CRUISE REPORT >DR. FRIDTJOF NANSEN=

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SURVEY OF THE FISH RESOURCES OF NAMIBIA

Horse mackerel survey methodology
07 - 19 October 1998

by

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CHAPTER 1 INTRODUCTION

1.1 Objectives

The cruise had the following overall objective:

-to improve the basis for horse mackerel abundance estimation through improved understanding of diurnal vertical migration dynamics.

Specific objectives were:

1) to establish diurnal vertical migration patterns of horse mackerel and related species.
2) to sample relevant acoustic recordings with pelagic trawl using the multi-sampler, and with bottom trawl.
3) to establish basic biological parameters of horse mackerel and related species.
4) to measure acoustic target strength of horse mackerel
5) to evaluate the multi-sampler.
6) to identify and conclude on aspects of improvement potential in horse mackerel abundance estimation methodology based on present findings.

The three first specific objectives were to be met by surveying a limited area with acoustics and trawling as many times as possible during the cruise in order to establish a diurnal vertical migration pattern.

The fourth specific objective was to be addressed by using a submersible transducer and the EK 500 system to resolve single targets in horse mackerel shoals.

The fifth specific objective was to be addressed on the basis of the experience with the use of the multi-sampler during the cruise.

The sixth objective was to be achieved through a synthesis of the results, partly to be accomplished during the cruise, but eventually to be completed when a thorough analysis of the material has been carried out.

1.2 Participation

The scientific staff consisted of:

From Namibia:

Michael EVENSON, Ferdi HAMUKUAYA, Ekkehard KLINGELHOEFFER (Team leader), Anja KREINER, Theopolina NAMWANDI, Justina SHITINDI

From South Africa:

Rob COOPER, Pierre MALAN

From New Zealand:

Neil BAGLEY (Guest, to observe multi-sampler)

From Norway:

Bjørn Erik AXSELSEN, Ingvar HUSE (Cruise leader), Jarle KRISTIANSEN, Magnar MJANGER, Roar SKEIDE, Jan Tore ØVREDAL

1.3 Narrative

"Dr. Fridtjof Nansen" left Walvis Bay on the evening of 7 October. The course was set for an area at around 250 m depth at S 17°45" and E 11°24" (Figure 1) where the "Nansen" arrived on 10 October. Fairly good concentrations of juvenile horse mackerel were found. Acoustic and trawl sampling was started immediately, back and forth along a 23 n. m. east/west transect at S 17°45', between 50 and 500 m depth. The weather was characterised by strong southerly winds most of the cruise. This work continued until 17 October, with additional target strength measurements towards the end of the period. On 17 October the pelagic trawl and multi-sampler was observed using the Focus underwater vehicle, before the "Nansen" set her course back to Walvis Bay where she arrived in the evening of 18 October.

CHAPTER 2 ENVIRONMENTAL OBSERVATION

2.1 CTD-data

The weather during the survey period was generally quite rough, with winds seldom below force 5. A force 7-8 southerly gale blew for about 30 hours on the 12th/13th of October, during which operations were suspended. (Figure 2)
Seabird CTD dips, measuring Temperature, Salinity and Oxygen, were done after trawls, at the trawl positions. A single transect was sampled repeatedly during the entire survey period. The trawls were done as acoustic targets presented themselves, causing the CTD dips to be done in a random order. The CTD data is thus not synoptic in nature. CTD sensors were calibrated immediately before this cruise.
CTD profiles are presented for the period before the storm (9/10 to 11/10) (Figure 3) as well as after the storm (13/10 to 17/10)(Figure 4).

2.1.1 Temperature

During the period 9 – 11 October the water was well mixed throughout the shelf area. The temperature on the surface was mainly in the region of 14°C. Two intrusions of warmer, 16°C water were found within 30 kilometres of the coast. After the storm, i.e. 13 – 17 October the water mass was quite strongly stratified, with a SST of 16°C being found over most of the survey area. Despite the stratification, no defined thermocline was present at any stage during the survey.

2.1.2 Salinity

The salinity structure generally followed that of temperature, becoming stratified after the storm.

2.1.3 Oxygen

The oxygen content of the water was comparatively high by Namibian standards. Before the storm oxygen levels at the surface were between 3 and 5 ml/l. levels of below 1ml/l were found below 250 meters. After the storm oxygen levels increased markedly, reaching almost

6 ml/l on the surface in places. This appears to have been caused by an inflow of comparatively oxygen rich water from the offshore regions. The oxygen content in the mid shelf increased from 1-2 ml/l to 2 – 3 ml/l.

2.1.4 Discussion

During the survey a single transect was sampled in a random way. This makes it somewhat difficult to draw any conclusions from the hydrological data other than those immediately associated with the transect. The change in conditions after the storm is quite marked. The wind appears to have caused warm, comparatively oxygen rich higher up water on the shelf. This is contrary to what is expected after a strong wind from the south, which one would expect to cause upwelling.

2.2 Light

The light measurements were carried out on two different light meters :

- Ambient light meter logging readings day and night. The sensor was placed on the roof of the wheel house.
- Underwater light meter measuring the light intensity from the surface down to 500 m. The sensor was placed on the CTD-probe.

To measure ambient light, a LI-COR LI-1000 logging system was used together with a photometric light sensor. The light was recorded every 10 minute as a mean value of the period. The sensor measured from 10E-3 - 100000 Lux. The results from the ambient light measurements are presented as light intensity for the survey period in Figure 5.

The underwater photomultiplier based light-meter was connected to the underwater housing of the CTD-probe. The meter has a cosine filter placed on the front of the housing. The light intensity was logged 24 times pr second along with the CTD-data. The light meter produced sensible readings down to 10E-4/ 10E-5, corresponding to about 350 m depth during the day.

The underwater plug on the housing was damaged after 5 days of survey. This caused a leak, and the meter could not be used any more.

Depth - light intensity profiles are given in Annex II.

Chapter 3 VERTICAL DYNAMICS

3.1 Introduction

Diurnal vertical migration is a common behavioural trait found in most pelagic fishes, and also in many demersal fishes. It is normally considered to be a mechanism which is applied in order to optimise survival and feeding. Fish will normally stay deep during the day to minimise predation from visual predators, and will migrate to upper layers during the night to improve feeding opportunity. Since this is a general strategy in most of the pelagic community, the major part of the animals in the system participate in this migration to some degree. This causes a very dynamic diel change in the vertical distribution of biomass in the system, which is strongly reflected in hydroacoustic recordings.

The acoustic reflection from fish is influenced by a number of factors. In the context of vertical migration the most important ones are fish tilt angle during upwards or downwards swimming, swim bladder volume variation relative to depth, and acoustic dead space near the bottom. Fish with an elongated swimbladder are directive acoustic targets, meaning that acoustic backscattering may be strongly variable, and that a tilting fish normally will reflect far less energy back towards the acoustic transducer than a horizontally swimming fish. Acoustic reflection from a fish will largely depend on the status of the swimbladder, which is compressed during descent and expanded during ascent according to Boyle's law which states that the product of volume and pressure is constant. As pressure increases one atmosphere every 10 m, the volume of a fish swimbladder at 100 m will be 1/11 of that at 0 m since the surface pressure is 1 atmosphere. This will obviously influence the acoustic reflective properties of most fish during vertical migration. The acoustic dead space near the bottom is caused by the blocking of the reception as soon as the first bottom echo returns, normally on the acoustic axis. Additional reduction in availability of fish near the bottom to acoustic detection is caused by an imperfect bottom detection algorithm, making it difficult to distinguish targets closer to the bottom than ½ pulse length (0.75 m at 1 ms pulse length) from the bottom echo. Also, a backstep of typically 1 m is used in the BEI post processing system, extending the total dead zone on the acoustic axis to 1.5-2 m, and obviously more in the outer parts of the beam. These sources of error in acoustic detection of fish will potentially influence data used for abundance estimation unequally at different times of day and night. If they are just causing greater variation around a correct mean this will not

necessarily induce errors, but if they represent biases the estimates obtained will of course also be biased. A basic understanding of the vertical migration pattern of the species in question is therefore a prerequisite for the development of adequate acoustically based survey methodologies. It is also of complimentary value to investigate other species in the same environment in order to understand the total vertical dynamics of the system in question, so that the driving forces of the mechanisms governing the migration can be understood and applied at other locations and in other contexts.

3.2 Methods

One single 23 n. mile east west transect between 50 and 500 m depth was surveyed continuously, only interrupted by trawl hauls and a few hours of strong winds from the arrival in the survey area on 10 October until 16 October. A total of 37 transects were completed. Survey speed was 10 knots. Acoustic data were logged at 38 kHz with the EK-500 system, and post processed on the BEI system. A description of the acoustics settings is given in Annex I. Altogether 17 bottom trawl hauls and 33 pelagic trawl hauls were fished. A description of the trawls used is given in Annex I. The trawl doors used were Thyborøen 2000 kg doors. They were attached at the pelagic (upper) bracket position during pelagic hauls and at the demersal (lower) bracket position during bottom trawl hauls. One pelagic haul was also carried out with the bottom trawl, with the doors attached at the pelagic position. Most trawl hauls were towed northwards (along the depth contour).

The Scanar multi-sampler system was attached to the pelagic trawl during all hauls with this trawl. In the listing of trawl data in Annex III, each of the 3 cod-ends of each multi-sampler haul is allocated as one trawl station. For a further description of the multi-sampler system, see the drawing in Annex I as well as item 5.1.

Fish were sampled by representative sub sampling from the deck, or by sampling all fish in the case of small catches. Lengths of 200 fish of commercial importance, if available, and total weights of measured fish were recorded from all trawl hauls with catches. Individual length/weight relationships were recorded for selected samples of horse mackerel. Horse mackerel stomachs and otoliths were collected from 20 fish per trawl for further analysis ashore. Random investigation of stomach contents of some other selected species was undertaken but not recorded in a scientific format. For more information on biological sampling and materials, see item 4.1 and Annex IV.

3.3 Results and Discussion

3.3.1. Acoustic observations

Diurnal vertical migration of the demersal and pelagic fish species in the northern Benguela system has been documented during the 1980's and 1990's. Diurnal vertical migration is probably one of the factors causing variability in acoustic abundance estimates of pelagic stocks. The following observations of single species migration behaviour along the transect line were noted:

Trachurus capensis (Cape horse mackerel)

Juvenile/immature horse mackerel < 17cm were observed to aggregate mainly near the bottom and partly in mid-water close inshore during day and night. However, vertical migration close to the surface was observed during the night.

Adult/maturing horse mackerel occurred further offshore, with fish close to the bottom during the day and further up in the water column during night, partly mixed with dense concentrations of mesopelagic fish.

Etrumeus whiteheadi (round herring)

Round herring were observed in mid-water during the day and night along the entire transect, with dense concentrations close inshore and far offshore. During the night in the inshore areas, round herring were observed to shoal close to the surface.

Engraulis capensis (anchovy)

Anchovy occurred mainly close inshore and always quite near the surface.

Dentex macropthalmus (dentex)

Dentex tended to remain aggregated near the bottom during the day, mixed with horse mackerel. The species was, however, also observed to move to mid-water.

Merluccius sp. (Cape hake and deep water hake)

Hake exhibited diurnal vertical migration as described by Pillar et al (1995/1997) and Huse et al. (1997). However, hake were observed to migrate to 70 m off the bottom compared to the usual 50 m.

Lampanyctodes hectoris (Myctophids)

Dense aggregations of myctophids showed clear vertical migration towards the surface during night and towards the bottom during daytime.

The horizontal distribution pattern as derived from the S_A values in the BEI database could not be analysed in detail on board. Consequently, the overall vertical distribution patterns as they appear in the acoustic data are emphasised. Figures 6 to 17 show vertical distribution patterns and variations in S_A values on a diurnal basis. Total S_A values showed deep distributions around noon and in the early morning and evening. The corresponding mean S_A values peaked in the afternoon, but this peak was mainly due to a peak in the round herring values, probably caused by a large school recorded at this time of day during one of the transects.

The graph showing diurnal vertical distribution of pooled horse mackerel (Figure 8) indicated a limited vertical migration, although noon and night values showed somewhat deeper distributions than morning and afternoon. The pooled horse mackerel mean S_A values (Figure 9), however, showed high daytime and night values, and low morning and evening values. This complies well with what is seen for other species like hake, herring and red fish in different parts of the world. The low morning and evening values are probably an effect of low acoustic target strength caused by articulate angular distribution during vertical migration morning and evening. This is even more clearly seen in horse mackerel larger than 17 cm (Figure 13) where mid-day values are substantially higher than all other values. This pattern is probably augmented by daytime schooling, which works to keep body orientation horizontal, increasing acoustic target strength.

The round herring graphs are strongly influenced by the big schools recorded one afternoon, and no clear pattern can be discerned. Hake (Figures 16 and 17) show the typical patterns demonstrated earlier on a “Nansen” cruise in 1996, with high daytime values and deep distributions around noon and at night.

Horse mackerel tended to be distributed along the bottom, particularly during the day, but also during parts of the night in waters shallower than 125 m. This may induce an acoustic dead zone problem causing loss of measured biomass in such areas.

Generally it can be concluded that the majority of the species investigated here shows the same patterns of vertical distribution and diurnal variation in S_A values as have been demonstrated earlier for a number of other species in different geographic locations.

Probably the vertical distribution trends can be clarified when the horizontal distribution picture is established.

Examples of echograms from the cruise are presented in Annex V.

3.3.2. Trawl observations

3.3.2.1 Introduction

The average catch rate for the survey (50 trawl stations) was 649.39 kg/hr. Horse mackerel were the major catch species accounting for 51 % of the total catch. Other important species were dentex (*Dentex macrophthalmus*) at 28 %, the two hake species, *Merluccius capensis* at 22 % and M*erluccius paradoxus* 16 %.

This section reports on the diurnal distribution and length data for the most important species. Some results from the Multisampler are also given. The assumption that the two trawl types are comparable has been made in presenting these data. Night has been defined as 17h00 to 05h00 UTC and daylight as 05h00 to 17h00 UTC. Station positions for day and night,

separately are given in Figure 18 and catch summaries for the top 4 species in Annex IV. Hake species were combined for the distribution plots.

3.3.2.2 Diurnal catch distributions

Distribution plots are given in Figures 19-25 for 3 species separately and for 2 species, horse mackerel (*Trachurus capensis*) and hake (*Merluccius* spp) by length class. The shading given in the plots is represented by black (> 500 fish per catch/hour), dark grey (50 to 500 fish per catch/hour) and light grey (< 50 fish catch/hour). Length frequency plots are given in Annex IV for the same 5 species separately, for 1-100 m, 101-200 m and >201 m bottom depth ranges and only represent horizontal distributions.

Horse mackerel less than 25 cm were more abundant mid-shelf to inshore during the day. At night there was a similar distribution pattern of horse mackerel in this area but a reduction in abundance. Off the edge of the shelf (> 200 m) this size class was not caught in trawls deeper than 350 m, while some fish were present below this depth at night. The data suggest an upward movement of horse mackerel on the shelf edge at night.

Horse mackerel greater than 25 cm were caught between 150 and 300 m during the day. At night this pattern changed. Fish were distributed over a wider area, both vertically and horizontally, which is also indicated by the length frequency data.

Horse mackerel increased in size by depth in day trawls. Juvenile fish were dominant in the 0 –100 m bottom depth range and adults in depths greater than 200 m. Night trawls had two modal peaks which suggests some mixing of size classes.

Both size groups of hake had an even distribution across the survey area during the day and night. Hake less than 30 cm showed some vertical migration up to 75 m off the bottom at night. Length frequencies for hake (*Merluccius capensis*) showed an increase in size by depth.

Dentex were evenly distributed along the bottom from 150 m to 500 m with a shift of the concentration from the mid-shelf region during the day to the shelf edge and deeper at night.

Anchovy were found in more dense concentrations near the bottom during the day compared to the diffuse night time distribution. The highest concentrations were found on the mid-shelf with moderate numbers caught on the shelf-break. No anchovy were caught at the bottom during the night.

Round herring were dispersed throughout the survey area in waters shallower than 300m. Higher concentrations were caught during the day than at night. Length frequency data showed similar modal peaks for night and day in bottom depth less than 100 m. A modal increase of 6 cm was observed from 0 – 100 m to 100-200 m bottom depth during day.

3.3.2.3 Multisampler observations

Three sets of Multisampler data were selected. Length and catch composition data are given in Annex IV. Samples taken at different depths recorded different species compositions. Length data in examples given showed no change in fish length with depth. Samples taken at the same depth showed similar species but varied in composition between trawls.

3.3.2.4 Other data

Length weight relationships were calculated from 607 horse mackerel ranging from 8 to 36 cm (*see* Annex IV). The power curve regression of the data was:

$W = 0.0052 \times L^{3.1345}$

When W is fish weight in grams and L is fish length in cm.

Maturity stages are given in Annex IV. Horse mackerel were found to be 50 % sexually mature at: 21 - 22 cm.

Horse mackerel stomach samples were collected for later analysis. Some *ad hoc* stomach samples were, however, analysed during the cruise, and the results are given in Figure 26.

The figure indicates that the horse mackerel investigated feed at opportunity as no pronounced diurnal rhythm was seen in the data.

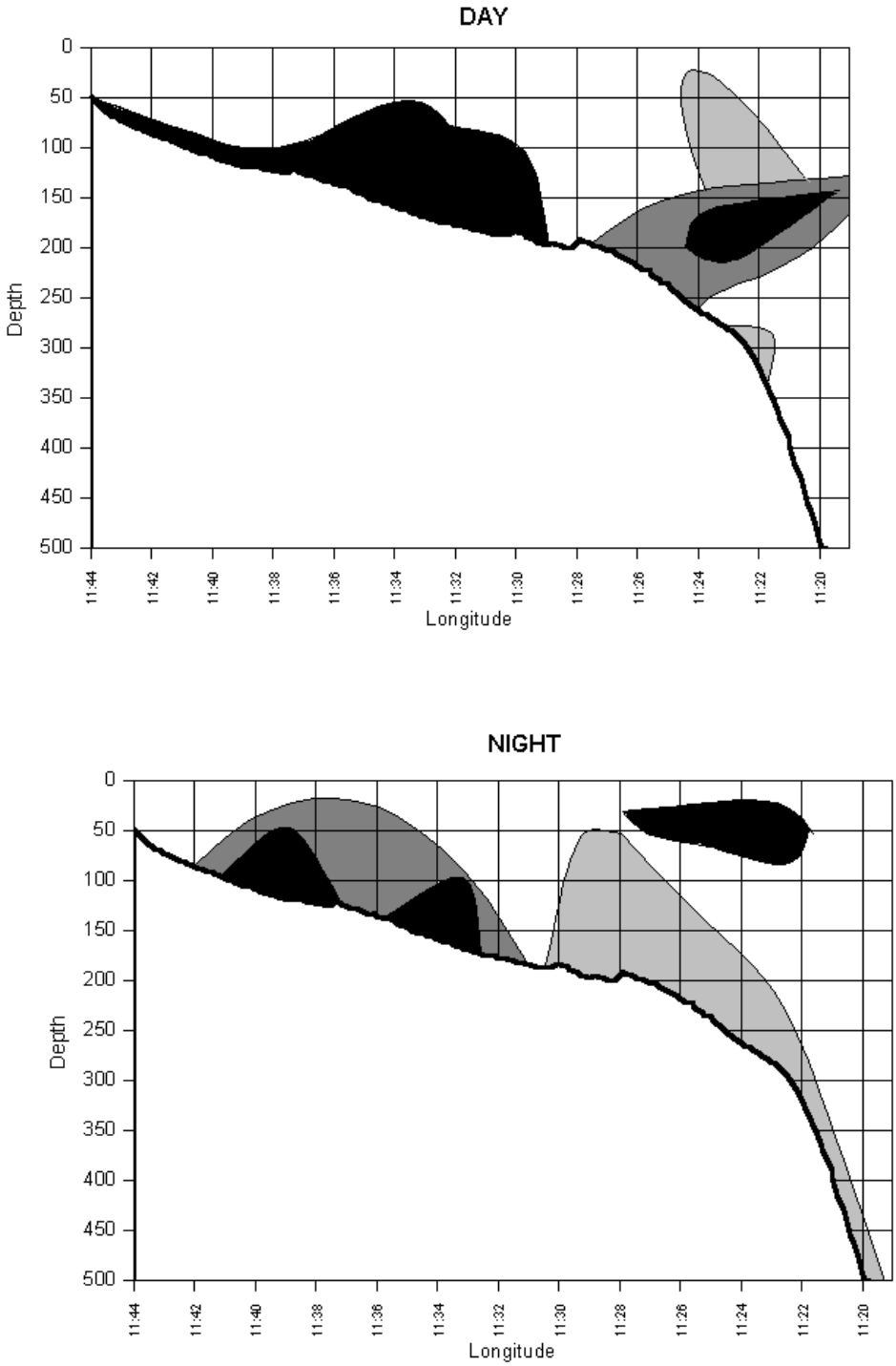


Figure 19. *Trachurus capensis* (<24 cm) day and night values

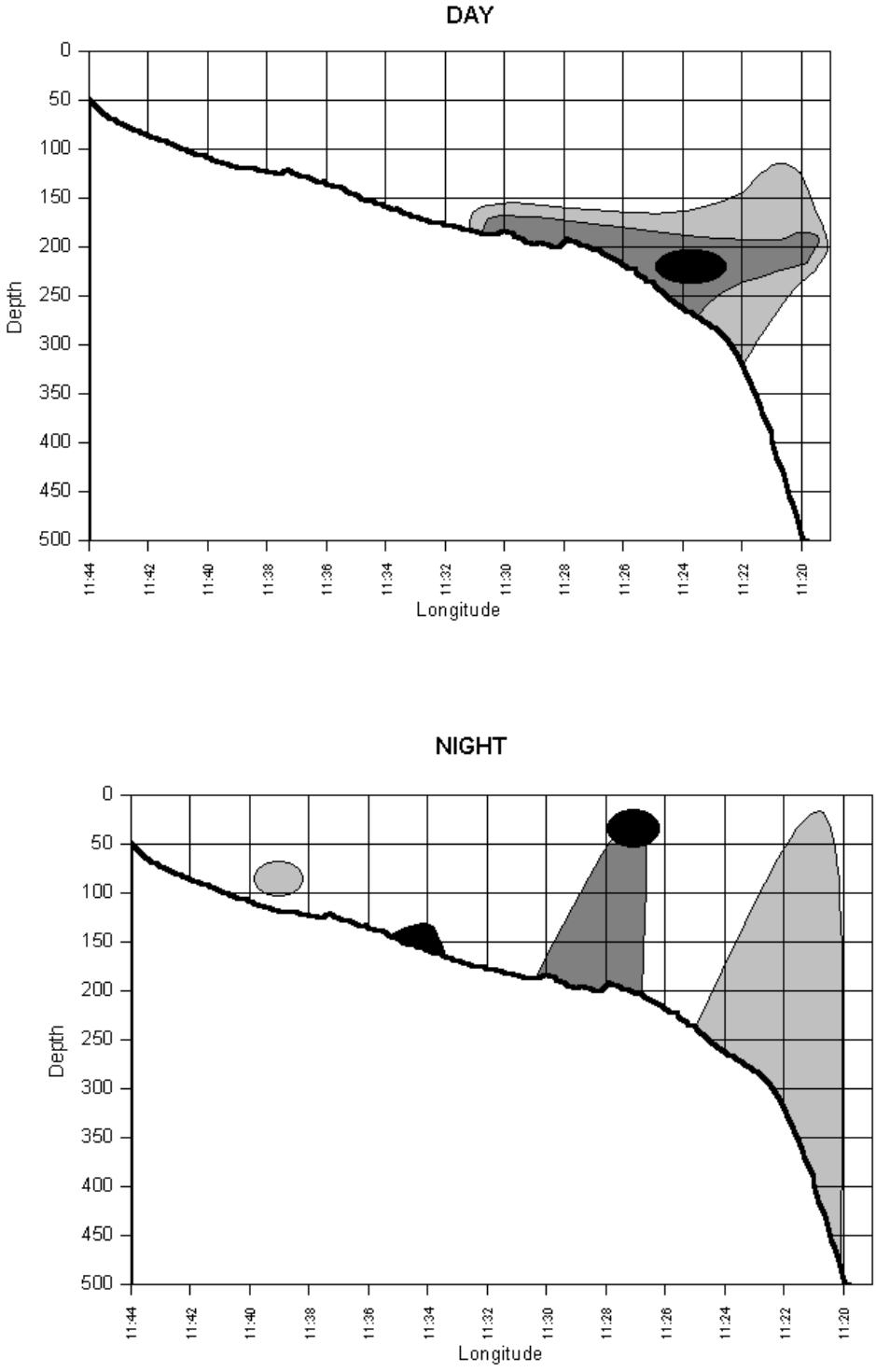


Figure 20. *Trachurus capensis* (>24 cm) day and night values

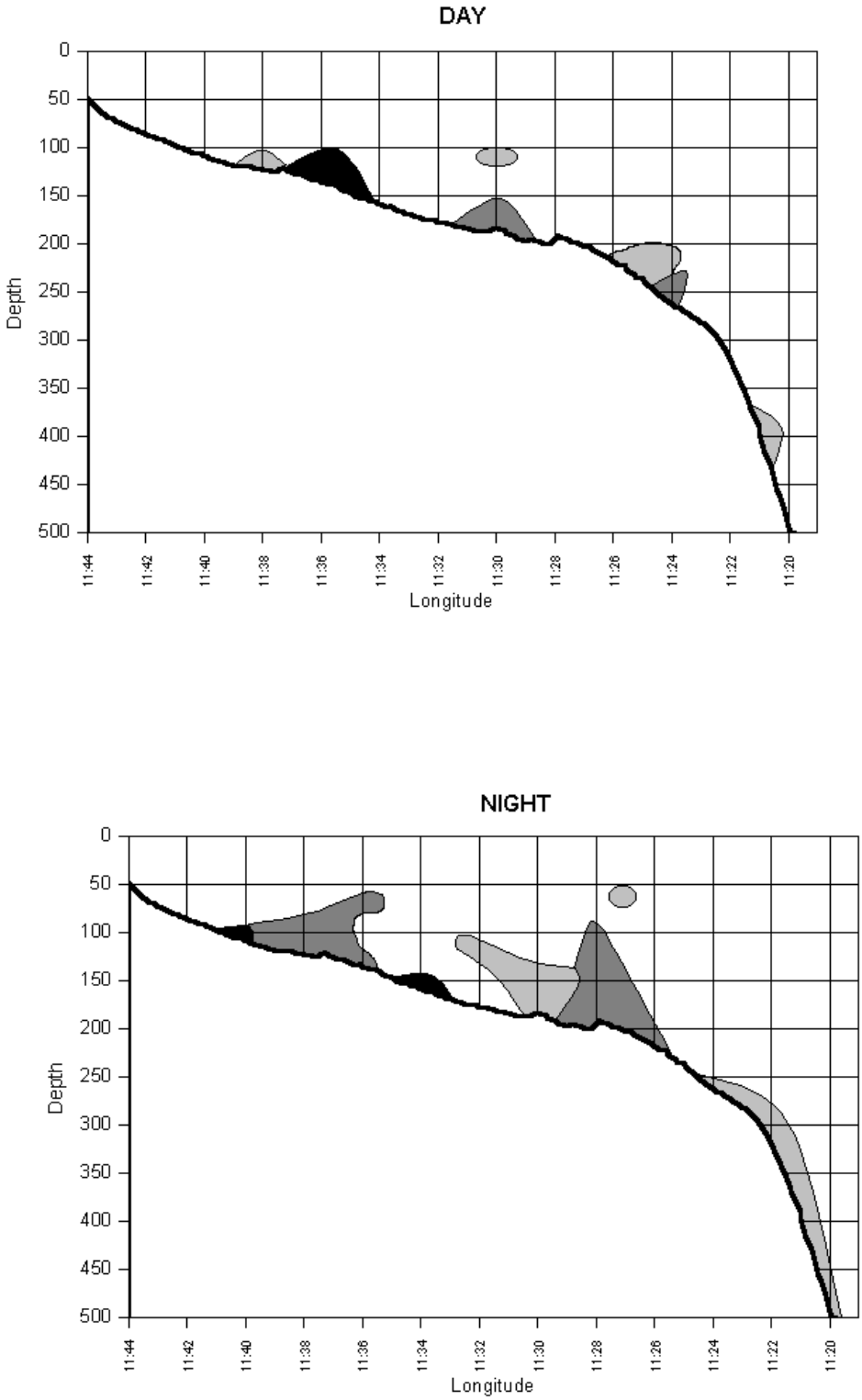


Figure 21. *Merluccius sp.* (<30 cm) day and night values

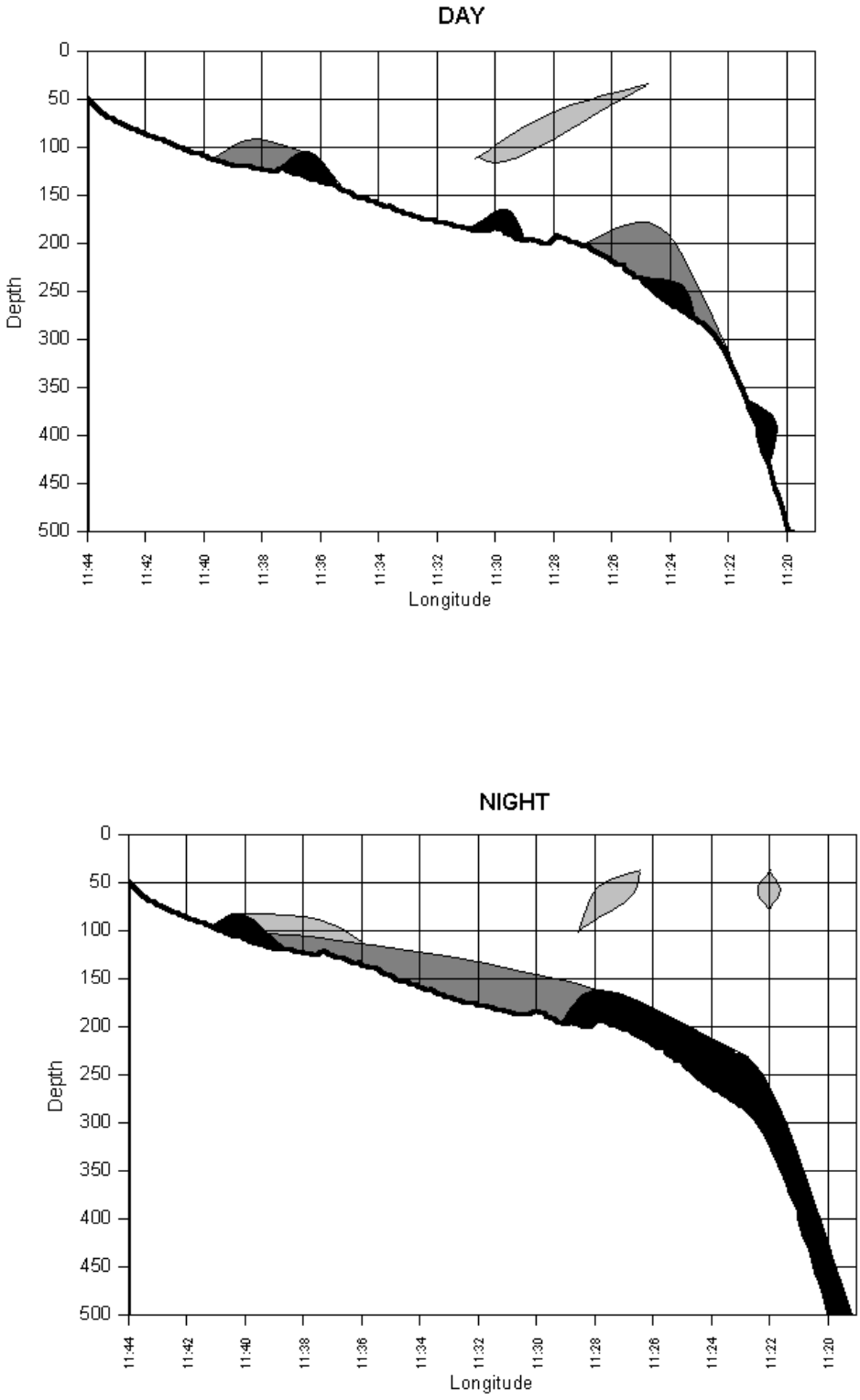
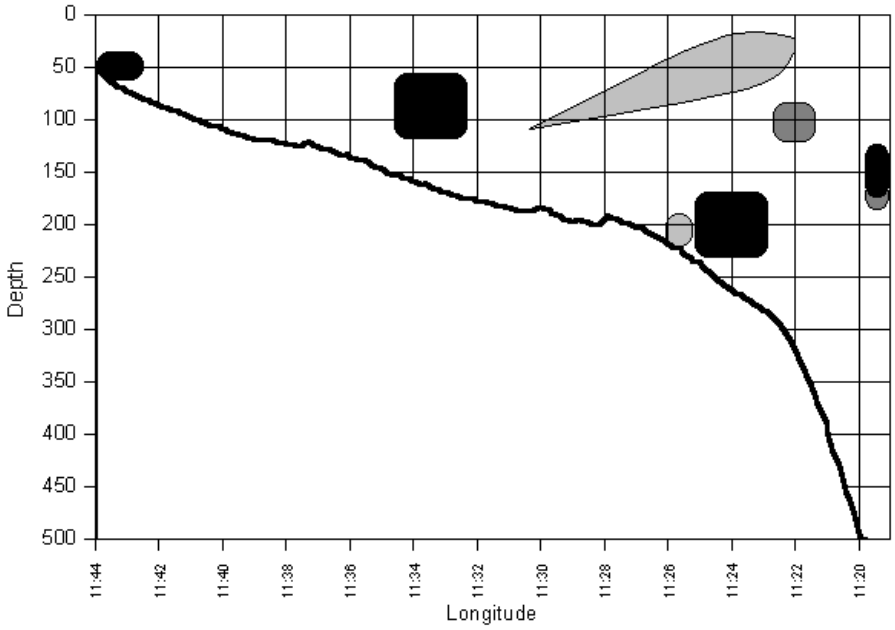


Figure 22. *Merluccius sp.* (>30 cm) night values

DAY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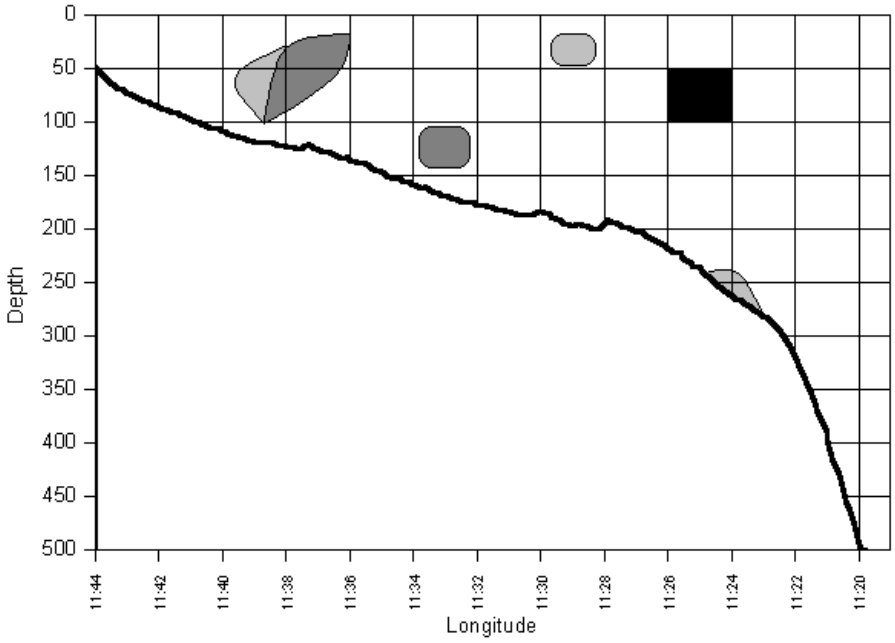
Longitude

NIGHT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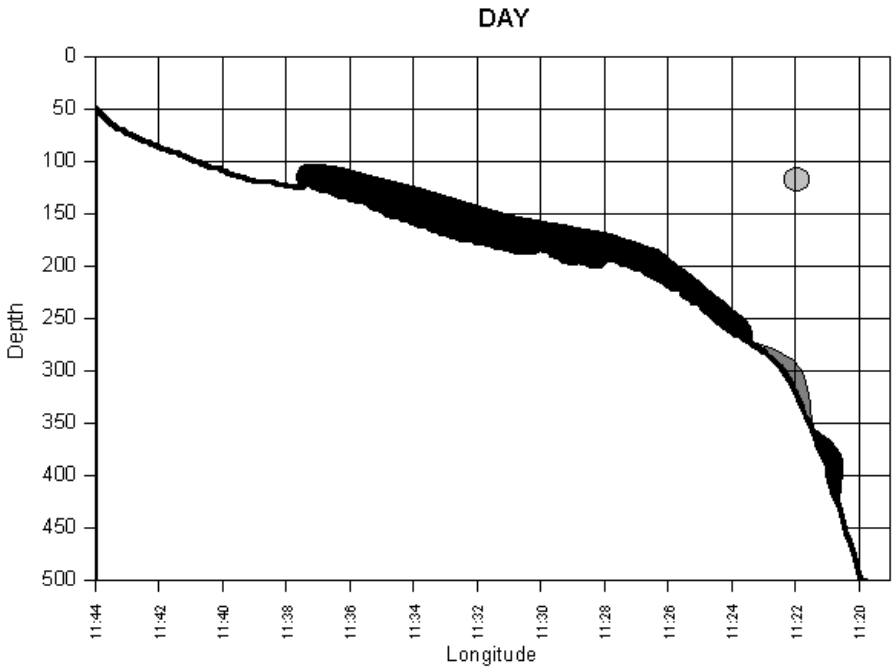
Longitude

Figure 23 . *Etrumeus whiteheadi* day and night values



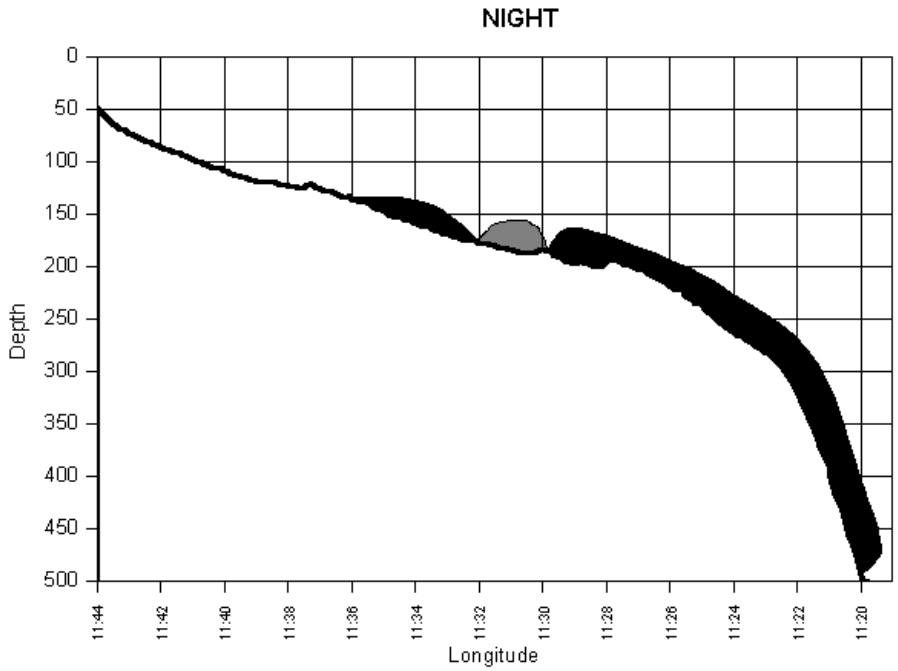


Figure 24. *Dentex macrophthalmus* day and night values

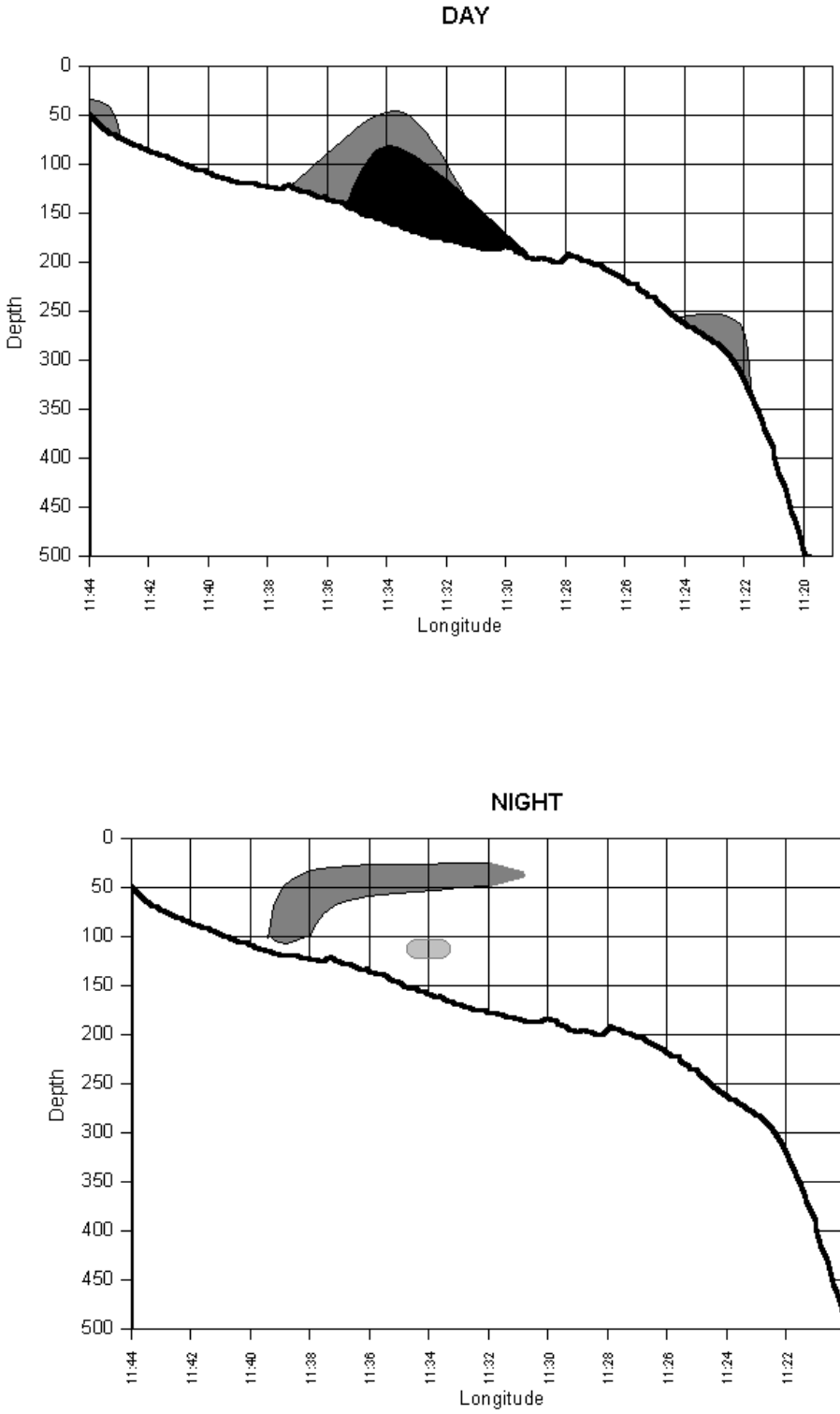


Figure 25. *Engraulis capensis* day and night values

3.4 Conclusions

Generally it can be concluded that the majority of the species investigated here shows the same patterns of vertical distribution and diurnal variation in S_A values as have been demonstrated earlier for a number of other species in different geographic locations. Probably the vertical distribution trends can be clarified when the horizontal distribution picture is established.

Horse mackerel tended to be distributed along the bottom, particularly during the day, but also during parts of the night in waters shallower than 125 m. This may induce an acoustic dead zone problem causing loss of measured biomass in such areas.

Of the five selected species all showed some change in distribution between day and night. The most marked changes were observed for anchovy, hake and dentex.

The cohorts of larger horse mackerel were found in deeper water on the shelf break. Both size classes migrated up into the water column and dispersed at night.

Anchovy at night might have migrated to the surface, i.e. less than 25 m, and been unavailable to the trawl.

Due to a lack of pelagic trawl stations inshore of 11°35’ E during the day and in the shelf-break area at night the relevant distributions in these areas are unknown.

CHAPTER 4 HORSE MACKEREL SURVEY METHODOLOGY

4.1 Methods

Below follows a description of the general methodology which has been used when surveying the Namibian horse mackerel stock. It is adapted from the 1996 horse mackerel survey report. Towards the end of this chapter (item 4.4), an attempt is made to outline avenues towards an improved methodology for horse mackerel on the basis of the results obtained on this cruise.

4.1.2 Distribution and abundance estimation

Survey area

The limits of the survey area are determined from the previous data of pelagic and mid-water fish distribution, i.e. the area from the Lüderitz upwelling cell (26°00' S) to the border between Namibia and Angola (17°15’ S). The survey follows a systematic parallel grid of transects 20 n. mile apart from 26°00’ to 21°00’ S and 15 n. mile apart from 21°00’ to 17°15’ S, due to the greater abundance of horse mackerel in the region north of 21°00’ S. The inshore area of the survey is limited to approximately 2 n. mile from the coast and the offshore area is covered to the 500 m isobath. At less than 100 m bottom depth a survey grid of systematic square tracks are often used to obtain a better coverage of the inshore juvenile horse mackerel.

Sampling methods and data analysis

A description of the acoustic instruments and their standard settings are given in Annex I, including a description of the fishing gear used.

An acoustic echo-integration system provide measurements of fish densities, averaged over 5 n. mile distances. The acoustic unit measured by this calibrated echo-integrator system is the area backscattering coefficient, $S_{A.}$

The scrutinising procedure of the Bergen Echo Integrator, BEI, is used to assign integrator data to species or species groups by separating echo recordings horizontally or vertically.

Integrator data from fish targets are allocated to the following groups on the basis of trawl sampling and acoustic character, as recognised from the echo recordings:

Juvenile horse mackerel (∠20 cm)
Juvenile/maturing horse mackerel (> 20 cm)
Pelagic 1 (pilchard, anchovy and round herring)
Pelagic mix
Gobies
Demersal species
Plankton and mesopelagic
Mesopelagic

Horse mackerel specimens larger than 20 cm are classified as adults only if they are mature.

Maps containing these integrator data are drawn for horse mackerel, and from these records the distribution of the fish is indicated.

Areas of fish distribution are divided into smaller units if significant differences were observed in the density of the fish and the average lengths of the fish in a specific area. The average S_A-values within an unit is then obtained by averaging all data measured during the coverage of that area, excluding those values obtained during trawling against the course line. The area is calculated in cm^2 with a planimeter and converted to NM^2.

The following target strength (TS) function is applied to convert S_A-values (mean integrator value for a given area) to number of fish:

$$TS = 20 \log L - 72 \quad [dB]$$

where the total length of the fish, L is expressed in centimetres. This target strength to size relationship has been used for a number of fish species (horse mackerel, pilchard, anchovy and round herring), although originally derivated from early measurements of North Sea herring. Experiments in the past have been carried out to determine the validity of the target strength presently used for the Cape horse mackerel. The target strength of the North Sea herring will however, be used until a more specific target strength for horse mackerel is determined.

The number of fish in each length frequency group (cm) in an area is calculated by applying the following formula:

$$N_i = S_A \cdot A \cdot P_i / \sum_{i=1}^{n} (P_i / C_{Fi})$$

where N_i = number of fish in length group i
A = area in NM^2
S_A = mean integrator value in the area
P_i = proportion of fish in length group i in samples from the area
C_{Fi} = fish conversion factor for length group i

The number per length group is then summed and the total number of fish obtained. The total biomass of fish is computed using the mean weight per length group obtained from trawl samples.

4.1.3 Biological sampling

Prior to sampling a trawl, the catch is well mixed. A random sample representative of the total catch is taken. The size of the sample depends on the size of the catch. In cases where the catch is small, the total catch is sampled.

To determine the catch composition of the trawl the number and weight in the random sample is recorded. This sample is then raised to the total catch.

The procedures to determine the size composition are as follows:

- Total length (Lt):
  200 horse mackerel per sample for total length

- Measurement:
  Recorded to the nearest 1 cm (below)

- Weight:
  Total weight of measured fish in kg

4.1.3.1 Biological data

Biological data are collected for the target species, Cape horse mackerel. The biological parameters recorded include:

- Total length (Lt.) to the nearest mm
- Body weight and gutted weight to the nearest g
- Sex, gonad weight and reproductive stages

4.1.3.2 Biological data sampling strategy

The sampling procedures per degree latitude are as follow:

- Size composition:

  20 fish per cm class are recorded to the nearest 1 mm below

- Fish weight:

  Total and gutted weight of 20 fish per cm class are recorded to the nearest 1 mg below

- Reproductive stages and sex determination:

  The seven stage categories as listed in Annex IV are used to describe the reproductive stage of the horse mackerel.

  Sex identification classes are: Juvenile (0), Male (1), Female (2)

- Gonad weight:

  Ovary and testes weight of 20 fish per cm class are recorded to the nearest 1 mg below.

- Otolith sampling:

  20 fish per cm class

  Both otoliths of the fish are collected

  Otoliths are stored in envelopes

  Only the station number and numerical number are recorded on the envelope. The numerical numbers used on the envelope correspond to the numerical numbers on work sheets containing the biological information listed above.

4.1.3.3 Processing of biological data

- Size composition:

The size composition of horse mackerel is pooled over two degrees of latitude. Size composition of the other pelagic and demersal commercially important species, are pooled by simple addition of all stations trawled during the survey. All trawl stations and biological data are entered into the NAN-SIS database.

- Length/weight relationship:

The total length/total weight/gutted weight relationships for the horse mackerel are calculated by fitting power curves to the weight-length regressions. These regression relationships included fish sampled for the whole region.

The length-weight data of horse mackerel are also used to calculate the fish condition factor, (weight X 100)/length^3, of the horse mackerel.

All data are processed on Microsoft Excel spreadsheets.

4.1.4 Acoustic target strength measurements

During the cruise, acoustic target strength of horse mackerel was measured with a submersible 38 kHz transducer positioned approximately 20-40 m from the horse mackerel shoals. The main advantage of this system is the ability to resolve layers and shoals into single fish targets by reducing the pulse volume compared to the hull mounted transducer. This ensures a high signal to noise ratio for the target strength measurements, as well as reducing the probability of multiple targets to be accepted as single targets. A substantial amount of useful data were collected. Trawl hauls were carried out immediately after each measurement session in order to secure relevant samples from the measured fish. The data will be analyzed and presented at a later stage.

4.2 Conclusions

The results of the investigations during the cruise with bearing on horse mackerel abundance estimation methodology can be concluded as follows:

Horse mackerel frequently occurred at the bottom, potentially in the dead zone. S_A values could therefore potentially be under-recorded.

Due to tilting of the fish during vertical migration, dusk and dawn values can be expected to be low. Day values are high due to horizontal orientation when the fish are schooling. Night values can be expected to be lower as the body orientation is more varied when the fish are not schooling. This may be evened out during a cruise, but should be considered when diurnal survey time is allocated. Also it should be considered when formulating a specific TS function for horse mackerel, as the average tilt angle will have strong bearing on this function.

During night horse mackerel dispersed into the upper layers of the water column and mixed with the mesopelagic fish. These horse mackerel recordings may thus easily have been underestimated within the dense mesopelagic fish aggregations. To compensate for these potential under-recordings of S_A values the scrutinising procedures should be optimised with the objective to separate the horse mackerel traces from the plankton and mesopelagic recordings.

There is also a need to conduct surveys which include both swept area and acoustic methods as a step towards minimising biases in horse mackerel abundance estimation methodology.

The target strength relationship applied to horse mackerel in Namibia is applied directly from that of North Sea herring, and might consequently not be valid. TS recordings were conducted on the cruise, but extensive analysis is required before a specific function can be formulated. The results will therefore be presented at a later stage.

Further investigation is required to determine to what extent vertical migration and the mixing of juvenile horse mackerel in the dense myctophid layers influence biomass estimates.

In addition an effort should be made to investigate what physical and biological factors are responsible for the diurnal vertical migration of horse mackerel. The feeding behaviour as well as predation on the stock need to be determined.

Chapter 5 TECHNOLOGY

5.1 MULTISAMPLER

5.1.1 Specifications

The «Multisampler» is a mechanical device that is constructed to take more than one discrete fish sample within a single trawl haul. The principle of operation is presented in the drawing in Annex I. It consists of a stainless steel frame 1 x 1.3 m that is attached to the pelagic trawl by a net extension. This then replaces the normal codend . The frame has two shafts, one at each side, that allows a set of 6 profile bars with a ring in each end to slide along them. The codends are supported by two bars, attached at the top and bottom of the mouth. These are then slid into the profile bars. When preparing the Multisampler before shooting the trawl, the six profile bars, i.e. three codends, are stacked on the upper end of the shafts . To release the bars and open the codends a hydroacoustic (HCL) device is operated from the ship bridge. The HCL system includes an operating unit, a hull mounted transducer on the ship, and a tranducer, a battery pack, an electronics pack and a motor driven release unit mounted on the Multisampler frame.

The electronics and hydroacoustic parts are manufactured by Scanmar and the whole system has been developed in co-operation between IMR and Scanmar. The system has, up to now mainly been used to take samples of herring in the stock assessment work in Norway. It has also been used on one cruise for sampling capelin in the Barents Sea . The Multisampler was then attached to the large «Åkratrawl».

On this survey the medium size midwater «Åkratrawl» was used. The extension piece was 10 m long as were each of the three codends. Both the extension piece and the codends were manufactured from 24 mm stretched mesh, thread no.14. Square meshes were used to prevent stretching of the net causing unwanted concentrations of fish in pockets in the extension piece.

5.1.2 Problems and Remedies

The Multisampler used during this cruise is the first system ordered from Scanmar on a fully commercial basis. There were some problems during operation. These included sand in the machinery and some of the mechanical parts requiring adjustment before they could be used. Initial preparation thus took some time. We hope these were just «teething problems» caused by a lack of good quality assurance routines which will be solved by the Scanmar staff and corrected for the next system.

The major problem was caused by large numbers of jellyfish caught by the trawl. The extension piece was torn twice due to large quantities of jellyfish. This may have been as a result of the trawl being old and stretched in some parts. The trawl was changed for a brand new one.

The problem with tearing seemed to be solved, but the huge tension caused by the weight and blanketing effect of jellyfish in the codends occasionally damaged the net profile bars. This problem was solved by sewing in extra selvage ropes that spread the tension from the middle of the profile bar to the selvage on the top panel of the codends.

The optimum angle of the Multisampler is 45° during towing. However this was not achieved during the survey. Angles recorded from the inclinometer ranged from about 20° to 40° and averaged about 30°. There were also problems in opening the nets at times and this was possibly related to the variable Multisampler angle. The lower selvage ropes in front of the Multisampler were shortened by 30 cm , but the problem reoccurred from time to time. An additional solution was tried by placing more floats on the upper selvage ropes of the extension piece to increase the angle. These adjustments helped to increase the angle slightly.

We hoped to be able to look at the Multisampler utilising the R.O.V. «Focus» , but the weather conditions did not allow it until the very end of the trip. The observations indicated that our problems with the incorrect angle may have been caused by the rigging of the trawl.

The lower selvage ropes were slack. The reason for that could possibly be that the lower bridles were lengthened with 3.5 m to maintain good vertical opening during deep water fishing. This could also have caused a pocket to form just before the codend. Concentrations of jellyfish were seen to collect in this area. The rigging of the entire trawl net can thus potentially affect the operation of the Multisampler.

5.1.3 Conclusions

We have some ideas on how to solve the problems with tearing of the net caused by jellyfish, including using a thicker cover on the lower and side panels of the extension piece. This may require some gear experiments.

The ability to sample discrete layers of fish during this cruise shows that the Multisampler could be a useful device which should be considered in stock assessment work for pelagic species.

5.2 Trawl symmetry system

Prior to the survey, a new Scantrol auto trawl system was installed on the vessel. The system controls trawl performance by means of Scanmar symmetry sensor. The symmetry sensor is placed in the centre of the headline and measures water flow and direction in the trawl opening. Information from this sensor is used to automatically control the winches.

During the survey, the system demonstrated that the trawl performance of the bottom trawl has been improved. During normal operation, the automatic trawl system adjusts wire length according to the difference in tension between the wires. However, tension adjustment may cause the trawl skewness to be increased during trawling under special circumstances, such as strong side wind and current causing the ship to drift sideways, thus causing deviation between ship heading and trawling direction. In this case, wire length should not be adjusted according to the tension of the wires, but according to the difference between trawling direction and ship heading. The new system keeps the trawl symmetric by adjusting wire length according to current flow in the trawl opening, when the trawl is skewed due to current conditions rather than wire tension.

5.3 Focus

The Focus 400 is a towed manoeuvrable vehicle with electrical supply for instruments, and fibre optic transmission of data to and from the ship. It can go down to 400 m and can go out to about 80 m on each side from the course line. It has surface or bottom lock autopilot modes. On this cruise it carried a Simrad Osprey 1324 SIT video camera and a Simrad/Mesotech FS-3300 sonar.

The Focus was used to observe the performance of the Multisampler during trawling. Because of the poor visibility in the water, the Focus could not be operated deeper than approximately 50 m. The Multisampler was observed about 330 m behind the vessel. In this position a very clear picture of the Multisampler was obtained, providing important information on the performance of the Multisampler in practical operation.

Figures

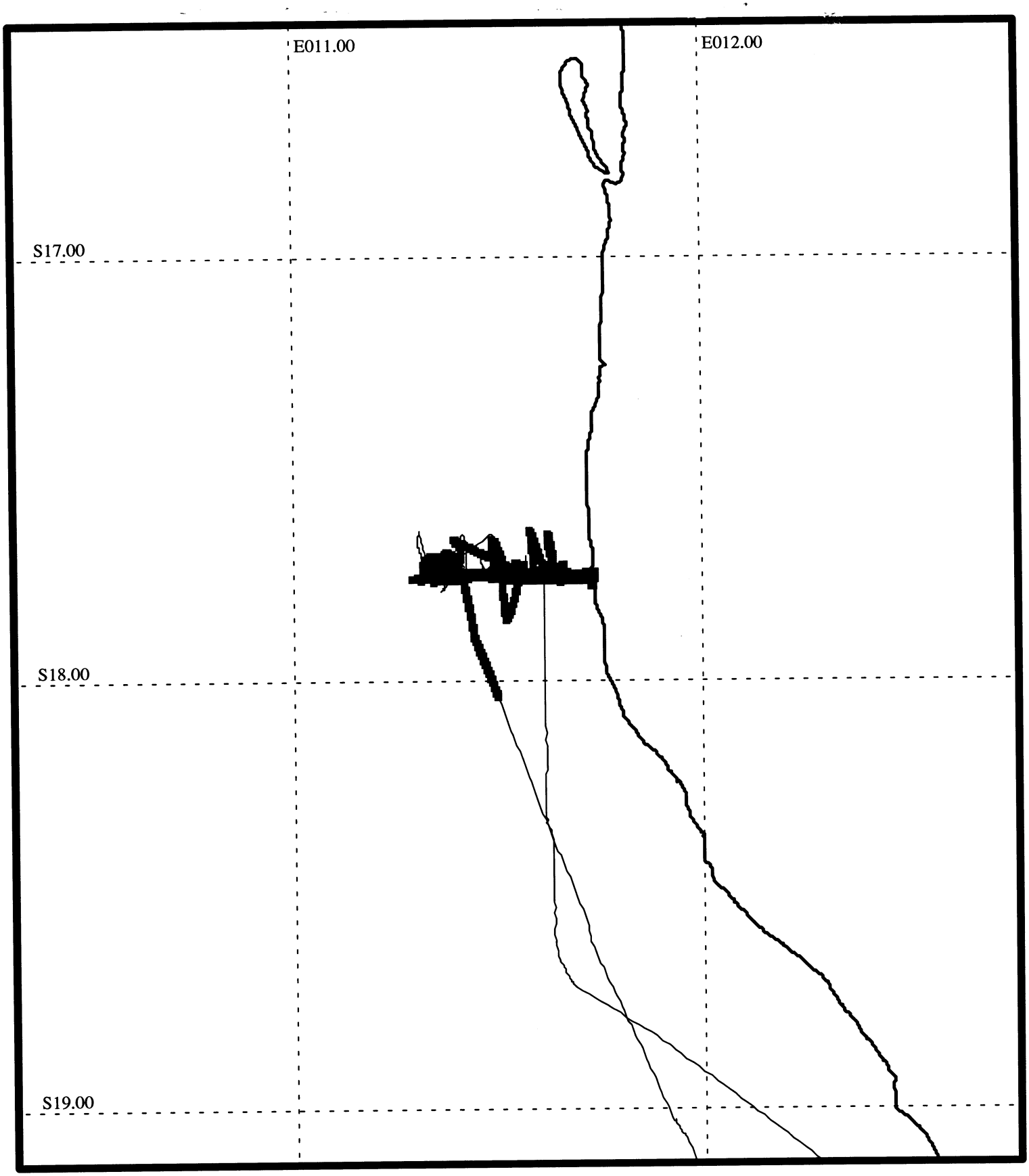


Figure 1: Survey track and location.

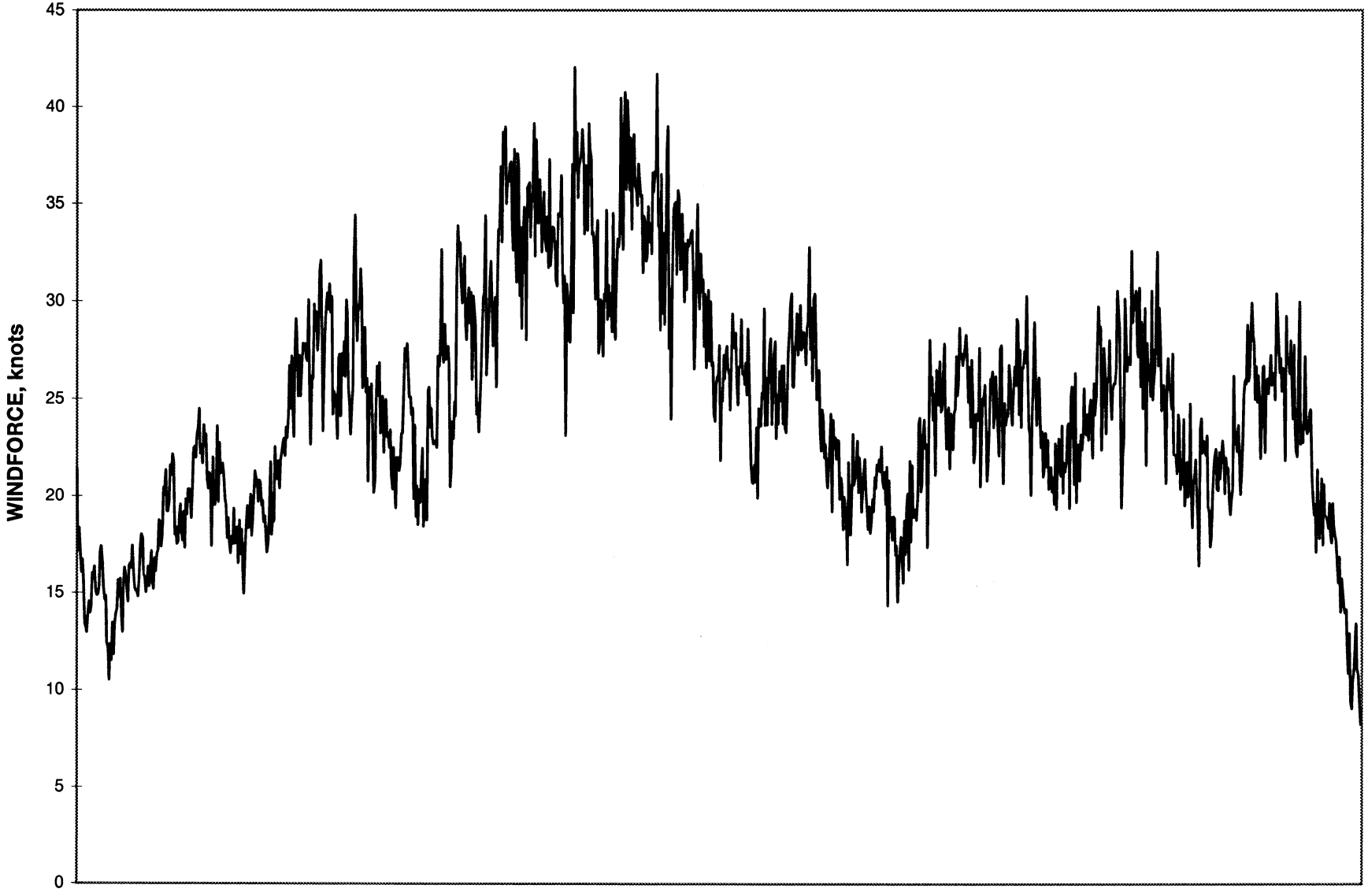
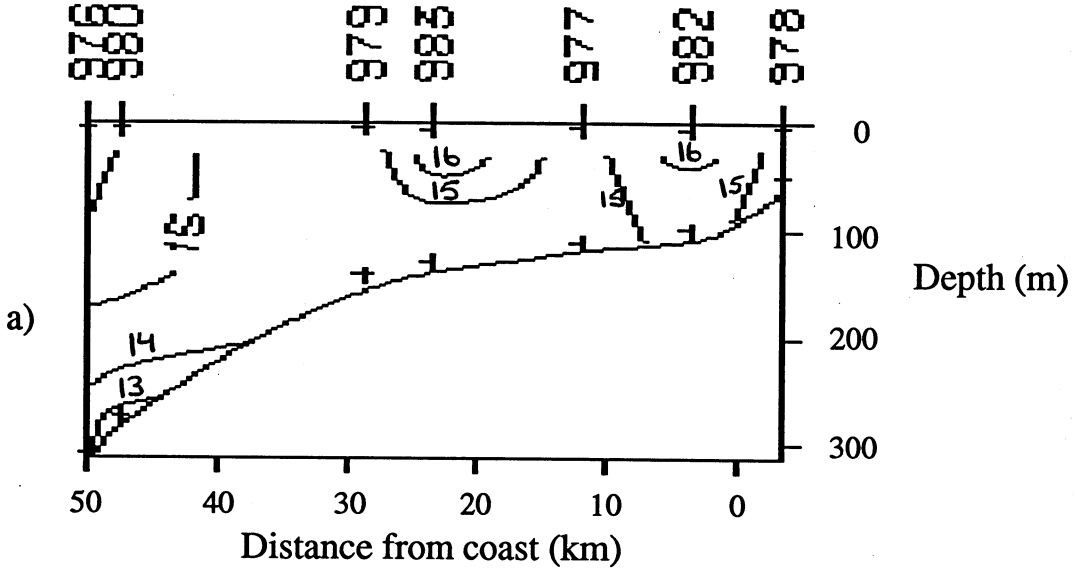
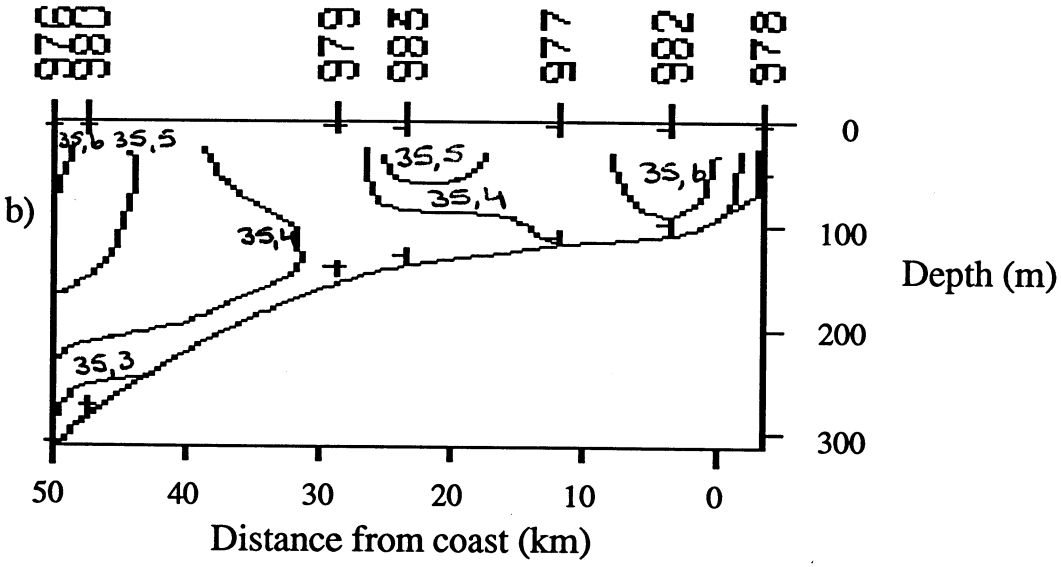


Figure 2 : Wind force recorded from the 7th to the 18th October

Figure 3 : Temperature, salinity and oxygen observations before the storm.

a) Temperature (°C), b) salinity (‰) and c) oxygen (ml/l) before storm (9.10 - 11.10 1998).





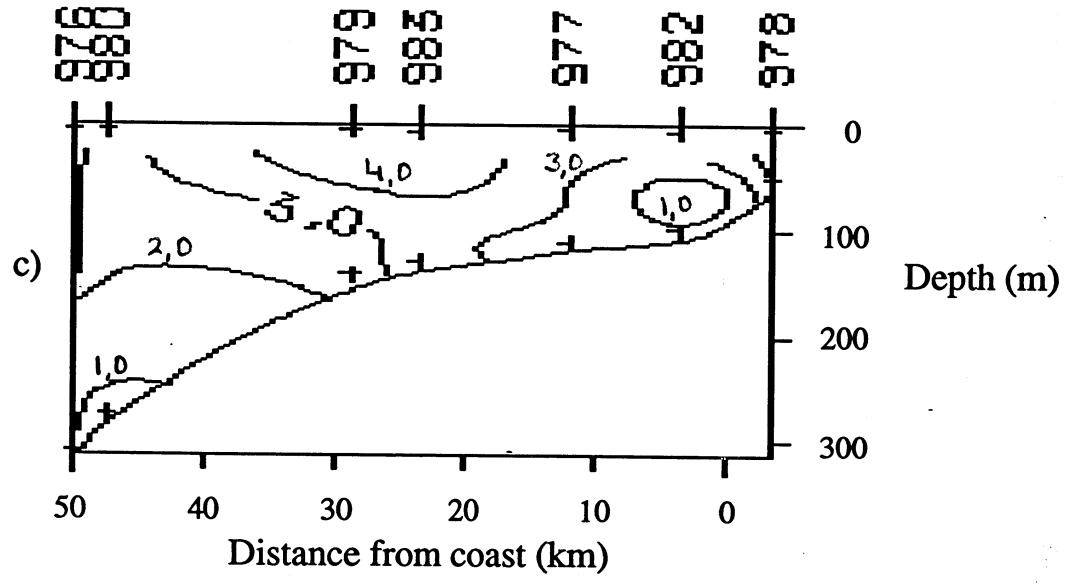
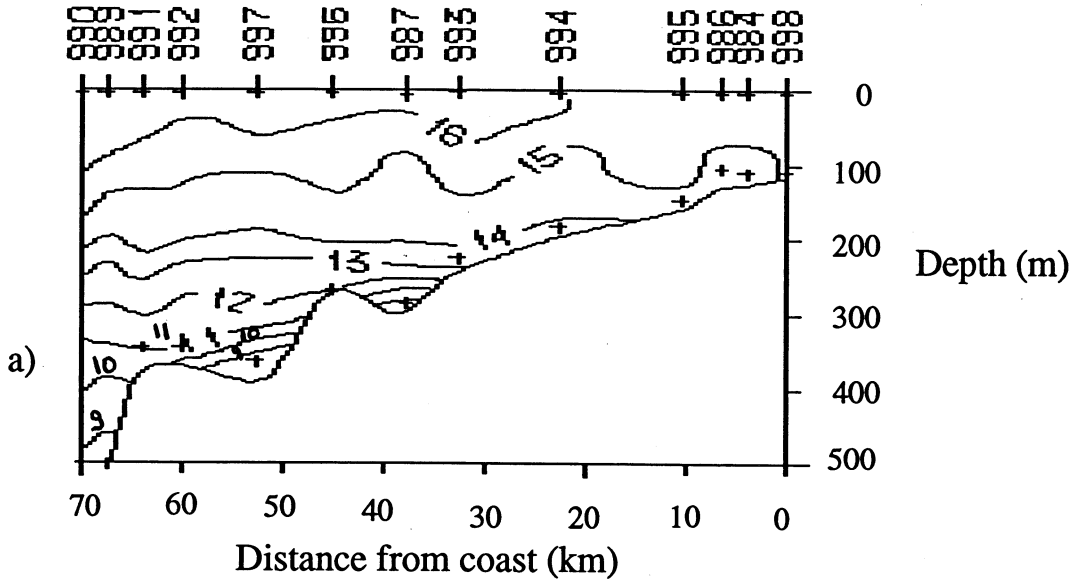
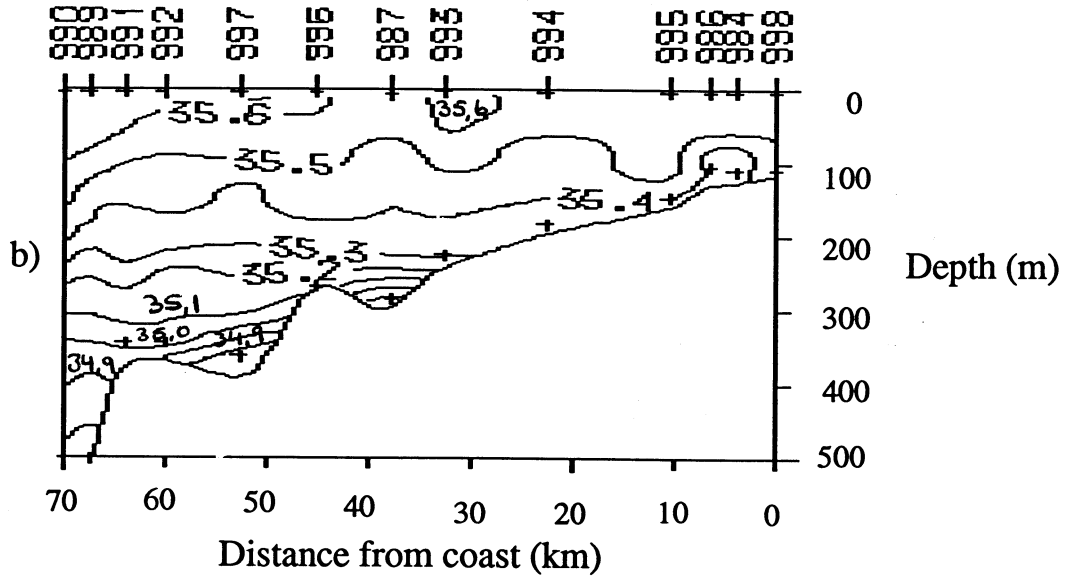
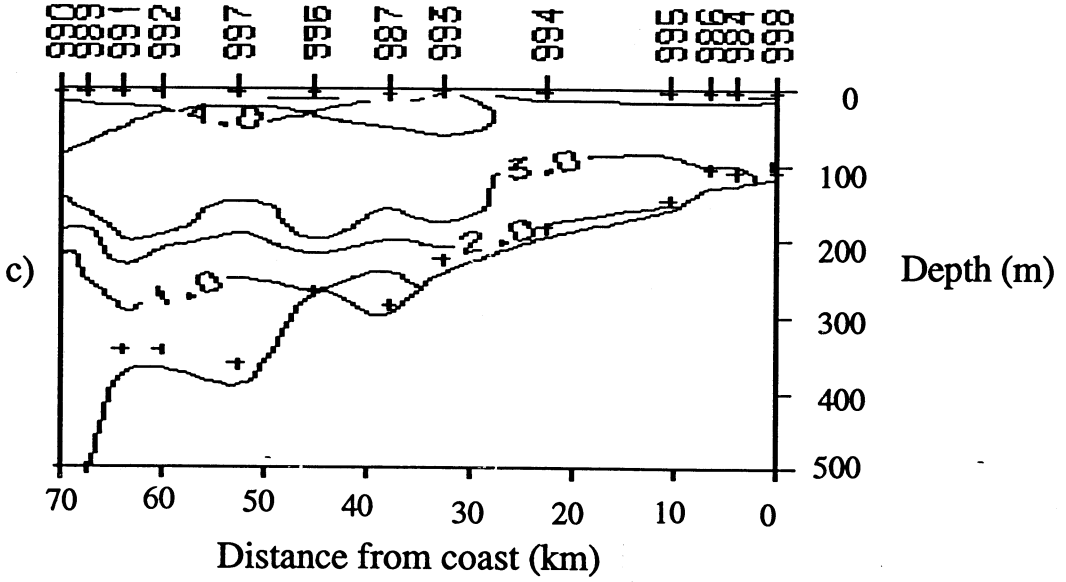


Figure 4 : Temperature, salinity and oxygen observations after the storm.

a) Temperature (°C), b) salinity (‰) and c) oxygen (ml/l) after storm (13.10 - 17.10 1998).







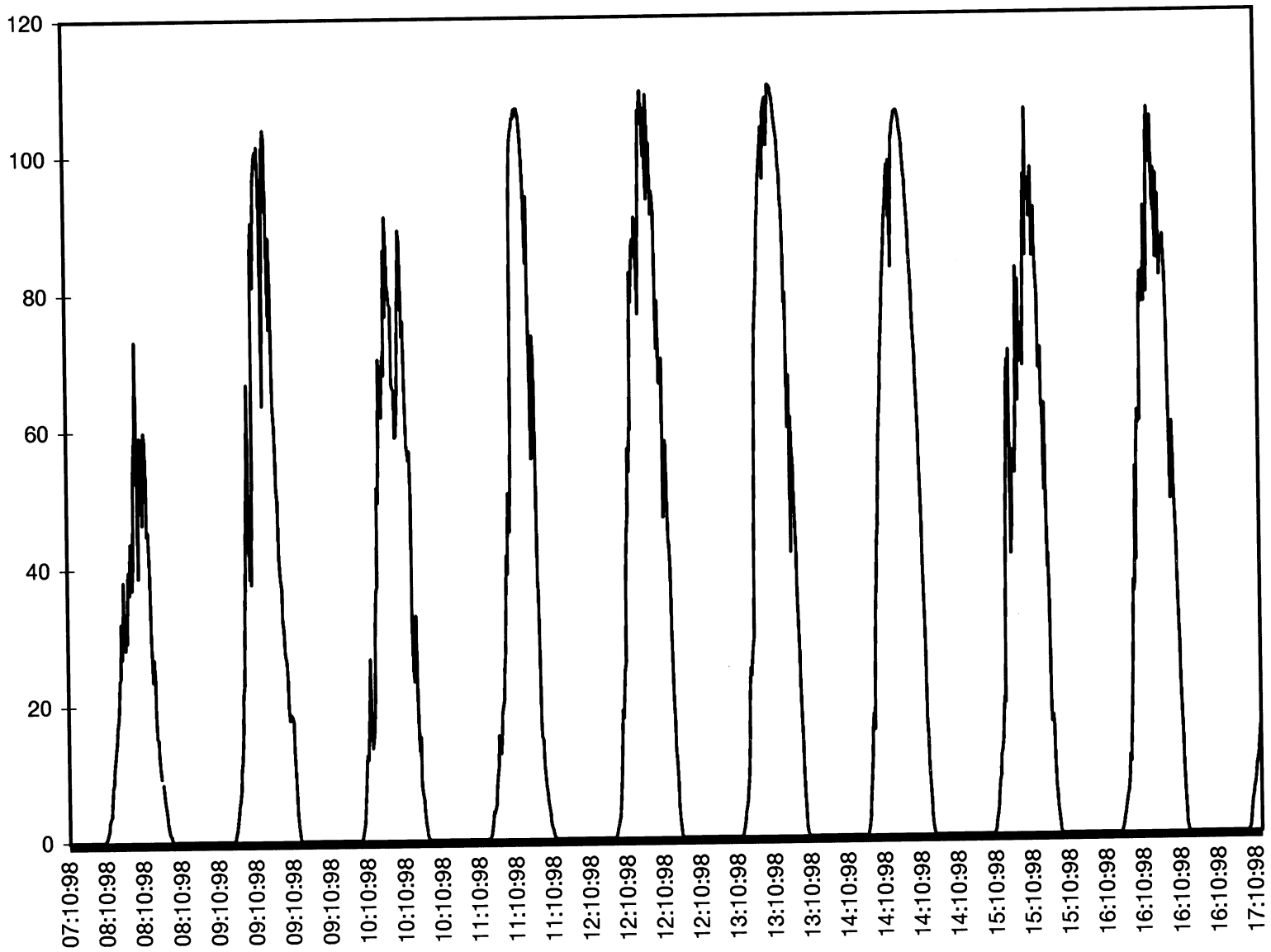


Figure 5 : Light recordings (KLux) recorded during the survey from a sensor mounted above the bridge.

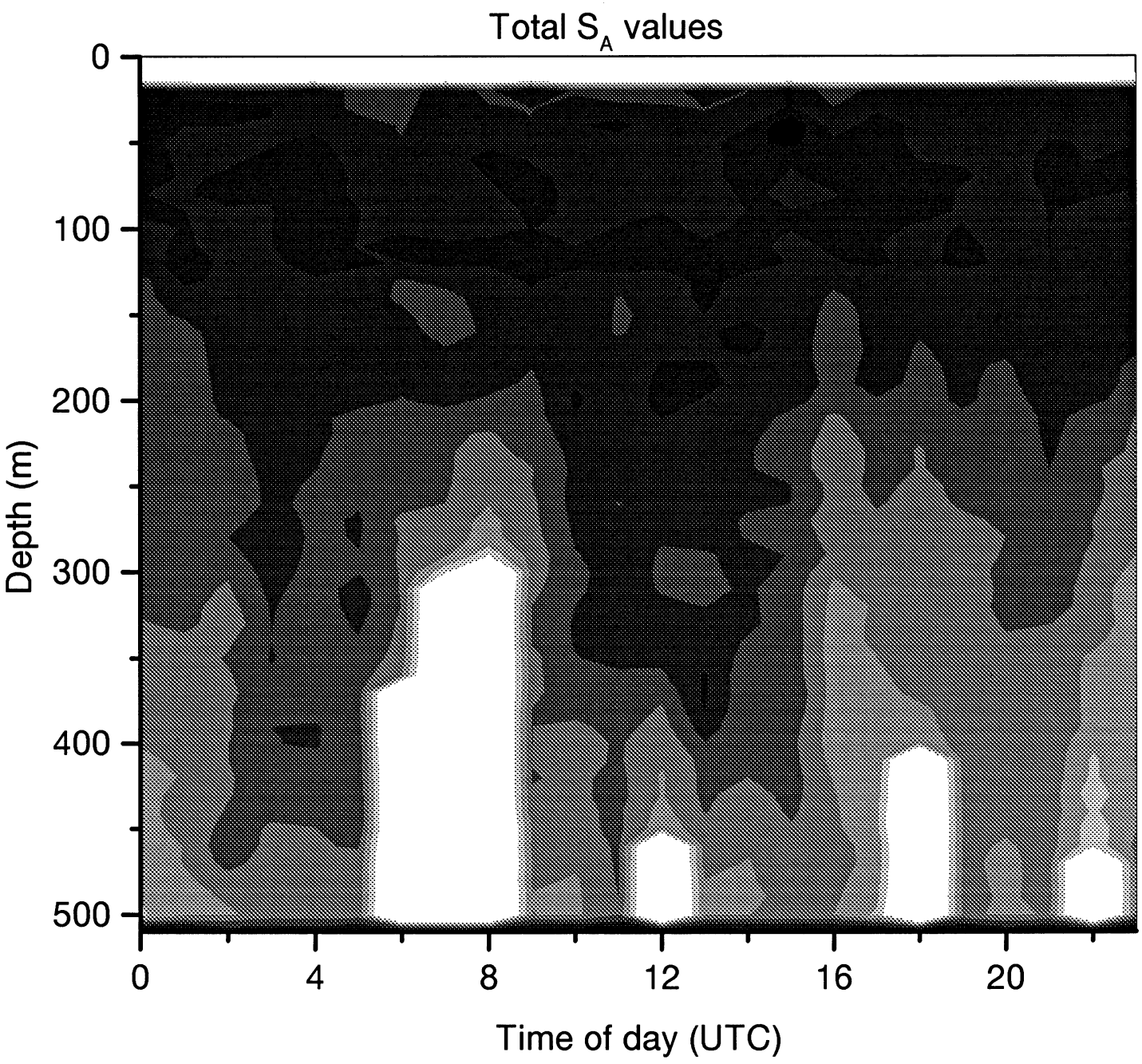


Figure 6 : Vertical distribution of S_A values. All data pooled.

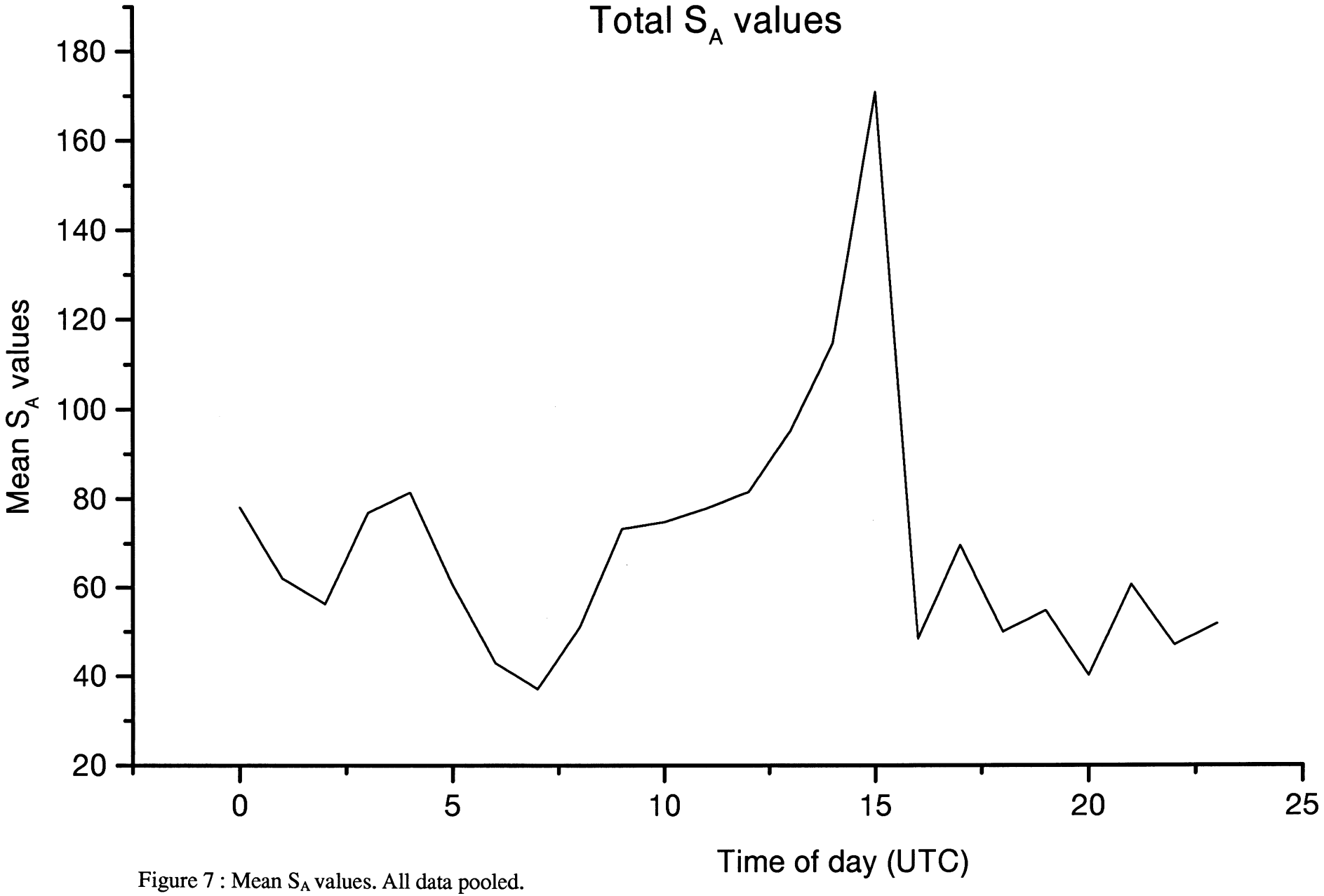


Figure 7 : Mean S_A values. All data pooled.

Figure 8 : Vertical distribution of S_A values for all horse mackerel. All data pooled.

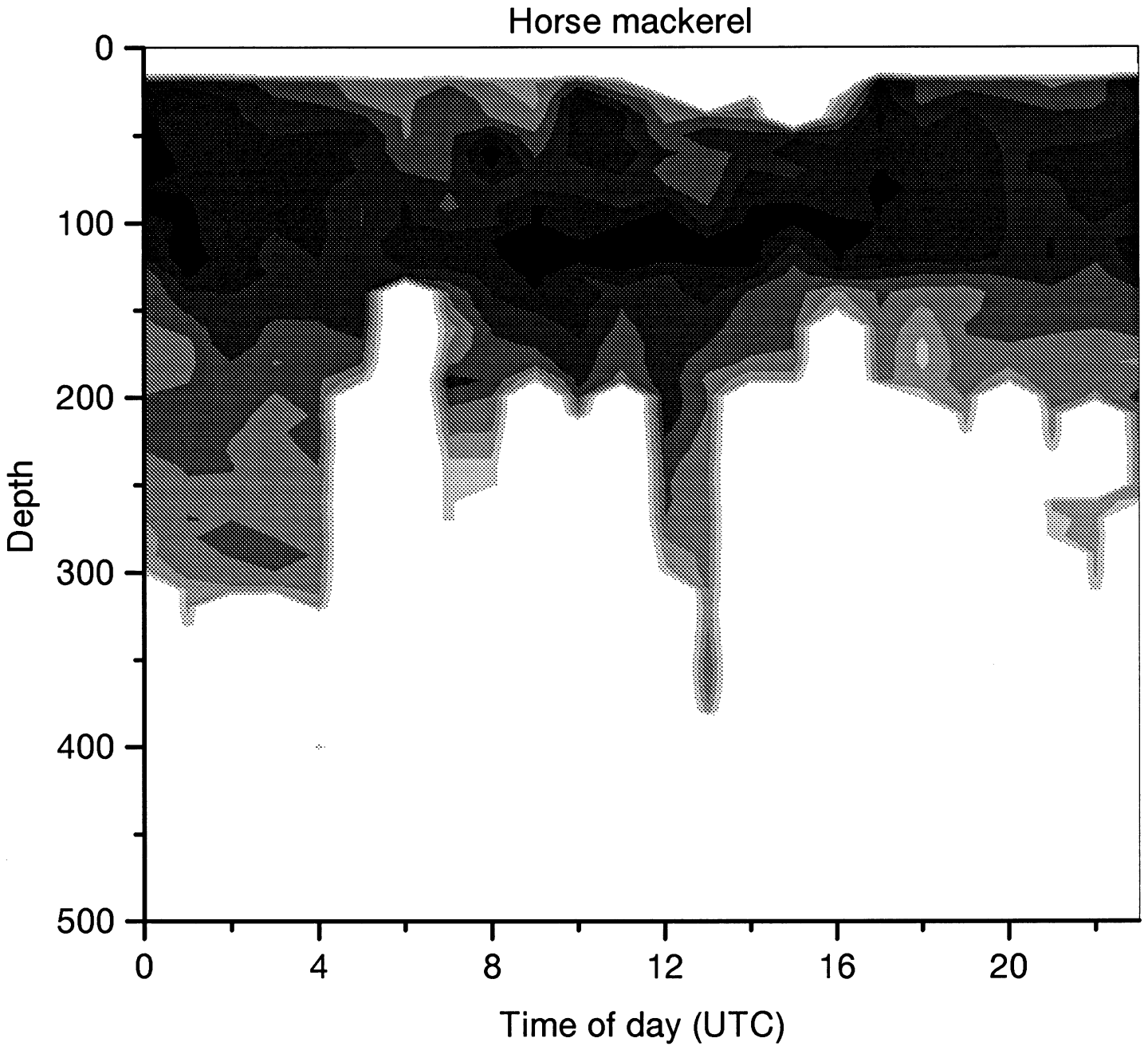


Figure 9 : Mean S_A values for all horse mackerel. All data pooled.

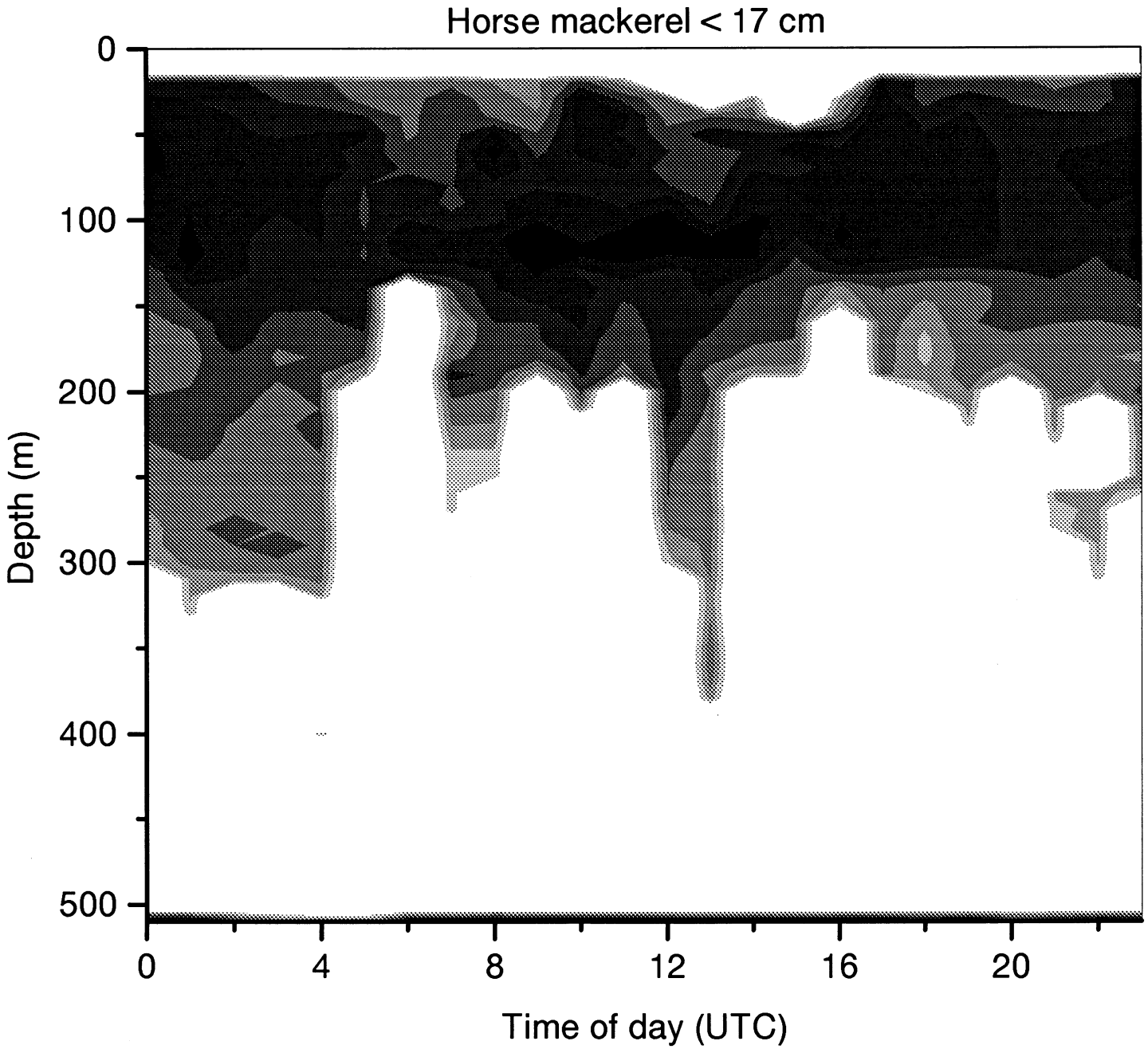


Figure 10 : Vertical distribution of S_A values for horse mackerel < 17 cm. All data pooled.

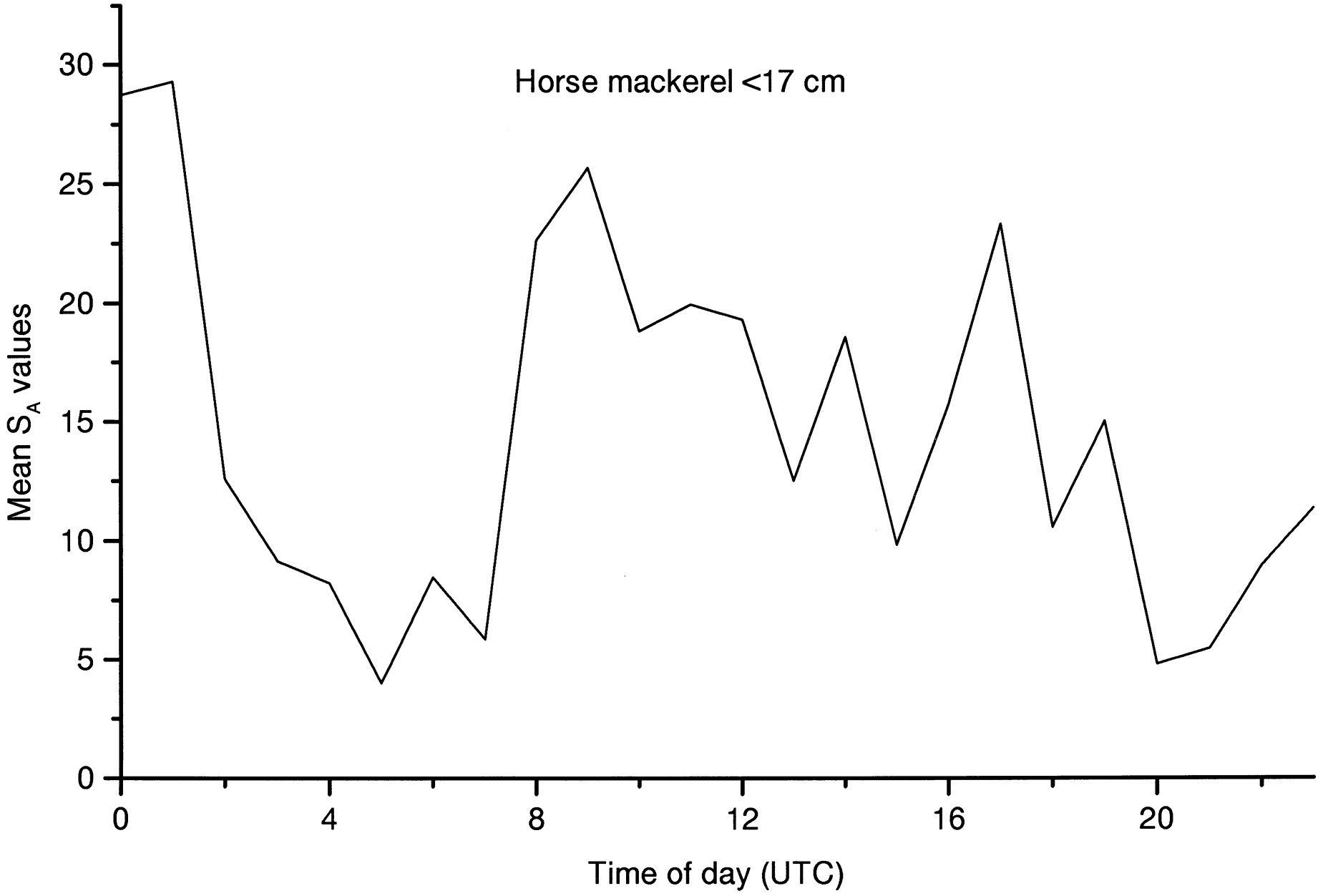


Figure 11 : Mean S_A values for horse mackerel < 17 cm. All data pooled.

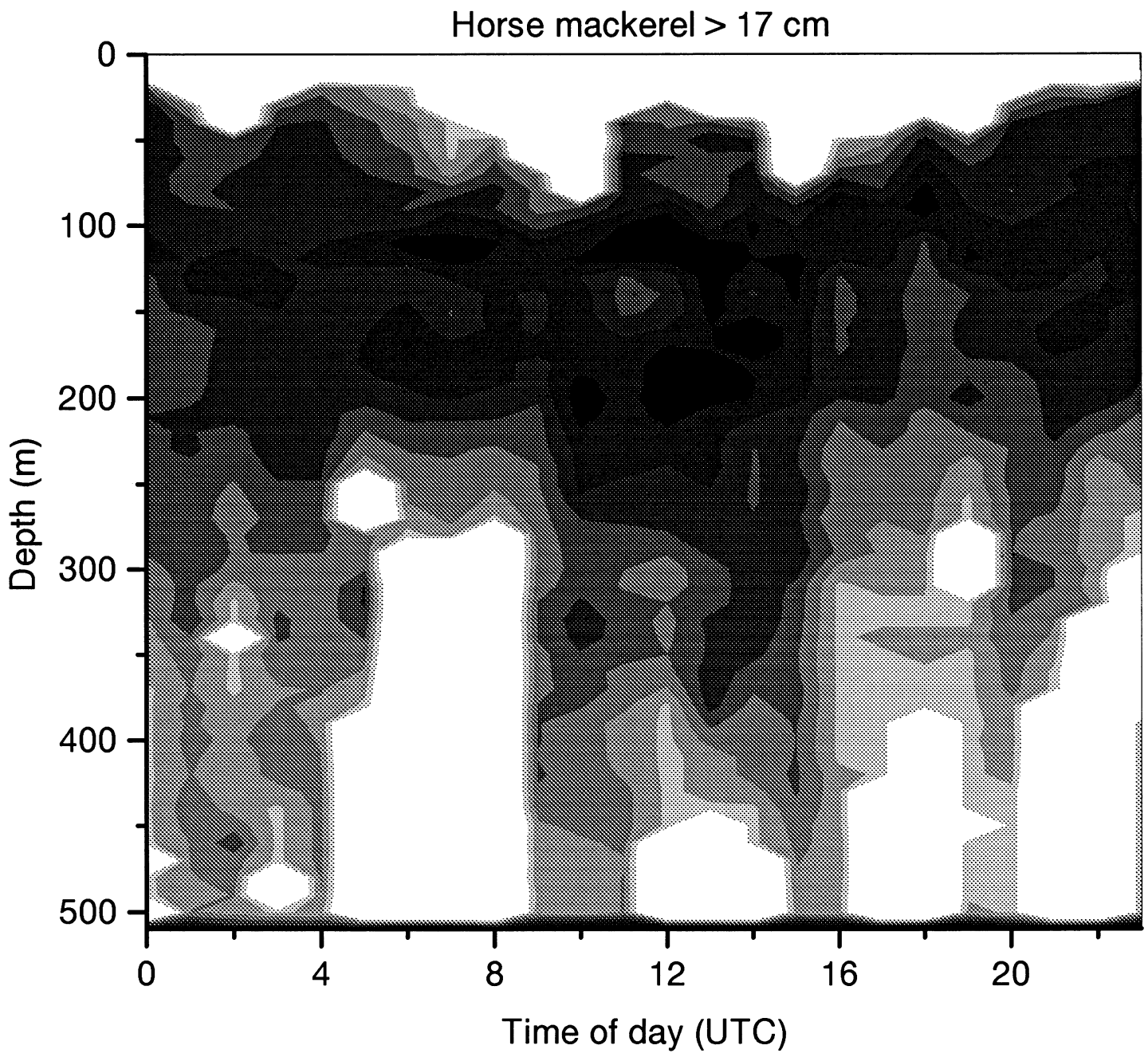


Figure 12 : Vertical distribution of S_A values for horse mackerel > 17 cm. All data pooled.

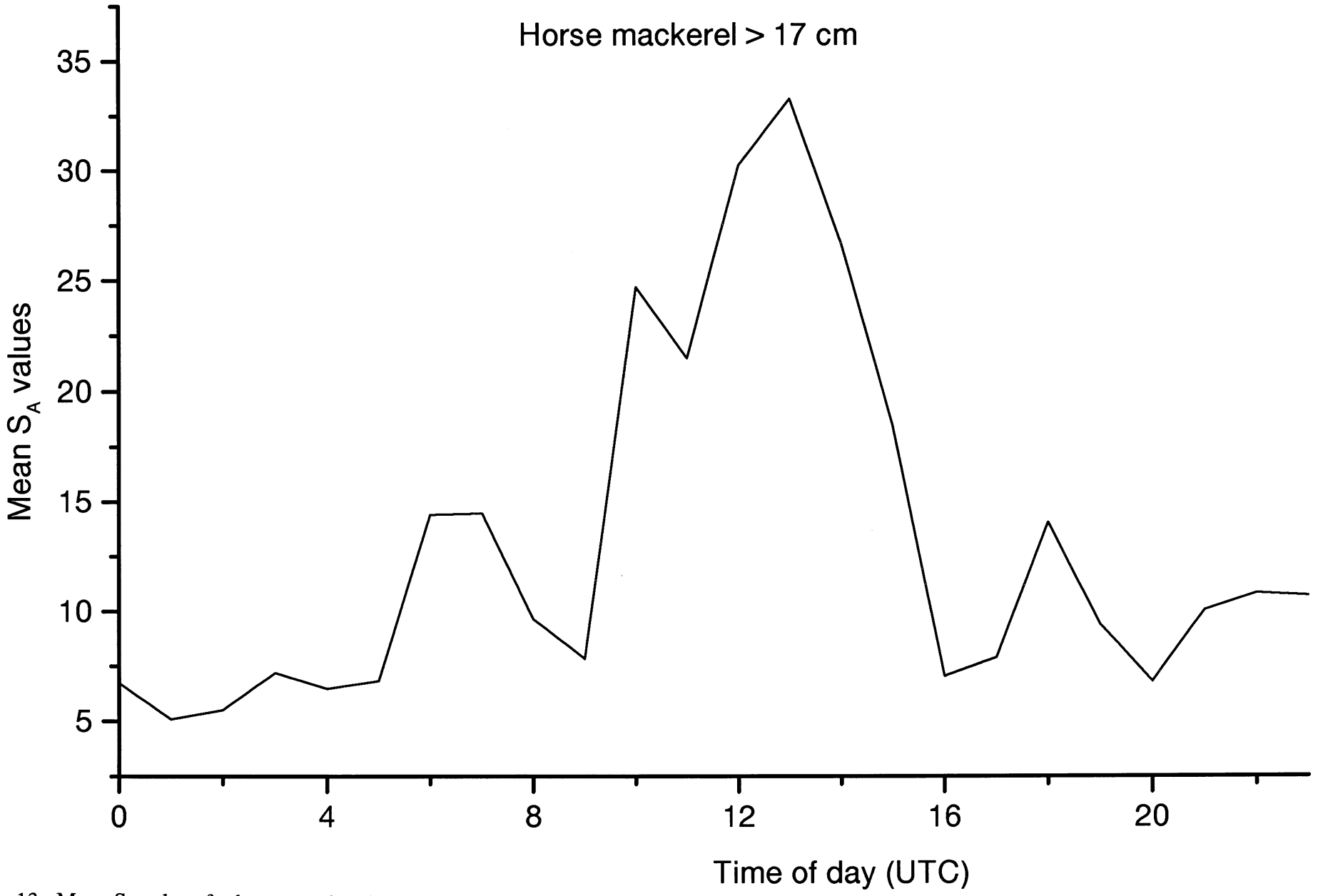


Figure 13 : Mean S_A values for horse mackerel > 17 cm. All data pooled.

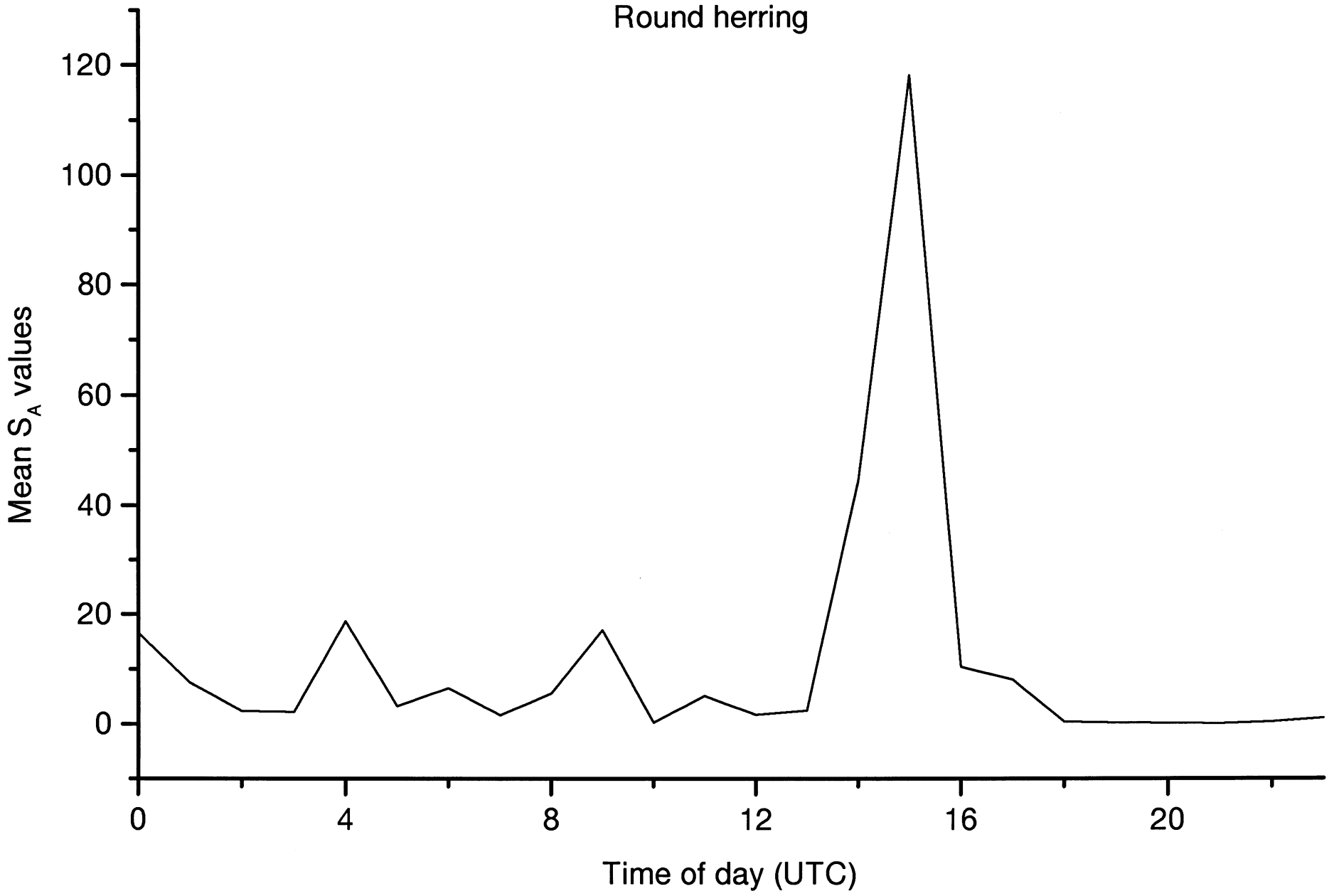


Figure 14 : Vertical distribution of S_A values for round herring. All data pooled.

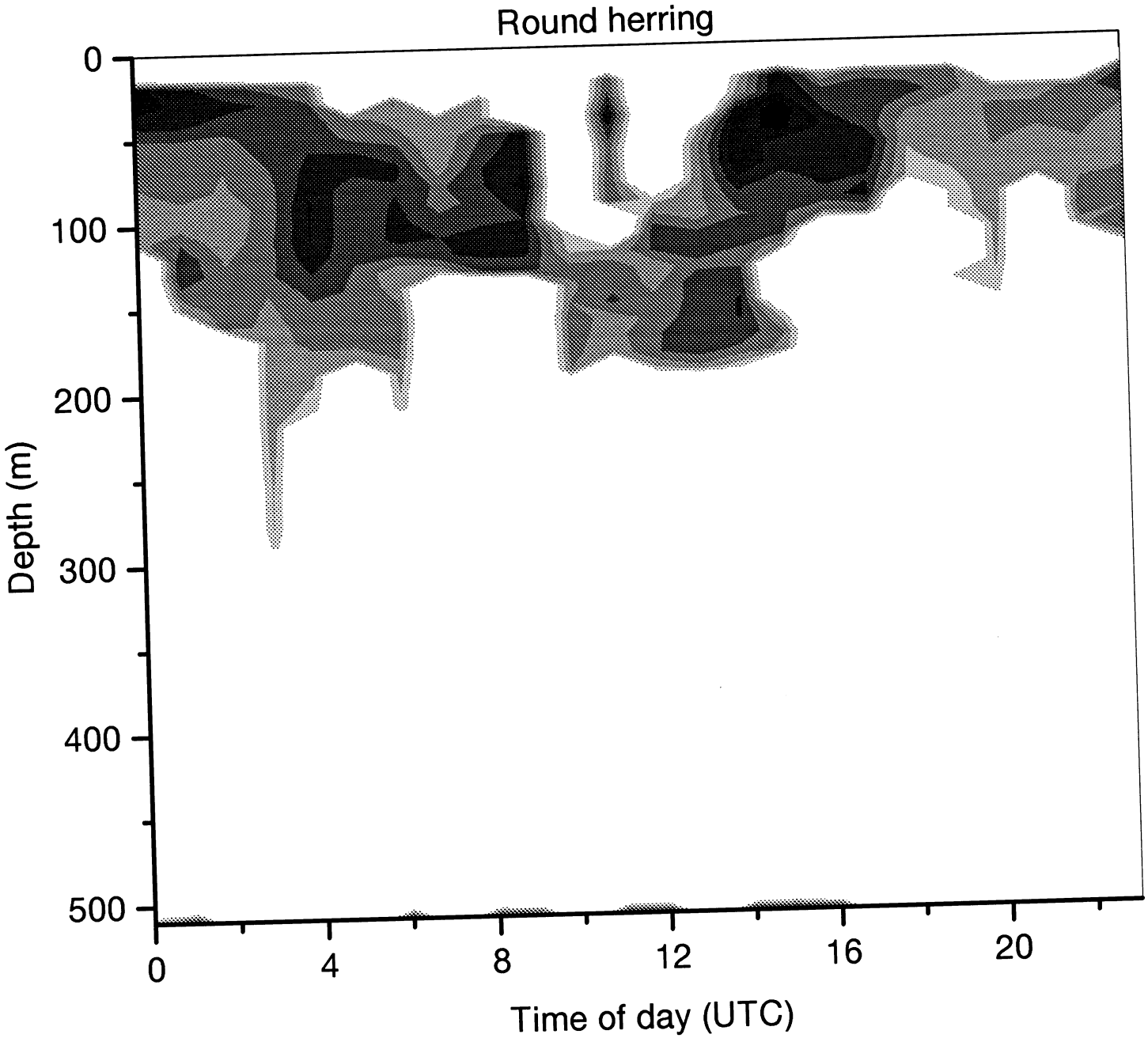


Figure 15 : Mean S_A values for round herring. All data pooled.

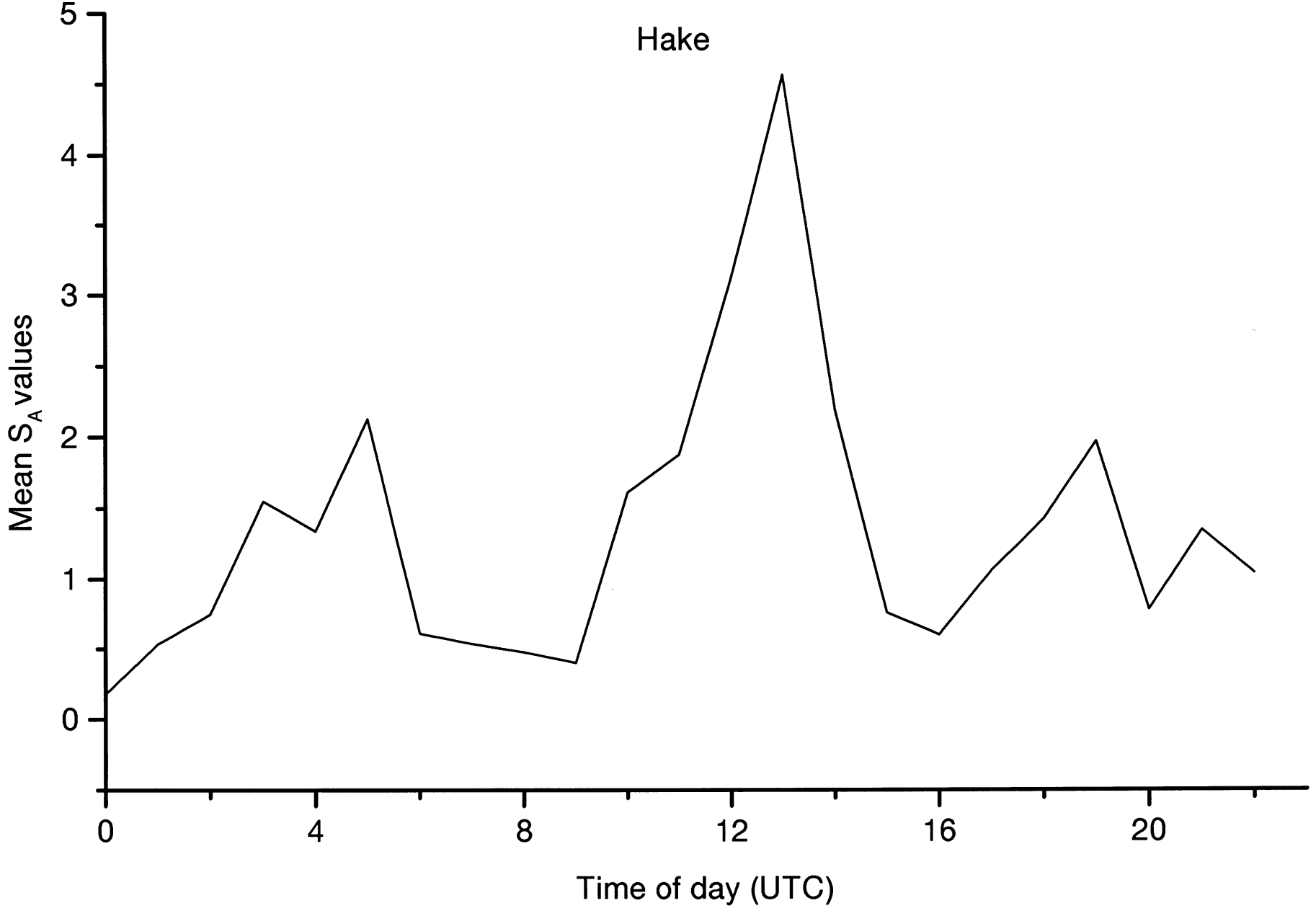


Figure 16 : Vertical distribution of S_A values for all hakes. All data pooled.

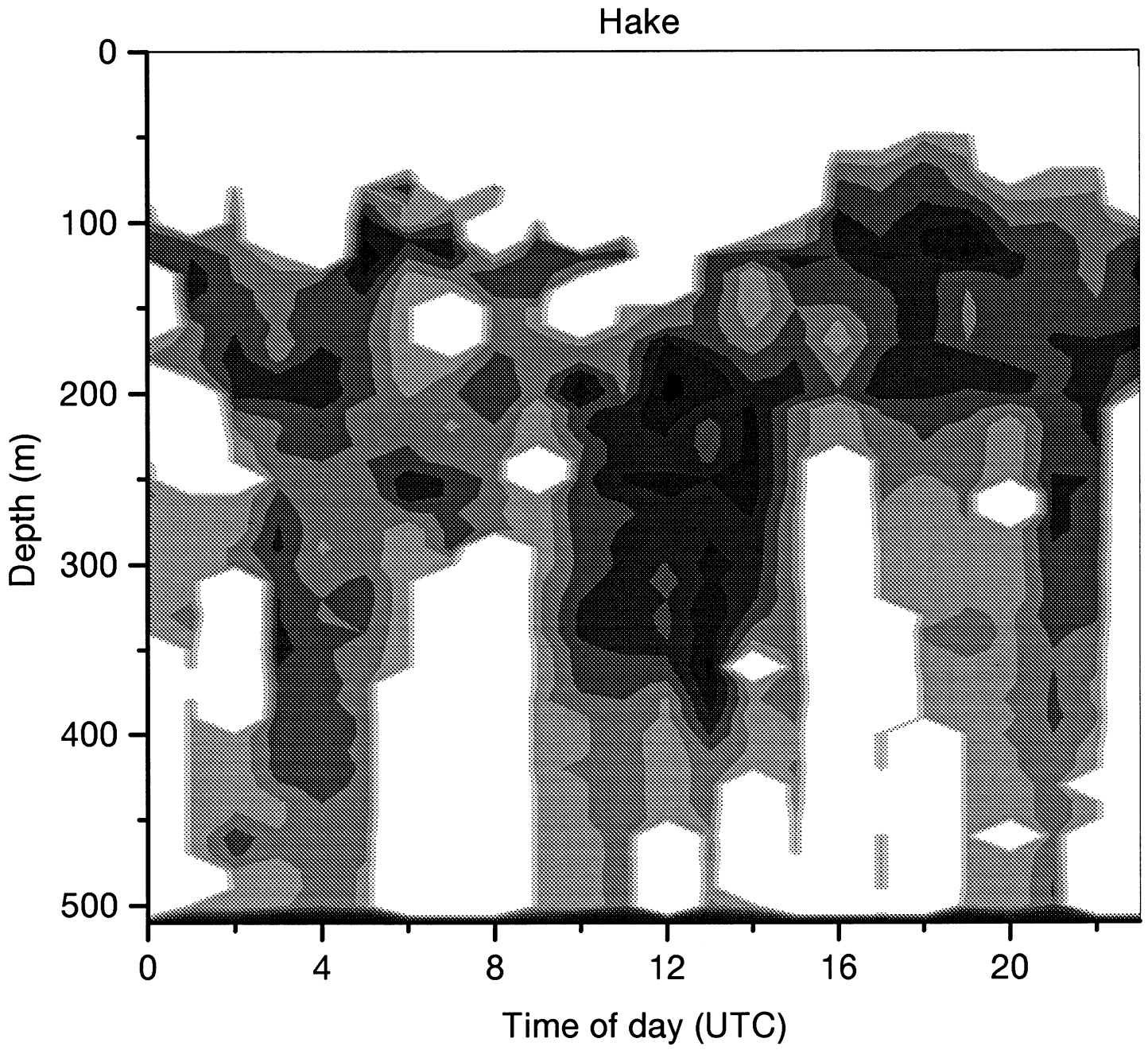


Figure 17 : Mean S_A values for all hakes. All data pooled.

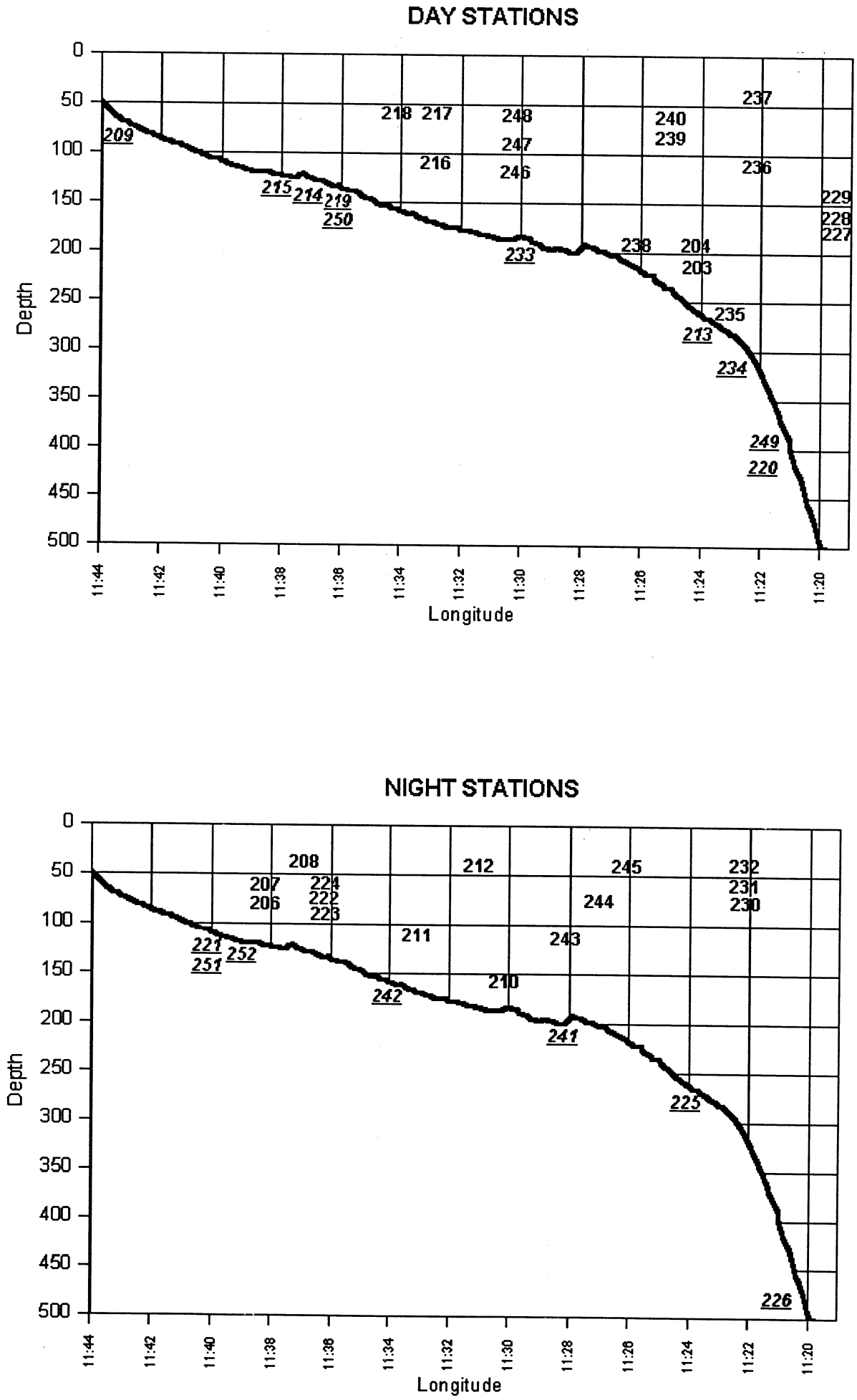
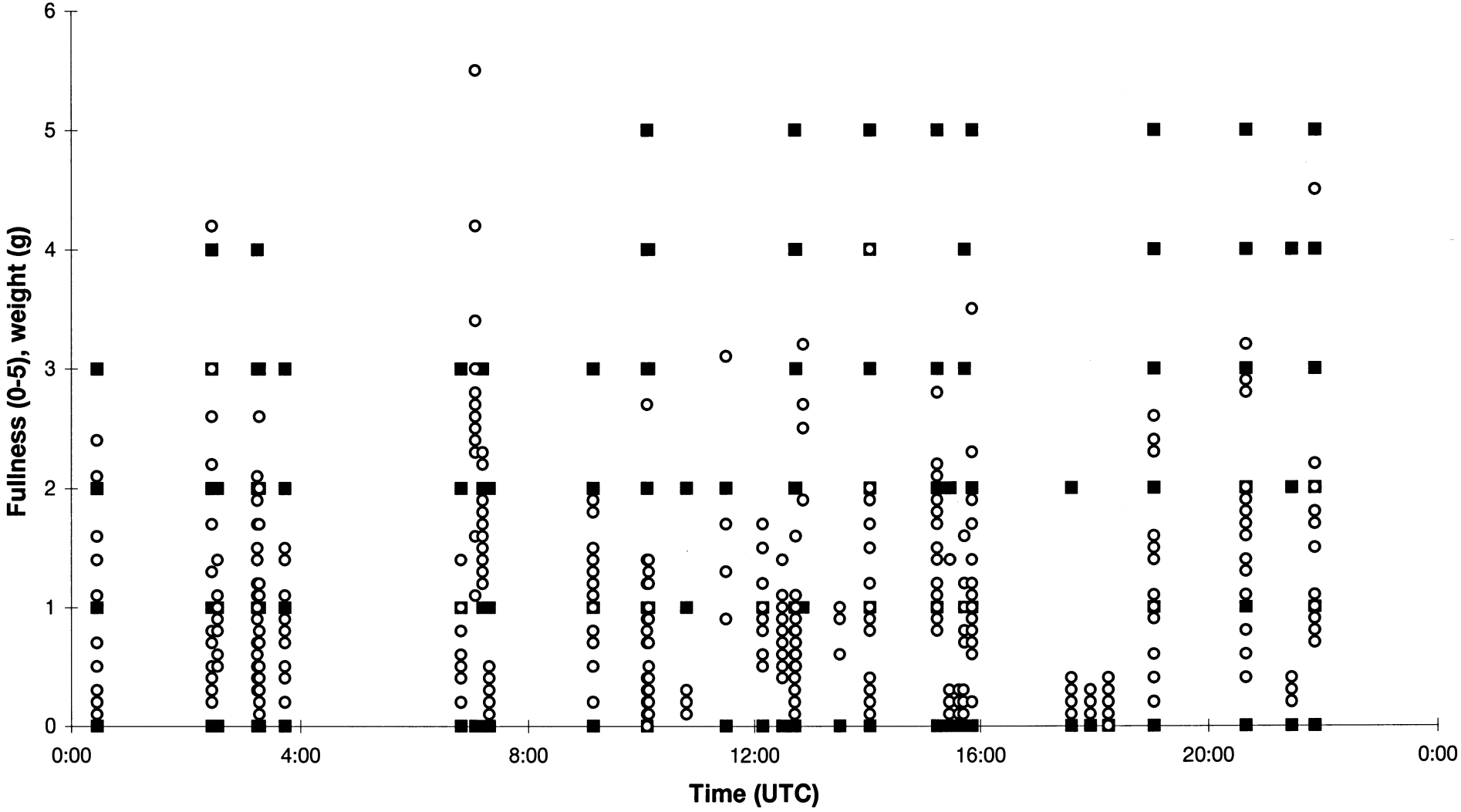


Figure 18 : Station positions for day and night trawls. Bottom trawls in italic's.

Figure 26: **Stomach fullness and stomach weight vs. time of day**



ANNEX I : TRAWL GEAR AND ACOUSTIC SETTINGS

Annex I Instruments and fishing gear

The Simrad scientific echo sounder EK 500/38 kHz, was used during the survey for estimation of fish density. The Bergen Echo Integrator system (BEI) logging the echogram raw data from the echo sounder, was used to scrutinise the acoustic records, and to allocate integrator data to fish species. All raw data was stored to tape, and a backup of the database of scrutinised data, stored. The details of the settings of the 38 kHz echo sounder were as follows:

Transceiver-1 menu

Transducer depth	5-7 m
Absorption coeff.	10 dB/km
Pulse length	medium
Bandwidth	wide
Max. power	2 000 W
Angle sensitivity	21.9
2-way beam angle	-21.0 dB
SV transducer gain	28.1 dB
TS transducer gain	28.0 dB
3 dB Beamwidth	6.8 deg
Alongship offset	0.00 deg
Athwardship offset	0.04 deg

Display menu

Echogram	1
Bottom range	12 m
Bottom start	10 m
TVG	20 log R
SV Colour minimum	-72 dB
TS Colour minimum	-65 dB

Printer settings

Range	0-100, 0-250 m, 0-500 m
TVG	20 log R
Sv Colour minimum	-72 dB

Bottom detection menu

Minimum level	-45 dB

FISHING GEAR

The vessel has two different "Åkrehamn" pelagic trawls and one "Gisund super" bottom trawl. For all trawls, the Tyborøn, 7.8 (1670 kg) trawl doors were used. Complete drawings of the trawls used are included.

F/F Dr. Fridtjof Nansen

OVER/UNDER/SIDER

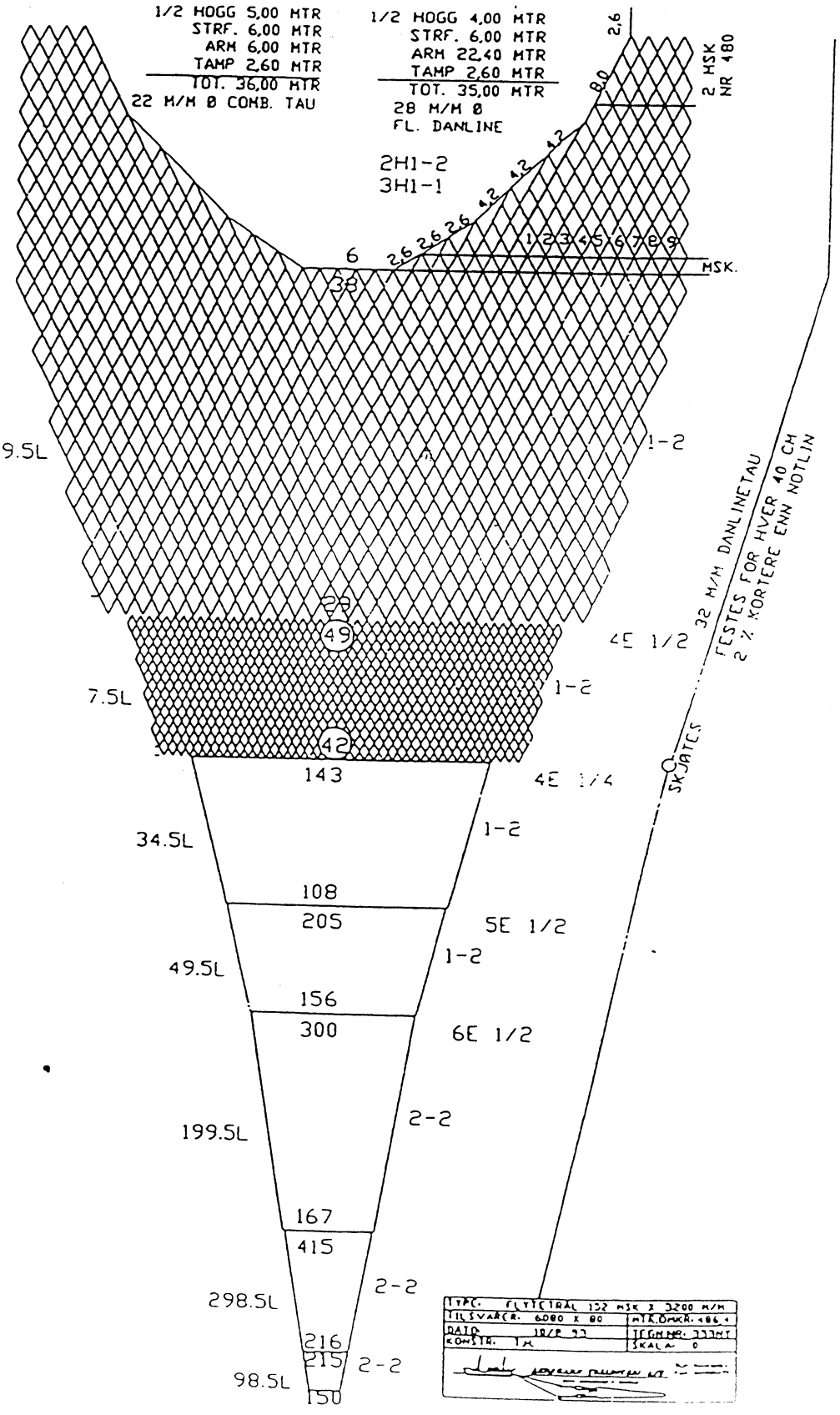
OVERDEL:
50 STK 11" PLASTKULER

UNDERDEL
14 M/M WIRE OMSP. MED
14 M/M BLYTAU
+ KJETTING.
TOTAL VEKT UNDER 400 KG.

1/2 HOGG 5,00 MTR
STRF. 6,00 MTR
ARM 6,00 MTR
TAMP 2,60 MTR
TOT. 36,00 MTR
22 M/M Ø COMB. TAU

SIDER.
1/2 HOGG 4,00 MTR
STRF. 6,00 MTR
ARM 22,40 MTR
TAMP 2,60 MTR
TOT. 35,00 MTR
28 M/M Ø
FL. DANLINE

MASKER M/M	TRAAD NR.	LENGDE I MTR.	MASKER I EVING	
3200.0	240	22.4	4	
3200.0	240	32.0	4	9.5L
1620.0	160	13.0	4	7.5L
400.0	48	14.0	4	34.5L
200.0	32	10.00	4	49.5L
100.0	24	20.0	4	199.5L
38.0	12	11.4	4	298.5L
38.0	18	3.76	4	98.5L



F/F Dr. Fridtjof Nansen

MASKER H/H	TRAAD NR.	LENGDE I MTR.	I EVING	
1620.0	160	19.4	4	
1620.0	160	25.9	4	15.5L
400.0	48	14.0	4	34.5L
200.0	32	10.00	4	49.5L
100.0	24	20.0	4	199.5L
38.0	12	11.4	4	298.5L
36.0	18	3.76	4	98.5L

OVER/UNDER

OVERDEL:
50 STK 11" KULER
OMSLUTTET AV NETT.

UNDERDEL:
14 M/M WIRE OMSP. MED
14 M/M BLITTAU.
+ KJETTING.
TOT. VEKT UNDER 400 KG.

1/2 HOGG 3,20 MTR
STRF. 4,50 MTR
ARML. 19,40 MTR
TAMP. 1,70 MTR
TOT. 29,00 MTR
22 M/M COMB. TAU.

4 MSK NR 240

7,5 L

HASKING

4III-2
4III-1

57

1-2

42

143

4E 1/4

1-2

108
205

5E 1/2

1-2

156
300

6E 1/2

2-2

167
415

2-2

216
215

2-2

150

SIDER

1/2 HOGG 8,40 MTR
STF. 2,30 MTR
ARML. 19,40 MTR
TAMP. 1,70 MTR
TOT. 24,20 MTR
28 M/M Ø
FL. DAMLINE

4 MSK NR 240

4HI-2

7,5 L

HASKING

42

15.5L

143

5E 1/4

34.5L

1-2

108
205

5E 1/2

49.5L

1-2

156
300

6E 1/2

199.5L

2-2

167
415

298.5L

2-2

216
215

98.5L

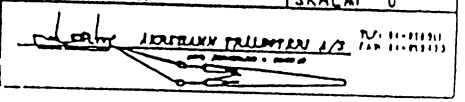
2-2

150

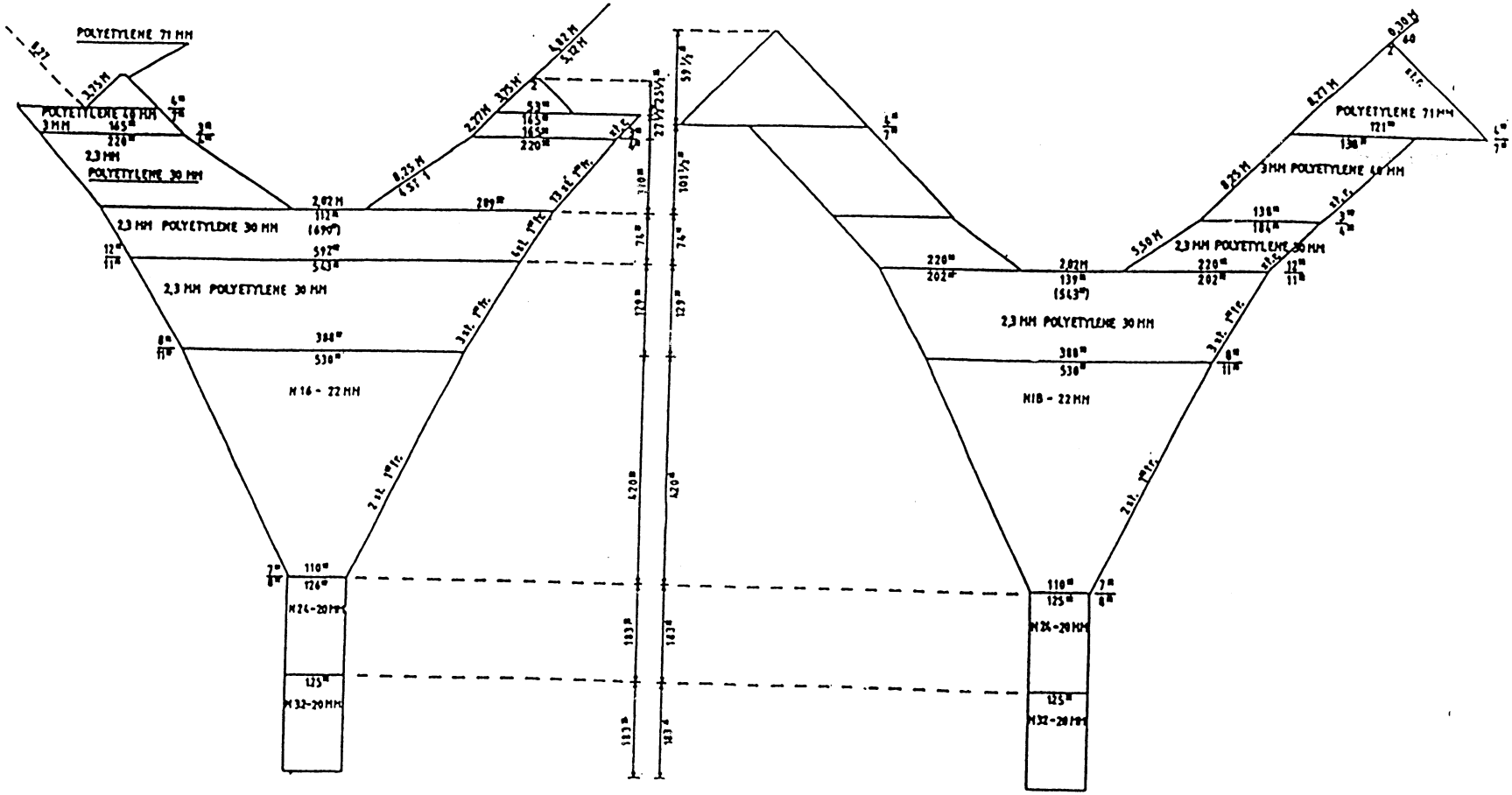
SKJØTES

22 M/M DAMLINETAU
2 STYKS FOR HVER 40 CM
2 ½ KORTERE ENN MOTLIN

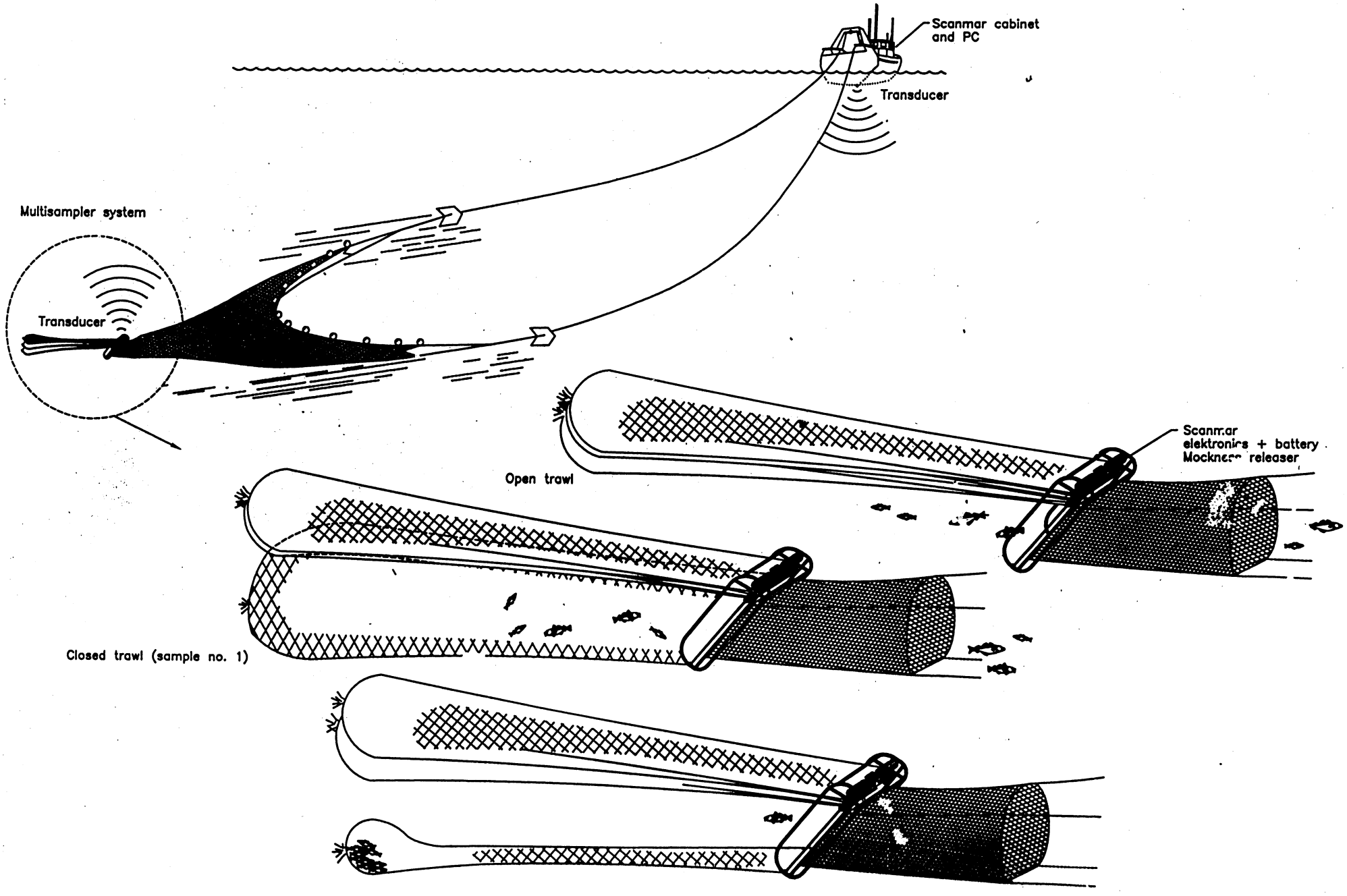
TYPE: FLYTETRÅL 198 MSK X 1620 M/H	
TILSVARER: 4010 X 80	MTR.OMKR: 320
DATO: 23/6 93	TEGN.NR: 510
KONSTR: T-H	SKALA: 0



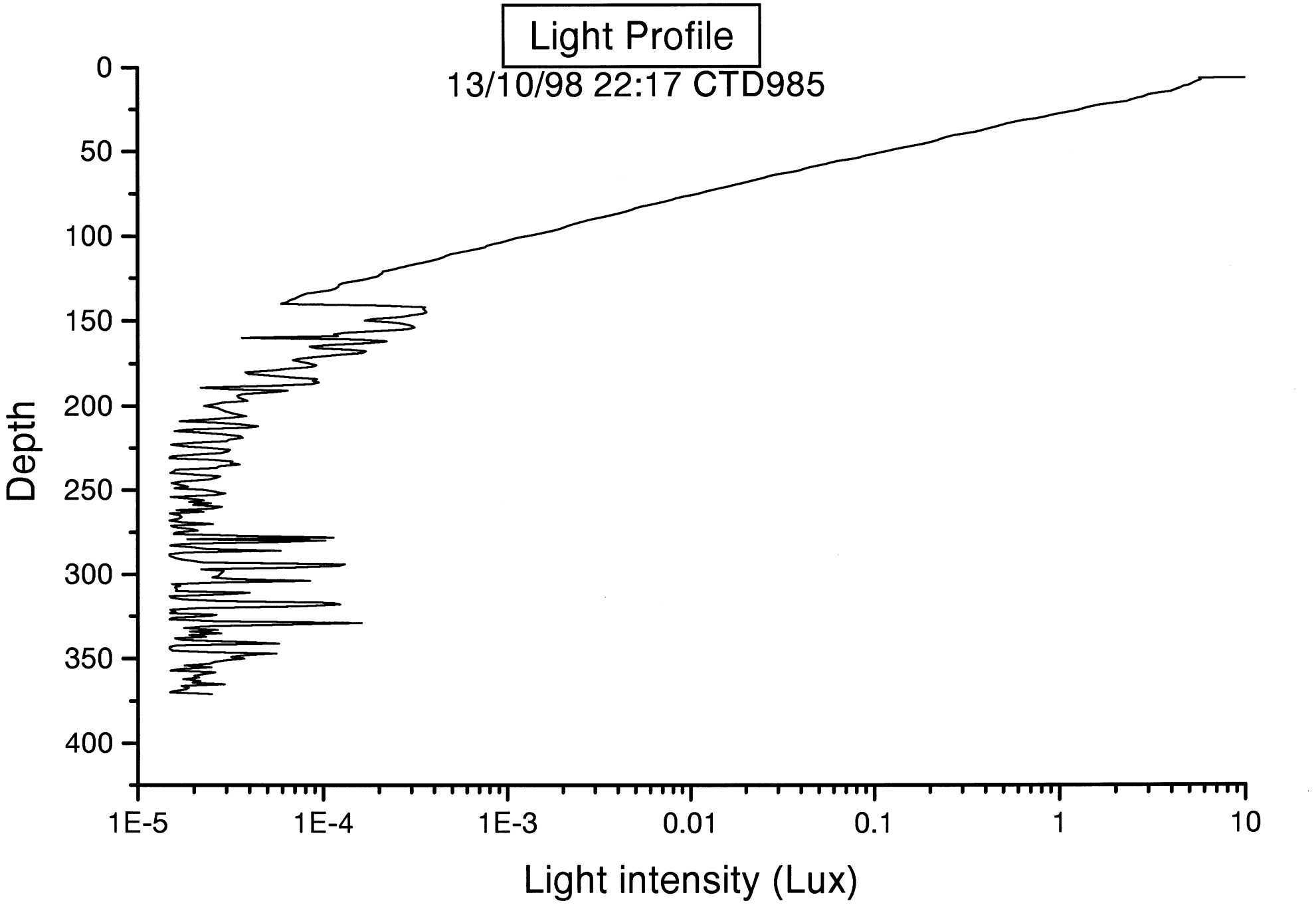
Bottom trawl: High opening shrimp and fish trawl with net headline 31m (floatline),foot-rope 47m, gear with 12 cm diameter roller disks, 40 m sweeps, estimated headline hight 6m and distance between wings during towing 18-20m.

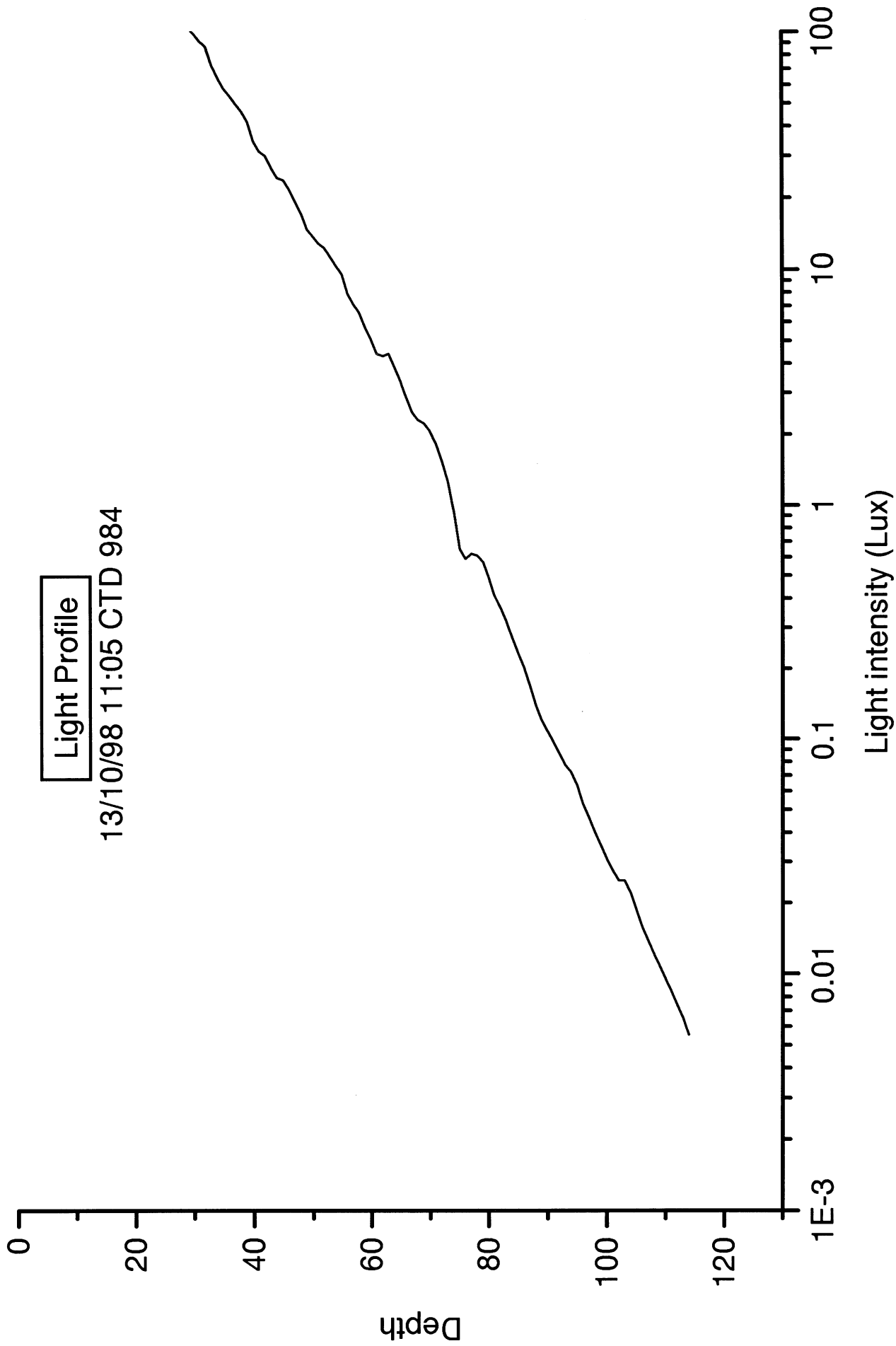


Annex 1 : A schematic diagram of the Multisampler system.



ANNEX II : CTD STATIONS AND LIGHT MEASUREMENTS


Light Profile
13/10/98 22:17 CTD985
Depth
0
50
100
150
200
250
300
350
400
1E-5
1E-4
1E-3
0.01
0.1
1
10
Light intensity (Lux)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80
100
120
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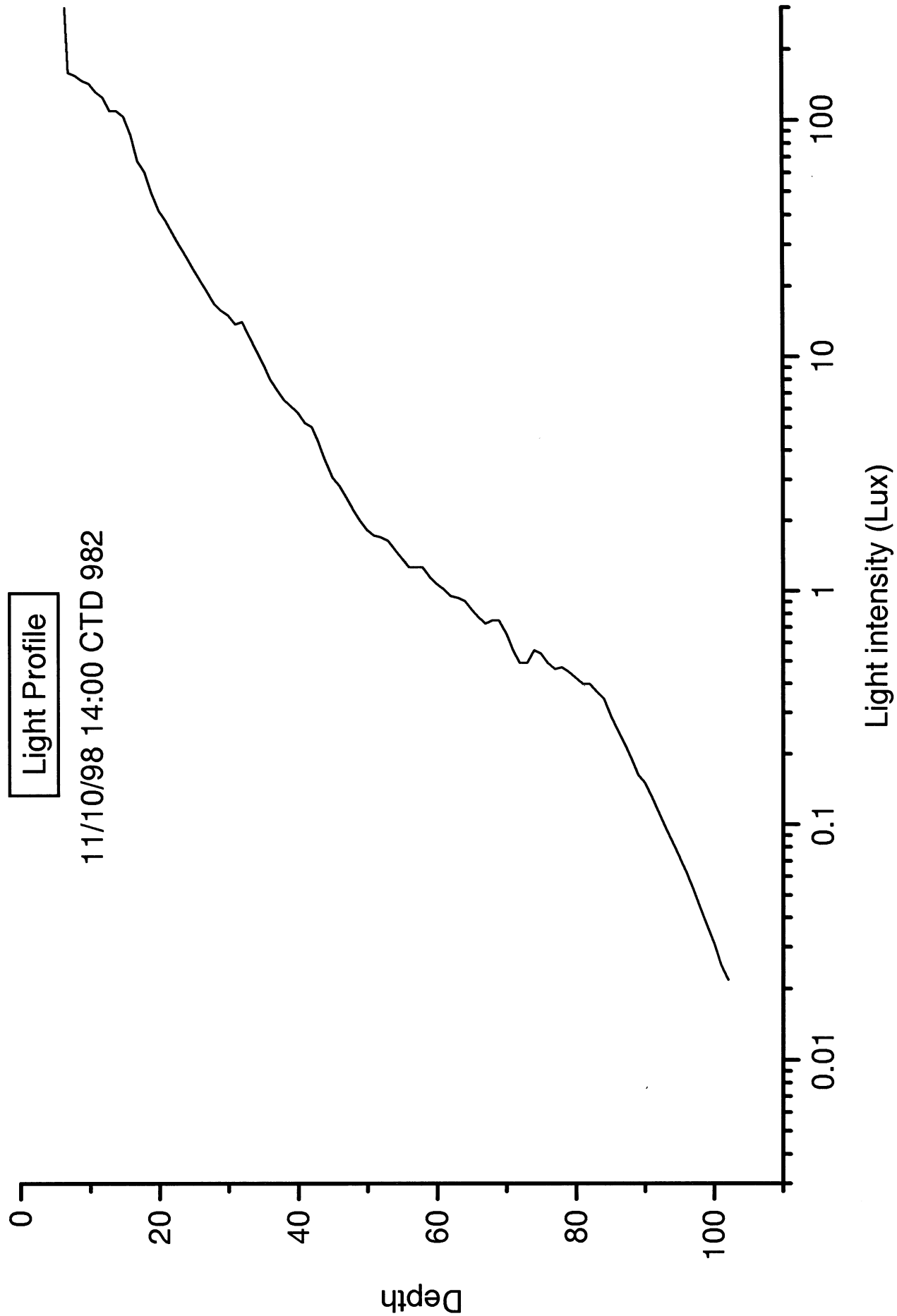
0.01
0.1
1
10
100
Light intensity (Lux)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Depth
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100
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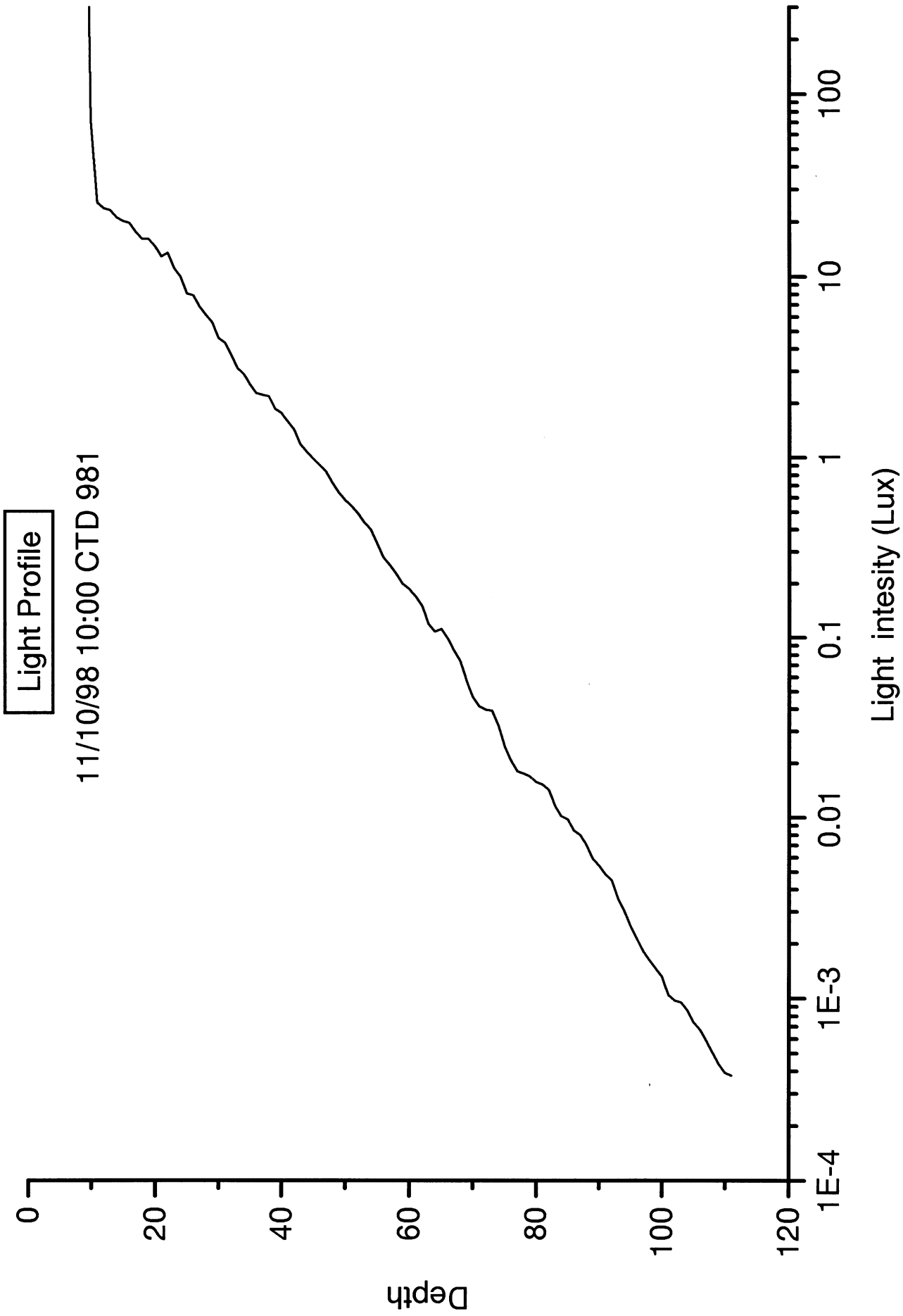
1
10
100
Light intensity (Lux)


Light Profile
11/10/98 10:00 CTD 981
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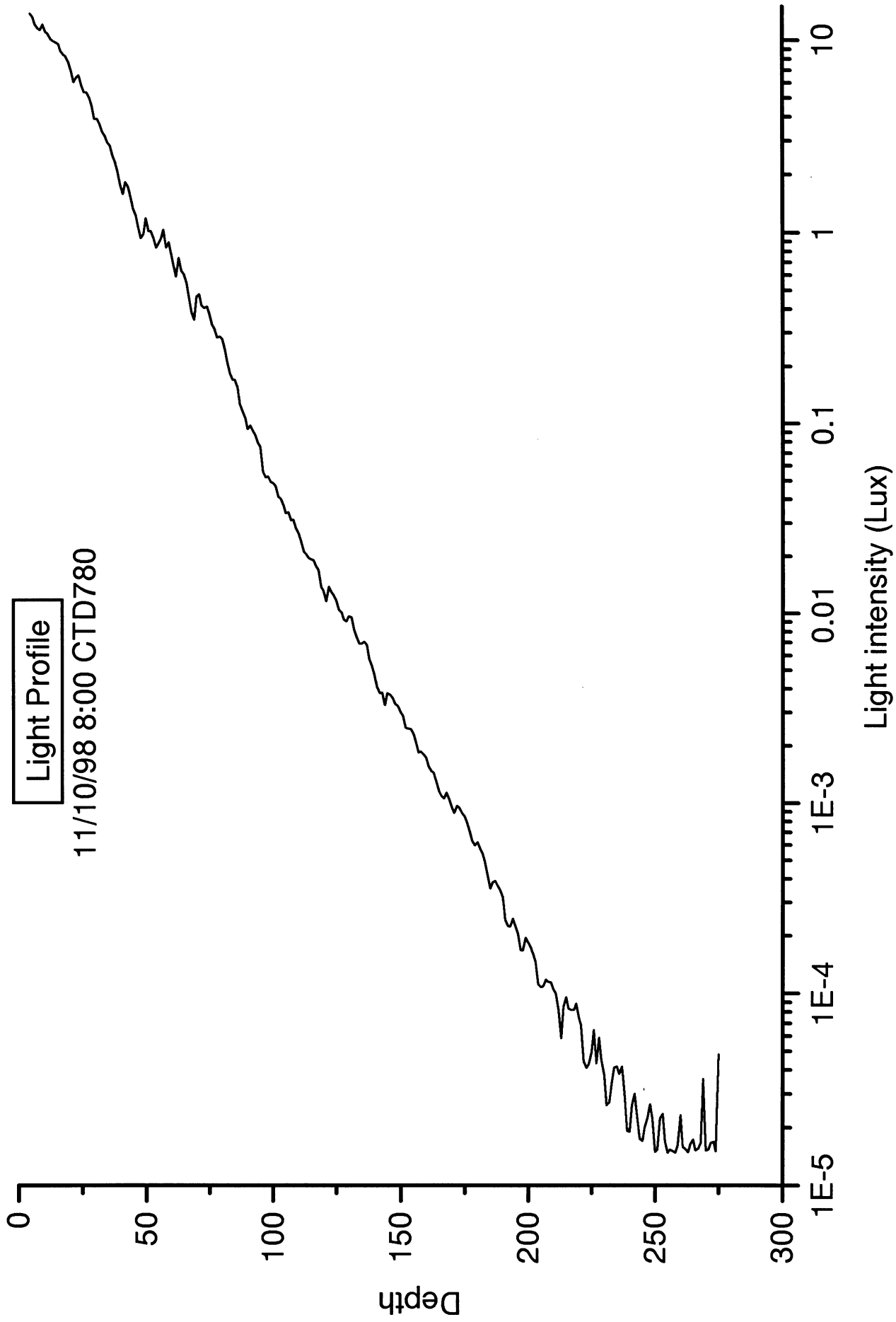
1E-3
0.01
0.1
1
10
100
Light intesity (Lux)


Light Profile
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200
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300
Light intensity (Lux)
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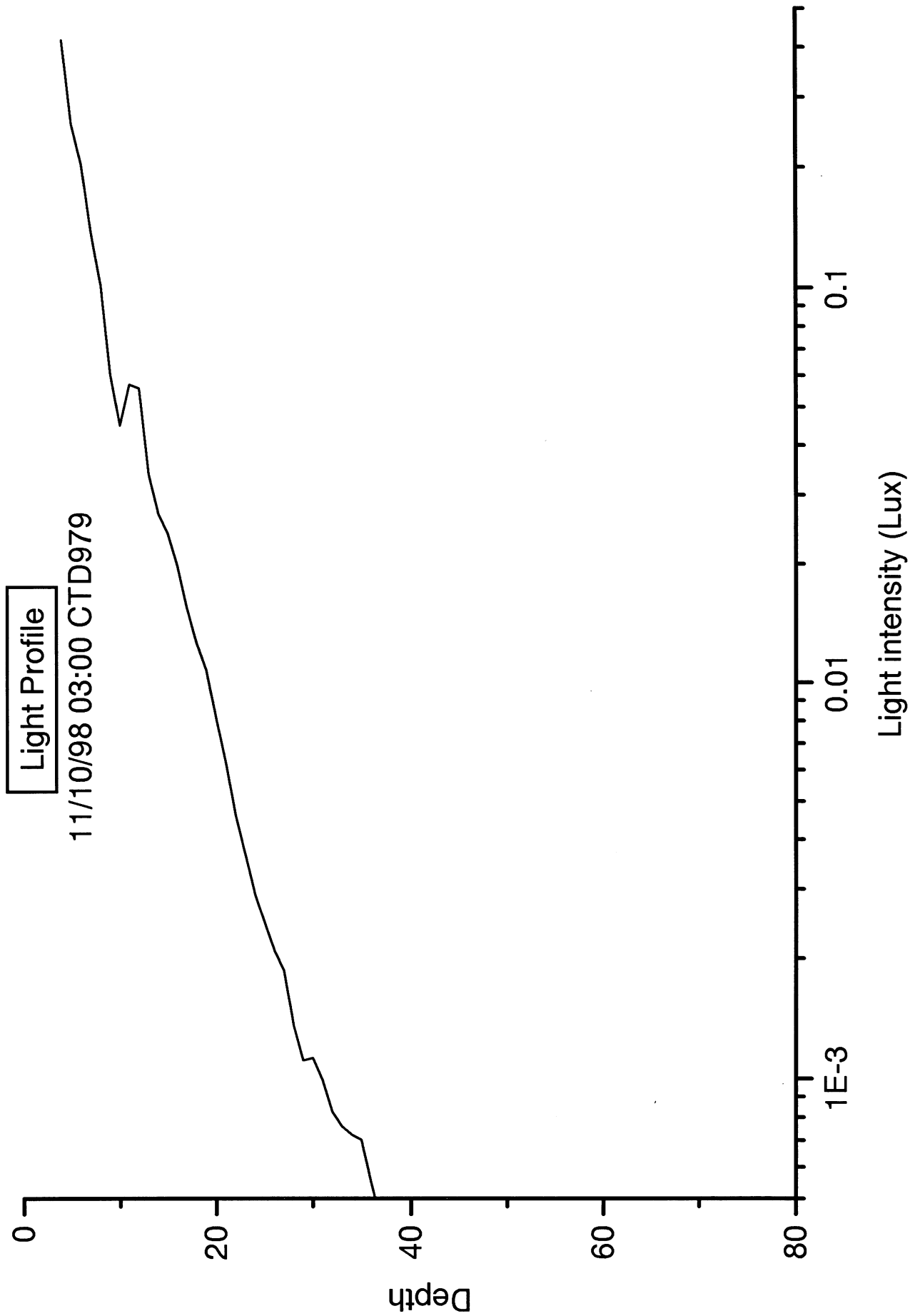
1E-4
1E-3
0.01
0.1
1
10


Light Profile
11/10/98 03:00 CTD979
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60
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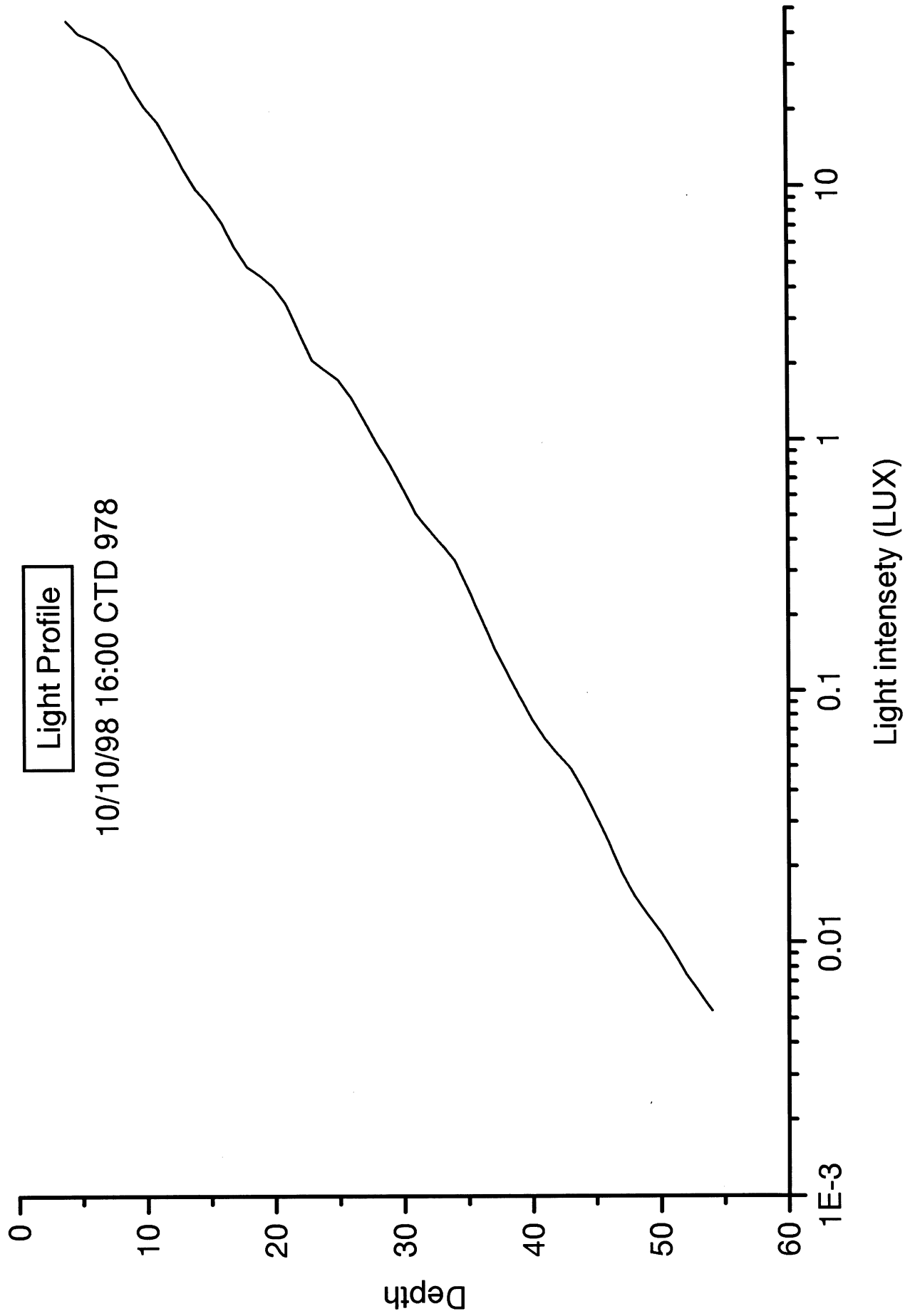
1E-3
0.01
0.1
Light intensity (Lux)


Light Profile
10/10/98 16:00 CTD 978
Depth
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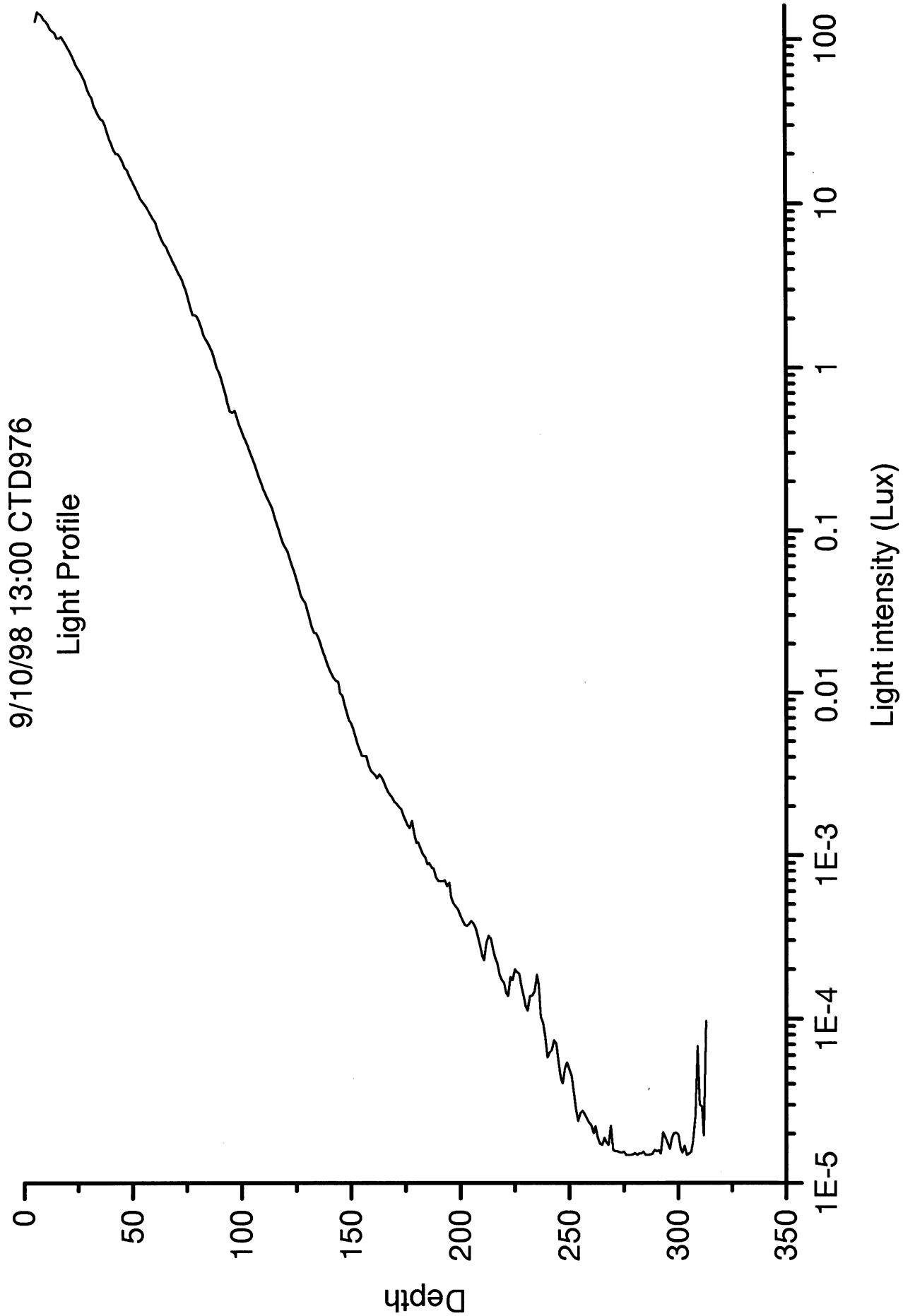
60
1E-3
0.01
0.1
1
10
Light intensety (LUX)


9/10/98 13:00 CTD976
Light Profile
Depth
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50
100
150
200
250
300
350
Light intensity (Lux)
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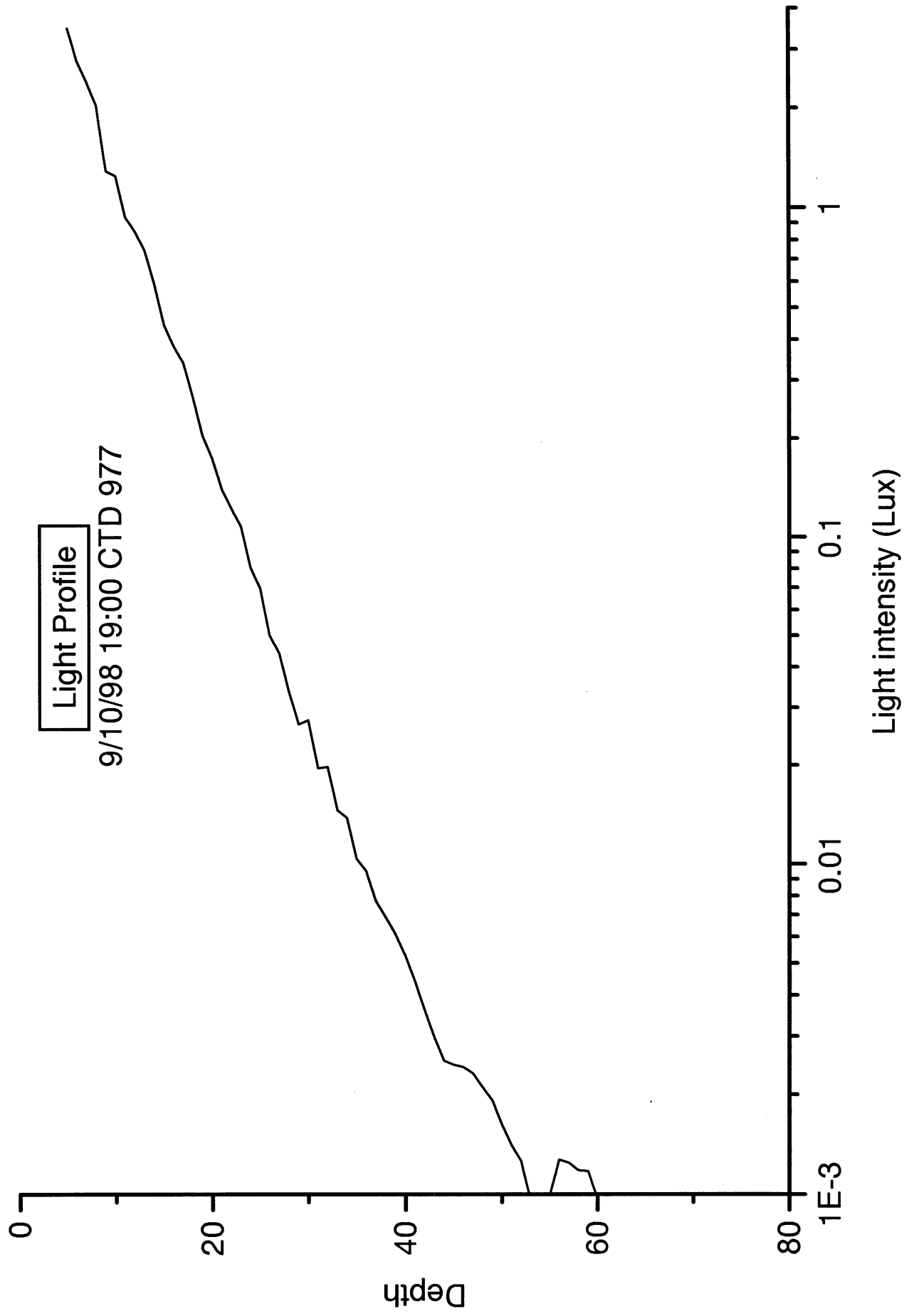
1E-4
1E-3
0.01
0.1
1
10
100


Light Profile
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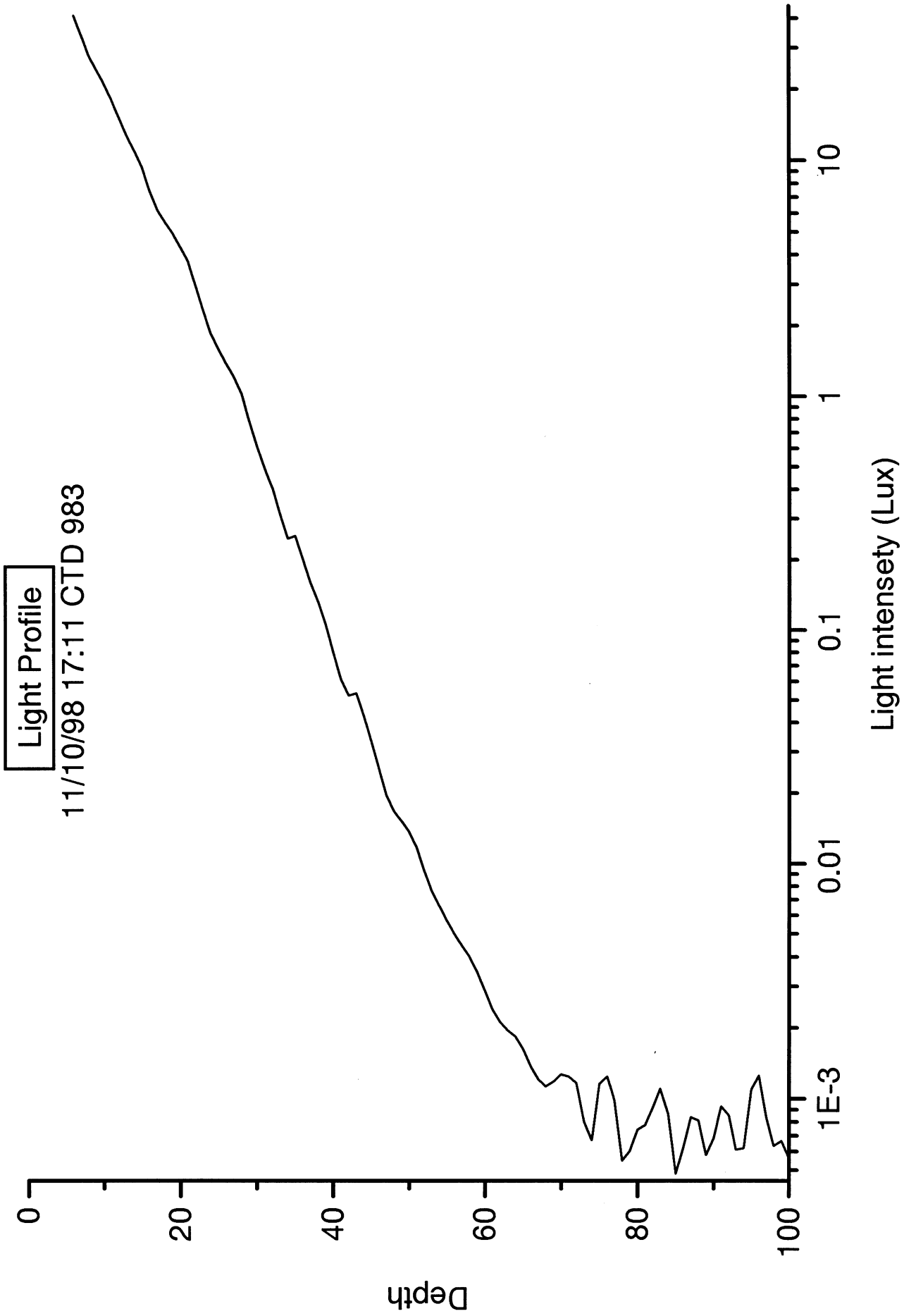
20
40
60
80
1E-3
0.01
0.1
1
Light intensity (Lux)


Light Profile
11/10/98 17:11 CTD 983
Depth
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20
40
60
80
100
1E-3
0.01
0.1
1
10
Light intensety (Lux)

ANNEX III : RECORDS OF FISHING STATIONS

ANNEX III Summary of trawl stations

Trawl number	Date	Latitude (°S)	Longitude (°S)	Time of day	Gear	Bottom depth	Trach.c. % catch	Etrum.w. % catch	Total catch/hr
203	09/10/98	17.45	11.24	12:09:00(D)	PT	256	70	17	943.68
204	09/10/98	17.44	11.24	12:30:08(D)	PT	267	86	14	364.42
205	09/10/98	17.43	11.24	12:48:28(D)	PT	291	0	0	Failure
206	09/10/98	17.43	11.38	17:36:56(D)	PT	123	99	0	491.33
207	09/10/98	17.42	11.38	17:56:53(D)	PT	122	96	0	25.2
208	09/10/98	17.41	11.37	18:15:00(N)	PT	120	24	55	7.8
209	10/10/98	17.46	11.44	15:27:49(D)	BT	58	16	80	64.7
210	10/10/98	17.42	11.33	19:00:59(N)	PT	185	0	0	316.8
211	11/10/98	17.46	11.35	01:45:51(N)	PT	161	49	12	10.96
212	11/10/98	17.43	11.33	03:15:02(N)	PT	165	0	1	42.44
213	11/10/98	17.41	11.24	07:04:19(D)	BT	258	1	0	1999.16
214	11/10/98	17.44	11.37	10:08:41(D)	BT	124	88	0	2112.71
215	11/10/98	17.45	11.39	12:44:30(D)	BT	117	87	0	2937.94
216	11/10/98	17.45	11.33	15:00:31(D)	PT	170	97	0	2426.4
217	11/10/98	17.45	11.33	15:00:22(D)	PT	168	58	40	252.4
218	11/10/98	17.45	11.34	00:00:00(N)	PT	159	18	80	145.32
219	13/10/98	17.45	11.36	00:00:00(N)	BT	132	15	0	906.24
220	13/10/98	17.44	11.21	13:56:25(D)	BT	424	0	0	583.11
221	13/10/98	17.45	11.44	19:03:31(N)	BT	106	61	0	5659.6
222	13/10/98	17.45	11.34	20:53:27(N)	PT	152	36	0	12.04
223	13/10/98	17.45	11.35	21:08:58(N)	PT	142	0	0	Failure
224	13/10/98	17.45	11.36	21:27:36(N)	PT	133	38	0	3.98
225	14/10/98	17.43	11.24	00:27:24(N)	BT	270	0	0	3658.74
226	14/10/98	17.44	11.22	02:33:19(N)	BT	491	3	0	1303.34
227	14/10/98	17.44	11.19	15:14:33(D)	PT	566	77	12	94.4
228	14/10/98	17.44	11.19	15:28:43(D)	PT	564	37	42	36.49
229	14/10/98	17.45	11.19	15:43:42(D)	PT	573	8	77	41.07
230	15/10/98	17.43	11.22	03:17:26(N)	PT	362	97	0	38.85
231	15/10/98	17.43	11.22	03:23:18(N)	PT	343	89	0	41.68
232	15/10/98	17.44	11.22	03:44:33(N)	PT	329	100	0	33.32
233	15/10/98	17.45	11.33	09:09:25(D)	BT	191	22	0	606.13
234	15/10/98	17.44	11.22	11:30:21(D)	BT	345	1	0	293.3
235	15/10/98	17.43	11.23	12:52:33(D)	PT	328	3	0	91.26
236	15/10/98	17.45	11.22	13:31:32(D)	PT	329	6	70	11.45
237	15/10/98	17.46	11.22	14:07:00(D)	PT	343	0	100	0.93
238	15/10/98	17.43	11.25	15:51:26(D)	PT	244	5	0	438.78
239	15/10/98	17.42	11.25	16:26:09(D)	PT	250	0	0	Failure
240	15/10/98	17.41	11.25	16:56:33(D)	PT	251	13	16	2.64
241	15/10/98	17.44	11.28	19:30:26(N)	BT	194	6	0	709
242	15/10/98	17.44	11.34	21:51:37(N)	BT	152	18	0	472.15
243	16/10/98	17.44	11.28	02:27:04(N)	PT	199	65	0	9.9
244	16/10/98	17.45	11.27	02:53:34(N)	PT	212	68	0	16.11
245	16/10/98	17.46	11.26	03:15:07(N)	PT	238	100	0	28.92
246	16/10/98	17.44	11.33	06:49:02(D)	PT	186	90	1	62.07
247	16/10/98	17.43	11.33	07:19:11(D)	PT	186	87	13	0.69
248	16/10/98	17.41	11.33	07:55:42(D)	PT	184	0	0	Failure
249	16/10/98	17.44	11.21	10:49:20(D)	BT	370	0	0	1781.15
250	16/10/98	17.45	11.36	14:03:14(D)	BT	139	22	0	455.29
251	16/10/98	17.45	11.44	20:39:10(N)	BT	115	91	0	1506.26
252	17/10/98	17.45	11.39	02:25:37(N)	BT	117	94	0	3679.44

Annex III Records of fishing stations

PROJECT STATION: 203

DATE: 9/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1745
start stop duration Long E 1124
TIME :12:09:00 12:19:00 10 (min) Purpose code: 1
LOG :3726.60 3727.10 0.50 Area code : 3
FDEPTH: 220 220 GearCond.code:
BDEPTH: 254 257 Validity code: 3
Towing dir: 360° Wire out: 580 m Speed: 3 kn*10

Sorted: 157 Kg Total catch: 157.28 CATCH/HOUR: 943.68

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	663.00	10950	70.26	4128
Etrumeus whiteheadi	157.20	3654	16.66	
Merluccius capensis	112.20	498	11.89	4127
Total	932.40		98.81	

PROJECT STATION: 204

DATE: 9/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1744
start stop duration Long E 1124
TIME :12:30:08 12:41:24 11 (min) Purpose code: 1
LOG :3727.59 3728.17 0.57 Area code : 3
FDEPTH: 180 180 GearCond.code:
BDEPTH: 261 273 Validity code: 3
Towing dir: 360° Wire out: 520 m Speed: 34 kn*10

Sorted: 66 Kg Total catch: 66.81 CATCH/HOUR: 364.42

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	312.55	3093	85.77	4129
Etrumeus whiteheadi	49.64	1500	13.62	4130
Total	362.19		99.39	

PROJECT STATION: 205

DATE: 9/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1743
start stop duration Long E 1124
TIME :12:48:28 12:56:42 8 (min) Purpose code: 1
LOG :3728.47 3728.95 0.46 Area code : 3
FDEPTH: 100 100 GearCond.code:
BDEPTH: 285 296 Validity code: 3
Towing dir: 360° Wire out: 300 m Speed: 30 kn*10

Sorted: Kg Total catch: CATCH/HOUR:

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Total				

PROJECT STATION: 206

DATE: 9/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1743
start stop duration Long E 1138
TIME :17:36:56 17:45:20 8 (min) Purpose code: 1
LOG :3762.10 3762.51 0.39 Area code : 3
FDEPTH: 90 90 GearCond.code:
BDEPTH: 121 124 Validity code: 3
Towing dir: 350° Wire out: 200 m Speed: 30 kn*10

Sorted: 65 Kg Total catch: 65.51 CATCH/HOUR: 491.33

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	461.03	39525	93.83	4131
Callorhinchus capensis	10.88	8	2.21	
Merluccius capensis	9.98	113	2.03	4134
Chelidonichthys capensis	5.55	23	1.13	
Engraulis capensis	1.50	120	0.31	4133
Etrumeus whiteheadi	1.28	158	0.26	4132
Perulibatrachus rossignoli	0.98	8	0.20	
Synagrops microlepis	0.08	8	0.02	
Aequorea aequorea	0.00	30		
Lepidopus caudatus	0.00			
Total	491.28		99.99	

PROJECT STATION: 207

DATE: 9/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1742
start stop duration Long E 1138
TIME :17:56:53 18:04:39 8 (min) Purpose code: 1
LOG :3763.16 3763.61 0.44 Area code : 3
FDEPTH: 55 55 GearCond.code:
BDEPTH: 123 120 Validity code: 3
Towing dir: 350° Wire out: 150 m Speed: 30 kn*10

Sorted: 3 Kg Total catch: 3.36 CATCH/HOUR: 25.20

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	24.08	2835	95.56	4136
Engraulis capensis	0.90	75	3.57	4137
CARANGIDAE	0.08	8	0.32	
Etrumeus whiteheadi	0.08	23	0.32	4135
Aequorea aequorea	0.00	15		
Total	25.14		99.77	

PROJECT STATION: 208

DATE: 9/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1741
start stop duration Long E 1137
TIME :18:15:00 18:24:18 9 (min) Purpose code: 1
LOG :3764.25 3764.89 0.64 Area code : 3
FDEPTH: 35 30 GearCond.code:
BDEPTH: 119 120 Validity code: 3
Towing dir: 350° Wire out: 100 m Speed: 35 kn*10

Sorted: 1 Kg Total catch: 1.17 CATCH/HOUR: 7.80

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Etrumeus whiteheadi	4.27	493	54.74	4139
Trachurus capensis	1.87	200	23.97	4138
Engraulis capensis	1.60	140	20.51	4140
Thyrsites atun	0.07	7	0.90	
Aequorea aequorea	0.00	27		
Total	7.81		100.12	

PROJECT STATION: 209

DATE:10/10/98 GEAR TYPE: BT No: 1 POSITION:Lat S 1746
start stop duration Long E 1144
TIME :15:27:49 15:39:24 12 (min) Purpose code: 1
LOG :3927.27 3927.81 0.52 Area code : 3
FDEPTH: 59 57 GearCond.code:
BDEPTH: 59 57 Validity code: 3
Towing dir: 360° Wire out: 150 m Speed: 32 kn*10

Sorted: 13 Kg Total catch: 12.94 CATCH/HOUR: 64.70

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Etrumeus whiteheadi	52.05	6850	80.45	4142
Trachurus capensis	10.40	1455	16.07	4141
Engraulis capensis	1.80	205	2.78	4144
Sardinops ocellatus	0.40	20	0.62	4143
Trichiurus lepturus	0.05	5	0.08	
Aequorea aequorea	0.00	25		
Total	64.70		100.00	

PROJECT STATION: 210

DATE:10/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1742
start stop duration Long E 1130
TIME :19:00:59 19:06:19 5 (min) Purpose code: 1
LOG :3951.91 3952.20 0.27 Area code : 3
FDEPTH: 140 150 GearCond.code:
BDEPTH: 184 185 Validity code: 3
Towing dir: 350° Wire out: 375 m Speed: 30 kn*10

Sorted: 26 Kg Total catch: 26.40 CATCH/HOUR: 316.80

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Dentex macrophthalmus	306.60	3444	96.78	4145
Merluccius capensis	9.24	84	2.92	4146
TRIGLIDAE	0.96	12	0.30	
Total	316.80		100.00	

PROJECT STATION: 211

DATE:11/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1746
start stop duration Long E 1135
TIME :01:45:51 02:37:26 52 (min) Purpose code: 1
LOG :4000.84 4004.07 3.09 Area code : 3
FDEPTH: 110 110 GearCond.code:
BDEPTH: 151 170 Validity code: 3
Towing dir: 350° Wire out: 300 m Speed: 30 kn*10

Sorted: 9 Kg Total catch: 9.50 CATCH/HOUR: 10.96

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	5.38	654	49.09	4147
Trigla lyra	1.33	12	12.14	
Callorhinchus capensis	1.29	1	11.77	
Etrumeus whiteheadi	1.26	153	11.50	
Chelidonichthys queketti	0.78	2	7.12	
Engraulis capensis	0.44	35	4.01	
Galeichthys feliceps	0.42	2	3.83	
Thyrsites atun	0.03	1	0.27	
Merluccius capensis	0.03	10	0.27	
Aequorea aequorea	0.00	8		
Total	10.96		100.00	

PROJECT STATION: 212

DATE:11/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1743
start stop duration Long E 1133
TIME :03:15:02 03:26:11 11 (min) Purpose code: 1
LOG :4005.27 4005.77 0.50 Area code : 3
FDEPTH: 30 26 GearCond.code:
BDEPTH: 167 162 Validity code: 3
Towing dir: 90° Wire out: m Speed: 30 kn*10

Sorted: 7 Kg Total catch: 7.78 CATCH/HOUR: 42.44

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Engraulis capensis	42.00	284	98.96	
Etrumeus whiteheadi	0.22	27	0.52	
Thyrsites atun	0.16	11	0.38	
Trachurus capensis	0.05	5	0.12	
Total	42.43		99.98	

PROJECT STATION: 213

DATE:11/10/98 GEAR TYPE: BT No: 3 POSITION:Lat S 1741
start stop duration Long E 1124
TIME :07:04:19 07:21:38 17 (min) Purpose code:
LOG :4028.88 4029.83 0.93 Area code : 3
FDEPTH: 252 263 GearCond.code: 1
BDEPTH: 252 263 Validity code: 3
Towing dir: 10° Wire out: 800 m Speed: 30 kn*10

Sorted: 566 Kg Total catch: 566.43 CATCH/HOUR: 1999.16

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	1275.18	1966	63.79	4234
Helicolenus dactylopterus	285.74	6148	14.29	
Dentex macrophthalmus	197.36	1158	9.87	4149
Chlorophthalmus atlanticus	127.34	4376	6.37	
Synagrops microlepis	25.41	367	1.27	
Trachurus capensis	19.59	116	0.98	4148
Pterothrissus belloci	17.65	127	0.88	
Atractoscion aequidens	17.40	14	0.87	
Squalus megalops	11.93	46	0.60	
Trigla lyra	7.34	28	0.37	
Mustelus palumbes	4.73	4	0.24	
Hyperoglyphe moselii	4.45	11	0.22	
Todarodes sagittatus	4.27	11	0.21	
Coelorinchus sp.	3.67	113	0.18	
Nezumia sp.	0.56	28	0.03	
Total	2002.62		100.17	

PROJECT STATION: 214

DATE:11/10/98 GEAR TYPE: BT No: 3 POSITION:Lat S 1744
start stop duration Long E 1137
TIME :10:08:41 10:25:14 17 (min) Purpose code: 1
LOG :4046.37 4047.02 0.64 Area code : 3
FDEPTH: 123 124 GearCond.code:
BDEPTH: 123 124 Validity code: 3
Towing dir: 360° Wire out: 450 m Speed: 30 kn*10

Sorted: 103 Kg Total catch: 598.60 CATCH/HOUR: 2112.71

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	1857.18	57596	87.91	4150
Dentex macrophthalmus	168.99	2181	8.00	
Merluccius capensis	60.56	1482	2.87	4151
Trigla lyra	10.59	64	0.50	
Chelidonichthys capensis	10.38	35	0.49	
Galeichthys feliceps	2.47	7	0.12	
Helicolenus dactylopterus	0.85	21	0.04	
Austroglossus microlepis	0.85	21	0.04	
Lepidopus caudatus	0.53	14	0.03	
Todaropsis eblanae	0.25	7	0.01	
Synagrops microlepis	0.04	11		
Sufflogobius bibarbatus	0.04	7		
Aequorea aequorea	0.00	124		
Total	2112.73		100.01	

PROJECT STATION: 215

DATE:11/10/98 GEAR TYPE: BT No: 3 POSITION:Lat S 1745
start stop duration Long E 1139
TIME :12:44:30 13:05:00 21 (min) Purpose code: 1
LOG :4061.79 4062.75 0.97 Area code : 3
FDEPTH: 117 116 GearCond.code:
BDEPTH: 117 116 Validity code: 3
Towing dir: 360° Wire out: 350 m Speed: 30 kn*10

Sorted: 198 Kg Total catch: 1028.28 CATCH/HOUR: 2937.94

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	2567.71	77391	87.40	4152
Argyrosomus hololepidotus	218.57	69	7.44	
Merluccius capensis	41.17	409	1.40	4153
Mustelus mustelus	40.00	3	1.36	
Galeichthys feliceps	17.83	83	0.61	
Chelidonichthys queketti	14.09	57	0.48	
RAYRB11	8.97	3	0.31	
Deepwater fish mixture	6.57		0.22	
Mustelus palumbes	6.43	3	0.22	
Lepidopus caudatus	6.06	86	0.21	
Dicologoglossa cuneata	3.91	94	0.13	
Sarda sarda	3.26	14	0.11	
Todarodes sagittatus	1.57	3	0.05	
Raja miraletus	1.37	3	0.05	
Mystriophis rostellatus	0.40	3	0.01	
MAJIDAE	0.03	3		
Total	2937.94		100.00	

PROJECT STATION: 216

DATE:11/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1745
start stop duration Long E 1133
TIME :15:00:31 15:00:58 4 (min) Purpose code: 1
LOG :4075.01 4075.20 0.19 Area code : 3
FDEPTH: 100 100 GearCond.code:
BDEPTH: 170 170 Validity code: 3
Towing dir: 90° Wire out: 320 m Speed: 33 kn*10

Sorted: 20 Kg Total catch: 161.76 CATCH/HOUR: 2426.40

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	2364.00	246240	97.43	4154
Engraulis capensis	50.40	4200	2.08	4155
Etrumeus whiteheadi	12.00	1680	0.49	4156
Total	2426.40		100.00	

PROJECT STATION: 217

DATE:11/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1745
start stop duration Long E 1133
TIME :15:00:22 15:01:31 3 (min) Purpose code: 1
LOG :4075.27 4075.46 0.19 Area code : 3
FDEPTH: 70 70 GearCond.code:
BDEPTH: 170 166 Validity code: 3
Towing dir: 90° Wire out: 280 m Speed: 33 kn*10

Sorted: 3 Kg Total catch: 12.62 CATCH/HOUR: 252.40

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	147.60	14840	58.48	4157
Etrumeus whiteheadi	102.00	11440	40.41	4158
Engraulis capensis	2.80	260	1.11	4159
Aequorea aequorea	0.00	260		
Total	252.40		100.00	

PROJECT STATION: 218

DATE:11/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1745
start stop duration Long E 1134
TIME :00:00:00 00:00:00 10 (min) Purpose code: 1
LOG :4075.91 4076.50 0.60 Area code : 3
FDEPTH: 65 70 GearCond.code:
BDEPTH: 163 154 Validity code: 3
Towing dir: 90° Wire out: 280 m Speed: 33 kn*10

Sorted: 3 Kg Total catch: 24.22 CATCH/HOUR: 145.32

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Etrumeus whiteheadi	115.92	13962	79.77	4161
Trachurus capensis	25.86	2856	17.80	4160
Engraulis capensis	3.48	348	2.39	4162
Sardinops ocellatus	0.06	6	0.04	4163
Aequorea aequorea	0.00	42		
Total	145.32		100.00	

PROJECT STATION: 219

DATE:13/10/98 GEAR TYPE: BT No: 1 POSITION:Lat S 1745
start stop duration Long E 1136
TIME :00:00:00 00:00:00 25 (min) Purpose code: 1
LOG :4326.60 4327.84 1.20 Area code : 3
FDEPTH: 137 127 GearCond.code:
BDEPTH: 137 127 Validity code: 3
Towing dir: 120° Wire out: 500 m Speed: 30 kn*10

Sorted: 145 Kg Total catch: 377.60 CATCH/HOUR: 906.24

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Dentex macrophthalmus	565.49	7536	62.40	4166
Merluccius capensis	172.18	1224	19.00	4165
Trachurus capensis	139.13	4567	15.35	4164
Chelidonichthys queketti	5.78	12	0.64	
Pterothrissus belloci	5.30	130	0.58	
Callorhinchus capensis	3.38	2	0.37	
Mustelus palumbes	2.71	2	0.30	
Engraulis capensis	2.62	187	0.29	
MYCTOPHIDAE	2.21	1370	0.24	
Synagrops microlepis	2.11	931	0.23	
Trigla lyra	1.44	12	0.16	
CARSL01	0.96	2	0.11	
Galeichthys feliceps	0.89	2	0.10	
Atractoscion aequidens	0.77	2	0.08	
Dicologoglossa cuneata	0.67	2	0.07	
Mystriophis rostellatus	0.22	2	0.02	
Todarodes sagittatus	0.17	2	0.02	
Zenopsis conchifer	0.12	2	0.01	
Lepidopus caudatus	0.10	5	0.01	
Aequorea aequorea	0.00	144		
Total	906.25		99.98	

PROJECT STATION: 220

DATE:13/10/98 GEAR TYPE: BT No: 1 POSITION:Lat S 1744
start stop duration Long E 1121
TIME :13:56:25 14:17:26 21 (min) Purpose code: 1
LOG :4349.83 4350.98 1.14 Area code : 3
FDEPTH: 407 441 GearCond.code:
BDEPTH: 407 441 Validity code: 3
Towing dir: 360° Wire out:1150 m Speed: 30 kn*10

Sorted: 204 Kg Total catch: 204.09 CATCH/HOUR: 583.11

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	182.20	514	31.25	4168
Merluccius capensis	155.17	226	26.61	4167
Helicolenus dactylopterus	148.29	1617	25.43	
Deepwater fish mixture	28.57		4.90	
Merluccius polli	16.57	23	2.84	4169
Deania calcea	12.80	3	2.20	
RAJIDAE	10.00	3	1.71	
Coelorinchus fasciatus	6.86	189	1.18	
Selachophidium guentheri	6.03	163	1.03	
Todarodes sagittatus	4.66	9	0.80	
Aristeus varidens	2.91	471	0.50	
Nezumia micronychodon	2.91	126	0.50	
Hoplostethus cadenati	1.37	69	0.23	
Trachurus capensis	1.34	3	0.23	
Galeus polli	1.14	14	0.20	
Dentex macrophthalmus	0.77	3	0.13	
Ebinania costaecanarie	0.71	3	0.12	
Epigonus denticulatus	0.26	11	0.04	
Raja straeleni	0.23	3	0.04	
HALOSAURIDAE	0.11	3	0.02	
Stomias boa boa	0.11	3	0.02	
Lamprogrammus exutus	0.06	3	0.01	
Bathyuroconger vicinus	0.03	3	0.01	
Bathynectes piperitus	0.03	3	0.01	
Total	583.13		100.01	

PROJECT STATION: 221

DATE:13/10/98 GEAR TYPE: BT No: 3 POSITION:Lat S 1745
start stop duration Long E 1140
TIME :19:03:31 19:09:13 6 (min) Purpose code: 1
LOG :4380.31 4380.54 0.20 Area code : 3
FDEPTH: 105 107 GearCond.code:
BDEPTH: 105 107 Validity code: 3
Towing dir: 270° Wire out: 400 m Speed: 30 kn*10

Sorted: 60 Kg Total catch: 565.96 CATCH/HOUR: 5659.60

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	3449.00	84120	60.94	4170
Merluccius capensis	1226.00	11250	21.66	4171
C R A B S	660.00	66000	11.66	
Chelidonichthys capensis	94.00	500	1.66	
Dicologoglossa cuneata	61.00	3810	1.08	
Atractoscion aequidens	41.00	130	0.72	
SPADE06	38.00	100	0.67	
Argyrosomus hololepidotus	37.60	10	0.66	
CONGRIDAE	25.00	400	0.44	
Lepidopus caudatus	24.00	400	0.42	
Ophisurus serpens	2.00	100	0.04	
Synagrops microlepis	2.00	800	0.04	
J E L L Y F I S H	0.00	800		
Total	5659.60		99.99	

PROJECT STATION: 222

DATE:13/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1745
start stop duration Long E 1134
TIME :20:53:27 21:08:04 15 (min) Purpose code: 1
LOG :4389.56 4390.38 0.80 Area code : 3
FDEPTH: 83 80 GearCond.code:
BDEPTH: 156 147 Validity code: 1
Towing dir: 90° Wire out: 220 m Speed: 35 kn*10

Sorted: 3 Kg Total catch: 3.01 CATCH/HOUR: 12.04

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	4.32	252	35.88	4173
Callorhinchus capensis	3.92	4	32.56	
Merluccius capensis	2.36	344	19.60	4172
Synagrops microlepis	1.44	448	11.96	
Chrysaora sp.	0.00	1400		
Aequorea aequorea	0.00	20		
Total	12.04		100.00	

PROJECT STATION: 223

DATE:13/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1745
start stop duration Long E 1135
TIME :21:08:58 21:21:58 13 (min) Purpose code: 1
LOG :4390.43 4391.14 0.69 Area code : 3
FDEPTH: 80 80 GearCond.code:
BDEPTH: 145 138 Validity code: 9
Towing dir: 90° Wire out: 220 m Speed: 35 kn*10

Sorted: Kg Total catch: CATCH/HOUR:

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Total				

PROJECT STATION: 224

DATE:13/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1745
start stop duration Long E 1136
TIME :21:27:36 21:35:44 8 (min) Purpose code: 1
LOG :4391.36 4391.78 0.40 Area code : 3
FDEPTH: 60 48 GearCond.code:
BDEPTH: 135 131 Validity code: 3
Towing dir: 90° Wire out: 110 m Speed: 35 kn*10

Sorted: Kg Total catch: 0.53 CATCH/HOUR: 3.98

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Synagrops microlepis	1.73	668	43.47	
Trachurus capensis	1.50	105	37.69	4174
Merluccius capensis	0.60	143	15.08	4175
MYCTOPHIDAE	0.15	53	3.77	
Aequorea aequorea	0.00	8		
Chrysaora sp.	0.00	233		
Total	3.98		100.01	

PROJECT STATION: 225

DATE:14/10/98 GEAR TYPE: BT No: POSITION:Lat S 1743
start stop duration Long E 1124
TIME :00:27:24 00:37:18 10 (min) Purpose code: 1
LOG :4407.14 4407.69 0.55 Area code : 3
FDEPTH: 265 275 GearCond.code:
BDEPTH: 265 275 Validity code: 1
Towing dir: 360° Wire out: 850 m Speed: 30 kn*10

Sorted: 170 Kg Total catch: 609.79 CATCH/HOUR: 3658.74

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	1750.32	2298	47.84	4177
Dentex macrophthalmus	1428.00	12462	39.03	
Helicolenus dactylopterus	282.60	6180	7.72	
Pterothrissus belloci	117.00		3.20	
Chlorophthalmus punctatus	19.80	780	0.54	
Lophius vomerinus	13.50	6	0.37	
Squalus mitsukurii	10.14	42	0.28	
Trachurus capensis	9.30	186	0.25	4176
MAJIDAE	8.40	1320	0.23	
Coelorinchus coelorhinc. polli	7.20	240	0.20	
Trigla lyra	5.52	24	0.15	
Synagrops microlepis	4.20	360	0.11	
Coelorinchus fasciatus	1.20	60	0.03	
Galeus polli	0.96	12	0.03	
Lepidopus caudatus	0.48	6	0.01	
Etrumeus whiteheadi	0.12	6		
Total	3658.74		99.99	

PROJECT STATION: 226

DATE:14/10/98 GEAR TYPE: BT No: 1 POSITION:Lat S 1744
start stop duration Long E 1120
TIME :02:33:19 02:50:43 17 (min) Purpose code: 1
LOG :4417.31 4418.21 0.88 Area code : 3
FDEPTH: 476 505 GearCond.code:
BDEPTH: 476 505 Validity code: 3
Towing dir: 360° Wire out:1400 m Speed: 30 kn*10

Sorted: 218 Kg Total catch: 369.28 CATCH/HOUR: 1303.34

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Helicolenus dactylopterus	388.69	2901	29.82	
Merluccius paradoxus	388.34	904	29.80	4179
Dentex macrophthalmus	190.38	1684	14.61	4182
Trachyrincus scabrus	149.19	1232	11.45	
Merluccius polli	43.76	49	3.36	4181
Merluccius capensis	37.13	71	2.85	4178
Trachurus capensis	31.66	501	2.43	4180
Deepwater fish mixture	22.55		1.73	
Nezumia micronychodon	21.28	1521	1.63	
Hoplostethus cadenati	10.16	318	0.78	
Aristeus varidens	8.15	1631	0.63	
Beryx splendens	2.65	11	0.20	
Epigonus telescopus	2.44	134	0.19	
Deania profundorum	1.76	4	0.14	
Histioteuthis reversa	1.59	21	0.12	
Squalus mitsukurii	1.59	4	0.12	
STOMIIDAE	0.74	21	0.06	
Selachophidium guentheri	0.74	21	0.06	
NEMICHTHYIDAE	0.21	11	0.02	
Ebinania costaecanarie	0.21	11	0.02	
MAJIDAE	0.11	11	0.01	
Total	1303.33		100.03	

PROJECT STATION: 227

DATE:14/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1744
start stop duration Long E 1119
TIME :15:14:33 15:26:52 12 (min) Purpose code: 1
LOG :4480.91 4481.51 0.58 Area code : 3
FDEPTH: 150 150 GearCond.code:
BDEPTH: 570 562 Validity code: 3
Towing dir: ° Wire out: 380 m Speed: 30 kn*10

Sorted: 18 Kg Total catch: 18.88 CATCH/HOUR: 94.40

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	73.10	1010	77.44	4183
Etrumeus whiteheadi	10.90	370	11.55	4184
Callorhinchus capensis	8.60	5	9.11	
PARMA02	1.60	115	1.69	
Lampanyctodes hectoris	0.15	60	0.16	
ONYCHOTEUTHIDAE	0.05	5	0.05	
Aequorea aequorea	0.00	40		
Total	94.40		100.00	

PROJECT STATION: 228

DATE:14/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1744
start stop duration Long E 1119
TIME :15:28:43 15:39:46 11 (min) Purpose code: 1
LOG :4481.60 4482.14 0.52 Area code : 3
FDEPTH: 150 150 GearCond.code:
BDEPTH: 562 565 Validity code: 3
Towing dir: 165° Wire out: 380 m Speed: 30 kn*10

Sorted: 6 Kg Total catch: 6.69 CATCH/HOUR: 36.49

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Etrumeus whiteheadi	15.38	556	42.15	4186
Trachurus capensis	13.53	164	37.08	4185
Sarda sarda	7.31	33	20.03	
PARMA02	0.22	16	0.60	
Lampanyctodes hectoris	0.05	22	0.14	
Total	36.49		100.00	

PROJECT STATION: 229

DATE:14/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1745
start stop duration Long E 1119
TIME :15:43:42 15:52:30 9 (min) Purpose code: 1
LOG :4482.36 4482.81 0.42 Area code : 3
FDEPTH: 125 125 GearCond.code:
BDEPTH: 568 577 Validity code: 3
Towing dir: 165° Wire out: 380 m Speed: 30 kn*10

Sorted: 6 Kg Total catch: 6.16 CATCH/HOUR: 41.07

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Etrumeus whiteheadi	31.80	1080	77.43	4188
Sarda sarda	5.67	27	13.81	
Trachurus capensis	3.13	53	7.62	4187
PARMA02	0.40	20	0.97	
Lampanyctodes hectoris	0.07	27	0.17	
Aequorea aequorea	0.00	47		
Total	41.07		100.00	

PROJECT STATION: 230

DATE:15/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1743
start stop duration Long E 1122
TIME :03:17:26 03:21:21 4 (min) Purpose code: 1
LOG :4545.83 4546.06 0.21 Area code : 3
FDEPTH: 50 50 GearCond.code:
BDEPTH: 367 357 Validity code: 3
Towing dir: 180° Wire out: 120 m Speed: 30 kn*10

Sorted: 2 Kg Total catch: 2.59 CATCH/HOUR: 38.85

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	37.80	825	97.30	4189
Lampanyctodes hectoris	0.45	180	1.16	
C E P H A L O P O D A	0.30	15	0.77	
Synagrops microlepis	0.15	15	0.39	
Hoplostethus cadenati	0.15	90	0.39	
Aequorea aequorea	0.00	75		
Total	38.85		100.01	

PROJECT STATION: 231

DATE:15/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1743
start stop duration Long E 1122
TIME :03:23:18 03:35:57 13 (min) Purpose code: 1
LOG :4546.17 4546.78 0.61 Area code : 3
FDEPTH: 50 50 GearCond.code:
BDEPTH: 352 334 Validity code: 3
Towing dir: 180° Wire out: 120 m Speed: 35 kn*10

Sorted: 9 Kg Total catch: 9.03 CATCH/HOUR: 41.68

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	37.15	600	89.13	4190
Squalus megalops	2.63	5	6.31	
Merluccius capensis	1.48	5	3.55	
Lampanyctodes hectoris	0.18	60	0.43	
Synagrops microlepis	0.09	5	0.22	
Hoplostethus cadenati	0.09	32	0.22	
C E P H A L O P O D A	0.05	5	0.12	
Aequorea aequorea	0.00	37		
Total	41.67		99.98	

PROJECT STATION: 232

DATE:15/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1744
start stop duration Long E 1122
TIME :03:44:33 03:57:31 13 (min) Purpose code: 1
LOG :4547.19 4547.84 0.64 Area code : 3
FDEPTH: 25 25 GearCond.code:
BDEPTH: 335 323 Validity code: 3
Towing dir: 180° Wire out: 70 m Speed: 30 kn*10

Sorted: 7 Kg Total catch: 7.22 CATCH/HOUR: 33.32

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	33.28	1020	99.88	4191
Lampanyctodes hectoris	0.05	18	0.15	
Total	33.33		100.03	

PROJECT STATION: 233

DATE:15/10/98 GEAR TYPE: BT No: POSITION:Lat S 1745
start stop duration Long E 1130
TIME :09:09:25 09:28:02 19 (min) Purpose code: 1
LOG :4584.38 4585.21 0.82 Area code : 3
FDEPTH: 184 197 GearCond.code:
BDEPTH: 184 197 Validity code: 3
Towing dir: 270° Wire out: 600 m Speed: 29 kn*10

Sorted: 28 Kg Total catch: 191.94 CATCH/HOUR: 606.13

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	232.42	925	38.34	4194
Dentex macrophthalmus	186.32	1554	30.74	4192
Trachurus capensis	134.91	1541	22.26	4193
Synagrops microlepis	24.63	4247	4.06	
Trigla lyra	11.97	126	1.97	
Callorhinchus capensis	8.59	6	1.42	
Pterothrissus belloci	4.11	139	0.68	
Lepidopus caudatus	1.01	13	0.17	
Chlorophthalmus punctatus	0.76	114	0.13	
Zenopsis conchifer	0.38	25	0.06	
MYCTOPHIDAE	0.38	328	0.06	
Squalus megalops	0.28	3	0.05	
Merluccius capensis, juveniles	0.25	38	0.04	
MAJIDAE	0.13	13	0.02	
Chrysaora sp.	0.00	253		
Aequorea aequorea	0.00	3022		
Total	606.14		100.00	

PROJECT STATION: 234

DATE:15/10/98 GEAR TYPE: BT No: POSITION:Lat S 1744
start stop duration Long E 1122
TIME :11:30:21 12:00:46 30 (min) Purpose code: 1
LOG :4598.72 4600.38 1.63 Area code : 3
FDEPTH: 320 369 GearCond.code:
BDEPTH: 320 369 Validity code: 3
Towing dir: 360° Wire out:1000 m Speed: 30 kn*10

Sorted: 31 Kg Total catch: 146.65 CATCH/HOUR: 293.30

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	123.80	160	42.21	4195
Helicolenus dactylopterus	79.20	1404	27.00	
Dentex macrophthalmus	72.72	456	24.79	
Pterothrissus belloci	6.36	48	2.17	
Aristeus varidens	3.48	924	1.19	
Trachurus capensis	1.94	12	0.66	4196
Merluccius polli	1.54	2	0.53	4197
Todarodes sagittatus	1.02	2	0.35	
Hoplostethus cadenati	0.84	48	0.29	
Nezumia sp.	0.84	24	0.29	
Nezumia micronychodon	0.72	24	0.25	
Nezumia sp.	0.24	48	0.08	
Ebinania costaecanarie	0.24	12	0.08	
Epigonus denticulatus	0.24	12	0.08	
Synagrops microlepis	0.12	12	0.04	
J E L L Y F I S H	0.00	120		
Total	293.30		100.01	

PROJECT STATION: 235

DATE:15/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1743
start stop duration Long E 1123
TIME :12:52:33 13:12:42 20 (min) Purpose code: 1
LOG :4602.91 4603.85 0.94 Area code : 3
FDEPTH: 280 280 GearCond.code:
BDEPTH: 312 343 Validity code: 3
Towing dir: 180° Wire out: m Speed: kn*10

Sorted: 30 Kg Total catch: 30.42 CATCH/HOUR: 91.26

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	70.20	156	76.92	4198
Dentex macrophthalmus	14.22	81	15.58	4199
Mustelus palumbes	3.75	6	4.11	
Trachurus capensis	2.43	12	2.66	4200
Synagrops microlepis	0.36	36	0.39	
Hoplostethus cadenati	0.21	84	0.23	
Lampanyctodes hectoris	0.09	30	0.10	
Aequorea aequorea	0.00	18		
Total	91.26		99.99	

PROJECT STATION: 236

DATE:15/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1745
start stop duration Long E 1122
TIME :13:31:32 13:57:13 26 (min) Purpose code: 1
LOG :4604.86 4606.20 1.30 Area code : 3
FDEPTH: 120 110 GearCond.code:
BDEPTH: 333 324 Validity code: 3
Towing dir: 180° Wire out: m Speed: kn*10

Sorted: 4 Kg Total catch: 4.96 CATCH/HOUR: 11.45

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Etrumeus whiteheadi	8.03	282	70.13	4202
Sarda sarda	2.40	12	20.96	
Trachurus capensis	0.69	7	6.03	4201
Dentex macrophthalmus	0.25	2	2.18	
Hoplostethus cadenati	0.02	5	0.17	
Lampanyctodes hectoris	0.02	5	0.17	
Synagrops microlepis	0.02	2	0.17	
Aequorea aequorea	0.00	138		
Chrysaora sp.	0.00	7		
Total	11.43		99.81	

PROJECT STATION: 237

DATE:15/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1746
start stop duration Long E 1122
TIME :14:07:00 14:17:54 11 (min) Purpose code: 1
LOG :4606.61 4607.15 0.52 Area code : 3
FDEPTH: 25 25 GearCond.code:
BDEPTH: 332 353 Validity code: 3
Towing dir: 180° Wire out: 60 m Speed: 35 kn*10

Sorted: 1 Kg Total catch: 0.17 CATCH/HOUR: 0.93

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Etrumeus whiteheadi	0.93	33	100.00	4203
Aequorea aequorea	0.00	360		
Total	0.93		100.00	

PROJECT STATION: 238

DATE:15/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1743
start stop duration Long E 1125
TIME :15:51:26 16:11:31 20 (min) Purpose code: 1
LOG :4613.98 4614.99 1.00 Area code : 3
FDEPTH: 200 200 GearCond.code:
BDEPTH: 240 248 Validity code: 3
Towing dir: 360° Wire out: 520 m Speed: 30 kn*10

Sorted: 73 Kg Total catch: 146.26 CATCH/HOUR: 438.78

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Dentex macrophthalmus	292.32	2397	66.62	4204
Merluccius capensis	117.90	501	26.87	4206
Trachurus capensis	22.14	300	5.05	4205
Synagrops microlepis	2.64	240	0.60	
Trigla lyra	1.17	6	0.27	
Squalus megalops	0.69	3	0.16	
Zenopsis conchifer	0.63	3	0.14	
Lepidopus caudatus	0.57	3	0.13	
Etrumeus whiteheadi	0.51	21	0.12	4207
Lampanyctodes hectoris	0.21	57	0.05	
J E L L Y F I S H	0.00	15		
Total	438.78		100.01	

PROJECT STATION: 239

DATE:15/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1742
start stop duration Long E 1125
TIME :16:26:09 16:46:55 21 (min) Purpose code: 1
LOG :4615.48 4616.37 0.87 Area code : 3
FDEPTH: 80 80 GearCond.code:
BDEPTH: 251 248 Validity code: 3
Towing dir: 360° Wire out: 200 m Speed: 30 kn*10

Sorted: Kg Total catch: CATCH/HOUR:

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
J E L L Y F I S H	0.00	11		
Total				

PROJECT STATION: 240

DATE:15/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1741
start stop duration Long E 1125
TIME :16:56:33 17:16:08 20 (min) Purpose code: 1
LOG :4616.75 4617.62 0.87 Area code : 3
FDEPTH: 50 50 GearCond.code:
BDEPTH: 250 252 Validity code: 3
Towing dir: 360° Wire out: 130 m Speed: 32 kn*10

Sorted: 2 Kg Total catch: 0.88 CATCH/HOUR: 2.64

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Merluccius capensis	0.69	3	26.14	
Dentex macrophthalmus	0.63	6	23.86	
Sarda sarda	0.57	3	21.59	
Etrumeus whiteheadi	0.42	12	15.91	
Trachurus capensis	0.33	6	12.50	4208
J E L L Y F I S H	0.00	129		
Total	2.64		100.00	

PROJECT STATION: 241

DATE:15/10/98 GEAR TYPE: BT No: 1 POSITION:Lat S 1744
start stop duration Long E 1128
TIME :19:30:26 20:00:39 30 (min) Purpose code: 1
LOG :4628.55 4630.02 1.47 Area code : 3
FDEPTH: 193 195 GearCond.code:
BDEPTH: 193 195 Validity code: 3
Towing dir: 360° Wire out: 570 m Speed: 30 kn*10

Sorted: 80 Kg Total catch: 354.50 CATCH/HOUR: 709.00

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Dentex macrophthalmus	320.32	2808	45.18	4211
Merluccius capensis	153.84	798	21.70	4210
Atractoscion aequidens	65.00	66	9.17	
Helicolenus dactylopterus	63.18	1128	8.91	
Trachurus capensis	40.96	312	5.78	4209
Trigla lyra	18.72	196	2.64	
Chlorophthalmus atlanticus	17.30	390	2.44	
Pterothrissus belloci	15.08	234	2.13	
Synagrops microlepis	10.14	1080	1.43	
Squalus megalops	4.04	14	0.57	
Hoplostethus cadenati	0.14	14	0.02	
Parapenaeus longirostris	0.14	14	0.02	
Lampanyctodes hectoris	0.14	84	0.02	
J E L L Y F I S H	0.00	118		
Total	709.00		100.01	

PROJECT STATION: 242

DATE:15/10/98 GEAR TYPE: BT No: 3 POSITION:Lat S 1744
start stop duration Long E 1134
TIME :21:51:37 22:18:03 26 (min) Purpose code: 1
LOG :4640.56 4641.85 1.26 Area code : 3
FDEPTH: 153 150 GearCond.code:
BDEPTH: 153 150 Validity code: 3
Towing dir: 360° Wire out: 450 m Speed: 30 kn*10

Sorted: 61 Kg Total catch: 204.60 CATCH/HOUR: 472.15

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Dentex macrophthalmus	252.76	3305	53.53	
Merluccius capensis	110.03	997	23.30	4213
Trachurus capensis	87.12	1484	18.45	4212
Trigla lyra	12.58	129	2.66	
Pterothrissus belloci	7.25	168	1.54	
Merluccius capensis, juveniles	0.60	83	0.13	
Helicolenus dactylopterus	0.60	14	0.13	
Zeus faber	0.55	2	0.12	
Synagrops microlepis	0.53	175	0.11	
Lampanyctodes hectoris	0.16	30	0.03	
J E L L Y F I S H	0.00	53		
Total	472.18		100.00	

PROJECT STATION: 243

DATE:16/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1744
start stop duration Long E 1128
TIME :02:27:04 02:46:55 20 (min) Purpose code: 1
LOG :4653.09 4654.04 0.95 Area code : 3
FDEPTH: 100 100 GearCond.code:
BDEPTH: 193 204 Validity code: 3
Towing dir: 230° Wire out: 250 m Speed: 35 kn*10

Sorted: 3 Kg Total catch: 3.30 CATCH/HOUR: 9.90

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Trachurus capensis	6.45	153	65.15	4214
Synagrops microlepis	1.80	486	18.18	
Merluccius capensis	1.38	69	13.94	4215
Lampanyctodes hectoris	0.27	102	2.73	
Chrysaora sp.	0.00	459		
Aequorea aequorea	0.00	534		
Total	9.90		100.00	

PROJECT STATION: 244

DATE:16/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1745
start stop duration Long E 1127
TIME :02:53:34 03:06:07 13 (min) Purpose code: 1
LOG :4654.36 4654.97 0.61 Area code : 3
FDEPTH: 60 60 GearCond.code:
BDEPTH: 207 217 Validity code: 3
Towing dir: 230° Wire out: 160 m Speed: 35 kn*10

Sorted: 3 Kg Total catch: 3.49 CATCH/HOUR: 16.11

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Trachurus capensis	11.03	286	68.47	4217
Merluccius capensis	4.20	32	26.07	4216
Synagrops microlepis	0.55	102	3.41	
Lampanyctodes hectoris	0.28	51	1.74	
Zenopsis conchifer	0.05	5	0.31	
Aequorea aequorea	0.00	65		
Chrysaora sp.	0.00	51		
Total	16.11		100.00	

PROJECT STATION: 245

DATE:16/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1746
start stop duration Long E 1126
TIME :03:15:07 03:29:41 15 (min) Purpose code: 1
LOG :4655.47 4656.43 0.95 Area code : 3
FDEPTH: 25 25 GearCond.code:
BDEPTH: 226 249 Validity code: 3
Towing dir: 230° Wire out: 70 m Speed: 35 kn*10

Sorted: 7 Kg Total catch: 7.23 CATCH/HOUR: 28.92

SPECIES	CATCH/HOUR weight	CATCH/HOUR numbers	% OF TOT. C	SAMP
Trachurus capensis	28.84	652	99.72	4218
Todarodes sagittatus	0.04	4	0.14	
Lampanyctodes hectoris	0.04	4	0.14	
Aequorea aequorea	0.00	4		
Chrysaora sp.	0.00	16		
Total	28.92		100.00	

PROJECT STATION: 246

DATE:16/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1744
start stop duration Long E 1130
TIME :06:49:02 07:09:21 20 (min) Purpose code: 1
LOG :4667.22 4668.21 0.97 Area code : 3
FDEPTH: 115 115 GearCond.code:
BDEPTH: 188 184 Validity code: 3
Towing dir: 360° Wire out: 275 m Speed: 30 kn*10

Sorted: 21 Kg Total catch: 20.69 CATCH/HOUR: 62.07

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	55.80	2760	89.90	4219
Merluccius capensis	3.57	21	5.75	4220
Sarda sarda	1.44	6	2.32	
Etrumeus whiteheadi	0.84	30	1.35	
Todarodes sagittatus	0.36	9	0.58	
Lampanyctodes hectoris	0.06	21	0.10	
Aequorea aequorea	0.00	927		
Chrysaora sp.	0.00	300		
Total	62.07		100.00	

PROJECT STATION: 247

DATE:16/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1743
start stop duration Long E 1130
TIME :07:19:11 07:40:25 21 (min) Purpose code: 1
LOG :4668.66 4669.66 1.00 Area code : 3
FDEPTH: 75 75 GearCond.code:
BDEPTH: 187 185 Validity code: 3
Towing dir: 360° Wire out: 200 m Speed: 30 kn*10

Sorted: Kg Total catch: 0.24 CATCH/HOUR: 0.69

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	0.60	43	86.96	
Etrumeus whiteheadi	0.09	3	13.04	4223
Chrysaora sp.	0.00	23		
Aequorea aequorea	0.00	1840		
Total	0.69		100.00	

PROJECT STATION: 248

DATE:16/10/98 GEAR TYPE: PT No: 1 POSITION:Lat S 1741
start stop duration Long E 1130
TIME :07:55:42 08:26:02 30 (min) Purpose code: 1
LOG :4670.36 4671.94 1.56 Area code : 3
FDEPTH: 50 50 GearCond.code: 3
BDEPTH: 185 183 Validity code:
Towing dir: 360° Wire out: 130 m Speed: 30 kn*10

Sorted: Kg Total catch: CATCH/HOUR:

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
J E L L Y F I S H	0.00	2426		
Total				

PROJECT STATION: 249

DATE:16/10/98 GEAR TYPE: BT No: 3 POSITION:Lat S 1744
start stop duration Long E 1121
TIME :10:49:20 11:20:30 31 (min) Purpose code: 1
LOG :4687.50 4689.26 1.69 Area code : 3
FDEPTH: 388 351 GearCond.code: 3
BDEPTH: 388 351 Validity code:
Towing dir: 360° Wire out: 100 m Speed: 30 kn*10

Sorted: 91 Kg Total catch: 920.26 CATCH/HOUR: 1781.15

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius capensis	962.13	1665	54.02	4224
Helicolenus dactylopterus	450.39	5381	25.29	
Dentex macrophthalmus	194.52	735	10.92	4225
Merluccius polli	58.26	77	3.27	4226
Pterothrissus belloci	32.71	252	1.84	
Coelorinchus fasciatus	18.97	658	1.07	
Selachophidium guentheri	17.23	387	0.97	
Galeus polli	14.71	174	0.83	
Callorhinchus capensis	8.65	4	0.49	
Merluccius paradoxus	6.19	39	0.35	4227
Hoplostethus cadenati	6.00	426	0.34	
Trachurus capensis	4.84	19	0.27	
Nezumia sp.	3.10	77	0.17	
Todarodes sagittatus	1.32	2	0.07	
Squalus megalops	0.99	2	0.06	
Synagrops microlepis	0.97	77	0.05	
Nezumia micronychodon	0.19	39	0.01	
J E L L Y F I S H	0.00	25		
Total	1781.17		100.02	

PROJECT STATION: 250

DATE:16/10/98 GEAR TYPE: BT No: 3 POSITION:Lat S 1745
start stop duration Long E 1136
TIME :14:03:14 14:25:21 22 (min) Purpose code: 1
LOG :4706.41 4707.51 1.10 Area code : 3
FDEPTH: 139 138 GearCond.code:
BDEPTH: 139 138 Validity code: 3
Towing dir: 360° Wire out: 380 m Speed: 30 kn*10

Sorted: 93 Kg Total catch: 166.94 CATCH/HOUR: 455.29

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Dentex macrophthalmus	145.25	1863	31.90	4229
Trachurus capensis	99.90	4162	21.94	4228
Raja alba	81.82	3	17.97	
Deepwater fish mixture	51.41		11.29	
Merluccius capensis	37.61	447	8.26	4230
Synagrops microlepis	12.44	6218	2.73	
Chelidonichthys queketti	8.81	19	1.94	
Todarodes sagittatus	4.36	19	0.96	
Trigla lyra	2.45	27	0.54	
Pterothrissus belloci	2.37	65	0.52	
Callorhinchus capensis	2.37	3	0.52	
Galeus polli	1.64	19	0.36	
Helicolenus dactylopterus	1.45	19	0.32	
Merluccius capensis, juveniles	1.09	218	0.24	4231
Lampanyctodes hectoris	0.74	368	0.16	
Todaropsis eblanae	0.63	8	0.14	
Austroglossus microlepis	0.55	8	0.12	
Lepidopus caudatus	0.22	3	0.05	
Hoplostethus melanopus	0.19	11	0.04	
Chrysaora sp.	0.00	117		
Total	455.30		100.00	

PROJECT STATION: 251

DATE:16/10/98 GEAR TYPE: BT No: 3 POSITION:Lat S 1745
start stop duration Long E 1140
TIME :20:39:10 21:04:29 25 (min) Purpose code: 1
LOG :4718.13 4719.21 1.07 Area code : 3
FDEPTH: 115 115 GearCond.code:
BDEPTH: 115 115 Validity code: 3
Towing dir: 360° Wire out: 300 m Speed: 30 kn*10

Sorted: 53 Kg Total catch: 627.61 CATCH/HOUR: 1506.26

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	1371.84	33775	91.08	4232
Argyrosomus hololepidotus	69.60	26	4.62	
Atractoscion aequidens	16.78	55	1.11	
Pterothrissus belloci	16.49	336	1.09	
MAJIDAE	9.50	1118	0.63	
Chelidonichthys capensis	8.11	55	0.54	
Merluccius capensis	6.96	84	0.46	4233
Loligo vulgaris	3.91	55	0.26	
Dicologoglossa cuneata	1.68	84	0.11	
Todaropsis eblanae	0.84	26	0.06	
Synagrops microlepis	0.55	110	0.04	
Chrysaora sp.	0.00	307		
Total	1506.26		100.00	

PROJECT STATION: 252

DATE:17/10/98 GEAR TYPE: BT No: 3 POSITION:Lat S 1745
start stop duration Long E 1139
TIME :02:25:37 02:40:16 15 (min) Purpose code: 3
LOG :4732.24 4733.05 0.80 Area code : 3
FDEPTH: 116 117 GearCond.code:
BDEPTH: 116 117 Validity code: 3
Towing dir: 360° Wire out: 400 m Speed: 30 kn*10

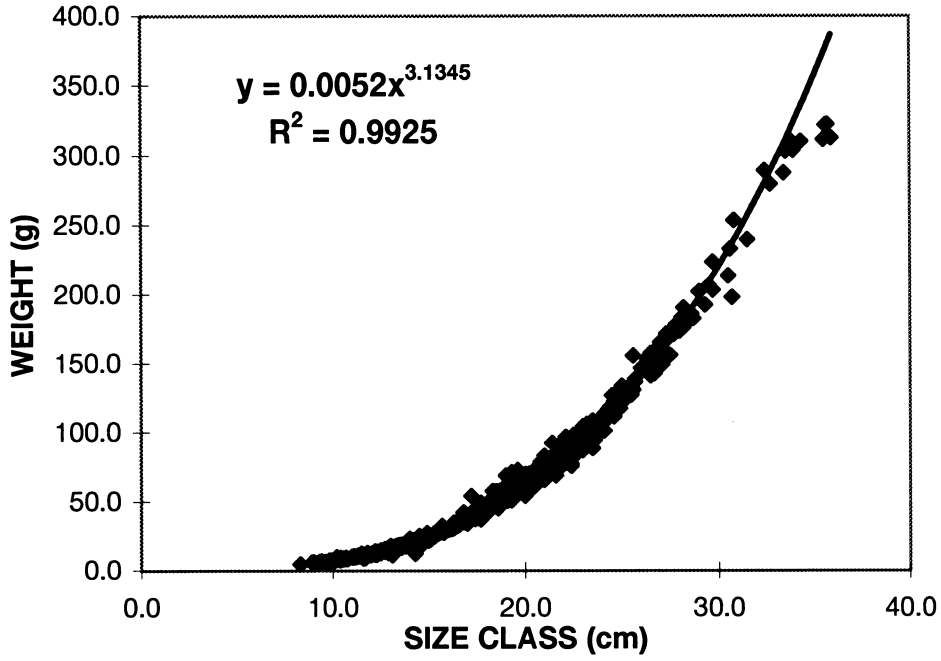
Sorted: 160 Kg Total catch: 919.86 CATCH/HOUR: 3679.44

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	3451.80	76708	93.81	4235
Raja alba	140.00	4	3.80	
Chelidonichthys capensis	19.64	96	0.53	
Atractoscion aequidens	18.36	40	0.50	
Merluccius capensis	16.40	116	0.45	4236
Callorhinchus capensis	13.68	4	0.37	
Raja straeleni	7.16	4	0.19	
Pterothrissus belloci	5.28	68	0.14	
Raja miraletus	3.68	4	0.10	
Galeichthys feliceps	2.00	12	0.05	
Lepidopus caudatus	0.76	20	0.02	
Loligo reynaudi	0.68	4	0.02	
Total	3679.44		99.98	

ANNEX IV : BIOLOGICAL DATA

Annex IV:

Length weight relationship of *Trachurus capensis*



Reproductive status of *Trachurus capensis*

Length class (cm)	Mean weight (g)	No. of fish	Weight range		percentage of fish per maturity stage						
			lowest	highest	1	2	3	4	5	6	7
8-8.9	5.3	2	4.6	6	100						
9-9.9	6.7	10	5.5	7.5	100						
10-10.9	8.2	25	6.8	10	100						
11-11.9	10.7	39	8.7	12.9	100						
12-12.9	13.8	45	11.2	16.9	100						
13-13.9	16.8	69	11	19.7	97	3					
14-14.9	21.4	62	12.3	27.4	83	15	2				
15-15.9	26.6	21	20.3	30.3		76	19	5			
16-16.9	34.6	22	29.5	42.2	9	45	36	10			
17-17.9	42.3	23	34.3	54		26	23	39		4	8
18-18.9	52	27	43	60.2	3	7	36	51	3		
19-19.9	59.4	40	50.5	72.8		10	43	37	10		
20-20.9	66.9	37	54.1	78.9		10	65	25			
21-21.9	67.4	47	65.6	92.4		17	58	21	4		
22-22.9	86.9	41	75.9	98.2		7	60	27	3	3	
23-23.9	98.8	17	86.9	108.7			65	30	5		
24-24.9	117.1	17	101.1	127			59	36	5		
25-25.9	134.5	9	124	155.8			56	33	11		
26-26.9	149	9	141.1	157.5			89	11			
27-27.9	166.2	15	149.3	178.2	6	7	40	40	7		
28-28.9	182.1	8	173.5	190.5			87	13			
29-29.9	204.9	6	173.9	199.5			17	49	17	17	
30-30.9	224.5	4	198.1	253.4			75	25			
31-31.9	239.6	1	239.6	239.6			100				
32-32.9	284.4	2	279.5	289.3				100			
33-33.9	301.3	4	287.7	320.4				75	25		
34-34.9	310.4	1	310.4	310.4			100				
35-35.9	317.3	4	311.8	322.4			25	75			

ANNEX IV Maturity Stages

The following seven stage scale was used in the investigation to determine reproductive stage of the horse mackerel during the **1997 June** hydro-acoustic horse mackerel survey.
Horse mackerel stages according to Hecht (1976) and modified in 1997.

JUVENILE/IMMATURE/SUB-ADULTS

0 UNKNOWN
Damaged fish; decayed.

1 JUVENILE
Not able to distinguish between male or female.
Approximately: 0.1 - 14 cm fish.

2 IMMATURE
Gonads are very small, less than half the body cavity length, and flattened or tubular i.e. thin and thread-like. The colour of the gonads is translucent. Sexes easy to distinguish.
Approximately: 14 - 20 cm fish.
Ovaries: Light orange gelatinous mass. Cannot sea eggs with the naked eye.
Testes: Translucent-white; thin, elongate balloon-like.

ADULT FISH

3 RECOVERING\INACTIVE
Gonads are slightly larger than stage 2, approximately half of body cavity length, but still generally flat. Colour more pronounced.
Ovaries: Pale reddish tint back to orange colour.
Testes: Creamy-white colour and very flat (lobe like) with sharp edges.

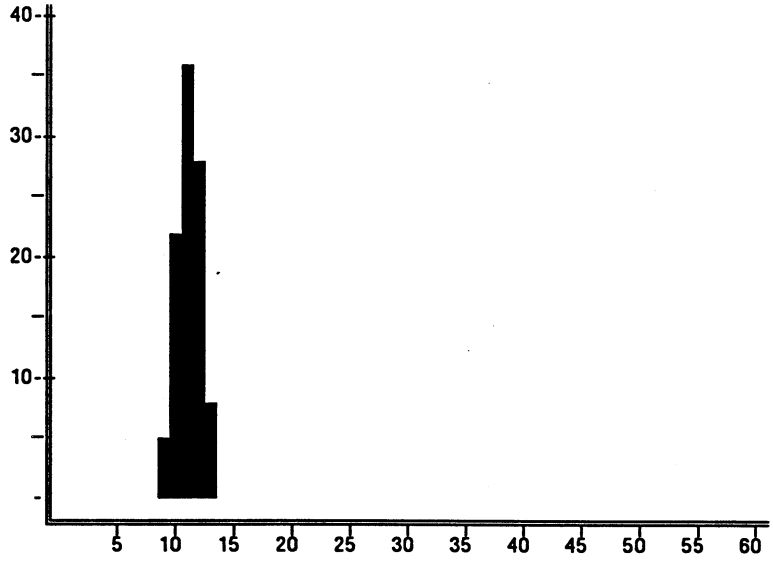
4 MATURING
Gonads longer than half body cavity length and becoming cylindrical.
Ovaries: Individual eggs clearly visible. Colour orange. Blood vessels marked. Spindle shaped.
Testes: White to cream/testes more swollen. Spindle shaped.

5 RIPE
Gonads very large, virtually filling body cavity, even causing distension of abdomen.
Ovaries: Individual eggs almost 0.5 mm or larger and lightly elongated. Ovary sac breaks realising eggs. Colour is a dark orange.
Testes: Cream, releases milt when punctured.

6 SPAWNING\RUNNING
Eggs or milt released through vent during handling i.e. running.
Ovaries: Ovary is dark orange and greatly swollen. Could also be partly spent.
Testis: External appearance changes from smooth structure to white and knob-like. Swollen to partly spent.

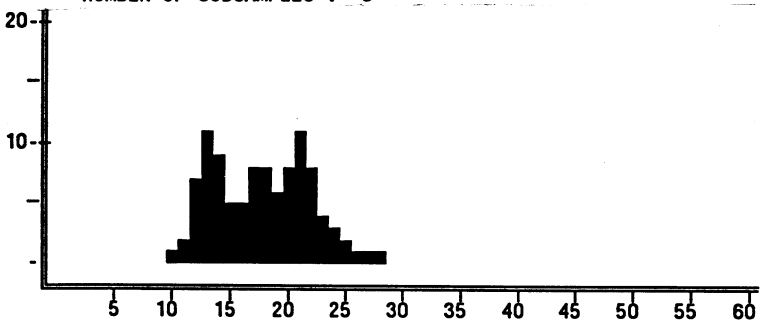
7 SPENT
Ovaries: Gonads flattened, but still elongated. Very blood-shot (dark red). Few eggs remaining appear grey\brown.
Testis: The testis are deflated and grey in colour.

DAY



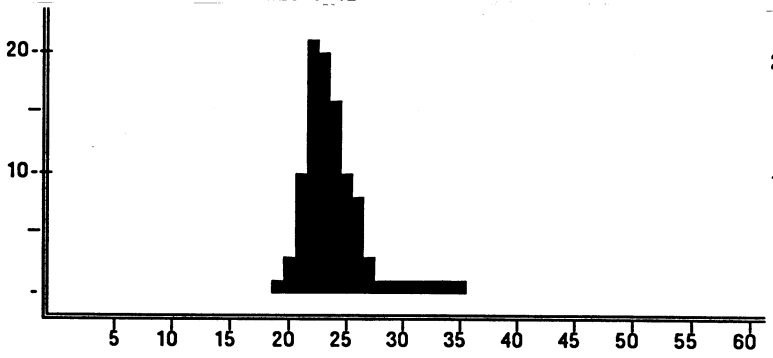
Trachurus capensis
Trachurus capensis:0 - 100m
Pooled sample (simple adding).

MEAN LENGTH = 11.62cm N= 808
NUMBER OF SUBSAMPLES : 6



Trachurus capensis
Trachurus capensis:101 - 200m
Pooled sample (simple adding).

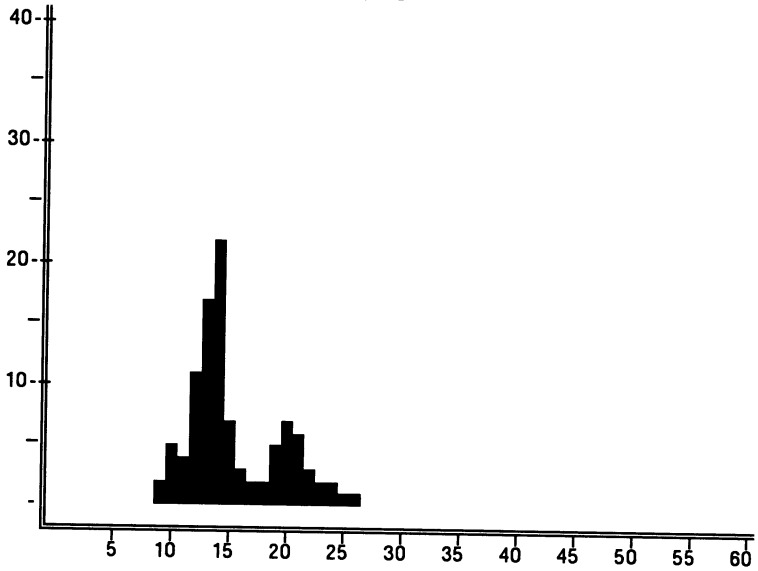
MEAN LENGTH = 18.33cm N= 1825
NUMBER OF SUBSAMPLES : 12



Trachurus capensis
Trachurus capensis:> 200+m
Pooled sample (simple adding).

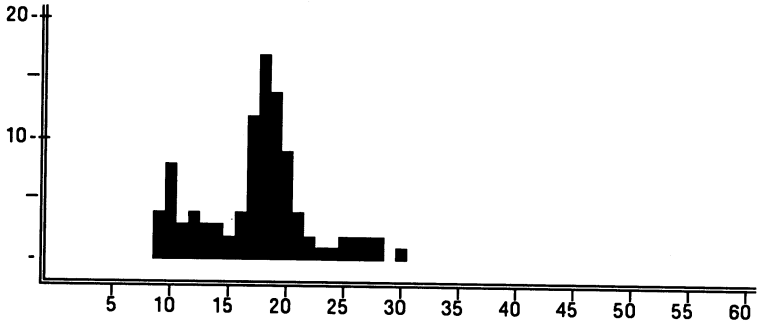
MEAN LENGTH = 24.40cm N= 343
NUMBER OF SUBSAMPLES : 4

NIGHT



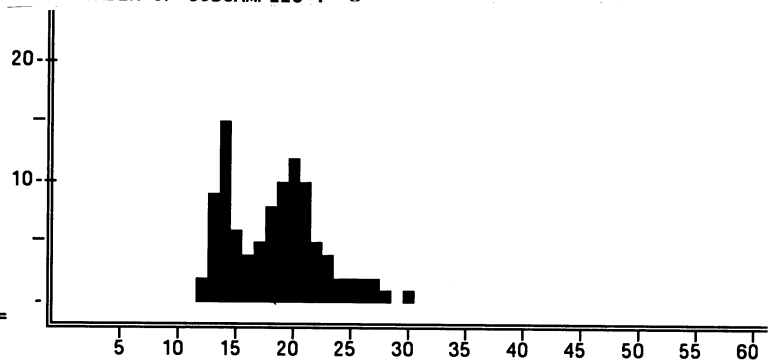
Trachurus capensis
Trachurus capensis: 0 - 100m
Pooled sample (simple adding).

MEAN LENGTH = 15.74cm N= 1181
NUMBER OF SUBSAMPLES : 11



Trachurus capensis
Trachurus capensis: 101- 200m
Pooled sample (simple adding).

MEAN LENGTH = 18.00cm N= 1267
NUMBER OF SUBSAMPLES : 6

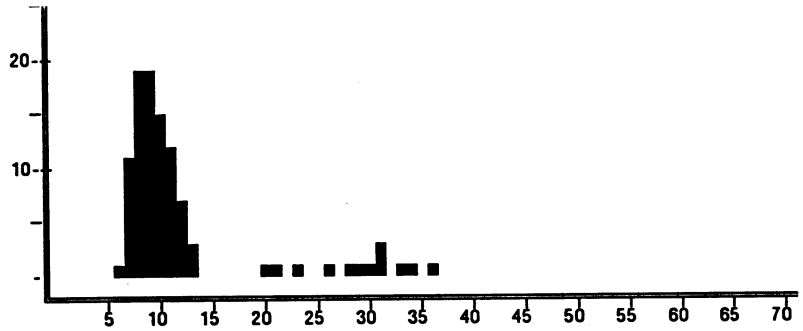


Trachurus capensis
Trachurus capensis: > 200m
Pooled sample (simple adding).

MEAN LENGTH = 18.99cm N= 2616
NUMBER OF SUBSAMPLES : 24

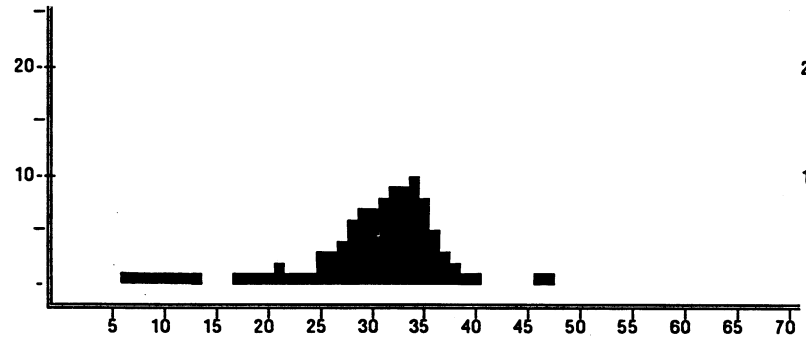
Annex 4: *Trachurus capensis* length distributions by depth range for day and night trawl stations.

DAY **NIGHT**



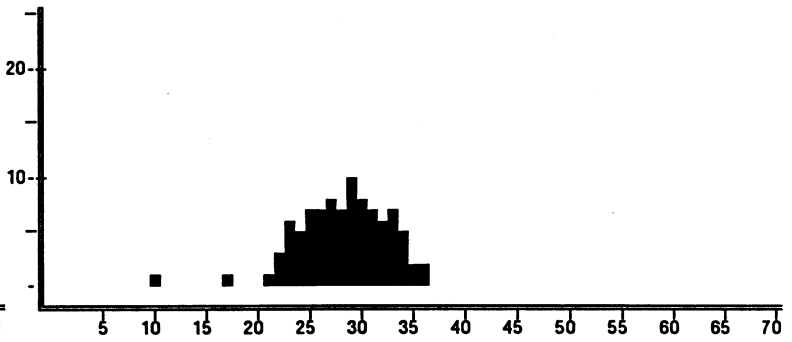
Merluccius capensis
Merlucius capensis:0 -100m
Pooled sample (simple adding).

MEAN LENGTH = 12.11cm N= 150
NUMBER OF SUBSAMPLES : 5



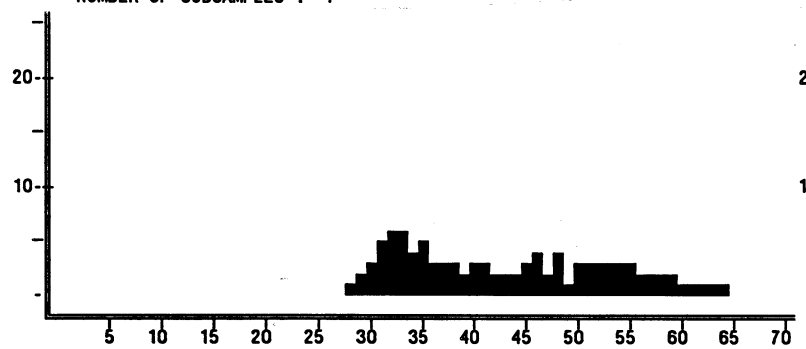
Merluccius capensis
Merlucius capensis: 101 - 200m
Pooled sample (simple adding).

MEAN LENGTH = 31.65cm N= 599
NUMBER OF SUBSAMPLES : 7



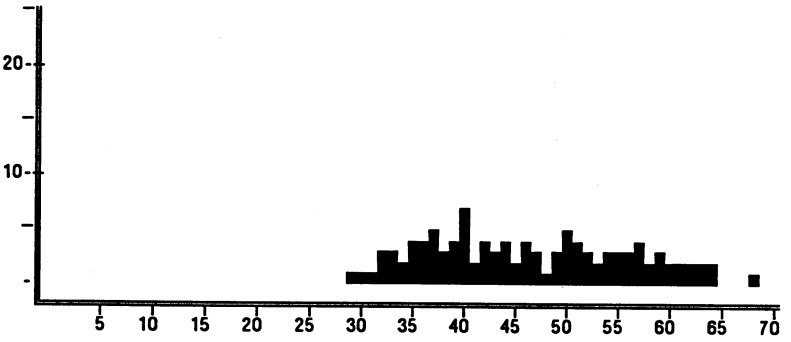
Merluccius capensis
Merlucius capensis: 101 - 200m
Pooled sample (simple adding).

MEAN LENGTH = 28.62cm N= 416
NUMBER OF SUBSAMPLES : 6



Merluccius capensis
Merlucius capensis: > 200m
Pooled sample (simple adding).

MEAN LENGTH = 43.90cm N= 931
NUMBER OF SUBSAMPLES : 6

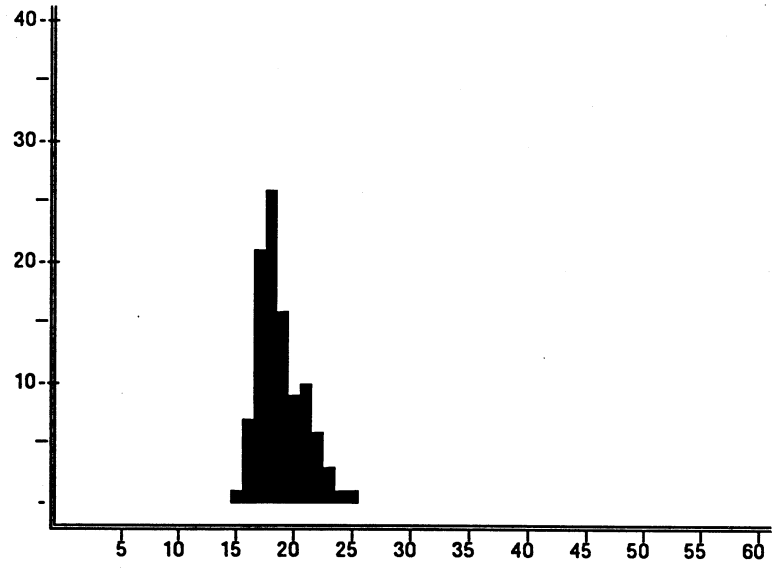


Merluccius capensis
Merluccius capensis: > 200m
Pooled sample (simple adding).

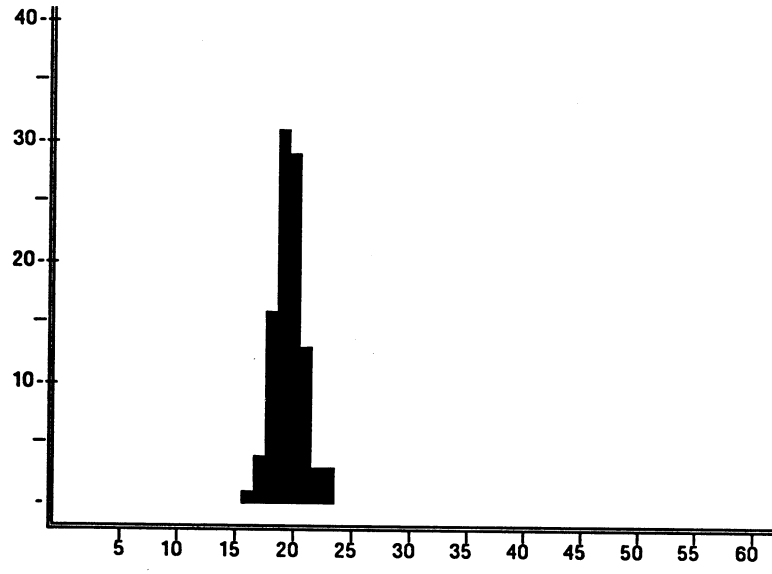
MEAN LENGTH = 46.67cm N= 194
NUMBER OF SUBSAMPLES : 2

Annex 4: *Merluccius capensis* length distributions by depth range for day and night trawl stations.

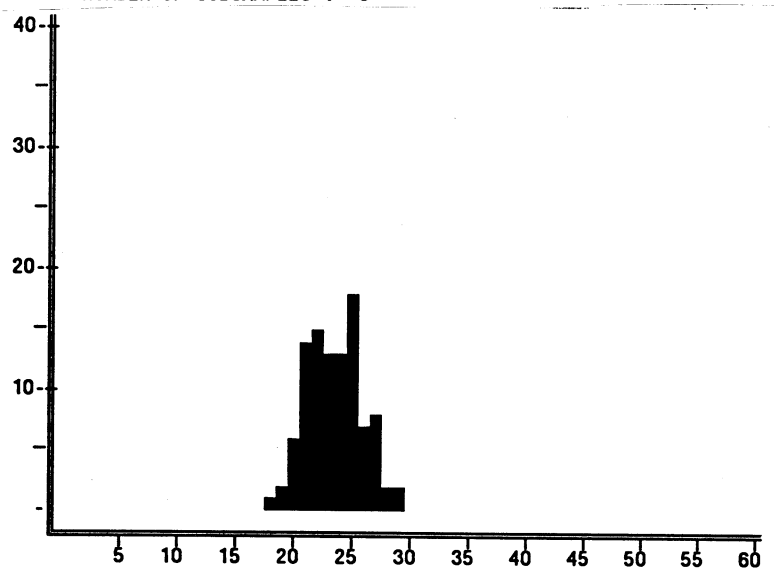
DAY **NIGHT**



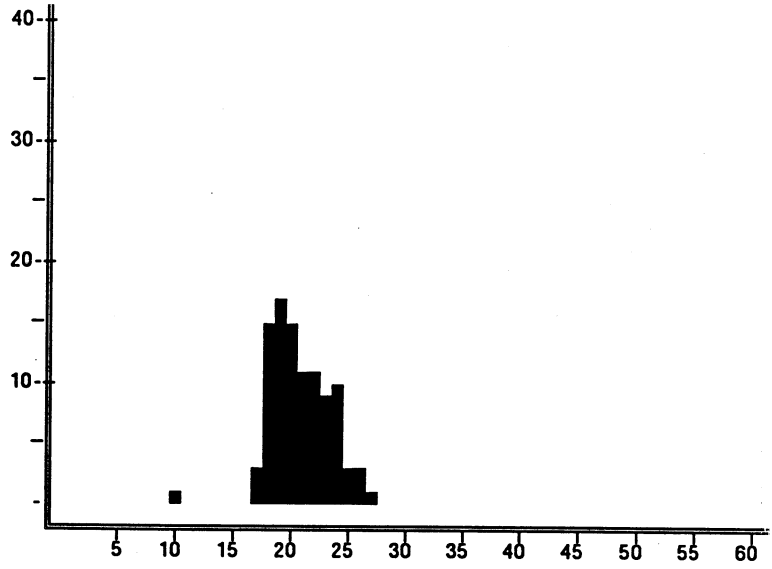
Dentex macrophthalmus
Dentex : 101 - 200m
Pooled sample (simple adding).
MEAN LENGTH = 19.25cm N= 732
NUMBER OF SUBSAMPLES : 5



Dentex macrophthalmus
Dentex : 101 -200m
Pooled sample (simple adding).
MEAN LENGTH = 20.01cm N= 289
NUMBER OF SUBSAMPLES : 2



Dentex macrophthalmus
Dentex : > 200m
Pooled sample (simple adding).
MEAN LENGTH = 23.97cm N= 106
NUMBER OF SUBSAMPLES : 3

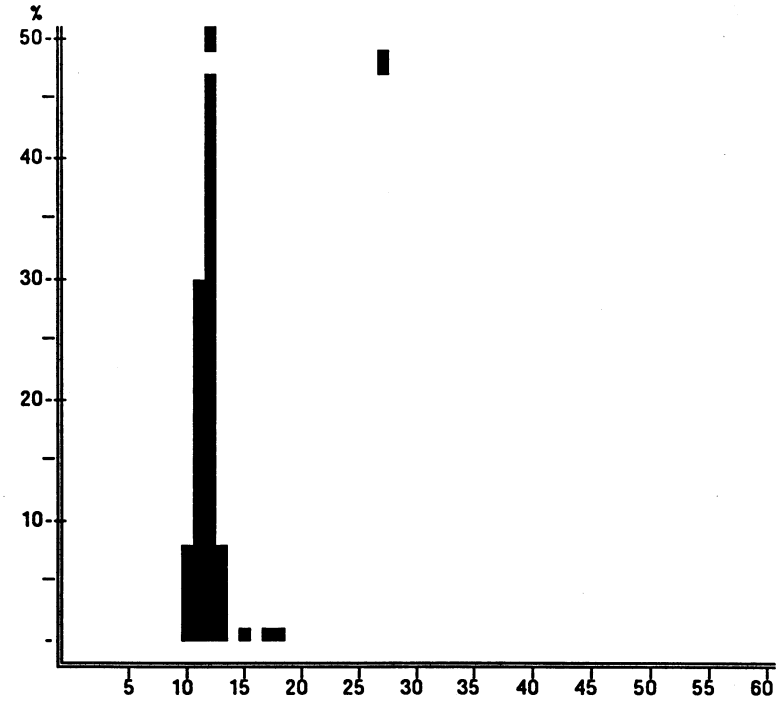


Dentex macrophthalmus
Dentex : > 200m
Pooled sample (simple adding).
MEAN LENGTH = 21.30cm N= 149
NUMBER OF SUBSAMPLES : 1

Annex 4: *Dentex macrophthalmus* length distributions by depth range for day and night trawl stations.

Annex 4.

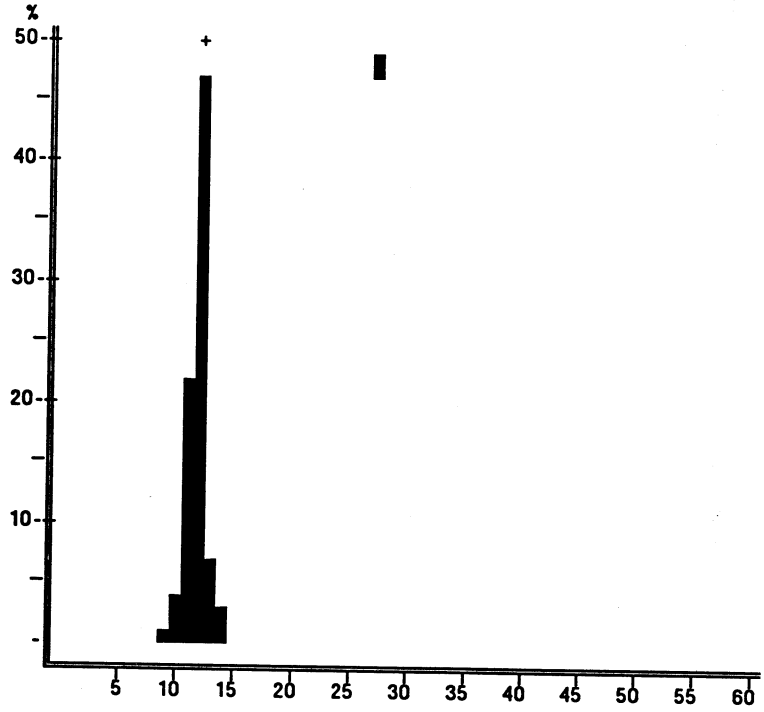
DAY



Etrumeus whiteheadi
Round herring : 0 - 100m
Pooled sample (simple adding).

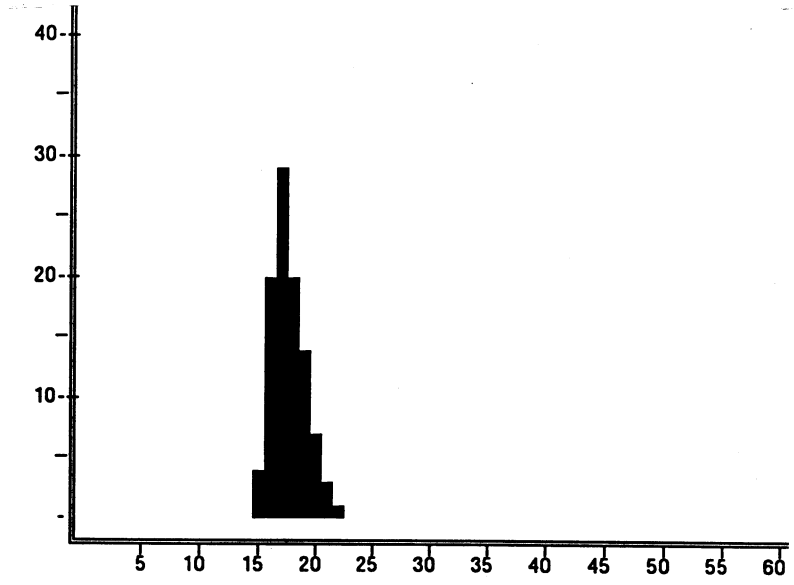
MEAN LENGTH = 12.22cm N= 328
NUMBER OF SUBSAMPLES : 6

NIGHT



Etrumeus whiteheadi
Round herring : 0 - 100m
Pooled sample (simple adding).

MEAN LENGTH = 12.30cm N= 98
NUMBER OF SUBSAMPLES : 3

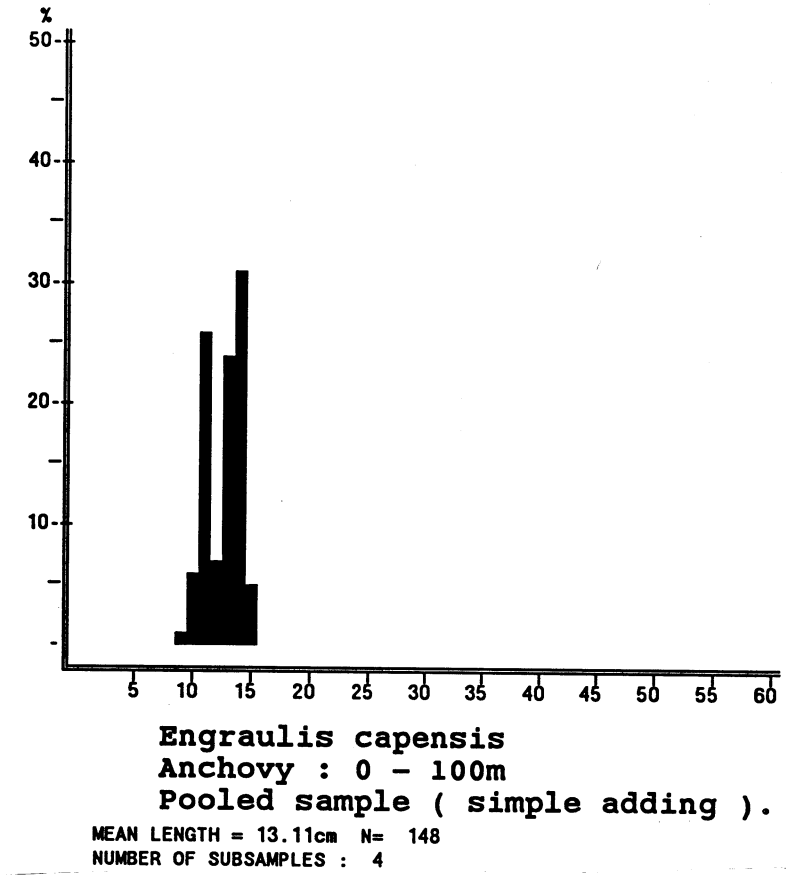


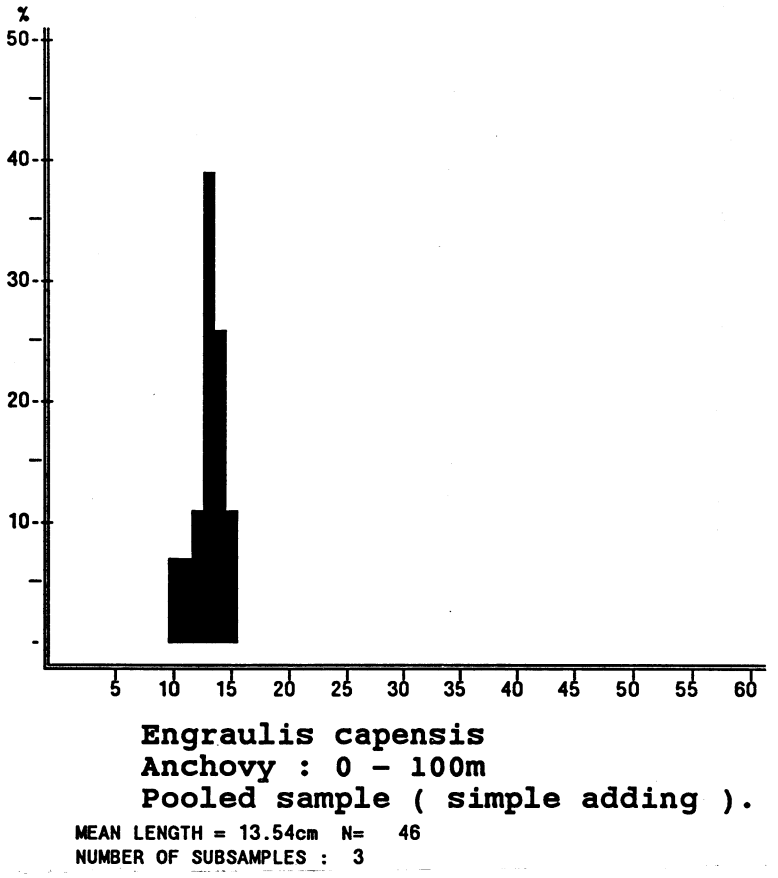
Etrumeus whiteheadi
Round herring : 101 - 200m
Pooled sample (simple adding).

MEAN LENGTH = 18.10cm N= 568
NUMBER OF SUBSAMPLES : 7

Figure : *Etrumeus whiteheadi* length distributions by depth range for day and night trawl stations.

DAY **NIGHT**

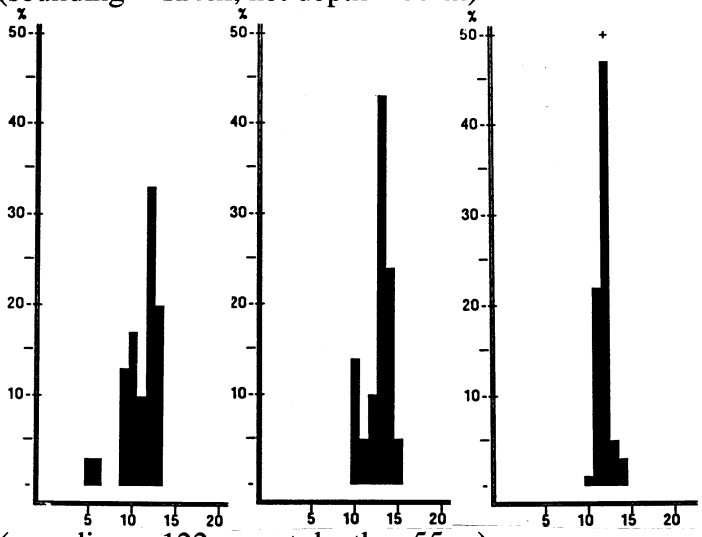




Annex 4: *Engraulis capensis* length distributions by depth range for day and night trawl stations.

Trachurus capensis	Engraulis capensis	Etrumeus whiteheadi

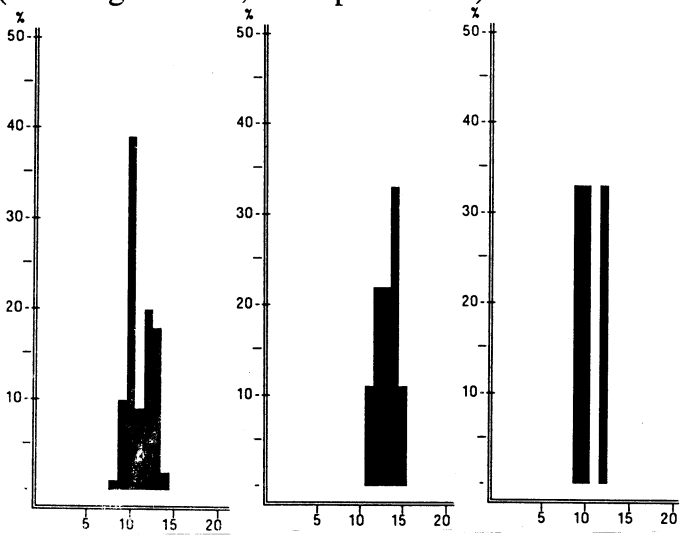
NET 3 (sounding = 120m, net depth = 33 m)



Trachurus capensis 24 %
Dentex macrophthalmus -
Engraulis capensis 21 %
Etrumeus whiteheadi 55 %
Merluccius capensis -

TOTAL CATCH (kg) 1.17

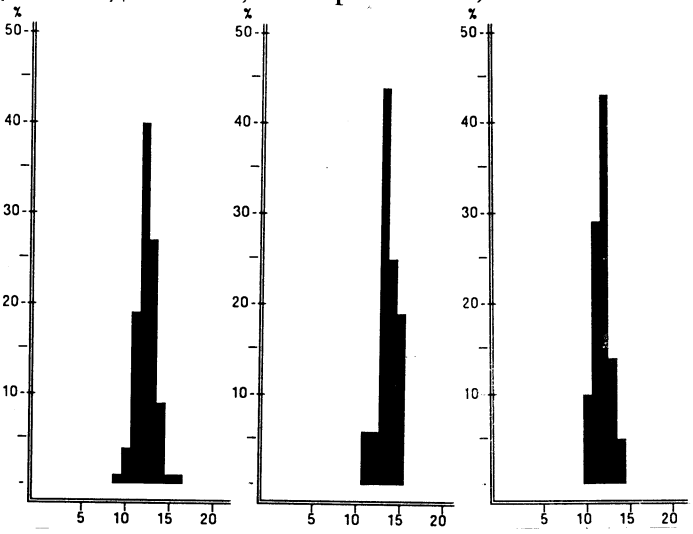
NET 2 (sounding = 122 m, net depth = 55 m)



Trachurus capensis 96 %
Dentex macrophthalmus -
Engraulis capensis 4 %
Etrumeus whiteheadi 1 %
Merluccius capensis -

TOTAL CATCH (kg) 3.36

NET 1 (sounding = 123 m, net depth = 90 m)



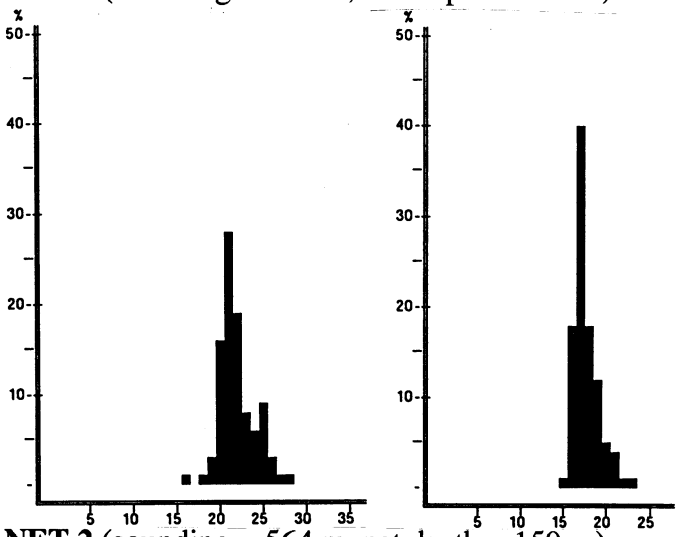
Trachurus capensis 94 %
Dentex macrophthalmus -
Engraulis capensis 1 %
Etrumeus whiteheadi 1 %
Merluccius capensis 2 %

TOTAL CATCH (kg) 65.51

Length and catch data from one set of Multisampler stations (stations 206, 207 and 208).

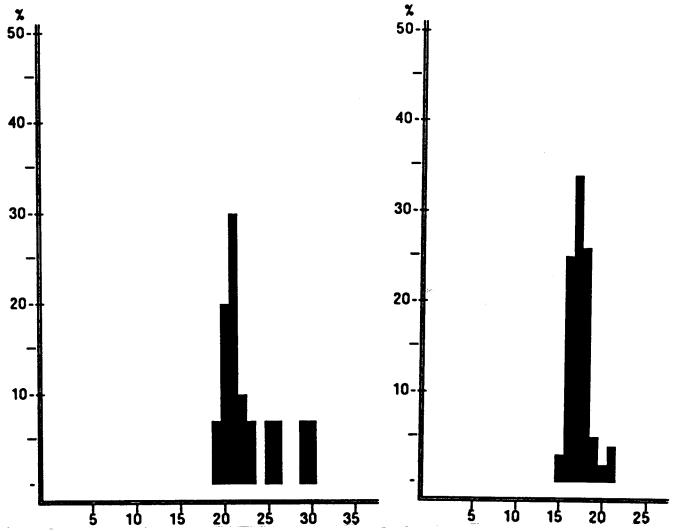
Trachurus capensis | **Etrumeus whiteheadi**

NET 3 (sounding = 566 m, net depth = 125 m)



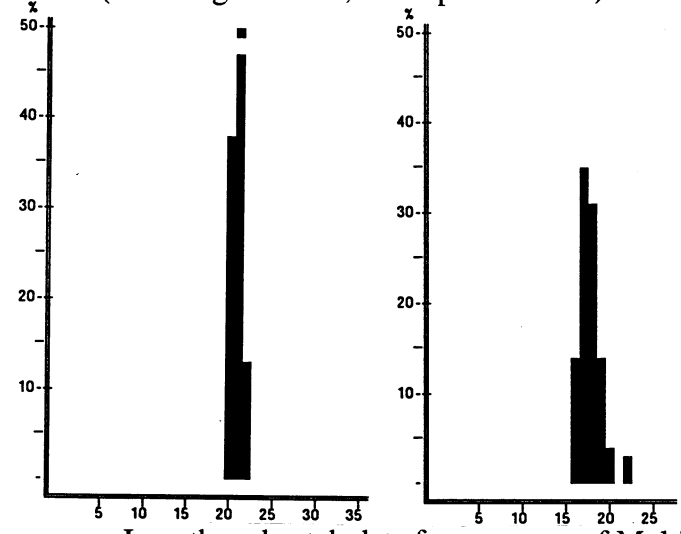
Trachurus capensis	8 %
Dentex macrophthalmus	-
Engraulis capensis	-
Etrumeus whiteheadi	77 %
Merluccius capensis	-
TOTAL CATCH (kg)	6.16

NET 2 (sounding = 564 m, net depth = 150 m)



Trachurus capensis	37 %
Dentex macrophthalmus	- %
Engraulis capensis	-
Etrumeus whiteheadi	42 %
Merluccius capensis	
TOTAL CATCH (kg)	6.69

NET 1 (sounding = 566 m, net depth = 150 m)

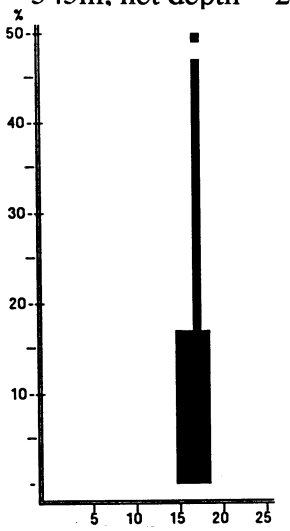


Trachurus capensis	77 %
Dentex macrophthalmus	-
Engraulis capensis	-
Etrumeus whiteheadi	12 %
Merluccius capensis	-
TOTAL CATCH (kg)	18.88

Length and catch data from one set of Multisampler stations (stations 227, 228 and 229)

Trachurus capensis **Etrumeus whiteheadi**

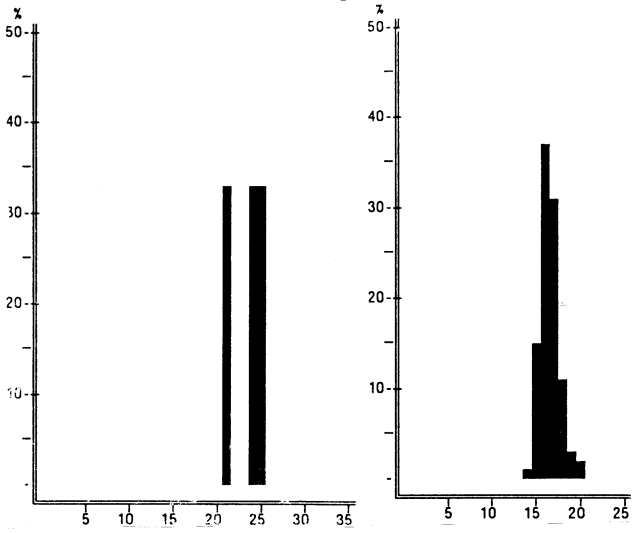
NET 3 (sounding = 343m, net depth = 25 m)



Trachurus capensis -
Dentex macrophthalmus -
Engraulis capensis -
Etrumeus whiteheadi 100 %
Merluccius capensis -

TOTAL CATCH (kg) 0.17

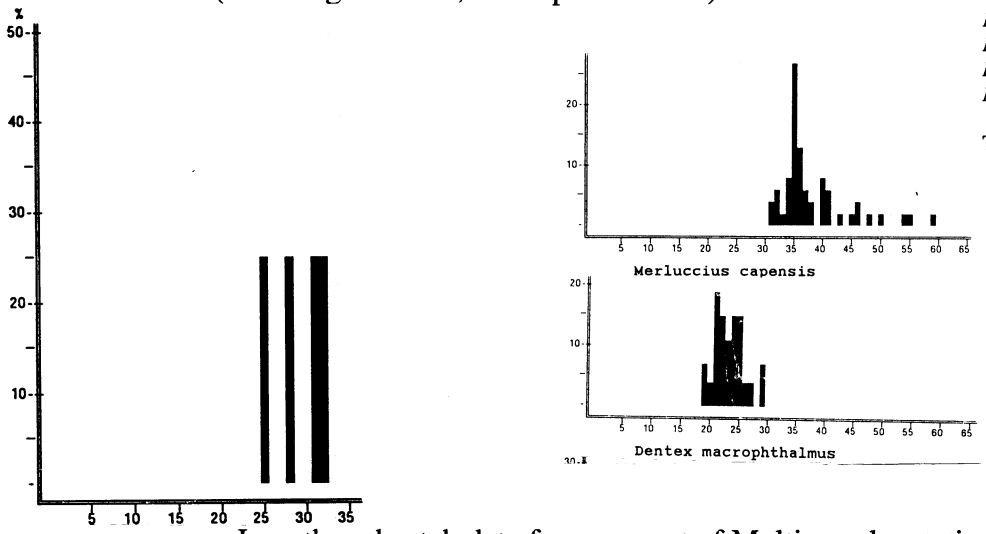
NET 2 (sounding = 328 m, net depth = 115 m)



Trachurus capensis 1%
Dentex macrophthalmus 1 %
Engraulis capensis -
Etrumeus whiteheadi 70 %
Merluccius capensis -

TOTAL CATCH (kg) 3.36

NET 1 (sounding = 328 m, net depth = 280 m)



Trachurus capensis 3 %
Dentex macrophthalmus 16 %
Engraulis capensis -
Etrumeus whiteheadi -
Merluccius capensis 76 %

TOTAL CATCH (kg) 30.42

Length and catch data from one set of Multisampler stations (stations 235, 236 and 237)

Lowest station: 203 Highest station: 252
Species code limits from CARTR04 To CARTR04

	CATCH KG/H	TOT.C KG/H	%OF TO
Sum of catch	17616.16	34401.86	51.21

Total number of stations where found: 44

Mean catch 352.32kg/hour

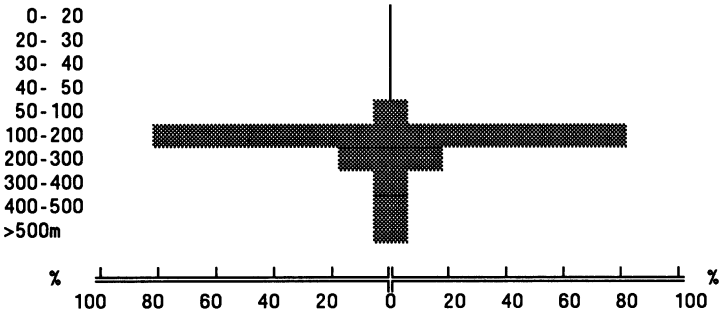
Catch distribution by classes (in kg or t /Hour):

0-30 kg	30-100	100-300	300-1000	1-3t	>3t
23	9	3	3	4	2

Mean catch Day: 315.78 n= 28 Night: 398.83 n= 22

Percent of total catch : 50.74
Means and percentages are based on all hauls within the limits specified.

DISTRIBUTION OF MEAN CATCH OF SELECTED SPECIES BY BOTTOM DEPTH
AS % OF SUM OF MEANS

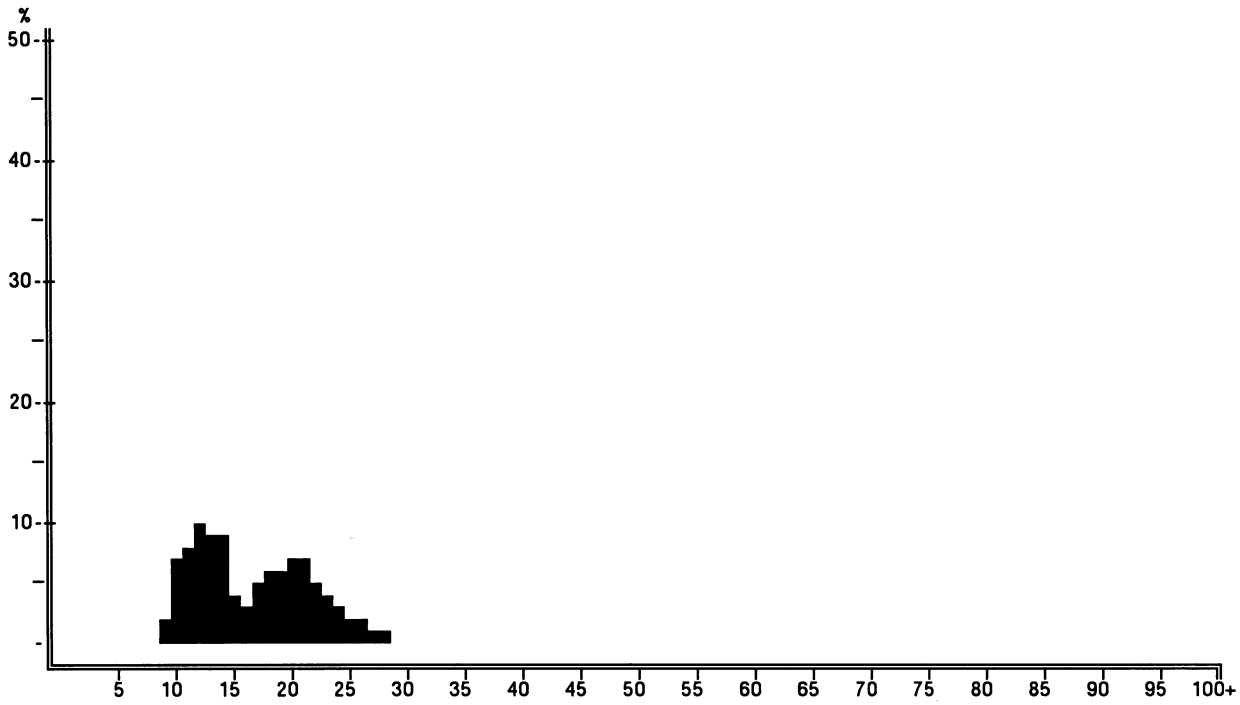


	MEAN C.	INCIDENCE	TOTN	TOT MEAN C.
0- 20				
20- 30				
30- 40				
40- 50				
50-100	10.40	1	1	64.70
100-200	626.85	23	26	878.93
200-300	106.68	8	10	745.25
300-400	14.77	7	8	286.49
400-500	16.50	2	2	943.23
>500m	29.92	3	3	57.32
Σ	352.32	44	50	694.39

Mean body weights by depth zones:		Variance in weight of catch by depth:
0- 20	kg	
20- 30	kg	
30- 40	kg	
40- 50	kg	
50-100	0.0071 kg	
100-200	0.0250 kg	1256094.54
200-300	0.0684 kg	47263.17
300-400	0.0473 kg	315.11
400-500	0.0655 kg	459.66
>500	0.0732 kg	1425.43

Grand body mean weight : 0.0262 kg by day: 0.0191 by night: 0.0419

Variance in selected		
total	catch of species	733918.42
day	catch of species	505507.56
night	catch of species	1058491.17



Trachurus capensis
HORSE MACKEREL:CUNENE RIVER
Pooled sample (simple adding).

MEAN LENGTH = 17.10cm N= 5397
NUMBER OF SUBSAMPLES : 40
SAMPLES FOUND BETWEEN ST. NO. 203 AND 251.
SAMPLES SEARCHED BETWEEN ST. NO. 203 AND 252 .

Number distribution in histogram

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
				2	2	7	7	208	654	771	967	934	873	393	311	539	617	621	671	682	495	358	254	191	156	94	74	30	31

31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
20	17	9	6	4	2		2																						

61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90

SUM OF CATCH ON SELECTED STATIONS BY SPECIES

Lowest station: 203 Highest station: 252
Species code limits from MERME04 To MERME04

	CATCH KG/H	TOT.C KG/H	%OF TO
Sum of catch	6694.73	31104.79	21.52

Total number of stations where found: 29

Mean catch 133.89kg/hour

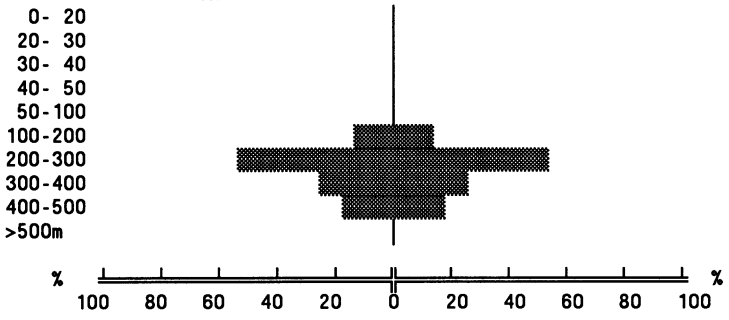
Catch distribution by classes (in kg or t /Hour):

0-30 kg	30-100	100-300	300-1000	1-3t	>3t
12	5	8	1	3	

Mean catch Day: 114.38 n= 28 Night: 158.73 n= 22

Percent of total catch : 19.28
Means and percentages are based on all hauls within the limits specified.

DISTRIBUTION OF MEAN CATCH OF SELECTED SPECIES BY BOTTOM DEPTH
AS % OF SUM OF MEANS

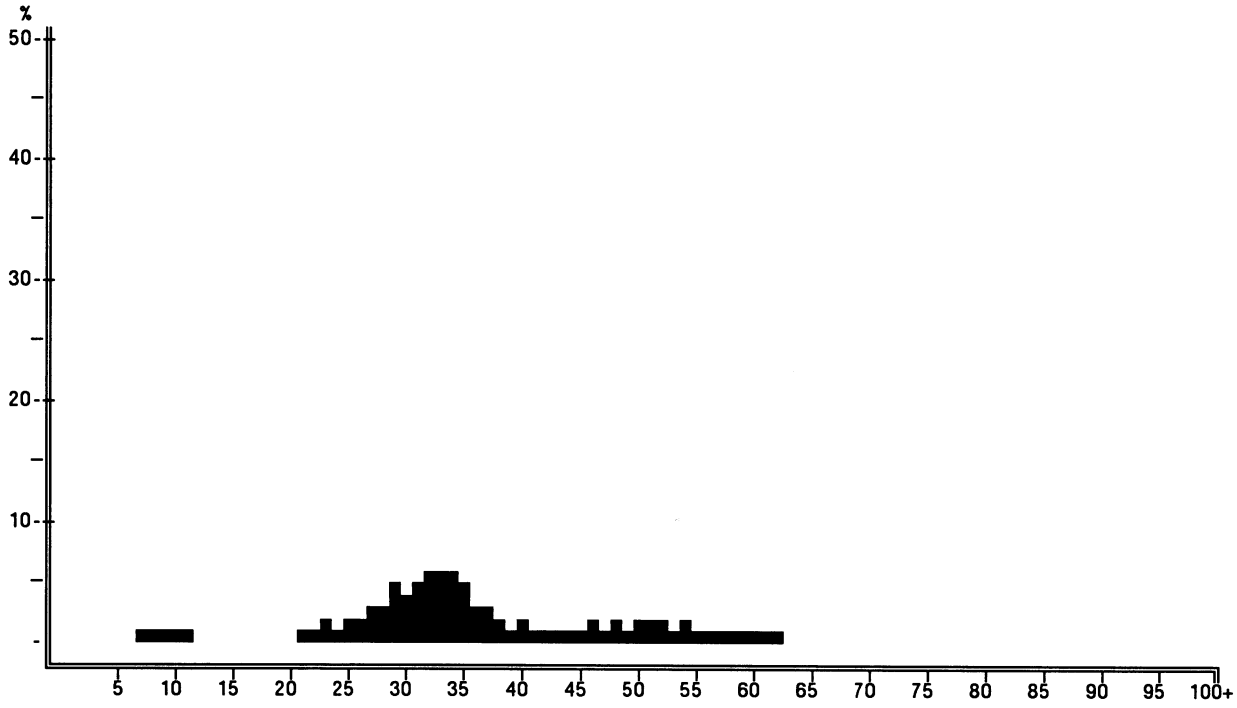


	MEAN C.	INCIDENCE	TOTN	TOT MEAN C.
50-100			1	64.70
100-200	80.17	17	26	878.93
200-300	326.05	6	10	745.25
300-400	144.70	4	8	286.49
400-500	96.15	2	2	943.23
>500m			3	57.32
Σ	133.89	29	50	694.39

Mean body weights by depth zones:			Variance in weight of catch by depth:
0- 20		kg	
20- 30		kg	
30- 40		kg	
40- 50		kg	
50-100		kg	
100-200	0.1126	kg	58508.83
200-300	0.6154	kg	405903.56
300-400	0.5829	kg	111206.17
400-500	0.6475	kg	6966.72
>500		kg	

Grand body mean weight : 0.2565 kg by day: 0.3736 by night: 0.1993

Variance in selected		
total	catch of species	131041.73
day	catch of species	85822.38
night	catch of species	194266.72



Merluccius capensis
MERLUCIUS CAPENSIS:Cunene Riv.
Pooled sample (simple adding).

MEAN LENGTH = 36.16cm N= 2261
NUMBER OF SUBSAMPLES : 25
SAMPLES FOUND BETWEEN ST. NO. 203 AND 251.
SAMPLES SEARCHED BETWEEN ST. NO. 203 AND 252 .

Number distribution in histogram

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
					9	75	137	137	124	88	44	40	4		9	35	27	31	44	71	88	150	124	195	226	270	305	469	442

31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
535	597	641	566	460	318	265	199	142	190	146	133	111	128	133	217	133	186	80	181	150	168	133	164	137	115	111	84	97	66

61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
62	71	49	40	13	18	4	4	4	4																				

SUM OF CATCH ON SELECTED STATIONS BY SPECIES

Lowest station: 203 Highest station: 252
Species code limits from MERME09 To MERME09

	CATCH KG/H	TOT.C KG/H	%OF TO
Sum of catch	576.73	3667.60	15.73

Total number of stations where found: 3

Mean catch 11.77kg/hour

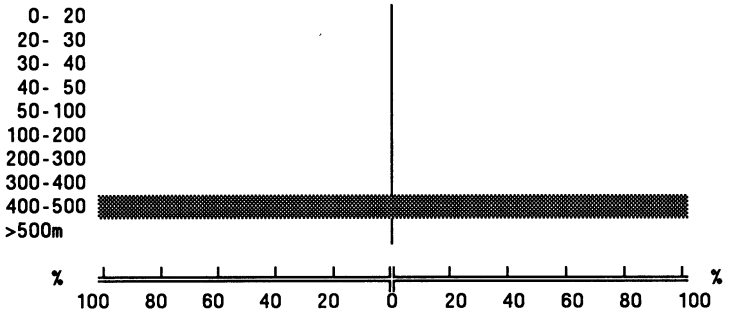
Catch distribution by classes (in kg or t /Hour):

0-30 kg	30-100	100-300	300-1000	1-3t	>3t
1		1	1		

Mean catch Day: 6.73 n= 28 Night: 18.49 n= 21

Percent of total catch : 1.86
Means and percentages are based on all hauls within the limits specified.

DISTRIBUTION OF MEAN CATCH OF SELECTED SPECIES BY BOTTOM DEPTH



	MEAN C.	INCIDENCE	TOTN	TOT MEAN C.
0- 20				
20- 30				
30- 40				
40- 50				
50-100			1	64.70
100-200			25	766.91
200-300			10	745.25
300-400	0.77	1	8	286.49
400-500	285.27	2	2	943.23
>500m			3	57.32
Σ	11.77	3	49	633.47

Mean body weights by depth zones:

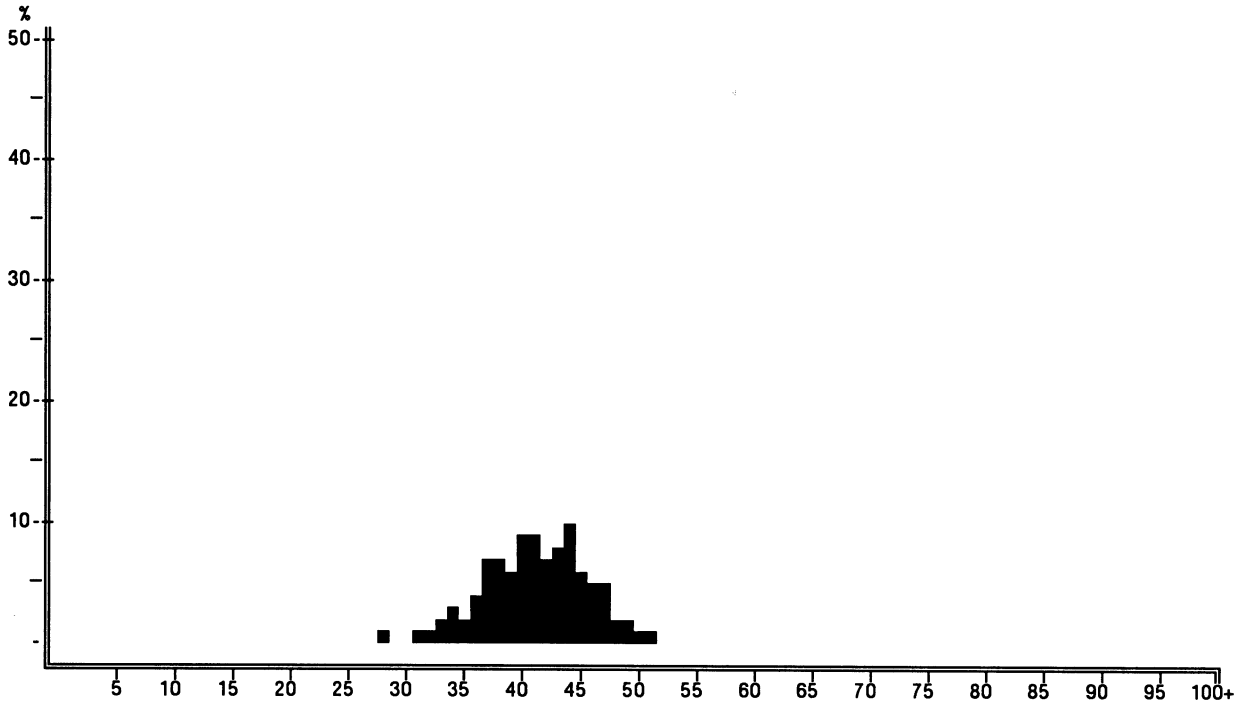
0- 20		kg
20- 30		kg
30- 40		kg
40- 50		kg
50-100		kg
100-200		kg
200-300		kg
300-400	0.1587	kg
400-500	0.4024	kg
>500		kg

Variance in weight of catch by depth:

300-400	4.79
400-500	21246.85

Grand body mean weight : 0.3958 kg by day: 0.3407 by night: 0.4296

Variance in selected	total catch of species	3692.81
	day catch of species	1183.99
	night catch of species	7181.33



Merluccius paradoxus
MERLUCIUS PARADOXIS:Cunene Riv
Pooled sample (simple adding).

MEAN LENGTH = 41.56cm N= 435
NUMBER OF SUBSAMPLES : 3
SAMPLES FOUND BETWEEN ST. NO. 220 AND 249.
SAMPLES SEARCHED BETWEEN ST. NO. 203 AND 252 .

Number distribution in histogram

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
																										23	92	46	23

31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
115	69	230	253	184	437	667	736	598	943	943	690	782	966	552	529	460	230	184	69	69	46		23	46					

61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90

SUM OF CATCH ON SELECTED STATIONS BY SPECIES

Lowest station: 203 Highest station: 252
Species code limits from CLUET02 To CLUET02

	CATCH KG/H	TOT.C KG/H	%OF TO
Sum of catch	564.94	9121.91	6.19

Total number of stations where found: 21

Mean catch 11.53kg/hour

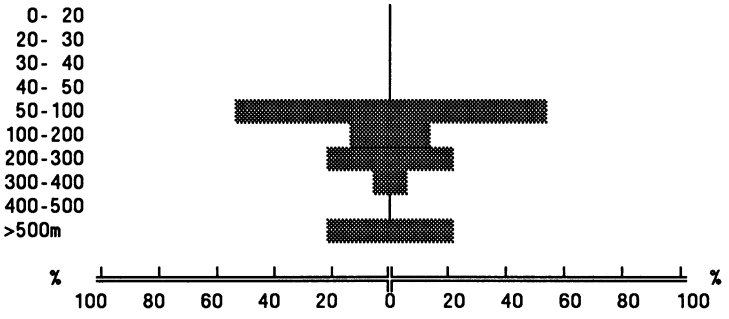
Catch distribution by classes (in kg or t /Hour):

0-30 kg	30-100	100-300	300-1000	1-3t	>3t
15	3	3			

Mean catch Day: 15.83 n= 28 Night: 5.80 n= 21

Percent of total catch : 1.82
Means and percentages are based on all hauls within the limits specified.

DISTRIBUTION OF MEAN CATCH OF SELECTED SPECIES BY BOTTOM DEPTH



	MEAN C.	INCIDENCE	TOTN	TOT MEAN C.
50-100	52.05	1	1	64.70
100-200	9.52	10	25	766.91
200-300	20.79	5	10	745.25
300-400	1.12	2	8	286.49
400-500			2	943.23
>500m	19.36	3	3	57.32
Σ	11.53	21	49	633.47

Mean body weights by depth zones:

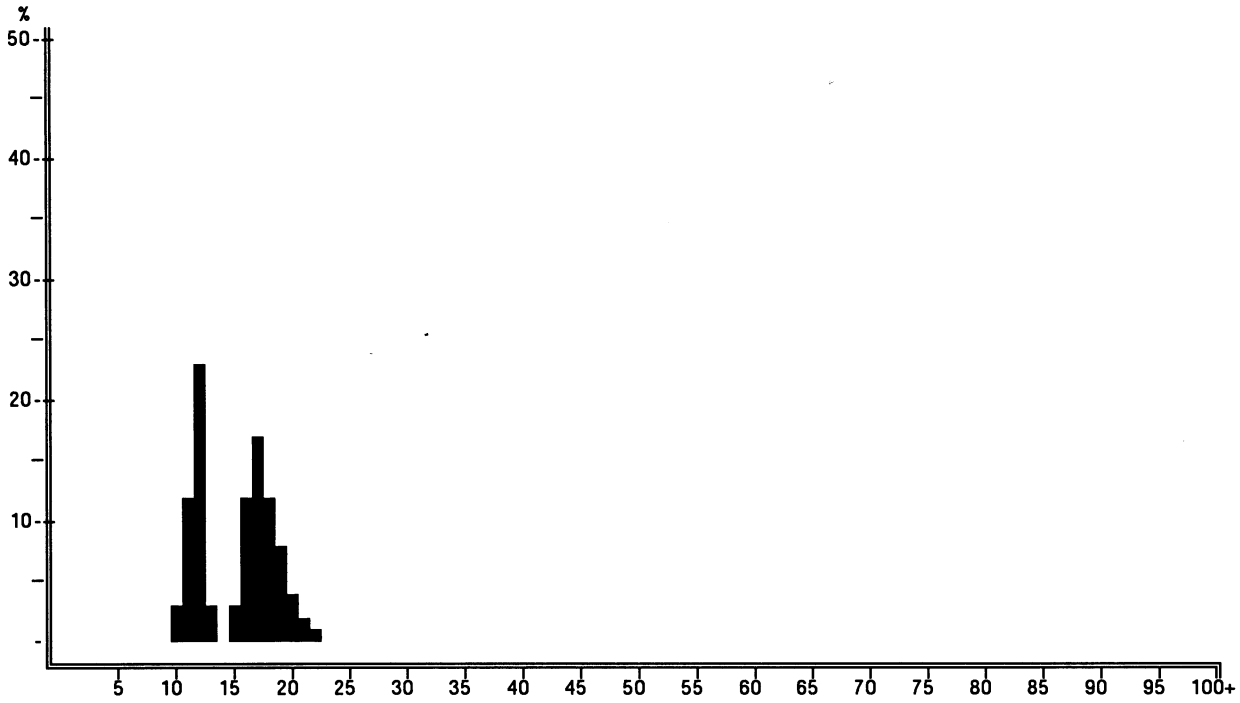
0- 20		kg
20- 30		kg
30- 40		kg
40- 50		kg
50-100	0.0076	kg
100-200	0.0085	kg
200-300	0.0400	kg
300-400	0.0284	kg
400-500		kg
>500	0.0290	kg

Variance in weight of catch by depth:

100-200	905.95
200-300	2539.40
300-400	7.90
>500	121.08

Grand body mean weight : 0.0133 kg by day: 0.0160 by night: 0.0083

Variance in selected total	catch of species	1016.91
day	catch of species	1290.90
night	catch of species	637.55



Etrumeus whiteheadi
RED EYE:CUNENE RIVER
Pooled sample (simple adding).

MEAN LENGTH = 15.59cm N= 994
NUMBER OF SUBSAMPLES : 16
SAMPLES FOUND BETWEEN ST. NO. 204 AND 247.
SAMPLES SEARCHED BETWEEN ST. NO. 203 AND 252 .

Number distribution in histogram

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
								20	30	21	27	29	4	33	2	27	21	57	17	00	11	87	795	423	181	60	10		

31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60

61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90

SUM OF CATCH ON SELECTED STATIONS BY SPECIES

Lowest station: 203 Highest station: 252
Species code limits from ENGEN04 To ENGEN04

	CATCH KG/H	TOT.C KG/H	%OF TO
Sum of catch	107.54	4372.79	2.46

Total number of stations where found: 10

Mean catch 2.19kg/hour

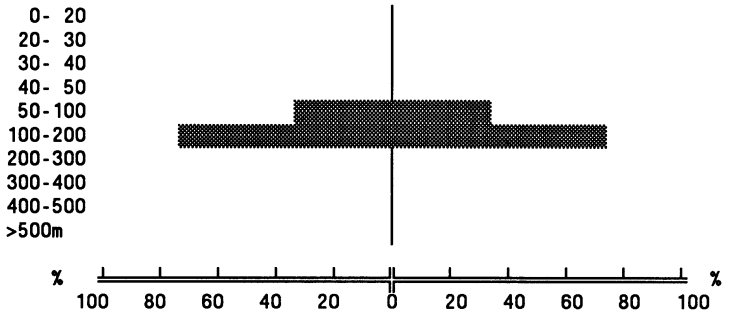
Catch distribution by classes (in kg or t /Hour):

0-30 kg	30-100	100-300	300-1000	1-3t	>3t
8	2				

Mean catch Day: 2.05 n= 28 Night: 2.39 n= 21

Percent of total catch : 0.35
Means and percentages are based on all hauls within the limits specified.

DISTRIBUTION OF MEAN CATCH OF SELECTED SPECIES BY BOTTOM DEPTH



	MEAN C.	INCIDENCE	TOTN	TOT MEAN C.
50-100	1.80	1	1	64.70
100-200	4.23	9	25	766.91
200-300			10	745.25
300-400			8	286.49
400-500			2	943.23
>500m			3	57.32
Σ	2.19	10	49	633.47

Mean body weights by depth zones:

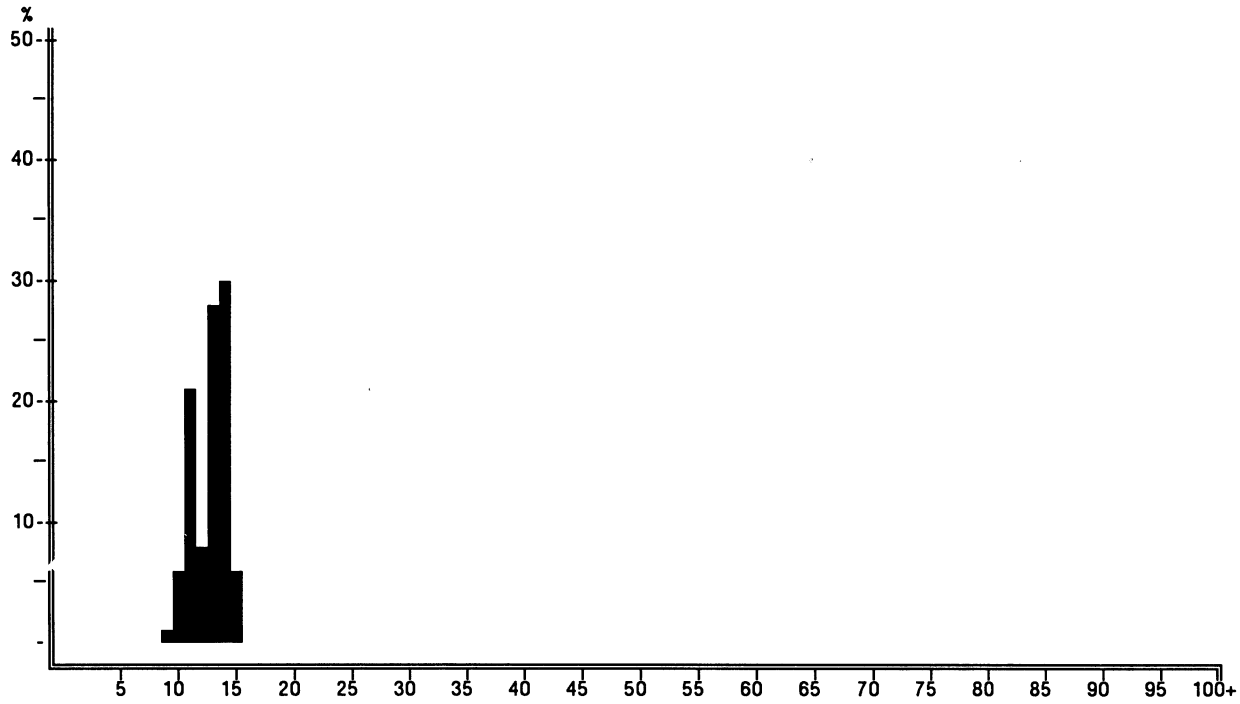
0- 20		kg
20- 30		kg
30- 40		kg
40- 50		kg
50-100	0.0088	kg
100-200	0.0187	kg
200-300		kg
300-400		kg
400-500		kg
>500		kg

Variance in weight of catch by depth:

100-200	162.06

Grand body mean weight : 0.0184 kg by day: 0.0118 by night: 0.0504

Variance in selected total	catch of species	85.50
day	catch of species	90.25
night	catch of species	83.30



Engraulis capensis
ANCHOVY : CUNENE RIVER
Pooled sample (simple adding).

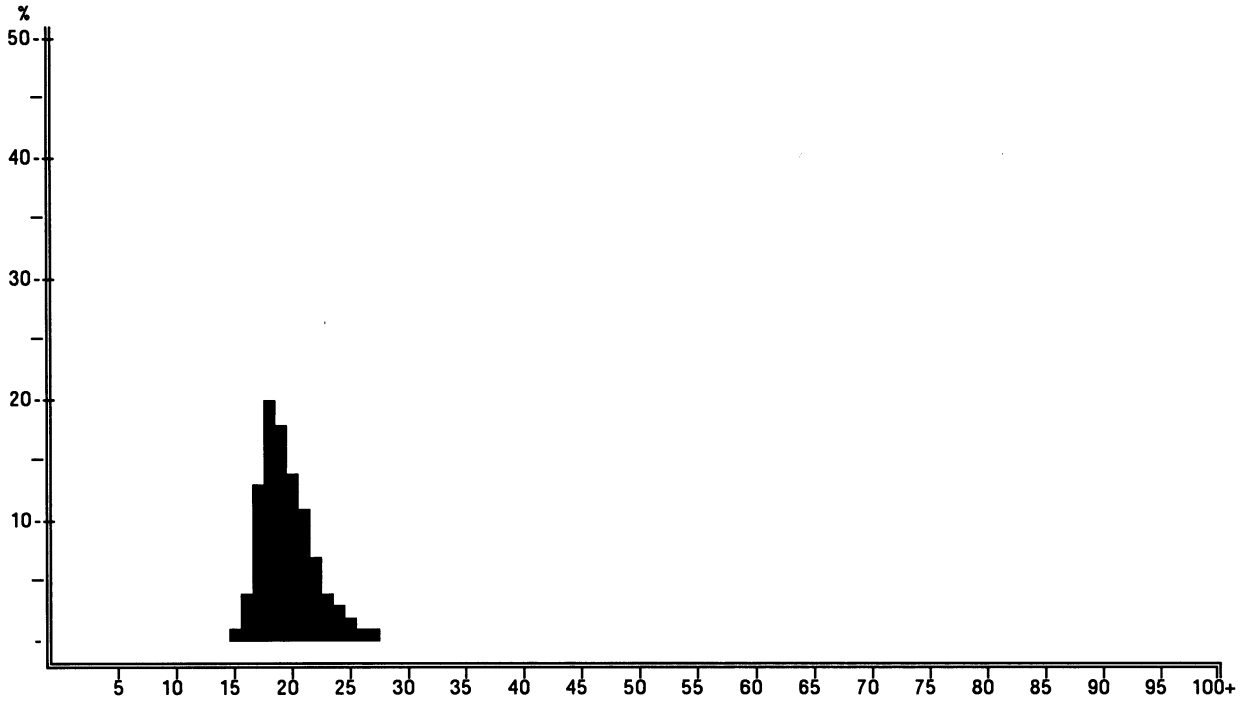
MEAN LENGTH = 13.21cm N= 194
NUMBER OF SUBSAMPLES : 7
SAMPLES FOUND BETWEEN ST. NO. 206 AND 218.
SAMPLES SEARCHED BETWEEN ST. NO. 203 AND 252 .

Number distribution in histogram

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
								52	61	92	113	82	52	78	42	99	0	61	9										

31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60

61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90



Dentex macrophthalmus
Dentex macropthalmus
Pooled sample (simple adding).

MEAN LENGTH = 20.05cm N= 1276
NUMBER OF SUBSAMPLES : 11
SAMPLES FOUND BETWEEN ST. NO. 210 AND 250.
SAMPLES SEARCHED BETWEEN ST. NO. 203 AND 252 .

Number distribution in histogram

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
									8					63	39	21	33	22	03	01	81	41	44	66	43	92	66	21	96	96	16	16	

31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60

61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90

91	92	93	94	95	96	97	98	99	100

SUM OF CATCH ON SELECTED STATIONS BY SPECIES

Lowest station: 203 Highest station: 252
Species code limits from SPADE03 To SPADE03

	CATCH KG/H	TOT.C KG/H	%OF TO
Sum of catch	4336.90	15741.25	27.55

Total number of stations where found: 17

Mean catch 86.74kg/hour

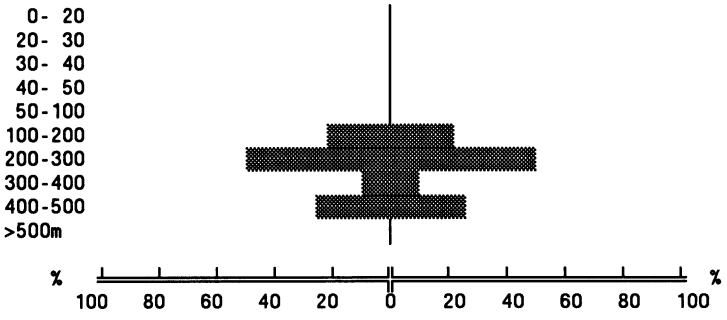
Catch distribution by classes (in kg or t /Hour):

0-30 kg	30-100	100-300	300-1000	1-3t	>3t
4	1	8	3	1	

Mean catch Day: 45.48 n= 28 Night: 139.25 n= 22

Percent of total catch : 12.49
Means and percentages are based on all hauls within the limits specified.

DISTRIBUTION OF MEAN CATCH OF SELECTED SPECIES BY BOTTOM DEPTH



	MEAN C.	INCIDENCE	TOTN	TOT MEAN C.
50-100			1	64.70
100-200	74.84	7	26	878.93
200-300	191.83	4	10	745.25
300-400	35.21	4	8	286.49
400-500	95.58	2	2	943.23
>500m			3	57.32
Σ	86.74	17	50	694.39

	Mean body weights by depth zones:		Variance in weight of catch by depth:
0- 20		kg	
20- 30		kg	
30- 40		kg	
40- 50		kg	
50-100		kg	
100-200	0.0857	kg	20761.41
200-300	0.1197	kg	199510.56
300-400	0.2211	kg	4772.63
400-500	0.1133	kg	17975.97
>500		kg	

Grand body mean weight : 0.1041 kg by day: 0.1220 by night: 0.0981

Variance in selected	total catch of species	51665.94
	day catch of species	7192.37
	night catch of species	106147.49

ANNEX V: ECHO TRACES

250 10 1967

NIGHT

250 10 1967

GEAR DEPTH: 110m

PT 211

250 10 1967

(ANNEX II)

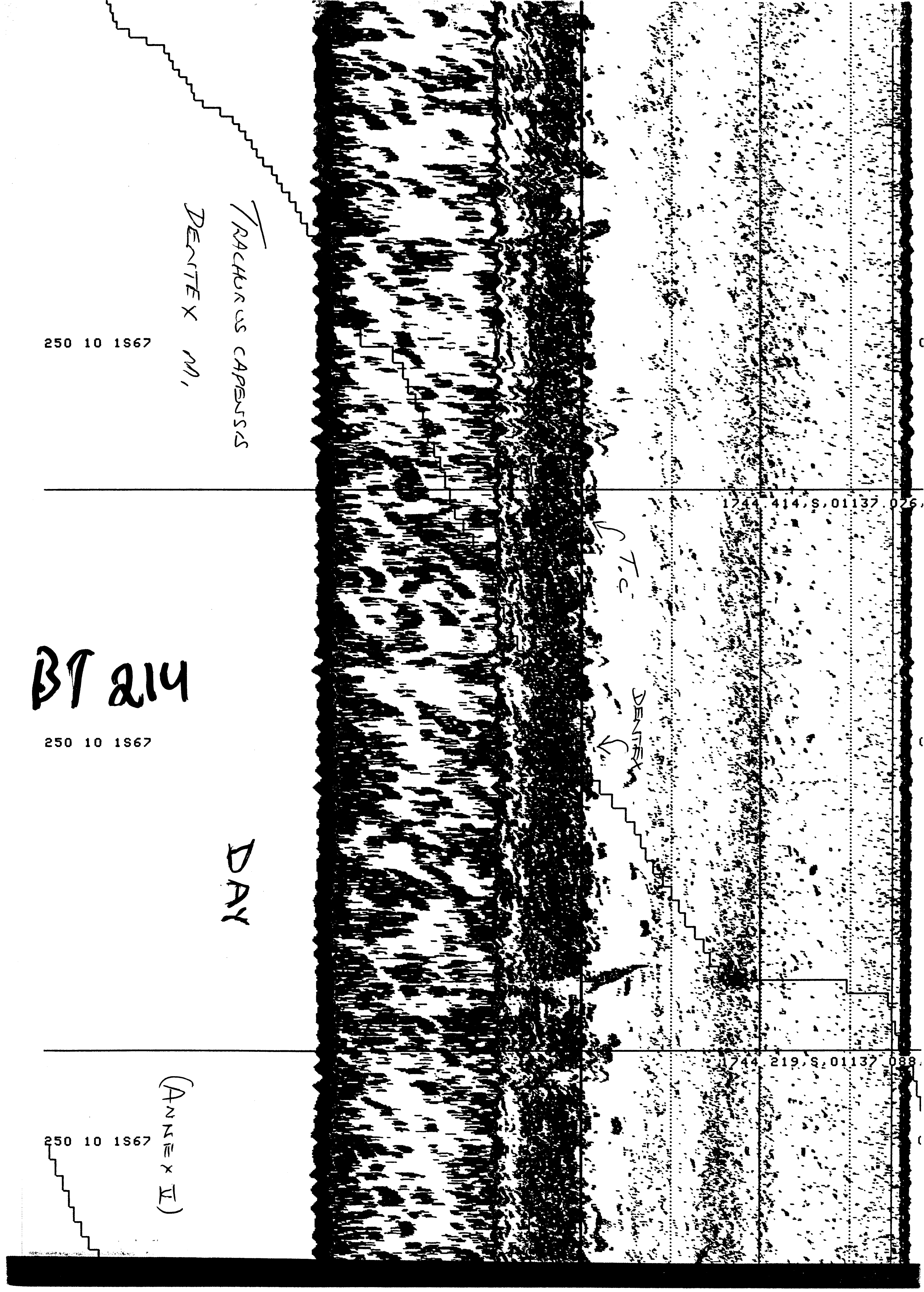
Close

T.C

E.C
E.W
T.C

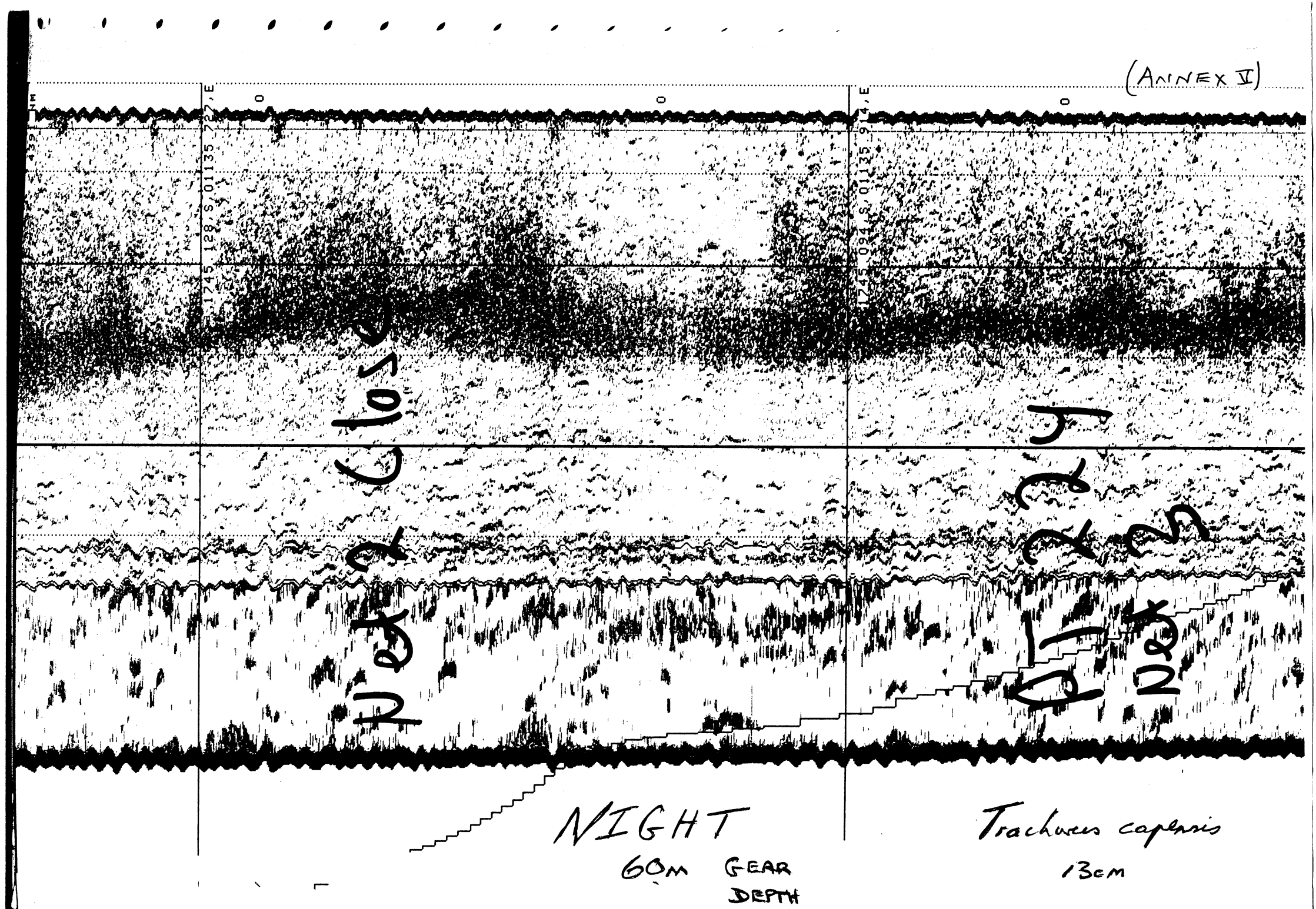
1745 471 S 01134 009

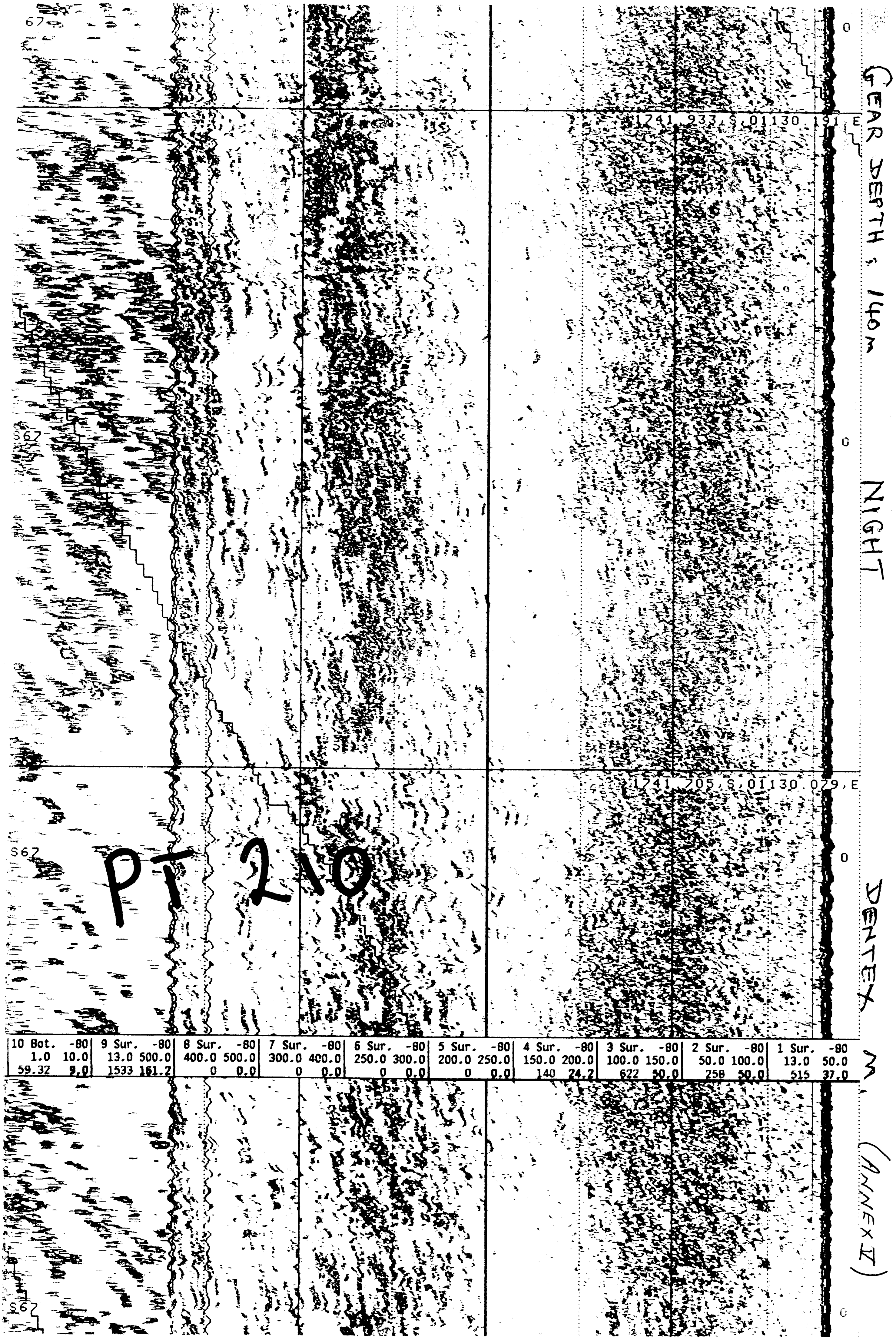
1745 283 S 01133 789



Trachurus capensis
Dentex M.
250 10 1S67
1744.414,S,01137.026
T.C.
Dentex
BT 214
250 10 1S67
DAY
1744.219,S,01137.088
250 10 1S67
(Annex I)

(ANNEX II)




GEAR DEPTH : 140m NIGHT DENTEX M (ANNEX V)
PT 210
1241 933 S 01130 191 E
1241 705 S 01130 029 E
10 Bot. -80 1.0 10.0 59.32 9.0
9 Sur. -80 13.0 500.0 1533 161.2
8 Sur. -80 400.0 500.0 0 0.0
7 Sur. -80 300.0 400.0 0 0.0
6 Sur. -80 250.0 300.0 0 0.0
5 Sur. -80 200.0 250.0 0 0.0
4 Sur. -80 150.0 200.0 140 24.2
3 Sur. -80 100.0 150.0 622 50.0
2 Sur. -80 50.0 100.0 258 50.0
1 Sur. -80 13.0 50.0 515 37.0