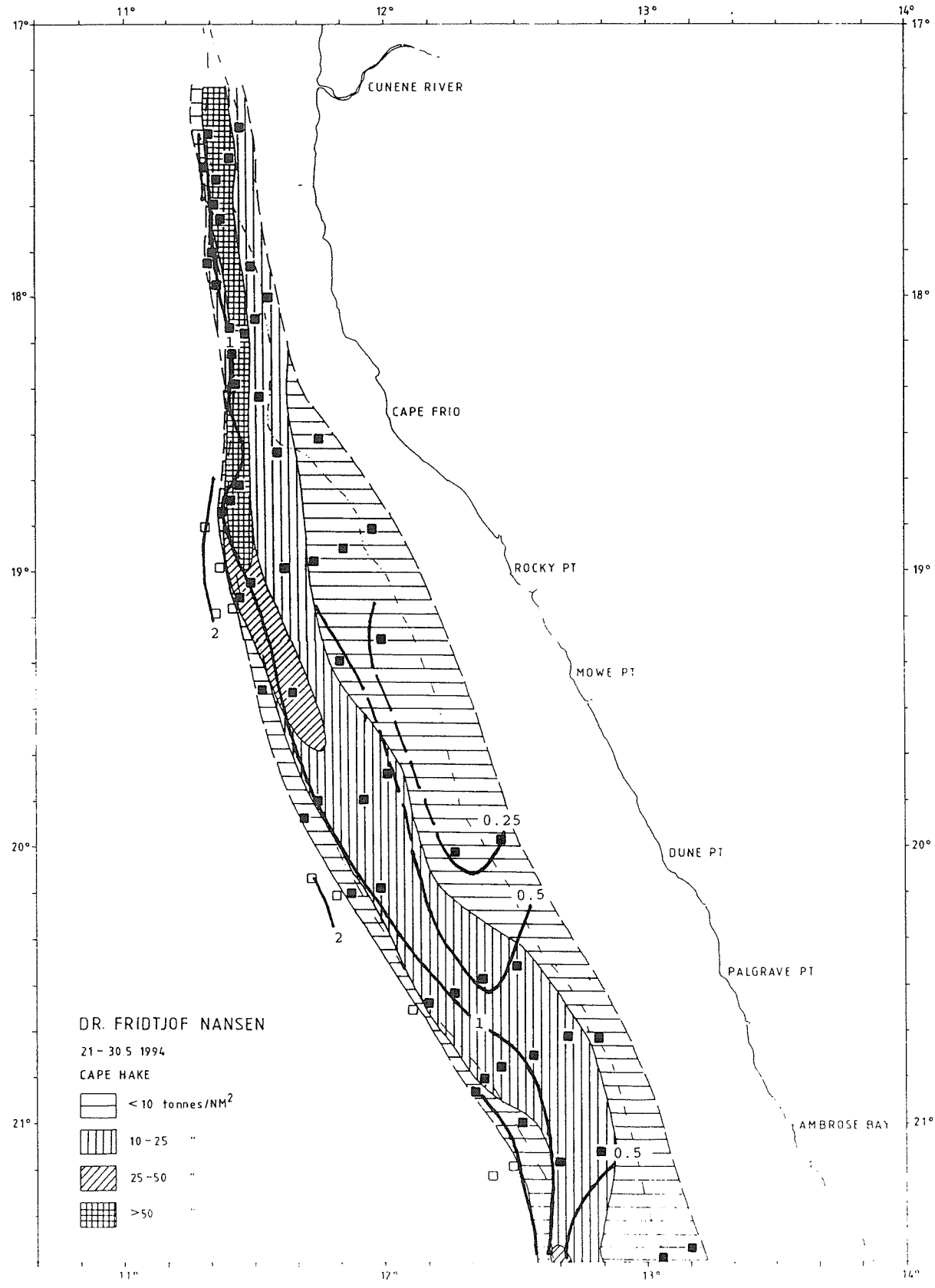

Figure 4c Ambrose Bay to Cunene River. Distribution of Cape hake and oxygen (ml/l) near the bottom.

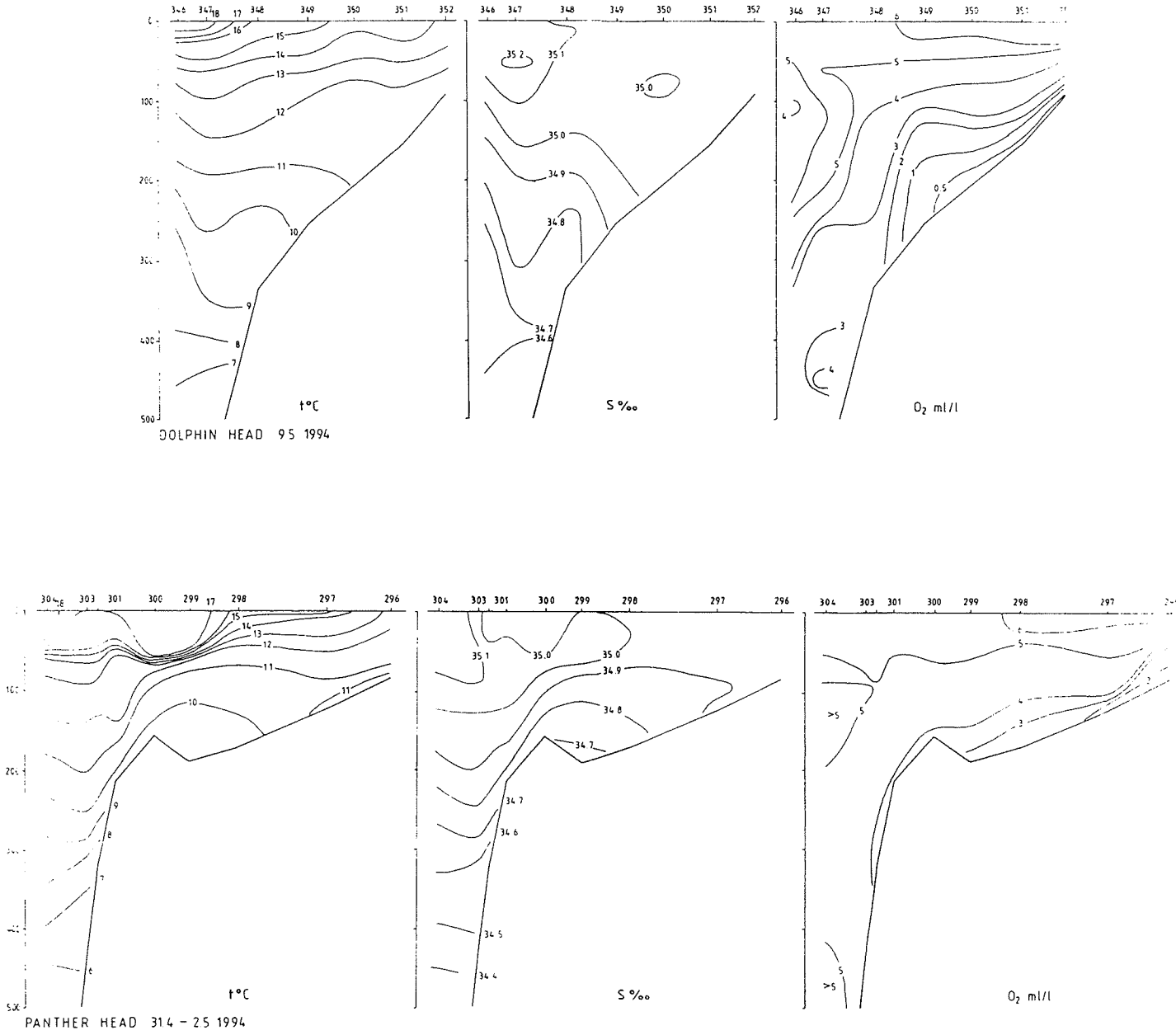

Figure 5a Orange River to St. Francis Bay. Temperature, salinity and oxygen in the standard profiles worked.

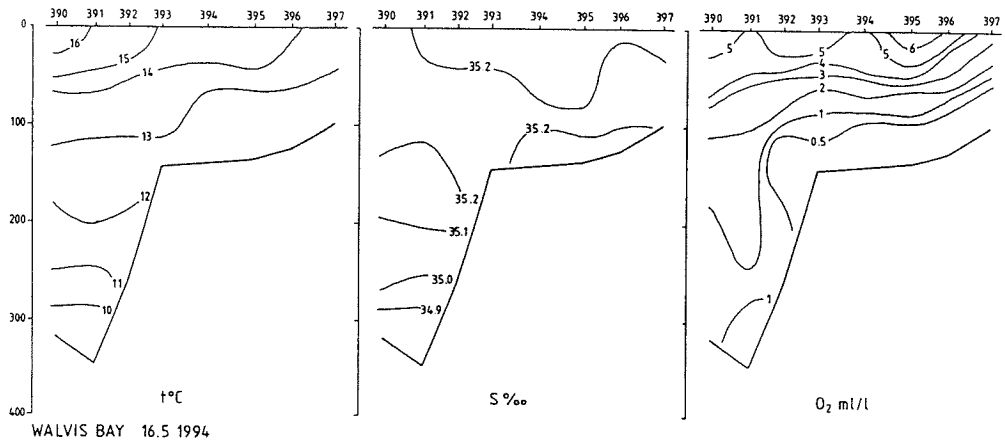

Figure 5b St. Francis Bay to Ambrose Bay. Temperature, salinity and oxygen in the standard profiles worked.

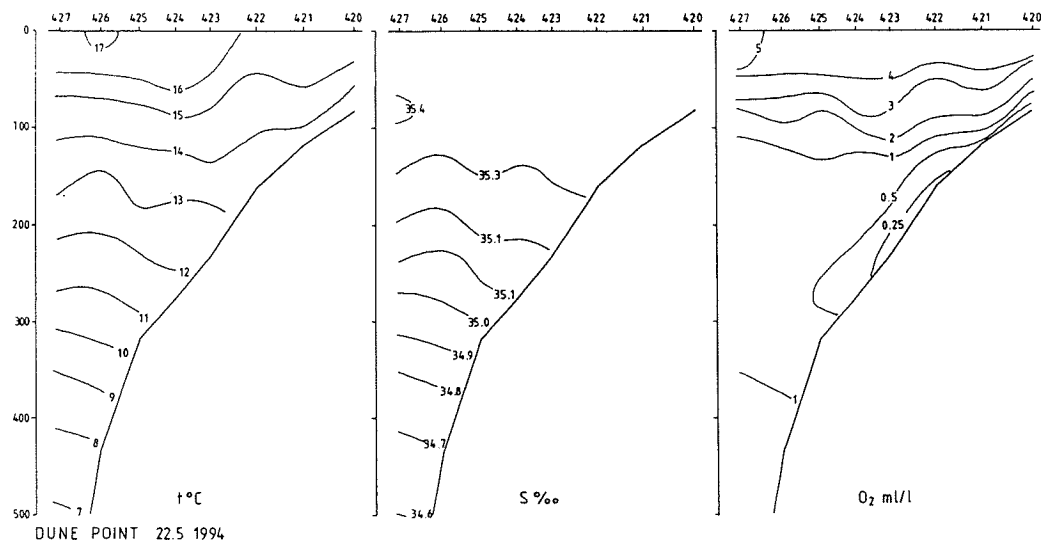

Figure 5c Ambrose Bay to Cunene River. Temperature, salinity and oxygen in the standard profiles worked.