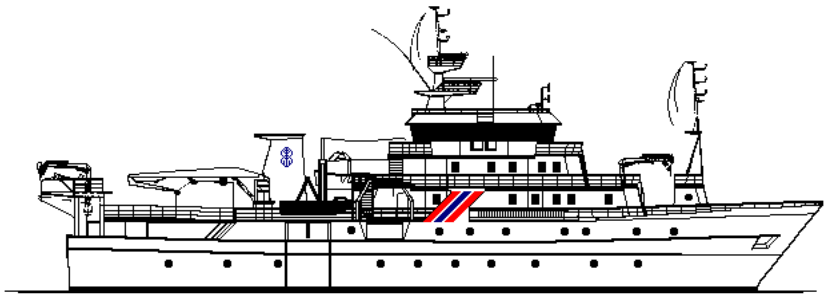

BCLME SURVEY NO. 3 2005

TRANSBOUNDARY SURVEY BETWEEN NAMIBIA AND SOUTH AFRICA WITH FOCUS ON SPAWNING AND THE EARLY LIFE HISTORY OF HAKES

Cruise Report No 10 2005

26 September – 17 October 2005

by

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Bergen, January 2006

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1 Introduction

Given the importance of *Merluccius paradoxus* for the South-African and Namibian fisheries surprisingly little is known about the early life stages of the species. There are anecdotal information on spawning grounds (Crawford *et al*., 1987; Hutchings *et al*., 2002) and some information on peak spawning periods is also gathered from the fisheries (B. Rose, Irvin and Johnson, Cape Town, unpublished data and pers. comm.), but systematic collection of information on spawning and eggs and larvae are missing. It is well established through surveys (Le Clus *et al*., 2005) that the area between Hondeklip Bay and Orange River holds large amount of juvenile fish and this is also the only area where small *M. paradoxus* less than 5 cm is encountered in the bottom trawl (Strømme *et al*., 2005). The survey carried out in February March 2005 confirmed that the area north of Hondeklip held the smallest fish, and as it grew bigger it diffused or migrated 'omnidirectional' from this site. That the area between Hondeklip Bay and Orange River forms the main nursery area for the *M. paradoxus* seems quite evident.

However, where the main spawning grounds are and what drift mechanisms the eggs and larvae utilises to reach the nursery ground are still not well understood. Also the annual spawning cycle of the stock needs an improved understanding. To put more light upon this question and to be able to describe the full lifecycle of the species was the overall objective of the survey documented here.

One of the key focus areas of the BCLME is the monitoring/assessment of major transboundary fish resources in the BCLME region to enable sustainable management of these resources. The biological and ecological dynamics of deepwater hake have come under spotlight in stock assessment of these resources. BCLME programme has therefore been involved in supporting appropriate research that could contribute to conservation and management efforts of this transboundary fish resource. During 2004, three surveys were conducted aiming at the development of ideas/hypotheses of the *Merluccius paradoxus* life cycle in the region as well as the study on spatial and biological patterns in relation to key bathymetric and environmental features of the local shelf and slope system. These transbounday surveys were aimed to provide enough material for terms of reference for future, more focused and specialised surveys directed for example at planktonic and early stage juveniles, reproducing adults and changing proportions of various size/age classes through space and time. A key question is if the *M. paradoxus* population in South Africa and Namibia has

common spawning and nursery grounds, something that would strongly indicate that they form one onit stock with consequences for the shared management issue.

Specific objectives of the cruise (Project LMR/NANSEN/05/03) were:

1. To plan and conduct a transboundary survey between Cape Agulhas and Lüderitz to produce distribution and abundance maps of eggs and larvae from *M. capensis* and *M. paradoxus*. Approximate age of eggs and larvae will be determined during the survey in order to assist in the tracing of the geographical origin of the spawning.
2. To sample the adult population of *M. paradoxus* at the outer shelf and slope to check for maturity stages in order to localise spawning grounds geographically.
3. To check the gonadosomatic index of a representative sample of the females in order to backcalulate the main spawning period.
4. To collect relevant environment data to better understand the environment impact on the distribution of hakes and of the drift lanes for eggs and larvae. Possible retention mechanisms that would facilitate aggregation of post larvae close to the nursery grounds will be looked for.
5. To collect otolithes of a representative sample of juvenile hake from the nursery ground in order to backcalculate the birthdate of the speciments and thus, if possible, depict a main spawning period.
6. To collect genetic samples of the two species of hake at adult and juvenile stage, to look for genetic robust identifiers to assist in the species differentiation of eggs and larvae.

2 Materials and methods

2.1 Registration of weather conditions

The underway weather data aboard Dr. Fridtjof Nansen are logged with the Aanderaa Weather Station unit fitted with the following sensors:

Sensor type	Measurement units
Air temperature	Degrees °C
Wind speed	M/s
Solar radiation	W/m^2
Wind direction	Degrees re. the magnetic N. Pole
Sea surface temperature	Degrees °C

All sensors but Sea surface temperature (SST) are mounted on a mast positioned midships, at about 20 meters above the sea level. The SST sensor is located at the intake of the water for cooling the engine and it readings are representative to a water layer at about 5 meters below the sea level.

The weather station data were logged continuously throughout the survey. The results presented in this report are based on a standard output from the logging system comprising one nautical mile averages along the ship's track.

2.2 Hydrography

The data on temperature salinity and oxygen were collected with a CTD *Seabird 9 plus* probe between the surface and 10 meters off the bottom. CTDs were made at each trawl station and, additionally, in the course of a few special studies. The CTD probe was fitted with a set of newly factory-calibrated sensors, installed in December 2004. In addition, water bottle samples for oxygen and salinity calibrations were taken at almost all CTD stations.

The salinity samples were analysed with the Guildline Portasal salinometer unit. The laboratory conditions onboard are suitable to detect deviations between the CTD and

in situ samples at a level of 0.005 of salinity units. Since no deviations reaching or exceeding this range were detected, the salinity values based on the factory calibration of the conductivity sensor are used throughout this report.

The samples for dissolved oxygen were titrated within 12 hours of sample collection, using the standard Winkler method.

2.3 Current measurements.

Current measurements were carried out with vessel-mounted acoustic Doppler current profiler (ADCP) by RD Instruments, which operated 150 kHz in broad-band mode with 5 m vertical cells. Currents were measured from a depth of 25 m down to about 30 meters above the bottom. Only the bottom-tracked data were used in the data analysis. Postprocessing of ADCP data is a described in previous cruise report (Strømme *et al*., 2005)

2.4 Plankton sampling and processing

2.4.1 *Multinet plankton sampler*

Eggs, larvae and zooplankton were sampled with a Multinet plankton sampler from Hydrobios. The plankton sampler has 5 nets with a mesh size of 405 μm. The opening of the plankton sampler is 0.5 x 0.5 m. A flow meter was mounted in the opening of each net to measure the filtered volume. A Scanmar depth recorder with acoustic transmission to the vessel was mounted on top of the Multinet. The depth intervals used during this survey were 0 - 50 m, 50 – 100 m, 100 – 150 m, 150 – 200 m and 200 – 10 m above bottom (maximum 600 m). When bottom depth was less than 200 m, the deepest net sampled from 10 m above the bottom to the nearest depth interval.

2.4.2 *Processing of ichthyoplankton*

After removing the cups from the Multinet the samples were transferred into petri dishes and examined under a stereomicroscope. All fish larvae and fish eggs were removed from the sample while the major zooplankton species were recorded. The fish larvae were identified using the key of Olivar and Fortuño, 1991. Since it is not possible to distinguish between the two hake species on the egg and larval stage, all hake eggs and larvae were preserved in either liquid nitrogen or 96% alcohol for genetic analyses. All fish larvae were counted and the standard length of hake larvae was measured

before they were preserved. Fish eggs were identified, counted and staged and all hake eggs were removed from the sample and preserved.

2.4.3 *Buoyancy measurements of fish eggs and larvae*

The onboard equipment from Martin Instrument Co. Ltd. was used to measure specific gravity of fish eggs. The equipment consists of three glass cylinders, 50 mm internal diameter and 700 mm high, submersed in a temperature-controlled transparent water container. The temperature was kept constant by a ship-mounted cooling unit. A linear salinity gradient was set up in each column by filling the columns from two conical flasks, each filled with 830 ml salt water solution, connected by a plastic tube at the bottom, one with low-salinity and the other with high-salinity. The filling of each column took about 30 min.

The columns were calibrated by inserting glass floats with known specific gravities ranging from about 1.021 to 1.027 g cm^{-3}, into each column. Table 1 shows the Id. number and the exact specific gravities at 11.5°C and 15°C for each float. The specific gravity of the floats was given with an accuracy of +/- 0.0002 g cm^{-3}.

The fish eggs to be measured were inserted into the columns with a pipette just below the surface and were allowed to settle before the first measurement of the vertical position in the column was taken. Only wild caught eggs were measured. Neutral buoyancy of the eggs was expressed in salinity units by calculating the salinity gradient in the column from the absolute densities of the floats and from the temperature in the columns.

Table 1: Exact specific gravities, ρ, at 11.5°C and 15°C of glass floats in the three columns.

Column I			Column II			Column III		
Id. No	ρat		Id. No	ρat		Id. No	ρat	
	11.5°C	15.0°C		11.5°C	15.0°C		11.5°C	15.0°C
22635	1.0233	1.0232	23745	1.0228	1.0228	22633	1.0218	1.0217
20381	1.0243	1.0242	20377	1.0248	1.0247	20380	1.0241	1.0240
20375	1.0255	1.0254	20372	1.0262	1.0261	20374	1.0256	1.0255
20366	1.0270	1.0269	20358	1.0281	1.0280	20362	1.0276	1.0275

2.5 Acoustic measurements

2.5.1 Acoustic equipment

The acoustic recordings were conducted using Simrad EK 500 echosounder coupled to a keel-mounted transducer of 38 kHz. Acoustic raw-data was logged on the Sun-Unix based Bergen Echo Integrator (BEI) version 2000. The technical specifications and operational settings of the echosounders used during the survey are given in Annex 2 together with the results from the last calibration of the system. The acoustic data were scrutinized using the post-processing module of the BEI software.

2.5.2 Classification

Scatterers were displayed at 38 kHz, standardized to 5 nautical miles (NM) echograms with 1,000 pings (horizontal) by 500 bins (vertical). The mean 5 NM area backscattering coefficients s_A (m^2/NM^2) was allocated to a predefined set of species or species groups on the basis established echogram features.

Acoustic groups used were: a) Juvenile pelagic hake < 17 cm, b) older hake, usually demersal, c) horse mackerel, d) Pelagic group1 (pilchard, anchovies, red eye), e) Pelagic group 2 (pelagic fish not of Pelagic 1), f) demersal fish, not hake, g) mesopelagic fish, h) plankton. The classification was based on the characteristics of the echo traces, experience accumulated from previous similar surveys in Namibia since 1990 and in South Africa since 2000, supported when possible with results from nearby bottom trawl stations.

The results from the acoustic system are considered as a pilot study with the main aim of delineating the limits of distribution of juvenile pelagic hake and some information on relative densities. The figures will not be converted to biomass, as the target strength is uncertain and as the classification scheme and methods are too course for such a purpose. Adult hake were very rarely observed in the acoustic channel during daytime, while it showed up frequently above bottom at nighttime.

2.6 Trawl sampling procedures

The standard bottom trawl of Dr. Fridtjof Nansen, a Gisund Super shrimp cum fish trawl, was used in the survey and for the intercalibration. A description of the trawl and gear is given in Annex 2. “Dr. Fridtjof Nansen” use a 20 m strapping on the warps 105

m in front of the doors to keep the door and wingspread constant at 50 m and 21 m respective, independent of trawl depth.

A standard haul was 30 minutes at 3 knots, sometimes reduced to 20 minutes in areas of expected high densities. The exact time for start and stop of the trawl operation was determined by SCANMAR sensors. The output from the SCANMAR system was also recorded on files to facilitate later analysis of bottom contact and door-spread if necessary.

For conversion of catch rates (kg/hour) to fish densities (t/NM²), the effective fishing area was considered as the product of the wing spread and the haul length, or distance over the bottom, based on GPS readings. In the survey a nominal wing spread of 18.5 m was applied to facilitate analysis with previous surveys. The area swept for each haul was thus 18.5 m times the distance trawled, converted to NM². The catchability coefficient (q), i.e. the fraction of the fish encountered by the trawl that was actually caught, was conservatively assumed equal to 1, to allow comparison with previous results.

2.6.1 Handling the catch

In most cases, the whole trawl catch was sorted and all species were recorded with their weight and numbers. For especially big catches the abundant species were sub-sampled while the other fish were sorted out. Length measurements (total length) were taken for target species. The length of each fish was recorded to the nearest 1 cm below. The mantle length of squid was measured to the nearest 1 cm below. All samples of small hake was checked for the species identity by vertebrae count (usually 3-5 fish were examined).

An electronic measuring board was used for length measurement, main sample weights were recorded by Scanvaegt electronic balances and a Marel weight was used for single fish and small species measurements.

2.6.2 Biological samples

Biological samples were collected for the two hake species in special areas. The following information were collected: Sex, maturity stage, gonad weight and stomach content. The maturity scale used was the one adopted at Marine and Coastal Management, Cape Town:

1: immature,

2: active,

3: ripe,
4: ripe and running,
5: spent and
6: inactive

2.6.3 Gonadosomatic index (GSI)

Biological samples (length, weight, sex, maturity, gonad weigh, stomach and otolith) were collected for *M. paradoxus* only, as the emphasis was on finding spawning grounds of the species in the survey area by examining maturity of large (>35 cm) adult fish. A total of 258 fish (210 females and 48 males) were sampled for Gonadosomatic Index (GSI) analysis.

2.6.4 Analysis of otoliths (by Richard Laubscher)

The same method reported by Durholtz (1999) for ageing squid was used in this investigation. Briefly, otoliths were measured along their longitudinal axis as well as along their widest sector. The otoliths were also weighed. This information was recorded onto an Excel spreadsheet database. Each otolith was given a reference number and then embedded in resin. The resin blocks, each containing an otolith, were ground down in the direction perpendicular to the longest axis of the otolith, using medium coarseness water paper (P400 grade). Grinding continued carefully until the nucleus of the otolith was exposed. This surface was then polished on a wet Kemet polishing cloth with an alumina containing micropolish. This polished face of the resin block was glued to a glass microscope slide using cyanoacrolate “super” glue (Satlon). Once the glue had hardened, the resin block was ground down in the direction perpendicular to the glass slide. The final thickness was less than ½ mm. Thinner sections were more difficult to prepare as the otolith sometimes detached from the resin, or the resin section detached from the glass slide. Ring clarity depended on the thickness of the section as well as how near the longitudinal axis was to the centre of the nucleus. Larger otoliths had a number of secondary nodes similar to the nucleus, but these were not used in counting.

Images of the otolith section were recorded at 100 x and 400 x resolution on a Zeiss Axioskop 40 binocular compound microscope and were best viewed using 10 x ocular and 10 x /0.25 Ph 1 (A-Plan) and 40 x/0.65 Ph 2 (Achroplan) objective lenses under phase contrast illumination from an unfiltered bottom mounted light source. The

camera used was an AxioCam MRc digital camera mounted on a TV2/3”C 0.63 x phototube. AxioVision Ver. 4.2 (© 2002-04 Carl Zeiss Vision GmbH) software was used to process and store captured images and set to capture images in black and white. *In situ* balancing of brightness and contrast allowed images of the highest clarity to be produced for capture.

The best resolution for images was 400 x. In order to cover the area between the nucleus and edge of the otolith, a number of overlapping images sometimes had to be recorded. Transects were drawn through areas of highest clarity, usually between prominent areas of the otolith image, using the drawing tools available in the imaging software. The length of transects was also recorded. The final result was a series of successive transects, one beginning near where the other ended, from the edge of the otolith nucleus through to the otolith edge, and which included a number of overlapping images. If this axis was unclear, then axes through areas of higher clarity were selected. A lower resolution image (100 x) allowed the axes through higher resolution composite images to be verified as being contiguous, by comparing their distances across similar regions in the lower resolution image.

Ring intervals were counted on the LCD monitor of the desktop PC. Resolution was set to the highest possible setting, and the software allowed further magnification of the image without the clarity being compromised by pixilation. The software allowed the rings to be tagged and counted through mouse clicks wherever the screen cursor was placed. Each transect was counted five times and the number of counts registered by the software were recorded on a custom designed spreadsheet. The average number of counts and standard deviation were calculated for each transect. The total number of counts along a series of five contiguous transects was summed and the average and standard deviation recorded. Each otolith record was recorded on a separate worksheet in the same spreadsheet. In addition to the transect tabulation table, a table for calculating the interpolated and extrapolated areas was set up. Where regions were too indistinct to be able to be counted, these areas were interpolated between two regions of clarity, or extrapolated from one region of clarity.

In order to moderate the results by adding a data quality control step, the images were assigned a grade according to the perceived clarity of the rings in the images. This subjective grading ranged from 0 – 5, where:

0 : a sample missing or lost in preparation;

1 : a sample too damaged to provide meaningful information;

2 : a sample where error would be likely to be high because of poor preparation;

3 : a sample that would yield reasonable information;

4 : a sample with high clarity of rings; and

5 : a sample that is of exceptional clarity.

An objective grading step was also included and this graded a sample according to how many of the otolith rings were estimated through interpolation and extrapolation. There were 4 grades in this process:

A : less than 5% of the rings were interpolated or extrapolated;

B : 5% to 10% of the rings were interpolated or extrapolated;

C : more than 10% but less than 20% of the rings were interpolated or extrapolated;

D : more than 20% of the rings were interpolated or extrapolated (with 60% being the cut-off point for discarding the sample.

A final grading could be obtained by first converting the objective grades into ordinals and then multiplying them with the subjective numerical grade to obtain a final numerical grade. This provided a scale ranging from above 1 to a maximum of 5, and containing decimal values. From this, four classes were assigned to the graded data which resulted in the data being assigned to groups designated poor, satisfactory, good and excellent. The boundaries could be altered without intentionally prejudicing individual data points. Each class was subjected to regression analysis in order to determine the goodness of fit of the data within that class. If the lowest rated class was considered not to conform to the set tolerances for acceptability, it could be discarded.

Classification matrix for rating data quality								
			Subjective classification					
Objective classification	Alphabetic	Ordinals	0	1	2	3	4	5
	A	1.00	-	-	2.00	3.00	4.00	5.00
	B	0.95	-	-	1.90	2.85	3.80	4.75
	C	0.80	-	-	1.60	2.40	3.20	4.00
	D	0.50	-	0.500	1.00	1.50	2.00	2.50

3 Narrative

The scientific staff consisted of:

From MCM, South Africa:

Marek R. Lipinski, Hans Verheie (until 6 Oct.), Larry Hutchins (from 6 Oct.), Hendrik Hoving, Phil Wittington, Felicia Keulder and Stephen Loubser

From NatMIRC, Namibia:

Paul Kainge, Suama Kashava, Victor Hashoongo, Rudy Cloete and Renate Lemke.

From IMR, Norway:

Tore Strømme (cruise leader), Erling Kåre Stenevik, Marek Ostrowski, Oddgeir Alvheim, Jan Frode Wilhelmsen and Einar Helge Osland

The cruise tracks with fishing and hydrographical stations are shown in Figures 3.1 and 3.2.

The vessel departed Cape Town on the afternoon of 26 September and steamed south to commense the work off Cape Agulhas. Transversal shelf transects with plankton and hydrographic stations were laid out. Bottom trawling was carried out at the outer shelf and at the slope to check for the maturity stage of the hakes. Work proceeded north to Doring Bay and then south to St. Helena Bay when the survey was interrupted with a call at Cape Town on evening of 5 October for crew change. Work was resumed on 7 October covering the inner part of the shelf between Cape Town and Doring Bay. North of Doring Bay five more transects were laid out. The sampling work was completed with three days of combined trawling and plankton sampling in order to check for spawning sites at the slope off Port Nolloth and northwards into Namibia.

End of survey was in Walvis Bay on 17 October. The weather conditions were in periods somewhat unfavourable, with sample work slowed down, but never interrupted. As less hake eggs and larvae than envisioned were recorded and no clear plume was detected in the central area, ichthyosampling continued more northwards and longer than originally planned. To compensite the extra time consumed, some of the sampling

on potentional spawners in Namibian water between Orange River and Luderitz had to be scaled back.

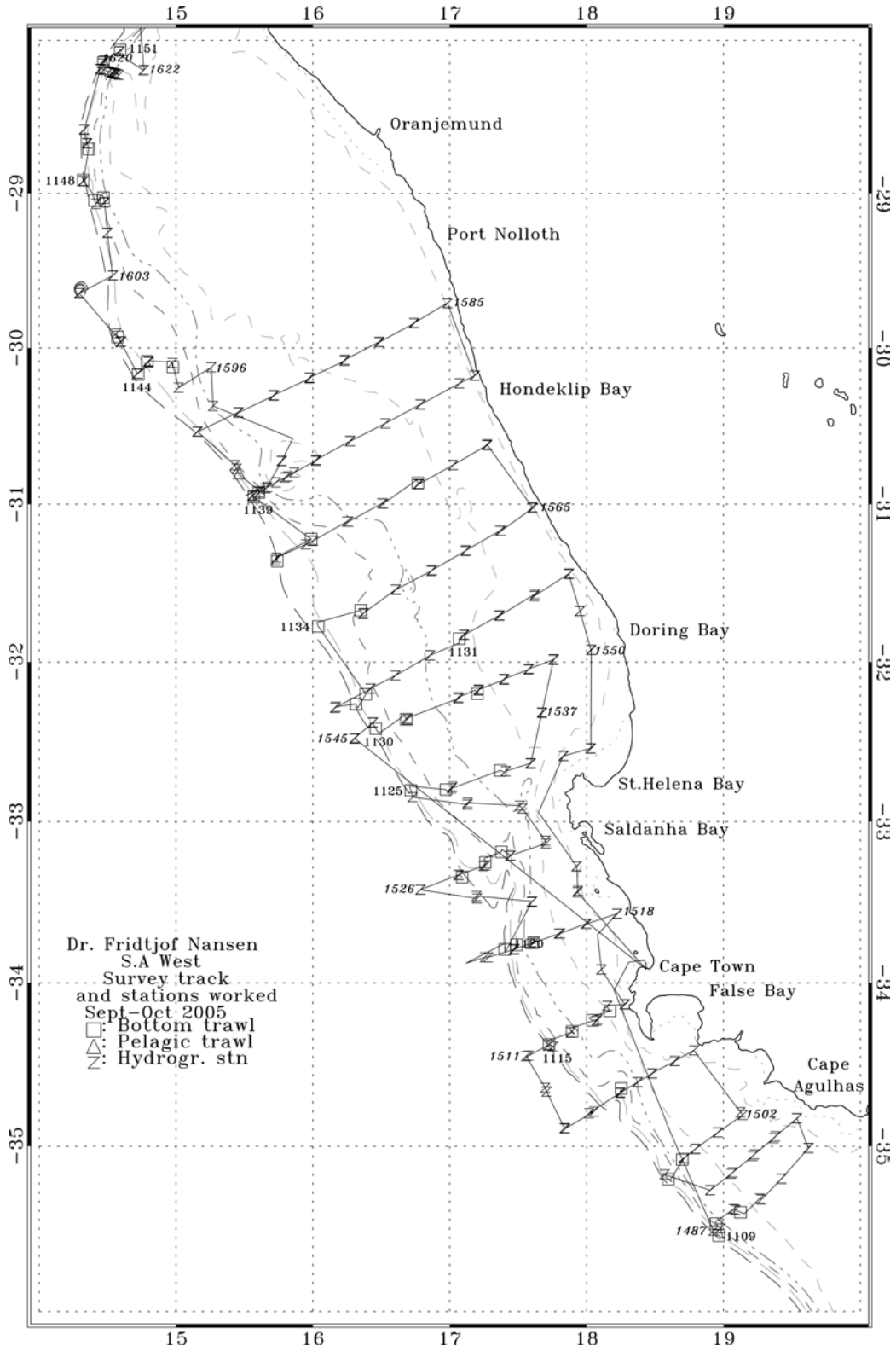

Figure 3.1 Course tracks and fishing and hydrographic stations.

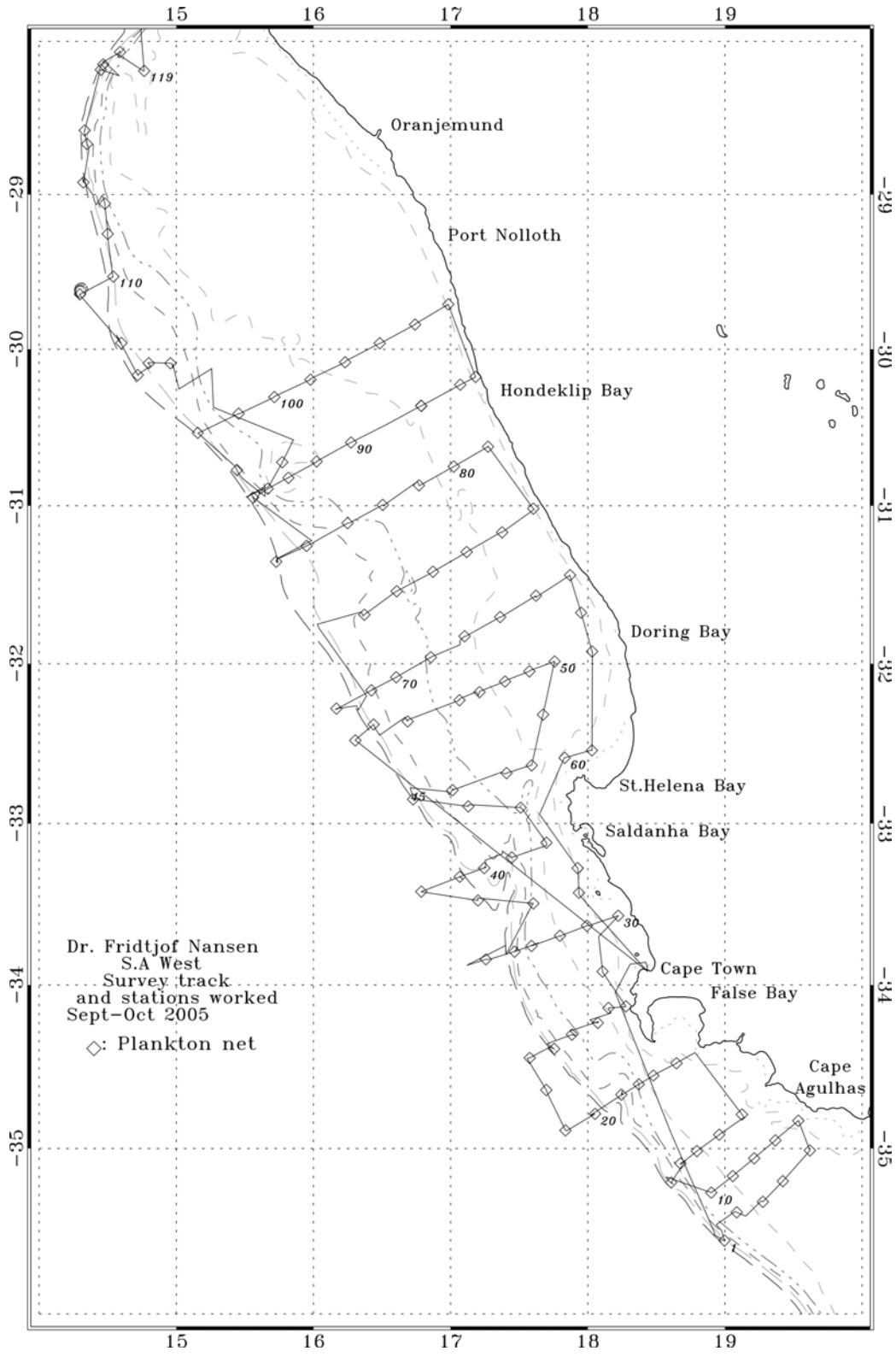

Figure 3.2 Course tracks and plankton stations.

4 Results

4.1 Hydrography

4.1.1 Wind patterns.

The wind observed during the survey showed the regular five to six days modulation (Figure 4.1), manifesting the pattern associated to the passage of the coastal lows (Nelson and Hutchings, 1983). Upwelling favorable southeasterly wind events were observed on Lines L03, L07, L09, L11, L15 and L16; the strongest wind reversals were seen on Lines L04, L19 and L20 (Figure 4.2).

4.1.2 Sections of temperature, salinity, sigma-t and oxygen

The sections of temperature and salinity are shown in Figure 4.3; these of oxygen and potential density (sigma-t) are shown in Figure 4.4. Over the Agulhas Bank, a 100-meter deep mixed layer was observed across the entire shelf on Lines L18, L19 and L20. It entrained Agulhas Bank water, T > 16ºC and S > 35.4. These sections were recorded during calm conditions and downwelling-favorable wind. Towards the west, with the offset of the southeasterly wind, the distributions exhibited a change in the tilt of the isotherms. The maximum growth of the upwelling plume was observed on Line L16 located just off Cape Town. A temperature and salinity front clearly emerged offshore of the plume. The sections located to the north of Cape Town and south of Cape Columbine (Line L13 and L15) were measured during the upwelling relaxation phase. The upwelling plume vanished and the top mixed layer was restored in the inshore areas. All oxygen distributions to the south of Cape Columbine (Figure 4) exhibited high concentrations (> 4 ml/l) in the entire water column.

The fronts separating the stratified offshore waters from the tongue of the upwelling water inshore were present on all section located to the north of Cape Columbine. These point to a presence of a permanent baroclinic jet current, oriented northwards. The salinity section on Line 07 was measured during an upwelling event. The distribution clearly shows a surface plume of the uplifted salinity spreading seawards, manifests a developed upwelling phase. Line L09 exhibits a depression of T, S and sigma-t located just offshore of the coastal front, an indicative of an anticyclonic eddy. Line L04 indicates that the coastal front was clearly positioned over the eastern slope

of the Child's Banks. This pattern is consistent with the observations from the past surveys with R/V Dr. F. Nansen in this region.

The oxygen distributions between St. Helena Bay and Hondeklip Bay, in contrast to those located further south, exhibit an inshore region of low concentrations (< 3 ml/l), often extending offshore as a near-bottom layer.

4.1.3. ADCP currents.

Figure 4.5 shows distributions of the ADCP measured current components. The coastal flow is obviously variable and the observed pattern erratic in response to wind events. The long times used to cover a section contributed additionally to the uncertainty of the measured currents by masking the synoptic net flow by shorter tidal and sub-inertial oscillations. In spite of this, the mean current pattern is evident. With respect to the currents, the survey area may be divided into three regions:

- Agulhas Bank (Lines L17, L18, L19). Northwestward flow from the surface to the maximum detected depth (250-300 m). With the onset of the wind event (Line 17) the flow intensified. On the eastern flank of the Agulhas Bank the westward (offshore) current intensified to above 40 cm/s.
- Cape Peninsula to Cape Columbine (Lines L16, L15 L13). The northwestward coastal jet current dominated the top layer. Along each section, the strongest flow was approximately collocated with the temperature and salinity front (see Figure 4.3). The strongest surface current (> 40 cm/s) was observed in the vicinity of Cape Columbine on (Line 13). All distributions show the presence of the poleward current, confined to the region below the mixed layer and to the offshore part of the sections. The strongest flow in this current was observed on Line L13 immediately below the northward flowing jet in the top layer.
- St. Helena to Hondeklip Bay. The coastal jet was detectable on all sections, although its intensity varied greatly from one section to another (20 and 50 cm/s on Line L07 and L05, respectively). A rather surprising feature was that a large proportion of the flow was oriented southward. In the extreme north of the survey area (Line L03), the southward flow extended over the entire region eastwards of the temperature front. Over the Child's Bank (Line L04) this flow component occupied the entire water column in the inshore region and only the

bottom layer over the rest of the section. Further south (Line L05), the southward flow bifurcated forming two limbs, inshore and over the shelf-break. The two branches rejoined at the northern flank of the St. Helena Bay. The flow continued southward, perhaps feeding the poleward flow at Line 13. The sharp decrease in the size of the area affected by the southward flow from Line L11 to L13 suggests for a possibility of a flow convergence around Cape Columbine, which may lead to a westward transport in the bottom layer that can disperse the entrained material away from the shelf.

4.1.4. The conceptual model of the drift in the survey area

The conceptual model of the drift, which emerges from the hydrographic and ADCP-measured currents during the survey, is represented in Figure 4.6, overlaid over the measured current distribution at a depth of 35 meters. The main transport pathway is oriented northwards. It originates on the slopes of Agulhas Bank. The minor southward drift line also exists, extending from the Hondeklip Bay southwards. The drift along the northward path is carried along the west coast until it reaches Cape Columbine. Here the flow bifurcates; the eastern limb is carried towards St. Helena Bay where it terminates with an anticyclonic eddy; the western limb follows the coastal jet to the north. However, due to the short-term wind modulations (Figure 4.1) the forcing which drives that current is variable. The resulting current pattern is erratic and causes dispersion of the particles it entrains. The opposing southward transport pathway links the region of St.Helena Bay to Hondeklip Bay area. It consists of two limbs; the first is close to the inshore the other is located along the shelf break (not shown in Figure 4.6). The inshore path is permanent. The flow in the offshore limb is variable, often located below the surface northward jet. At times, the southward drift alternates with the northward jet over the same area, depending on the phase of the wind modulation.

4.2 Ichthyoplankton

Since the results from the genetic analyses was not available when the report was written it was impossible to distinguish between the two species of hake when the distributions of eggs and larvae are presented.

4.2.1 Horizontal distribution

The horizontal distribution of hake eggs showed that eggs were only observed in the southernmost part of the survey area, mostly over bottom depths ranging from 200 m to 500 m, and no eggs were found north of 32°S (Figure 4.7a). Highest concentrations of eggs were observed on a line going southwest from Cape Town. Here, concentrations of eggs on the three outermost stations ranged from 341 eggs $10m^{-2}$ to 411 eggs 10 m^{-2}. There was in addition a branch of eggs extending southwards to the Western Agulhas Bank and one just inside of the 500m-isobath extending northwards to about 32°S. Highest concentrations of hake eggs were found in the upper 100 m but eggs were observed throughout the water column (Figure 4.7c, e, g, I and k). The deeper eggs were distributed further from the shore compared with eggs found in the upper layers.

Highest abundance of hake larvae were found between the Western Agulhas Bank and Saldanha Bay (Figure 4.7b). Peak concentration on the Western Agulhas Bank was 72 larvae $10m^{-2}$. In addition, there was a band of hake larvae stretching northwards to about 30°S. Since no eggs were observed in the northern area, this indicated that there had been a northward transport of larvae from the spawning grounds. Most of the larvae were found in the upper 150 m and only few larvae were observed deeper than that (Figure 4.7d, f, h, j and l).

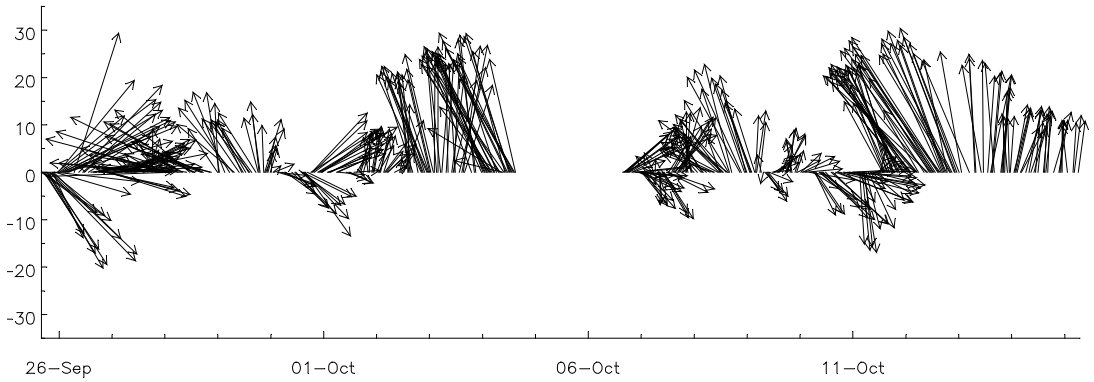

Figure 4.1. Wind stick vector diagram for the survey period, illustrating the characteristic 5-6 modulation of wind conditions off the west coast during summer. The gap in the recording is during the period of the ship's scheduled service stop at Cape Town. Wind speed in knots.

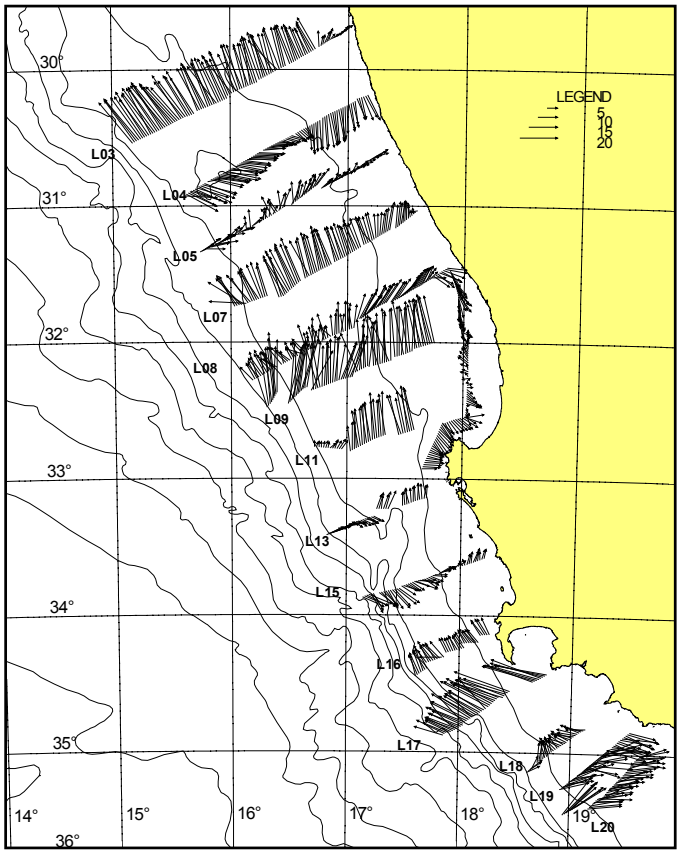

Figure 4. 2. Wind vectors during the survey, extracted on lines perpendicular to the coast. The line symbols referred in the text are shown to the left of each respective line. Wind speed in m/s.

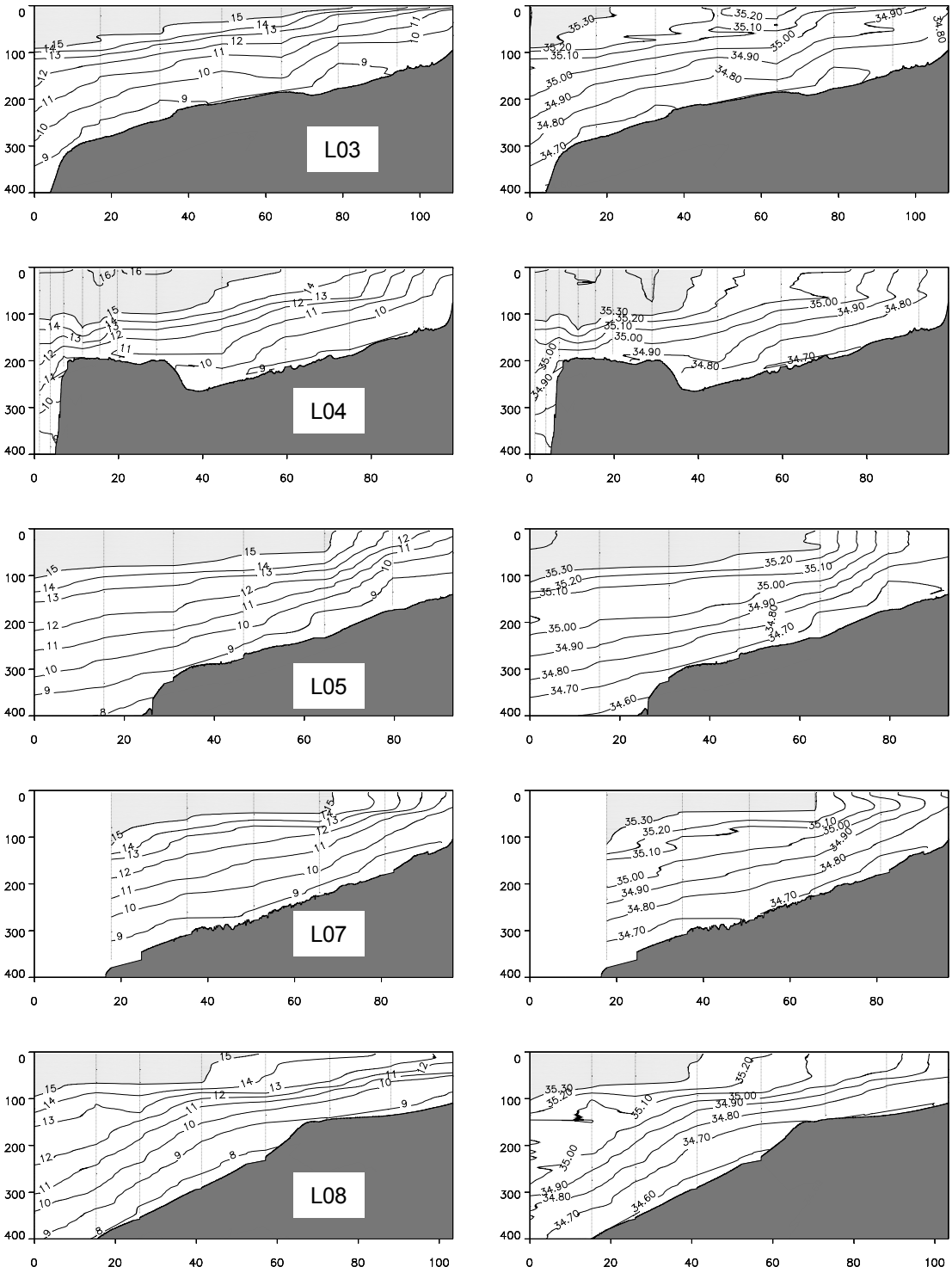

Figure 4.3. Sections of temperature (left) and salinity (right) along the surveyed lines. The location of the lines according to Figure 4.1. Temperature in Degrees Centigrade; salinity is dimensionless. The horizontal and vertical axes denote distance in nautical miles and depth in meters, respectively.

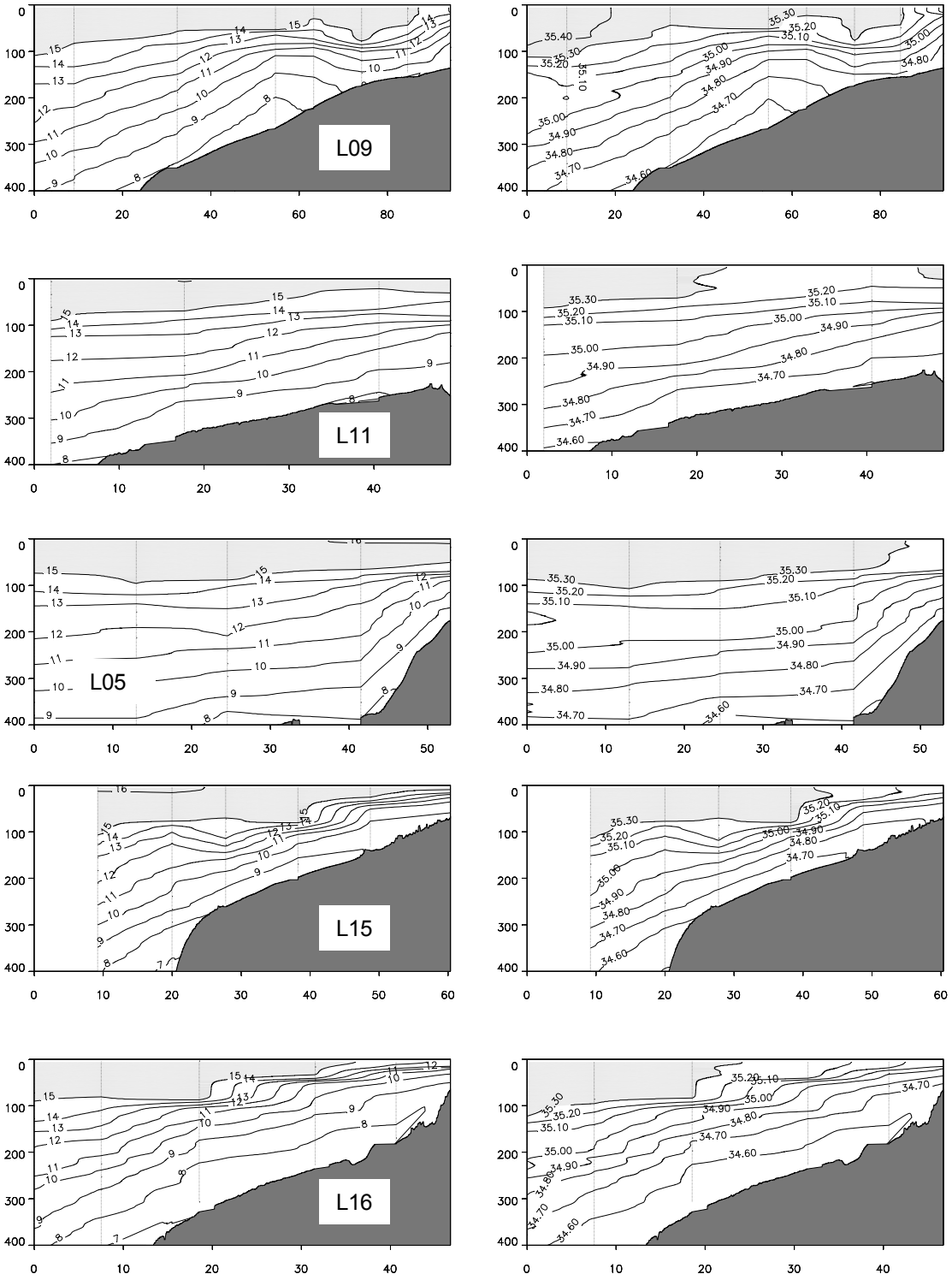

Figure 4.3 continued.

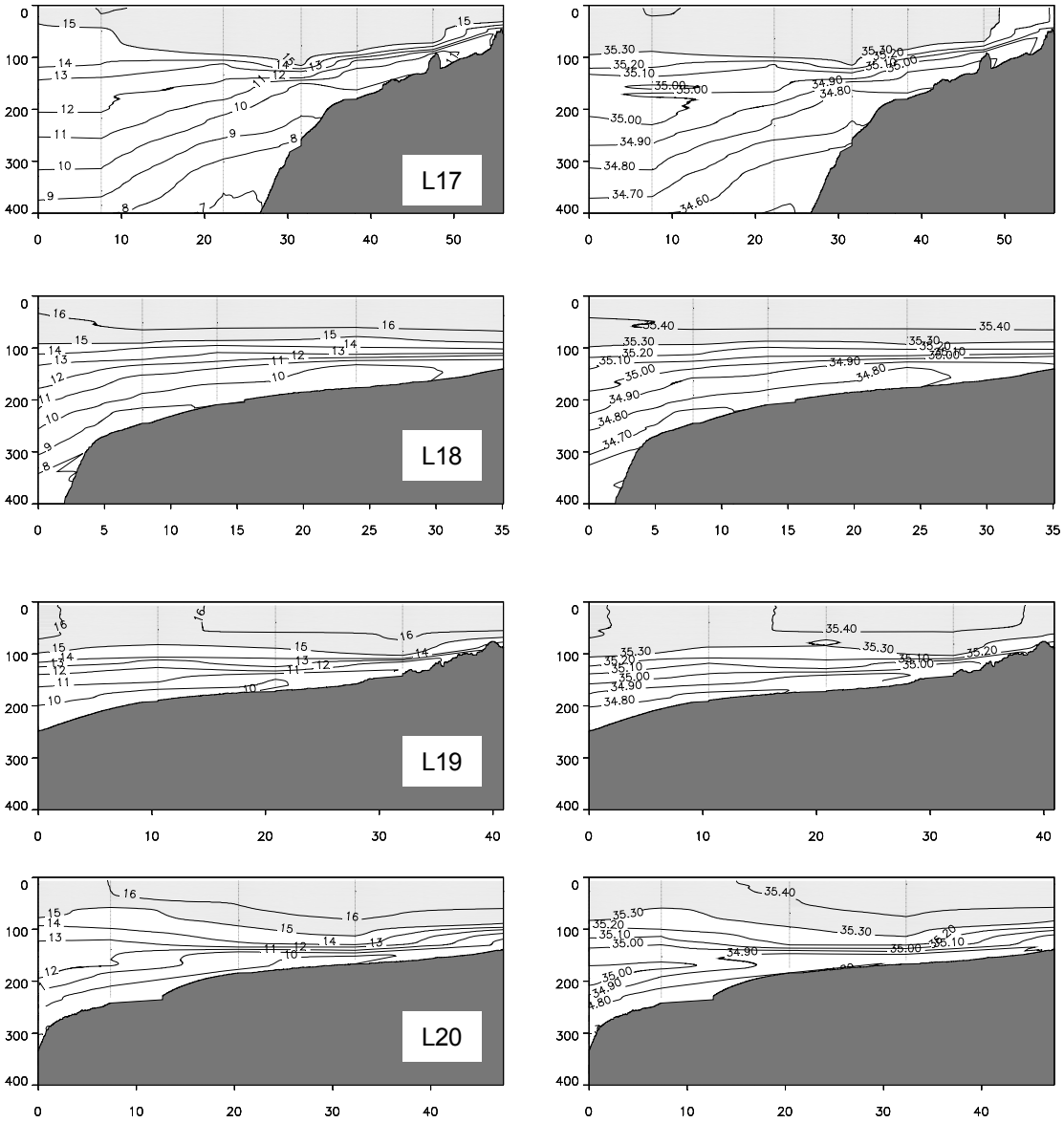

Figure 4.3 continued.

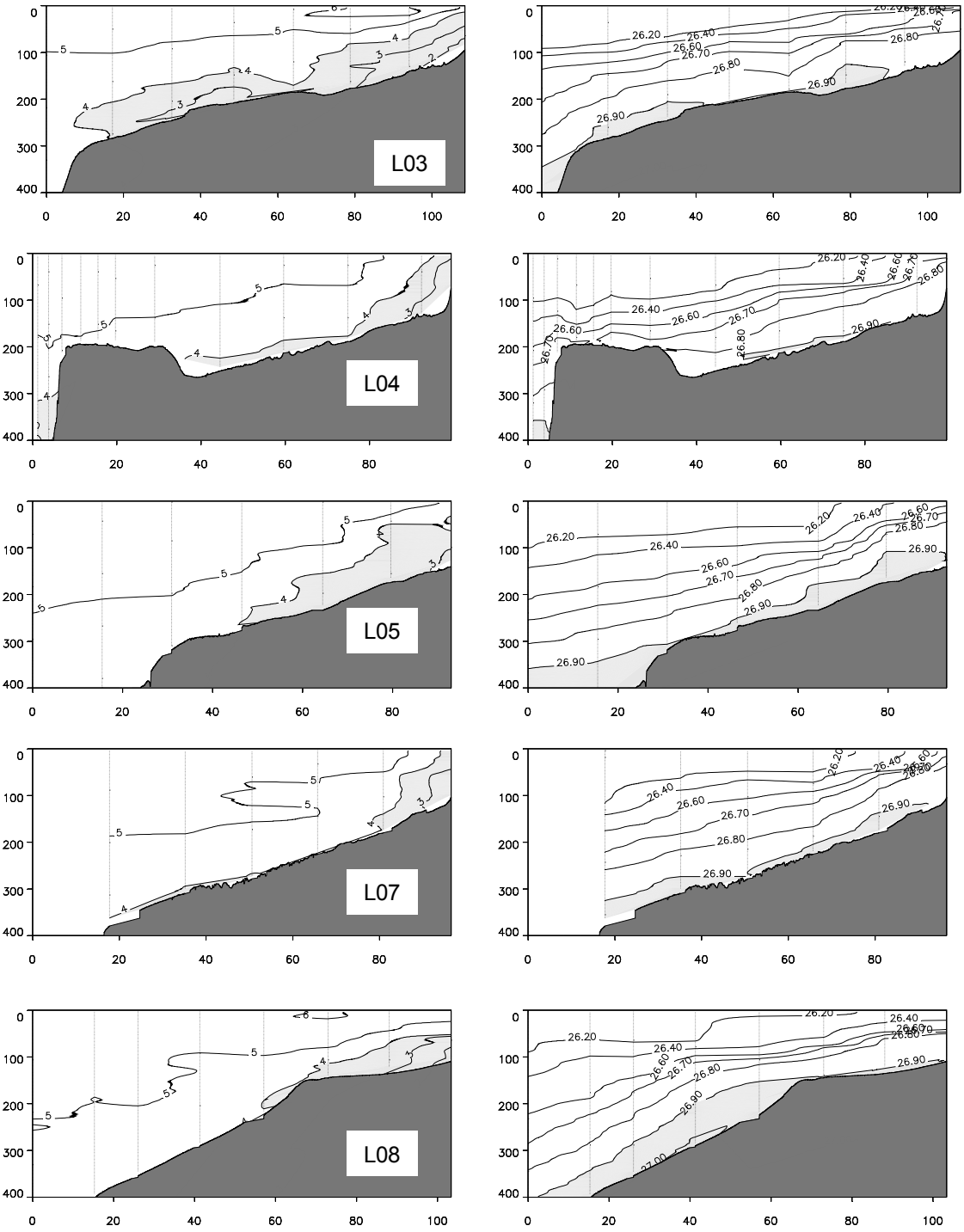

Figure 4.4. Sections of oxygen (left) and potential density (right) along the surveyed lines. The location of the lines according to Figure 4.1. Oxygen concentration in ml/l, potential density in *sigma-t* units. The horizontal and vertical axes denote distance in nautical miles and depth in meters, respectively.

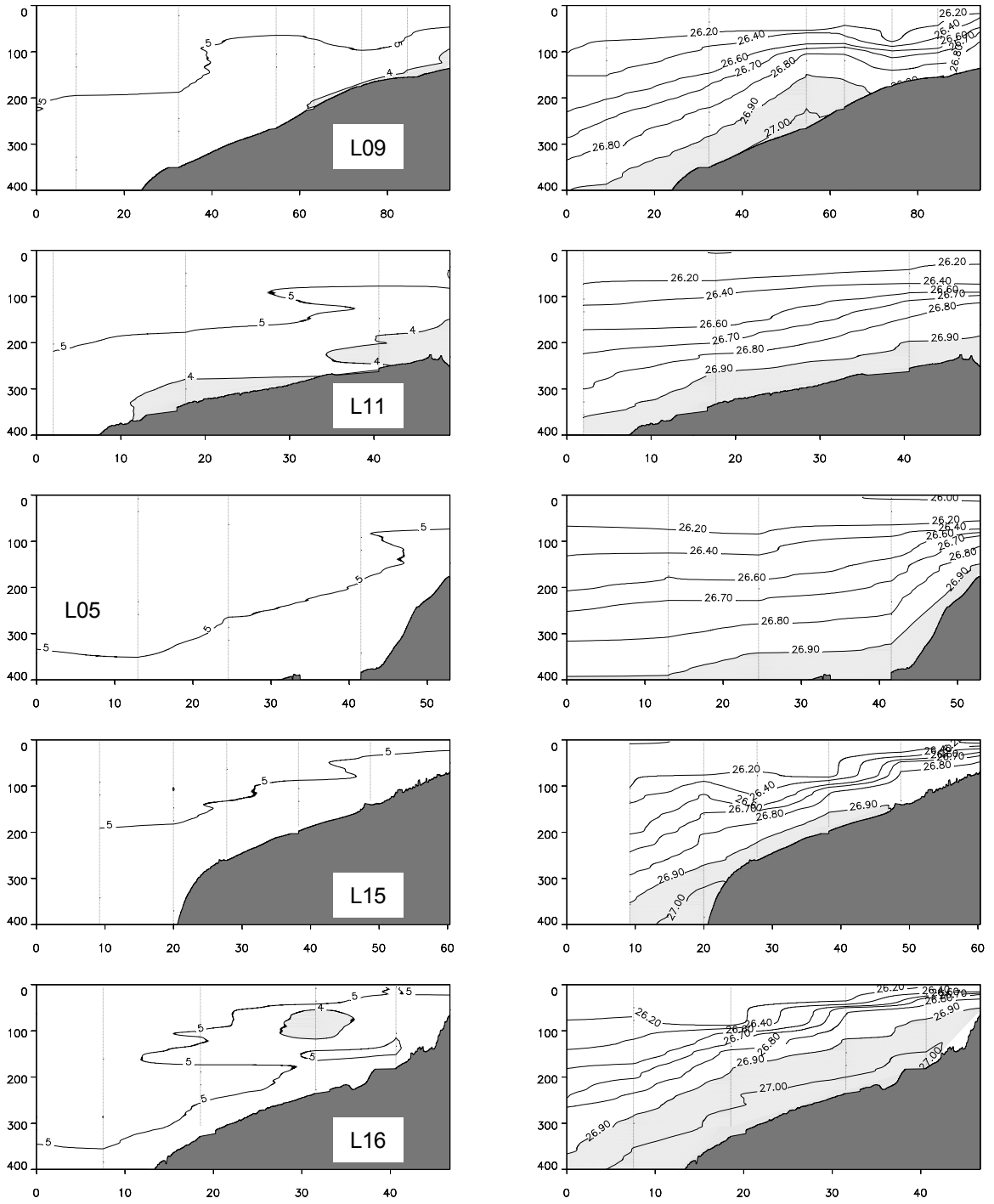

Figure 4.4 continued.

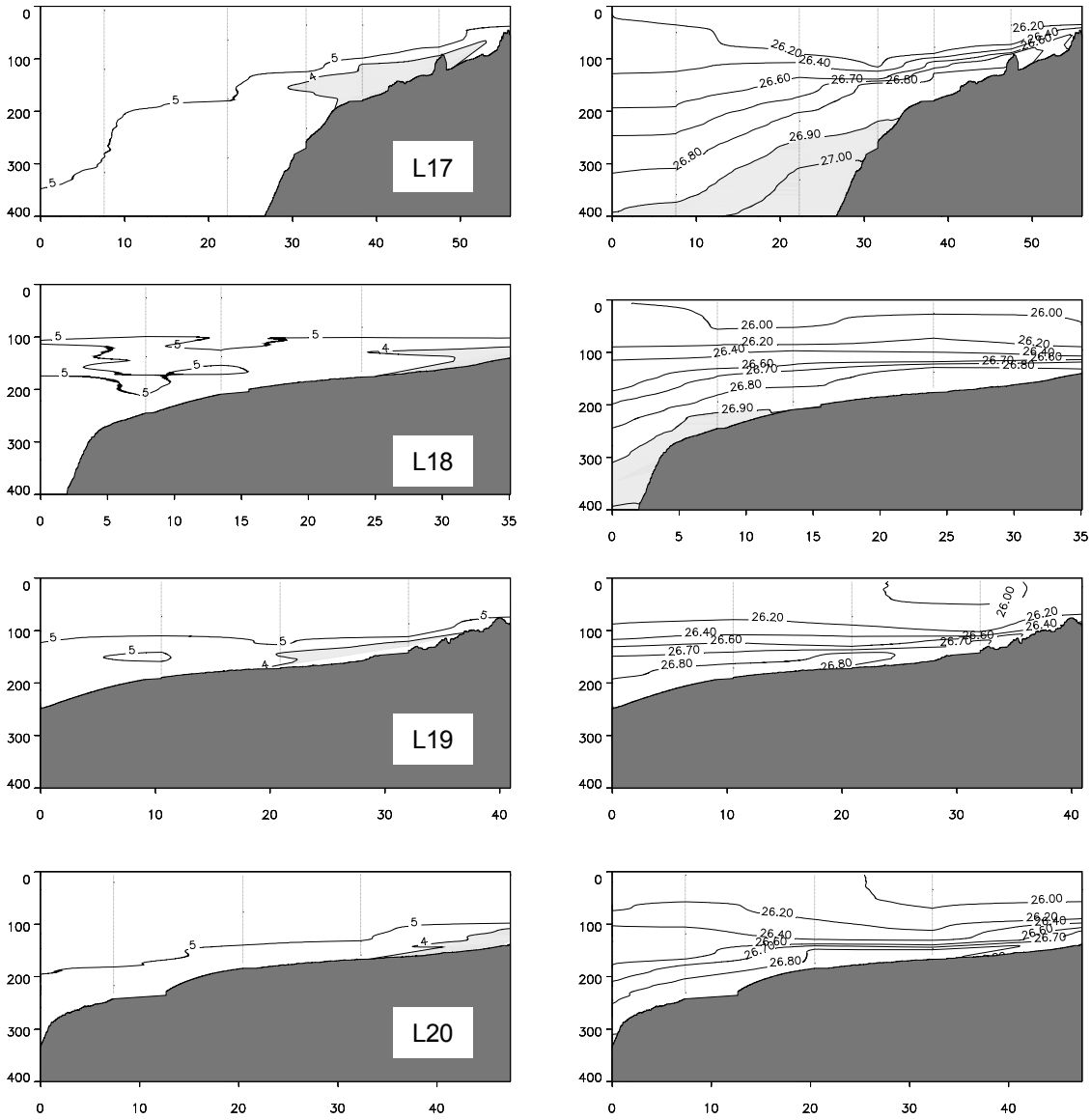

Figure 4.4 continued.

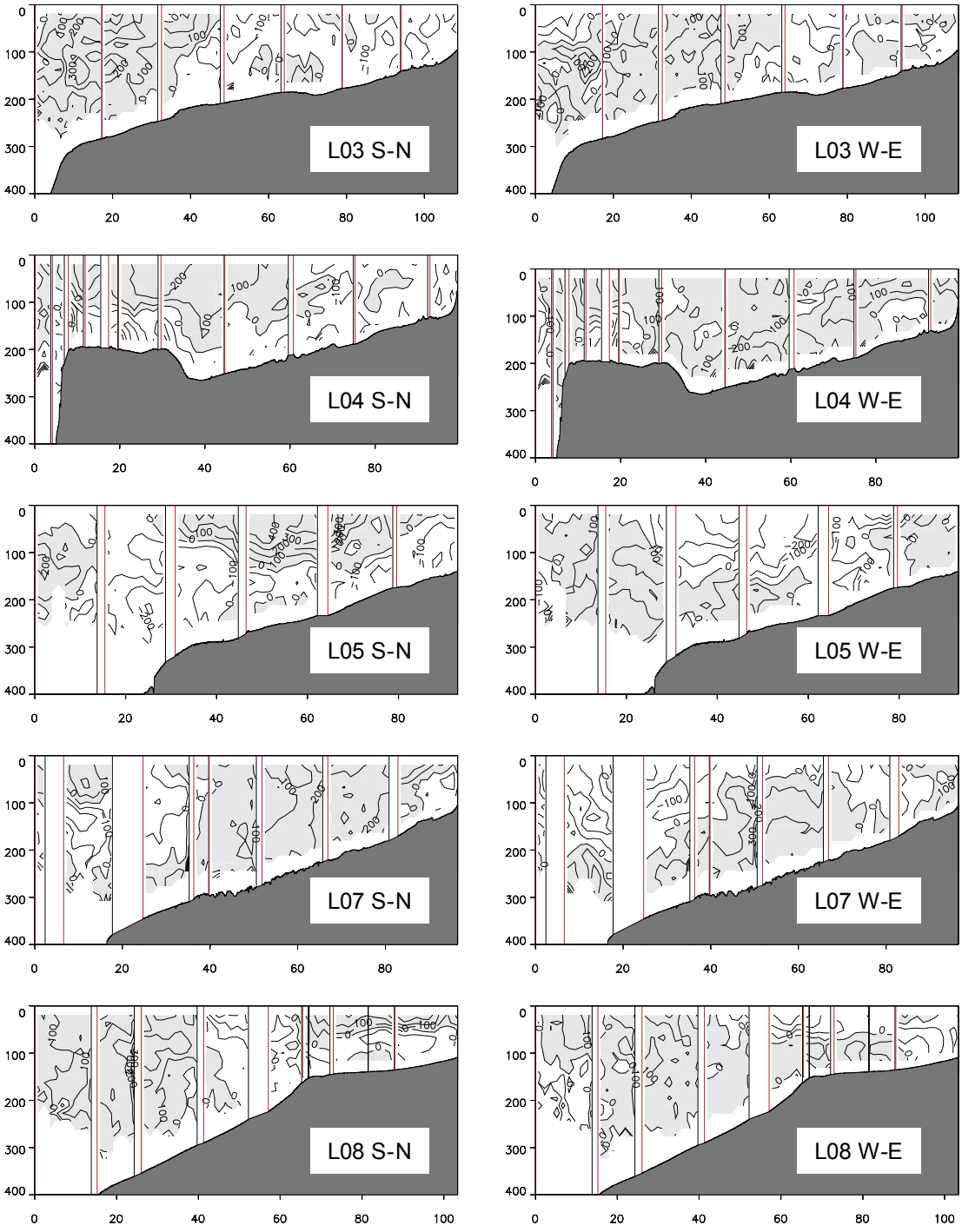

Figure 4.5. Sections of the south-north (left) and west-east (right) components of the ADCP derived current along the surveyed lines. The areas of positive current velocities (northward and eastward) are shaded. The location of the lines according to Figure 4.1. Current speed in mm/s. The horizontal and vertical axes denote distance in nautical miles and depth in meters, respectively.

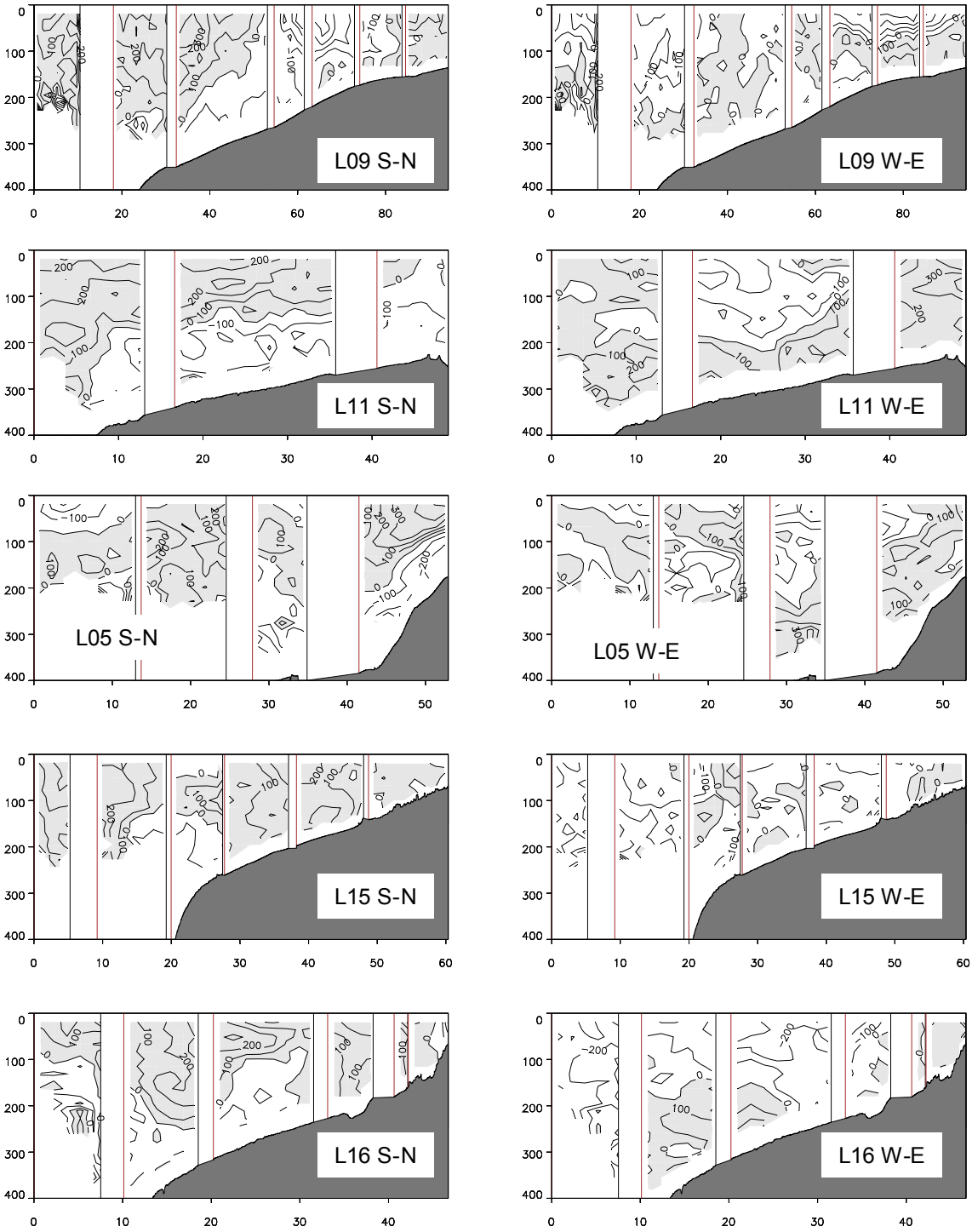

Figure 4.5 continued.

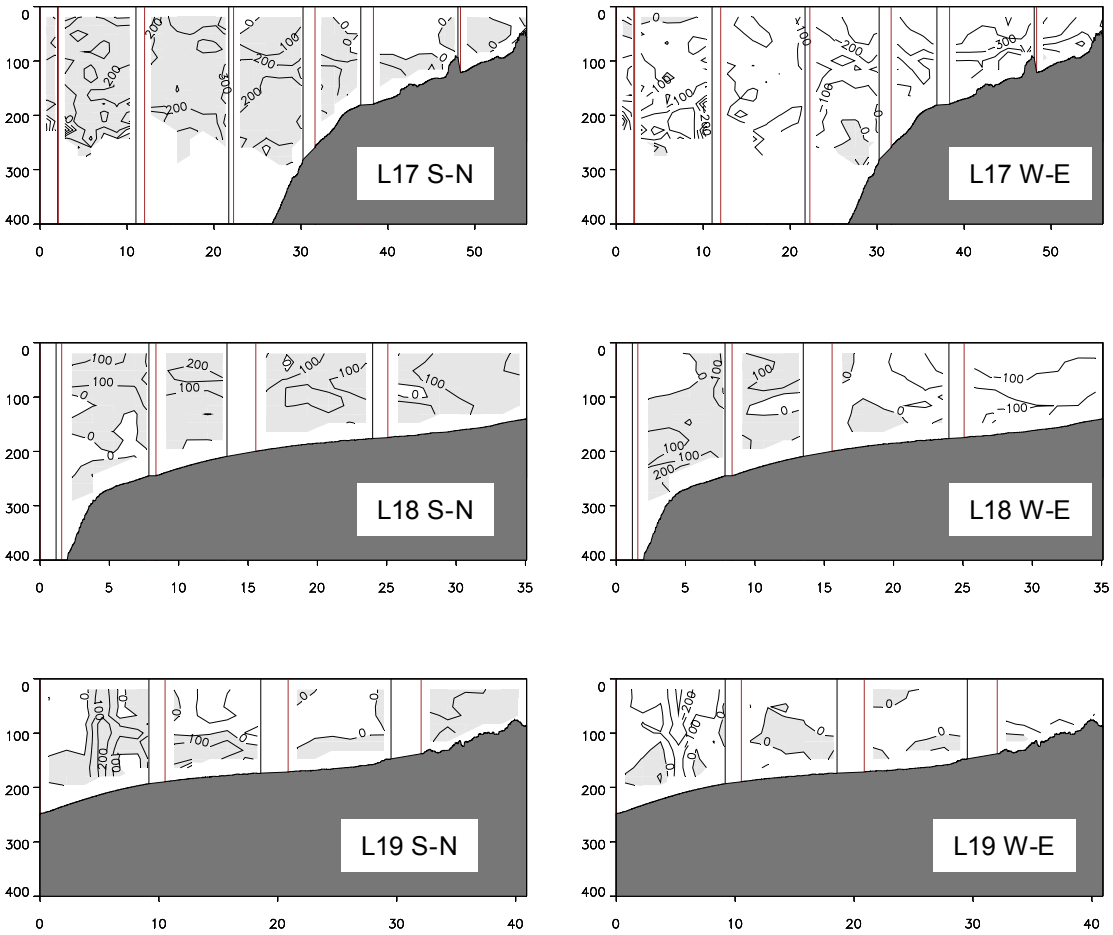

Figure 4.5 continued.

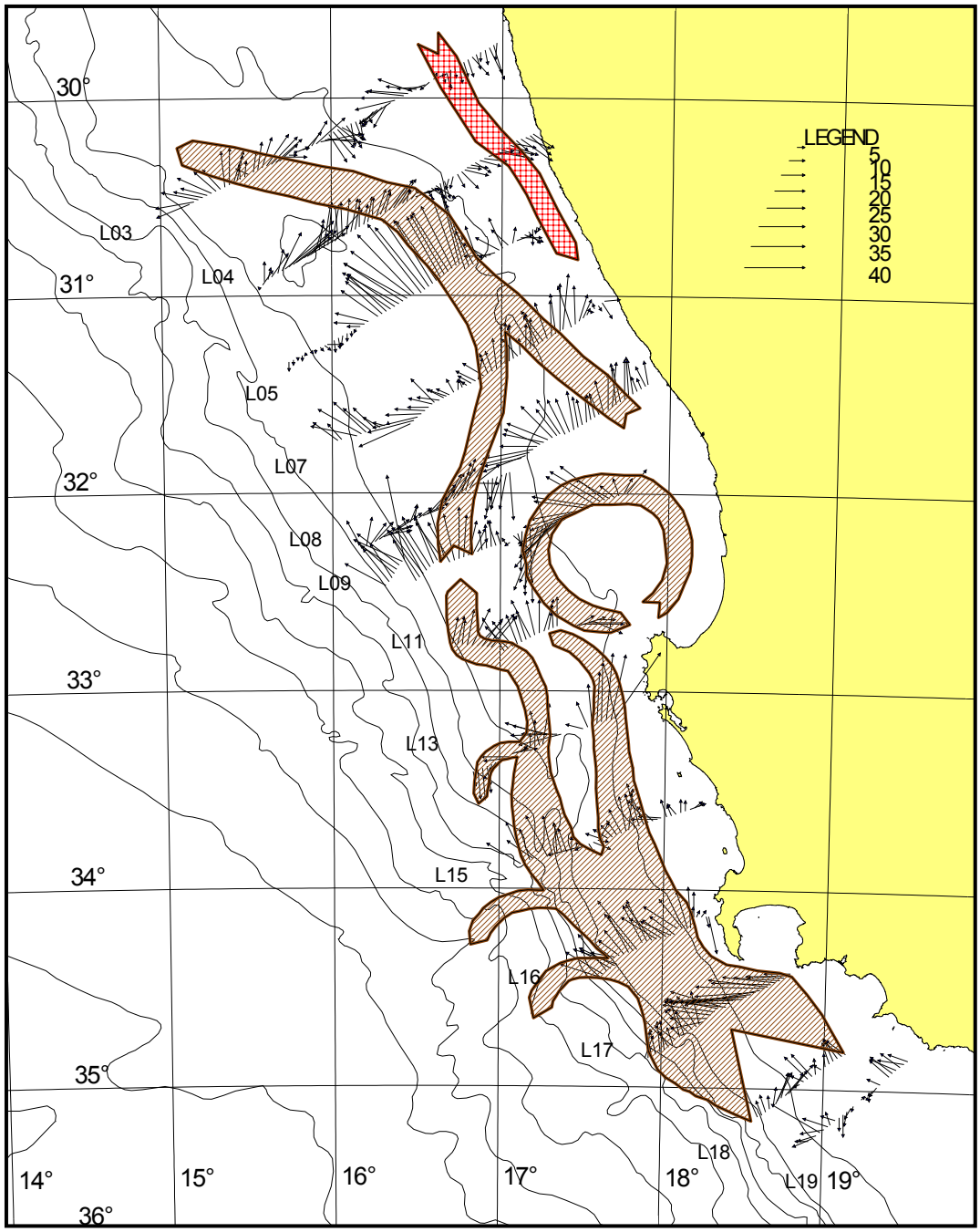

Figure 4.6. Conceptual model of the drift pathways based on the ADCP measured currents. The model is overlaid over the current vectors from a depth of 35 meters. Current speed in cm/s. The line symbols referred to in the text are shown to the left of the respective line. The model is applicable to a top 100-150 m of the water column.

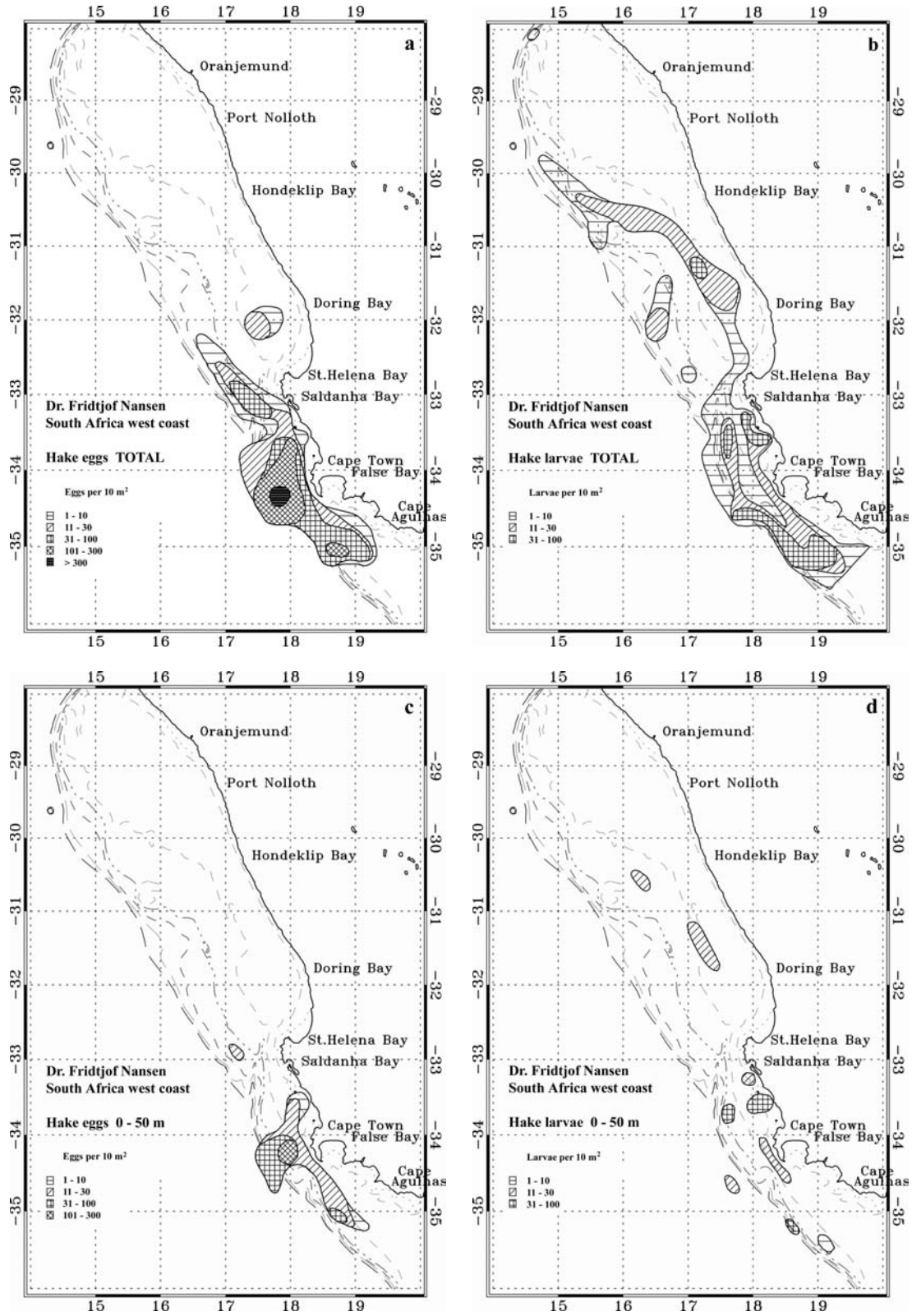

Figure 4.7 a-d Distribution of hake eggs and larvae.

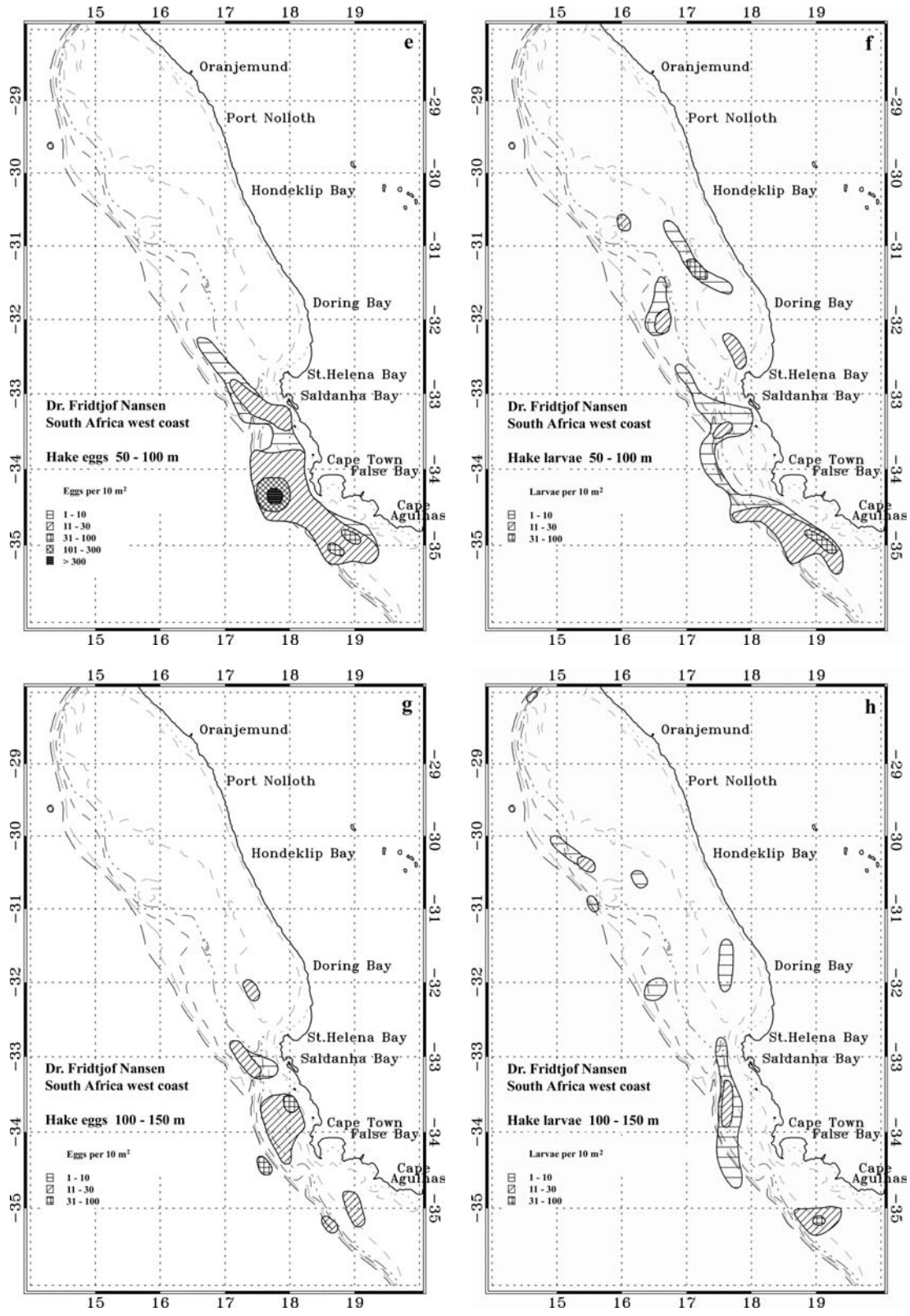

Figure 4.7 e-h Distribution of hake eggs and larvae.

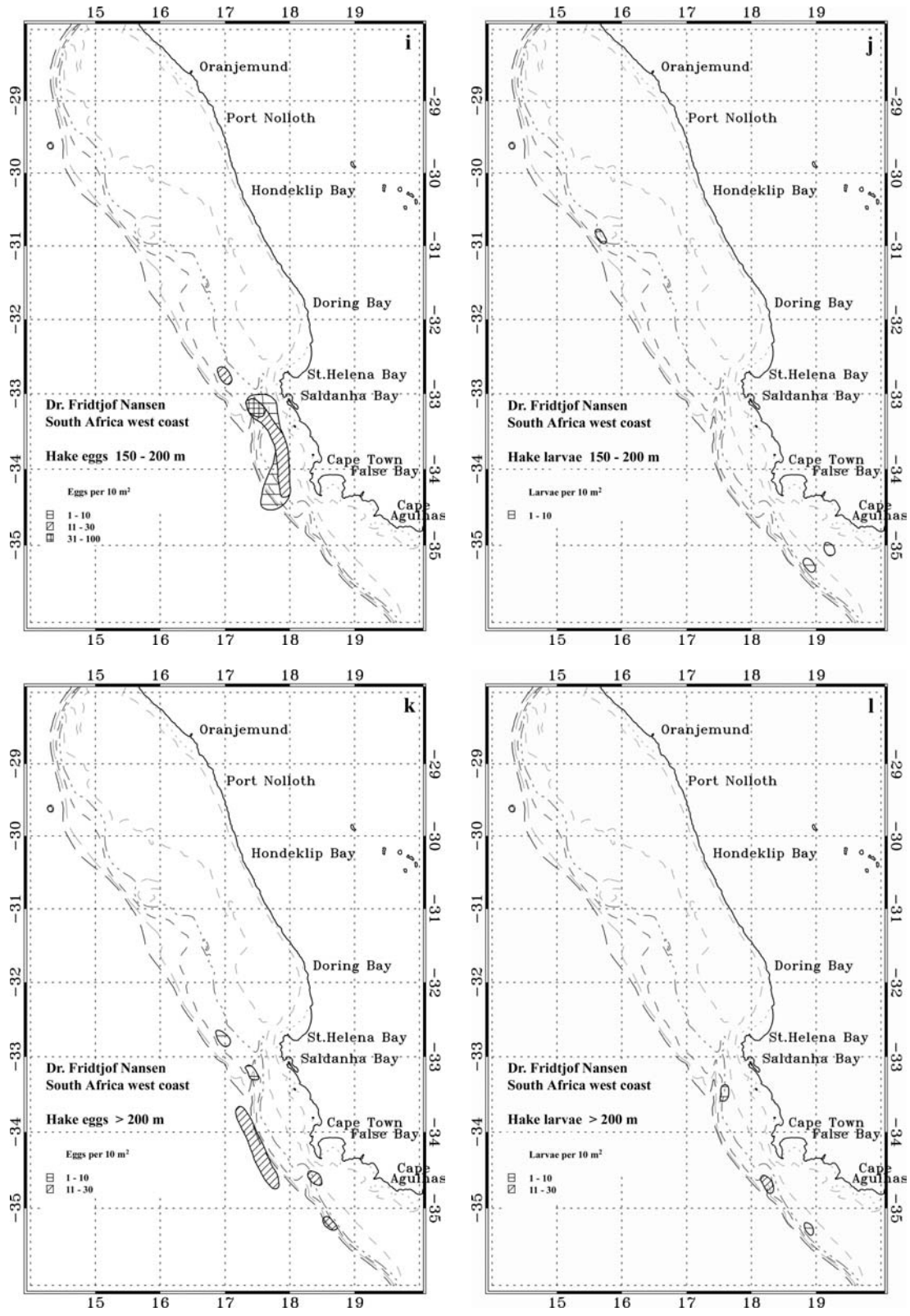

Figure 4.7 i-l Distribution of hake eggs and larvae.

4.2.2 Size distribution

The size of the hake larvae were relatively small, ranging from 2 to 15 mm with most of the larvae between 3 and 6 mm (Figure 4.8). Using a growth rate of 0.45 mm day^{-1} (Grote, 2005) most of the larvae would then be between one and two weeks old at the time they were collected.

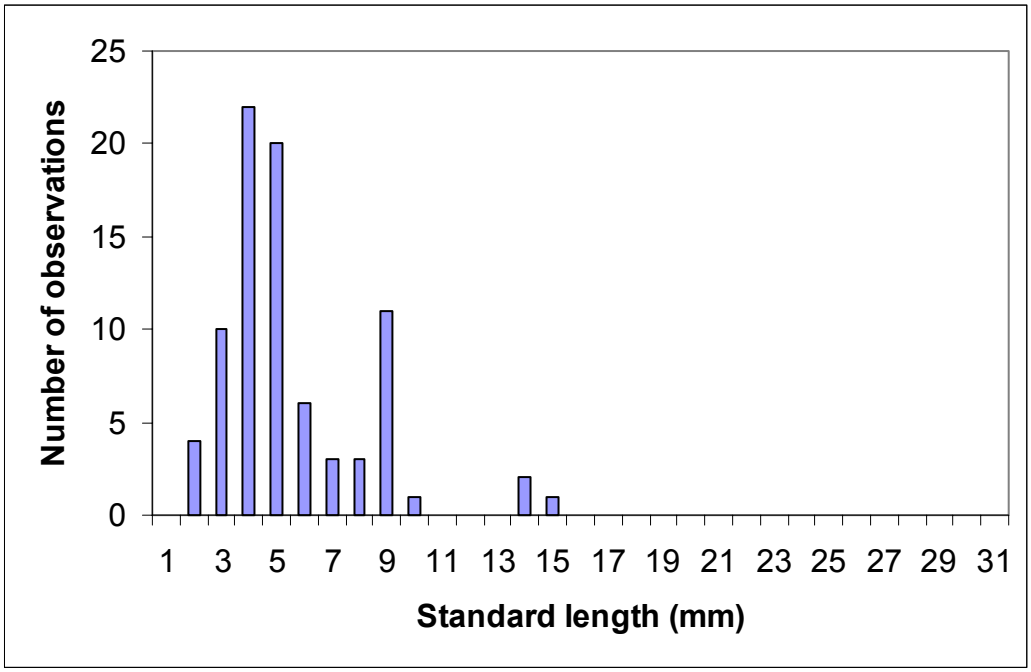

Figure 4.8. Size distribution of hake larvae caught in the Multinet.

4.2.3 Buoyancy measurements

No hake eggs in good condition for buoyancy measurements were observed on the survey. However, a sample of good quality round herring eggs was taken at a station just north of St. Helena Bay. 30 of these eggs were inserted into one of the density gradient columns and measured several times until hatching. The eggs were in late stage and started to hatch the day after sampling. The salinity of neutral buoyancy of the round herring eggs varied between 31.8 and 34.5 (Figure 4.9) and the mean value was 32.8.

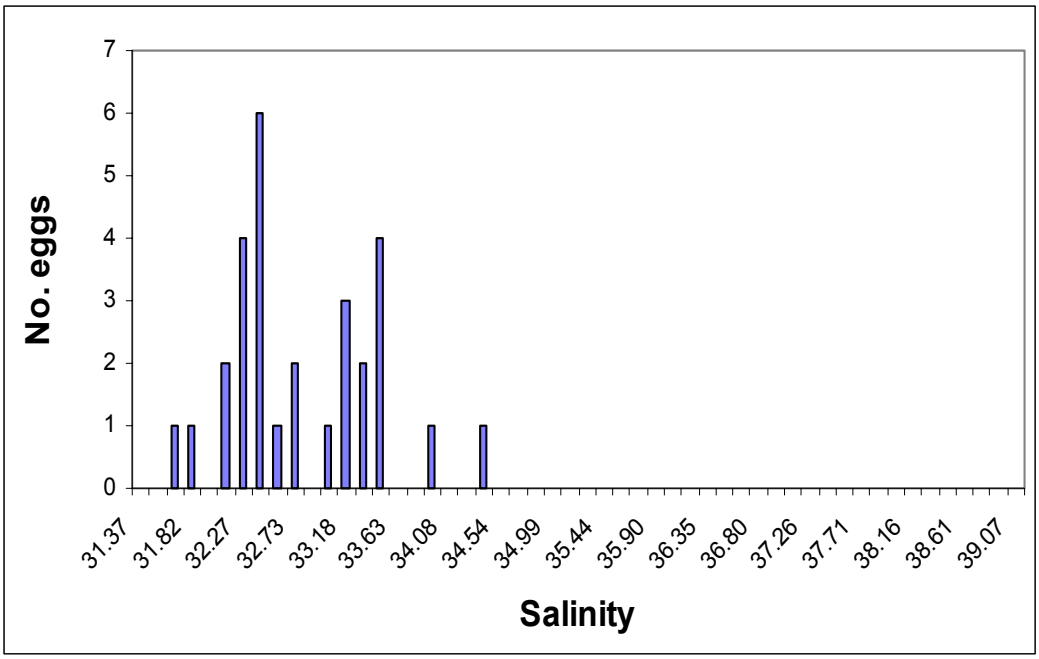

Figure 4.9. Salinity of neutral buoyancy of round herring eggs close to hatching.

4.3 Fish Biology

Annex 1 shows the complete record of the fishing stations.

4.3.1 Maturity stages

Figure 4.10 shows the size distribution in the biological samples of *M. paradoxus* while Figure 4.11 shows the relative distribution of maturity stages by latitude for *M. paradoxus* larger than 39 cm during the survey. The figure shows an increasing share of ripe and spent gonads southwards. In the north it is mainly active-inactive gonads, while the few running specimens were only observed in the very south of the survey area.

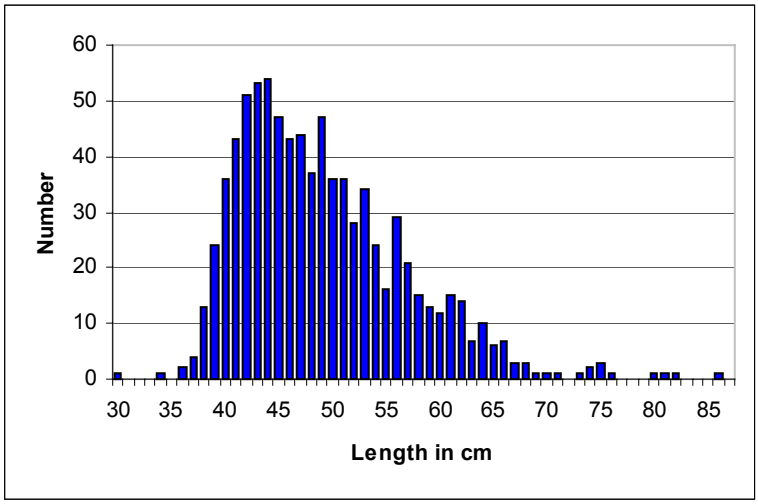

Figure 4.10 size distribution in the biological samples of *M. paradoxus*

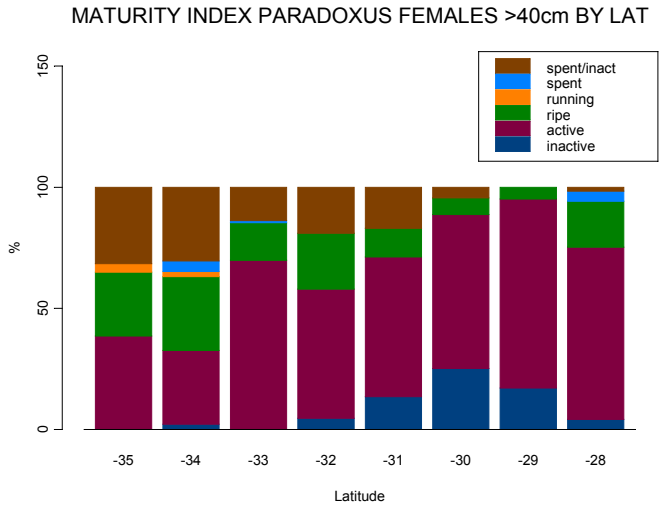

Figure 4.11 Maturity distribution of female deep-water hake larger than 40cm by latitude.

4.3.2 Gonadosomaic index (GSI)

Changes in GSI (defined as [gonad weigh/(whole weight-gonad weight)]*100) are used as indicators of reproductive phases in fishes, where a peak in GSI is linked to peak spawning activities. The mean size of fish sampled for biological purposes was 54 cm.

With the exception of latitudes 29 and 31, the GSI seems to be generally high in the sampling area, with a peak observed between 33 and 35 degrees (Fig. 4.12). This indicates a presence of fish with mature ovaries, and some form of spawning activities in this area. This should however be confirmed by histological analysis of ovaries in

the laboratory, to see if there are some ovaries with post-ovulatory follicles (POF, spent gonads).

Macroscopically, there were no ripe&running (spawning) female ovaries found during the course of the survey, although there were some ripe as well as spent ones.

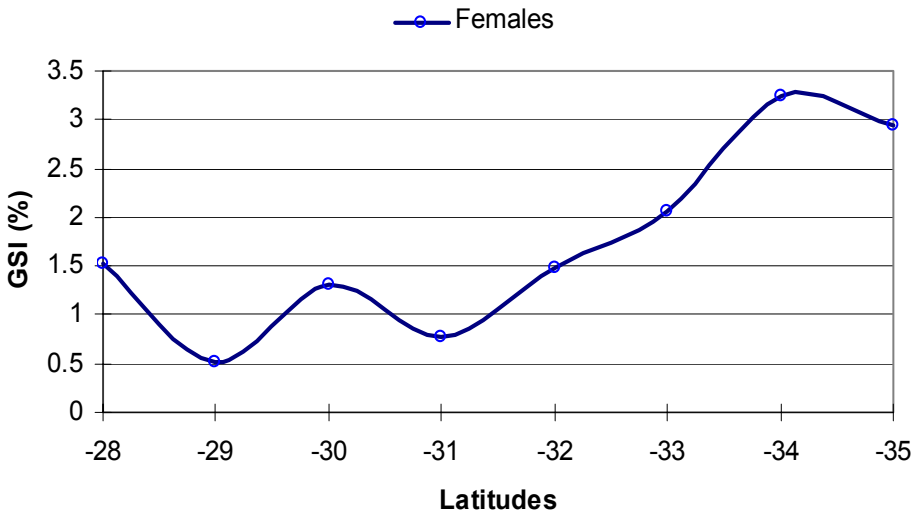

Figure 4.12 Mean GSI per latitude for *M. paradoxus* females sampled during the cruise

4.3.3 Aging from otolithes (by Richard Laubscher*)*

A total of 120 *M. paradoxus* (hake) otoliths from a range of size cohorts were processed, of which 114 yielded data. The sample was subjectively selected with the bias towards the smallest fish (based on fish length). A few larger individuals were also selected to provide depth to age:size relationships. Thus the data presented here has no relation to any seasonal or environmental parameters. An Excel spreadsheet was set up to capture the morphometric data of the fish and otoliths, to which was added the otolith ring number. The number of rings detected was plotted against the length of the whole fish. A graph was plotted in Excel using otolith ring number as the independent variable and fish length as the dependant variable (Figure 4.13). Using the graph fitting tool of Excel, a regression line was fitted to the coordinates. An exponential curve fitted the data best with $r^2 = 0.75$ (n = 114).

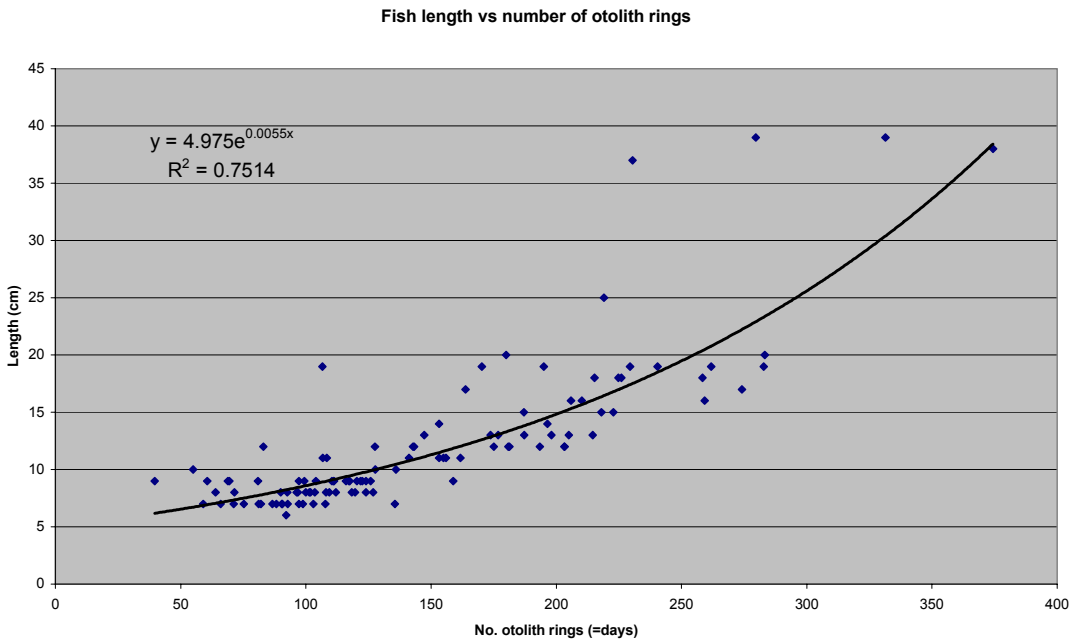

Figure 4.13

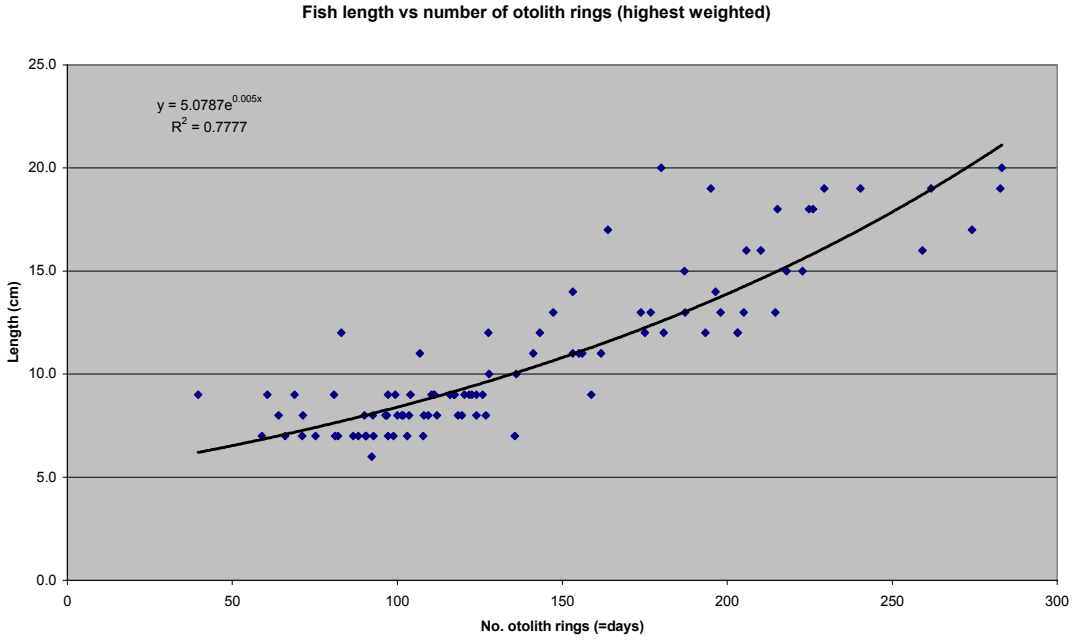

Figure 4.14

Using the weighting system, lower scoring data points (points weighted at less than 2 out of 5) were excluded and the age length variables replotted (Figure 4.14). This resulted in an increase in r^2 to 0.78 (n = 96). The data points excluded included those originating from larger otoliths. Larger otoliths were more difficult to prepare and to count rings.

Certain technical difficulties were encountered in the otolith studies, especially in determining the hatching point from microscopic investigations of longitudinally sectioned sagittal otoliths. Smaller otoliths provided the clearest samples to count ring structures; larger samples required more care in determining the correct plane of sectioning. An assumption was made that ring formation was the function of daily circadian activity. Quite often, rings near the nucleus were arranged in discrete bundles and which were interpreted as being bundles of sub-daily rings. Once again these were much clearer in the smaller otoliths, with larger otoliths having more diffuse bands. Larger otoliths also had multiple secondary nuclei, and this made accurate ring counting more difficult. This can be clearly seen in Fig. 4.13, where there are broader groupings of age-length coordinates as the putative age of the fish increases. Selective removal of lower weighted quality rated data points indicates that the quality weighting developed for squid statoliths has some use as a tool for improving precision in age determination studies in hake otoliths. Larger sample sizes may also lead to a higher confidence in age estimations.

To conclude, the regression curve fitting the data coordinates reveals a positive relationship between number of rings and fish length. A regression of 0.75 indicates a relatively close relationship between number of otolith rings and the size of fish, although the exclusion of low quality rated data does improve the r^2 value. Nevertheless, the results suggests that if otolith rings can be shown to be a product of daily deposition, otolith samples can provide a high resolution tool for ageing hake.

5 Considerations of the survey results

- The survey was conducted in a period of oscillating wind patterns, which generated unstable currents with no clear formation of retention areas, except for a gyre formed in St. Helena Bay. However, the general flow on the shelf was northwards, with a southward coastal counter current observed off Hondeklip Bay.
- The maturity index shows low presence of running females and these are found only south of Cape Town. In the north it is recorded mainly inactive-active gonads while there is a southward increasing trend of ripe gonads. This fish is mainly located at the outer shelf and slope.
- Hake eggs were only observed in the southernmost part of the survey, mostly over bottom depths between 200 and 500 m. No eggs were observed north of 32°S. Highest concentrations were observed south-west of Cape Town.
- Eggs were observed throughout the water column, but the upper 100m held the highest concentrations. The deeper eggs tended to be more offshore than eggs observed in the upper layers.
- The major part of hake larvae were found in the southern area, south of Saldanha Bay and with the highest abundance on the western Agulhas Bank. North of Saldanha Bay, a band of larvae of lower density was observed, forming an offshore trend northwards. Since no eggs were observed in this area it is assumed that the larvae originates from an egg-stage more south, drifting northwards.
- Most of the larvae were observed in the upper 150 m water column.
- The size of the hake larvae were relatively small, most of them between 3 and 6 mm, calculated to be between one and two weeks old.
- It was not possible to distinguish between the two species of hake eggs and larvae in the field. Such separation will be left for a post survey review when the results from the post-survey genetic analysis will be available.

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Strømme, T., Lipinski, M., Ostrowski, M. and Alvheim, O. 2004. A transboundary study with emphasis on deep water hake in the Lüderitz – Orange River Cone Area. BCLME SURVEY NO. 1 2004. Bergen 2004, 37 pp. Mimeo.

Strømme, T., Lipinski, M., Ostrowski, M. and Alvheim, O. 2004. Transboundary survey between Namibia and South Africa with focus on shared stocks of hake. SURVEY NO. 1 2005. Bergen 2005, 82 pp. Mimeo.

Annex 1 Records of fishing stations

PROJECT STATION:1109

DATE:27/ 9/05 GEAR TYPE: BT No:15 POSITION:Lat S 3533
start stop duration Long E 1858
TIME :05:49:52 06:22:31 33 (min) Purpose code: 3
LOG :8509.03 8510.54 1.49 Area code : 1
FDEPTH: 550 538 GearCond.code:
BDEPTH: 550 538 Validity code:
Towing dir: 140ø Wire out:1400 m Speed: 30 kn*10

Sorted: 741 Kg Total catch: 762.38 CATCH/HOUR: 1386.15

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	1030.91	4787	74.37	9645
Merluccius paradoxus	138.18	122	9.97	9644
Lophius vomerinus	45.45	11	3.28	9647
Caelorinchus simorhynchus	41.82	685	3.02	
Todaropsis eblanae - females	32.73	164	2.36	9650
Todaropsis eblanae	32.73	182	2.36	9648
Todaropsis eblanae - males	20.00	133	1.44	9649
Helicolenus dactylopterus	12.73	51	0.92	9646
Bassanago albescens	9.09	22	0.66	
Coelorinchus braueri	9.09	325	0.66	
Malacocephalus laevis	4.18	13	0.30	
Myxine capensis	1.82	20	0.13	
Lucigadus ori	1.82	202	0.13	
Photichthys argenteus	1.42	18	0.10	
Holohalaelurus regani	0.98	2	0.07	
Psychrolutes inermis	0.91	13	0.07	
Tripterophycis gilchristi	0.71	45	0.05	
Raja leopardus	0.35	4	0.03	
Ophichthus bennettai	0.29	2	0.02	
Chaceon chuni	0.24	2	0.02	
Epigonus sp.	0.22	13	0.02	
Lycoteuthis lorigera	0.20	4	0.01	
Shrimps, small, non comm.	0.11	9	0.01	
Parapagurus pilosimanus	0.11	4	0.01	
Rossia enigmatica	0.11	4	0.01	
Stereomastis sp.	0.05	7		
Lampanyctodes hectoris	0.02	7		
Maurolicus muelleri	0.00	2		
Total	1386.27		100.02	

PROJECT STATION:1110

DATE:27/ 9/05 GEAR TYPE: BT No:15 POSITION:Lat S 3528
start stop duration Long E 1857
TIME :10:05:14 10:16:55 12 (min) Purpose code: 3
LOG :8521.95 8522.57 0.62 Area code : 1
FDEPTH: 390 381 GearCond.code:
BDEPTH: 390 381 Validity code: 2
Towing dir: 320ø Wire out:1050 m Speed: 30 kn*10

Sorted: 206 Kg Total catch: 205.75 CATCH/HOUR: 1028.75

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	335.00	1920	32.56	9651
Helicolenus dactylopterus	175.00	860	17.01	9653
Parapagurus pilosimanus	115.00		11.18	
Caelorinchus simorhynchus	100.00	2500	9.72	
Todaropsis eblanae - females	92.50	575	8.99	9656
Todaropsis eblanae - males	70.00	570	6.80	9655
Rochinia sp.	50.00		4.86	
Scyliorhinus capensis	27.50	30	2.67	
Malacocephalus laevis	18.50	60	1.80	
Torpedo nobiliana	12.50	5	1.22	
Lophius vomerinus	12.00	10	1.17	9654
Holohalaelurus regani	5.00	5	0.49	
Lepidopus caudatus	5.00	10	0.49	
Zeus capensis	5.00	5	0.49	9655
Trachurus capensis	3.50	15	0.34	9652
Lampanyctodes hectoris	0.50		0.05	
Maurolicus muelleri	0.50		0.05	
Tripterophycis gilchristi	0.50	40	0.05	
Coelorinchus braueri	0.35	30	0.03	
Physiculus capensis	0.20	20	0.02	
Paracallionymus costatus	0.15	20	0.01	
Lucigadus ori	0.05	35		
Octopus magnificus	0.00	5		
Total	1028.75		100.00	

PROJECT STATION:1111

DATE:27/ 9/05 GEAR TYPE: BT No:15 POSITION:Lat S 3524
start stop duration Long E 1907
TIME :13:07:12 13:36:55 30 (min) Purpose code: 3
LOG :8534.34 8535.85 1.50 Area code : 1
FDEPTH: 235 229 GearCond.code:
BDEPTH: 235 229 Validity code:
Towing dir: 120ø Wire out: 580 m Speed: 30 kn*10

Sorted: 356 Kg Total catch: 355.94 CATCH/HOUR: 711.88

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	314.00	1748	44.11	9661
Merluccius capensis	118.00	266	16.58	9658
Lepidopus caudatus	76.00	160	10.68	
Prionace glauca	56.00	2	7.87	
Merluccius capensis	29.00	24	4.07	9657
Caelorinchus simorhynchus	22.00	386	3.09	
Parapagurus dimorphus	18.00		2.53	
Merluccius paradoxus	17.00	106	2.39	9659
Lophius vomerinus	16.00	20	2.25	9664
Helicolenus dactylopterus	10.00	88	1.40	9662
Squalus megalops	8.00	24	1.12	
Raja straeleni	6.00	8	0.84	
Holohalaelurus regani	6.00	16	0.84	
Zeus capensis	4.00	14	0.56	9666
Todaropsis eblanae	2.80	28	0.39	9667
Paracallionymus costatus	2.80	280	0.39	
Scyliorhinus capensis	2.60	14	0.37	
Cynoglossus zanzibarensis	2.60	50	0.37	9663
Genypterus capensis	0.52	2	0.07	9665
Merluccius paradoxus, juvenile	0.46	64	0.06	9660
Champsodon capensis	0.10	16	0.01	
Total	711.88		99.99	

PROJECT STATION:1112

DATE:28/ 9/05 GEAR TYPE: BT No:15 POSITION:Lat S 3512
start stop duration Long E 1836
TIME :10:29:31 10:59:51 30 (min) Purpose code: 3
LOG :8666.64 8668.22 1.57 Area code : 1
FDEPTH: 622 605 GearCond.code:
BDEPTH: 622 605 Validity code:
Towing dir: 130ø Wire out:1500 m Speed: 30 kn*10

Sorted: 140 Kg Total catch: 139.86 CATCH/HOUR: 279.72

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	60.00	42	21.45	9668
Merluccius paradoxus	50.00	172	17.88	9669
Coelorinchus braueri	48.00	1600	17.16	
Lophius vomerinus	22.00	8	7.87	9671
Helicolenus dactylopterus	18.00	86	6.44	9670
Etmopterus brachyurus	14.58	248	5.21	
Chaceon chuni	13.20	132	4.72	
Todaropsis eblanae	11.00	62	3.93	9672
Sergia sp.	10.20		3.65	
Bassanago albescens	6.00	6	2.15	
Selachophidium guentheri	3.58	38	1.28	
Nezumia sp.	3.40	340	1.22	
Notacanthus sexspinis	3.26		1.17	
Myxine capensis	2.82	30	1.01	
Rochinia sp.	2.52	252	0.90	
Psychrolutes macrocephalus	2.20	42	0.79	
Eptatretus profundus	1.80	2	0.64	
Raja leopardus	1.62	60	0.58	
Lucigadus ori	0.92	86	0.33	
Malacocephalus laevis	0.82	2	0.29	
Photichthys argenteus	0.72	16	0.26	
Funchalia woodwardi	0.50	30	0.18	
Caelorinchus simorhynchus	0.46	12	0.16	
Trachyscorpia capensis	0.34	4	0.12	
Coelorinchus matamua	0.32	2	0.11	
Ophichthus bennettai	0.28	2	0.10	
Bathypolypus valdiviae	0.24	4	0.09	
Tripterophycis gilchristi	0.24	12	0.09	
Epigonus sp.	0.16	12	0.06	
Rossia enigmatica	0.12	4	0.04	
Oreosoma atlanticum	0.12	2	0.04	
Plesiopenaeus edwardsianus	0.06	2	0.02	
Symbolophorus boops	0.06	4	0.02	
Hoplostethus mediterraneus	0.06	36	0.02	
Physiculus capensis	0.04	2	0.01	
Lampanyctodes hectoris	0.04	18	0.01	
Diaphus sp.	0.02	2	0.01	
Diaphus effulgens	0.02	2	0.01	
Argyropelecus sp.	0.00	2		
Paraliparis australis	0.00	4		
Total	279.72		100.02	

PROJECT STATION:1113

DATE:28/ 9/05 GEAR TYPE: BT No:15 POSITION:Lat S 3505
start stop duration Long E 1842
TIME :15:45:33 16:16:37 31 (min) Purpose code: 3
LOG :8688.45 8690.09 1.63 Area code : 1
FDEPTH: 252 265 GearCond.code:
BDEPTH: 252 265 Validity code:
Towing dir: 230ø Wire out: 625 m Speed: 30 kn*10

Sorted: 156 Kg Total catch: 281.27 CATCH/HOUR: 544.39

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	355.35	1845	65.27	9674
Trachurus capensis	78.39	356	14.40	9676
Helicolenus dactylopterus	27.87	478	5.12	9677
Merluccius capensis	27.87	39	5.12	9673
Caelorinchus simorhynchus	12.93	323	2.38	
Merluccius paradoxus, juvenile	10.03	3165	1.84	9675
Paracallionymus costatus	6.14	766	1.13	
Lophius vomerinus	4.84	21	0.89	9679
Holohalaelurus regani	4.18	21	0.77	
Chelidonichthys capensis	4.01	4	0.74	
Champsodon capensis	3.27	285	0.60	
Parapagurus dimorphus	2.88		0.53	
Todaropsis eblanae	2.54	39	0.47	9680
Malacocephalus laevis	1.61	10	0.30	
Cynoglossus zanzibarensis	1.32	83	0.24	9678
Scyliorhinus capensis	1.05	4	0.19	
Lampanyctodes hectoris	0.14	25	0.03	
Total	544.42		100.02	

PROJECT STATION:1114

DATE:29/ 9/05 GEAR TYPE: BT No:15 POSITION:Lat S 3439
start stop duration Long E 1815
TIME :11:19:37 11:49:50 30 (min) Purpose code: 3
LOG :8795.85 8797.25 1.39 Area code : 1
FDEPTH: 483 490 GearCond.code:
BDEPTH: 483 490 Validity code:
Towing dir: 165ø Wire out:1200 m Speed: 30 kn*10
Sorted: 458 Kg Total catch: 457.66 CATCH/HOUR: 915.32

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	702.00	2502	76.69	9675
Merluccius paradoxus	106.00	82	11.58	9674
Bassanago albescens	46.00	64	5.03	
Caelorinchus simorhynchus	22.00	440	2.40	
Lophius vomerinus	14.00	6	1.53	9677
Todaropsis eblanae - females	13.60	76	1.49	9679
Todaropsis eblanae - males	6.40	48	0.70	9678
Helicolenus dactylopterus	1.78	36	0.19	9676
Raja leopardus	0.84	30	0.09	
Sergia sp.	0.60		0.07	
Rochinia sp.	0.28	36	0.03	
Funchalia woodwardi	0.26	20	0.03	
Lucigadus ori	0.22	22	0.02	
Parapagurus pilosimanus	0.20	12	0.02	
Bathypolypus valdiviae	0.18	8	0.02	
Epigonus sp.	0.18	18	0.02	
Physiculus capensis	0.14	10	0.02	
Tripterophycis gilchristi	0.14	10	0.02	
Hoplostethus mediterraneus	0.14	6	0.02	
Rossia enigmatica	0.10	4	0.01	
Lampanyctodes hectoris	0.10	54	0.01	
Photichthys argenteus	0.08	2	0.01	
Paracallionymus costatus	0.06	10	0.01	
Stereomastis sp.	0.02	2		
Total	915.32		100.01	

PROJECT STATION:1115

DATE:30/ 9/05 GEAR TYPE: BT No:15 POSITION:Lat S 3423

start stop duration Long E 1743

TIME :05:42:41 06:12:35 30 (min) Purpose code: 3

LOG :8874.54 8876.01 1.46 Area code : 1

FDEPTH: 510 525 GearCond.code:

BDEPTH: 510 525 Validity code:

Towing dir: 320ø Wire out:1250 m Speed: 30 kn*10

Sorted: 418 Kg Total catch: 417.83 CATCH/HOUR: 835.66

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	666.00	2682	79.70	9681
Merluccius paradoxus	64.00	42	7.66	9680
Caelorinchus simorhynchus	22.00	314	2.63	
Bassanago albescens	21.00	36	2.51	
Helicolenus dactylopterus	12.00	84	1.44	9682
Octopus magnificus	10.80	2	1.29	
Coelorinchus braueri	8.80	338	1.05	
Notacanthus sexspinis	7.34	130	0.88	
Todaropsis eblanae - males	5.54	38	0.66	9684
Shrimps, small, non comm.	4.00		0.48	
Squalus mitsukurii	4.00	2	0.48	
Todaropsis eblanae - females	3.90	20	0.47	9685
Lophius vomerinus	3.00	4	0.36	9683
Psychrolutes macrocephalus	0.90	4	0.11	
Lucigadus ori	0.62	64	0.07	
Tripterophycis gilchristi	0.46	22	0.06	
Maurolicus muelleri	0.40		0.05	
Myxine capensis	0.34	4	0.04	
Epigonus sp.	0.20	16	0.02	
Lampanyctodes hectoris	0.20		0.02	
Paracallionymus costatus	0.06	8	0.01	
Rossia enigmatica	0.04	2		
Physiculus capensis	0.04	4		
Hoplostethus mediterraneus	0.02	2		
Total	835.66		99.99	

PROJECT STATION:1116

DATE:30/ 9/05 GEAR TYPE: BT No:16 POSITION:Lat S 3418

start stop duration Long E 1754

TIME :09:46:13 10:15:57 30 (min) Purpose code: 3

LOG :8890.52 8892.06 1.51 Area code : 1

FDEPTH: 309 314 GearCond.code:

BDEPTH: 309 314 Validity code:

Towing dir: 310ø Wire out: 800 m Speed: 30 kn*10

Sorted: 218 Kg Total catch: 217.93 CATCH/HOUR: 435.86

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	204.00	1566	46.80	9687
Trachurus capensis	74.00	258	16.98	9689
Merluccius capensis	48.00	44	11.01	9686
Caelorinchus simorhynchus	45.80	776	10.51	
Emmelichthys nitidus	22.00	46	5.05	
Genypterus capensis	22.00	8	5.05	9692
Lophius vomerinus	6.00	4	1.38	9691
Helicolenus dactylopterus	3.40	36	0.78	9690
Todaropsis eblanae - males	2.32	18	0.53	9693
Todaropsis eblanae - females	2.28	16	0.52	9694
Octopus magnificus	2.00	2	0.46	
Merluccius paradoxus, juvenile	1.50	562	0.34	9688
Malacocephalus laevis	1.20	4	0.28	
Lampanyctodes hectoris	0.54		0.12	
Mursia cristimanus	0.32	28	0.07	
Champsodon capensis	0.22	38	0.05	
Paracallionymus costatus	0.12	16	0.03	
Parapagurus pilosimanus	0.08	6	0.02	
Holohalaelurus regani	0.06	4	0.01	
Squilla acuelata calmani	0.02	2		
Rochinia sp.	0.00	2		
Total	435.86		99.99	

PROJECT STATION:1117

DATE:30/ 9/05 GEAR TYPE: BT No:16 POSITION:Lat S 3414

start stop duration Long E 1803

TIME :12:58:20 13:28:17 30 (min) Purpose code: 3

LOG :8907.27 8908.89 1.58 Area code : 1

FDEPTH: 247 248 GearCond.code:

BDEPTH: 247 248 Validity code:

Towing dir: 315ø Wire out: 600 m Speed: 30 kn*10

Sorted: 292 Kg Total catch: 1512.02 CATCH/HOUR: 3024.04

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	2818.00	11918	93.19	9697
Merluccius paradoxus	51.80	518	1.71	9696
Parapagurus dimorphus	38.86	4318	1.29	
Maurolicus muelleri	31.00		1.03	
Caelorinchus simorhynchus	31.00	622	1.03	
Helicolenus dactylopterus	29.00	870	0.96	9698
Emmelichthys nitidus	14.00	52	0.46	
Todaropsis eblanae	4.36	52	0.14	9699
Merluccius capensis	4.24	10	0.14	9695
Paracallionymus costatus	1.04	166	0.03	
Rossia enigmatica	0.42	10	0.01	
Champsodon capensis	0.32	52	0.01	
Total	3024.04		100.00	

PROJECT STATION:1118

DATE:30/ 9/05 GEAR TYPE: BT No:16 POSITION:Lat S 3410

start stop duration Long E 1810

TIME :15:08:18 15:38:07 30 (min) Purpose code: 3

LOG :8920.39 8921.95 1.55 Area code : 1

FDEPTH: 184 185 GearCond.code:

BDEPTH: 184 185 Validity code:

Towing dir: 330ø Wire out: 450 m Speed: 30 kn*10

Sorted: 89 Kg Total catch: 88.92 CATCH/HOUR: 177.84

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Etrumeus whiteheadi	76.00	2000	42.74	
Zeus capensis	36.00	342	20.24	9708
Trachurus capensis	20.00	98	11.25	9702
Merluccius capensis	16.00	38	9.00	9700
Chelidonichthys capensis	12.00	34	6.75	9706
Genypterus capensis	6.00	10	3.37	9705
Thyrsites atun	6.00	4	3.37	9704
Caelorinchus simorhynchus	1.36	16	0.76	
Todaropsis eblanae	1.20	10	0.67	9707
Helicolenus dactylopterus	1.16	24	0.65	9703
Emmelichthys nitidus	1.10	4	0.62	
Squalus megalops	0.56	2	0.31	
Galeus polli	0.26	2	0.15	
Paracallionymus costatus	0.10	14	0.06	
Holohalaelurus regani	0.08	2	0.04	
Merluccius paradoxus, juvenile	0.02	8	0.01	9701
Total	177.84		99.99	

PROJECT STATION:1119

DATE: 1/10/05 GEAR TYPE: BT No:16 POSITION:Lat S 3345

start stop duration Long E 1737

TIME :05:08:17 05:39:29 31 (min) Purpose code: 3

LOG :9007.86 9009.42 1.56 Area code : 1

FDEPTH: 256 249 GearCond.code:

BDEPTH: 256 249 Validity code:

Towing dir: 70ø Wire out: 700 m Speed: 30 kn*10

Sorted: 302 Kg Total catch: 963.90 CATCH/HOUR: 1865.61

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	1381.94	5106	74.07	9712
Merluccius paradoxus	236.90	2725	12.70	9711
Caelorinchus simorhynchus	118.45	3385	6.35	
Thyrsites atun	42.58	15	2.28	9714
Parapagurus dimorphus	17.38		0.93	
Lampanyctodes hectoris	15.10		0.81	
Maurolicus muelleri	15.10		0.81	
Paracallionymus costatus	10.86	2172	0.58	
Merluccius capensis	9.10	6	0.49	9709
Merluccius capensis	6.58	14	0.35	9710
Todaropsis eblanae - females	5.07	33	0.27	9715
Malacocephalus laevis	2.30	60	0.12	
Helicolenus dactylopterus	2.17	118	0.12	9713
Holohalaelurus regani	0.85	6	0.05	
Lycoteuthis lorigera	0.52	14	0.03	
Etrumeus whiteheadi	0.46	6	0.02	
Champsodon capensis	0.19	14	0.01	
Rossia enigmatica	0.06	6		
Total	1865.61		99.99	

PROJECT STATION:1120

DATE: 1/10/05 GEAR TYPE: BT No:16 POSITION:Lat S 3346

start stop duration Long E 1729

TIME :09:39:09 10:09:46 31 (min) Purpose code: 3

LOG :9026.30 9027.79 1.49 Area code : 1

FDEPTH: 393 400 GearCond.code:

BDEPTH: 393 400 Validity code:

Towing dir: 200ø Wire out:1000 m Speed: 30 kn*10

Sorted: 263 Kg Total catch: 890.27 CATCH/HOUR: 1723.10

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	1440.00	8890	83.57	9718
Caelorinchus simorhynchus	156.77	5806	9.10	
Merluccius capensis	34.84	25	2.02	9716
Genypterus capensis	19.35	4	1.12	9723
Ancistrocheirus lesueuri	10.72	2	0.62	
Paracallionymus costatus	8.88	741	0.52	
Helicolenus dactylopterus	8.59	89	0.50	9720
Lophius vomerinus	7.74	15	0.45	9722
Todaropsis eblanae - females	6.12	23	0.36	9726
Bassanago albescens	5.81	10	0.34	
Lophius vomerinus	5.81	6	0.34	9721
Helicolenus dactylopterus	5.81	12	0.34	9719
Merluccius paradoxus	3.87	8	0.22	9717
Todaropsis eblanae - males	3.14	29	0.18	9725
Zeus capensis	1.94	4	0.11	9724
Lycoteuthis lorigera	0.95	23	0.06	
Octopus magnificus	0.89	2	0.05	
Ctenopteryx sicula	0.77	8	0.04	
Emmelichthys nitidus	0.70	2	0.04	
Lucigadus ori	0.27	29	0.02	
Stereomastis sp.	0.14	29	0.01	
Total	1723.11		100.01	

PROJECT STATION:1121

DATE: 1/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 3348

start stop duration Long E 1724

TIME :16:43:36 17:05:16 22 (min) Purpose code: 3

LOG :9069.39 9070.54 1.13 Area code : 1

FDEPTH: 603 598 GearCond.code:

BDEPTH: 603 598 Validity code: 1

Towing dir: 180ø Wire out: 15 m Speed: 30 kn*10

Sorted: 209 Kg Total catch: 209.12 CATCH/HOUR: 570.33

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Coelorinchus braueri	245.45	3897	43.04	
Merluccius paradoxus	152.73	603	26.78	9728
Merluccius paradoxus	54.55	57	9.56	9727
Lepidion capensis	46.36	117	8.13	
Chaceon sp.	12.27	90	2.15	
Nezumia sp.	9.35	1336	1.64	
Funchalia woodwardi	8.18	908	1.43	
Lophius vomerinus	6.55	3	1.15	9729
Shrimps, small, non comm.	5.89		1.03	
Etmopterus brachyurus	5.45	123	0.96	
Trachyscorpia capensis	3.14	19	0.55	
Psychrolutes macrocephalus	3.08	22	0.54	
Notacanthus sexspinis	2.73	65	0.48	
Bassanago albescens	2.73	5	0.48	
Todaropsis eblanae - males	2.45	16	0.43	9730
Synaphobranchus kaupii	1.94	11	0.34	
Todaropsis eblanae - females	1.91	8	0.33	9731
Bathypolypus valdiviae	1.25	16	0.22	
RAJIDAE	0.76	5	0.13	
Raja caudaspinosa	0.76	25	0.13	
Hoplostethus mediterraneus	0.57	5	0.10	
Photichthys argenteus	0.55	25	0.10	
Kuronezumia leonis	0.33	5	0.06	
Lycodes agulhensis	0.33	3	0.06	
Lucigadus ori	0.27	25	0.05	
Ophichthus bennettai	0.27	3	0.05	
Tripterophycis gilchristi	0.14	8	0.02	
Selachophidium guentheri	0.14	5	0.02	
Epigonus sp.	0.08	3	0.01	
Lepidion capensis	0.05	3	0.01	
Symbolophorus boops	0.03	3	0.01	
Diaphus sp.	0.03	3	0.01	
Total	570.32		100.00	

PROJECT STATION:1122

DATE: 2/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 3321

	start	stop	duration			Long E 1705
TIME	:10:13:06	10:43:00	30	(min)	Purpose code: 3	
LOG	:9164.94	9166.49	1.54		Area code : 1	
FDEPTH:	605	606			GearCond.code:	
BDEPTH:	605	606			Validity code:	

Towing dir: 310ø Wire out:1500 m Speed: 30 kn*10

Sorted: 330 Kg Total catch: 331.90 CATCH/HOUR: 663.80

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	288.00	1188	43.39	9733
Merluccius paradoxus	144.00	144	21.69	9732
Funchalia woodwardi	74.00	3700	11.15	
Coelorinchus braueri	68.00	1114	10.24	
Chaceon sp.	30.00	300	4.52	
Bathyraja smithii	10.00	2	1.51	
Nezumia sp.	8.00		1.21	
Malacocephalus laevis	7.00	24	1.05	
Etmopterus brachyurus	6.76	30	1.02	
Bassanago albescens	4.60	20	0.69	
Helicolenus dactylopterus	3.80	16	0.57	9734
Selachophidium guentheri	3.12	34	0.47	
Coelorinchus matamua	3.10	18	0.47	
Eptatretus profundus	2.00	2	0.30	
Photichthys argenteus	1.54	32	0.23	
Symbolophorus boops	1.52	114	0.23	
Raja sp.	1.28	4	0.19	
Hydrolagus africanus	1.10	4	0.17	
Lucigadus ori	0.88	54	0.13	
Holohalaelurus regani	0.80	2	0.12	
RAJIDAE	0.76	6	0.11	
Raja leopardus	0.64	2	0.10	
Lycoteuthis lorigera	0.50	12	0.08	
Psychrolutes macrocephalus	0.42	18	0.06	
Todaropsis eblanae - females	0.40	2	0.06	9735
RAJIDAE	0.36	2	0.05	
Myxine capensis	0.32	6	0.05	
Lycodes agulhensis	0.24	2	0.04	
Notacanthus sexspinis	0.22	2	0.03	
Epigonus sp.	0.20	12	0.03	
Careproctus griseldea	0.14	2	0.02	
Oreosoma atlanticum	0.06	2	0.01	
Rossia sp.	0.04	2	0.01	
Total	663.80		100.00	

PROJECT STATION:1123

DATE: 2/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 3315

	start	stop	duration			Long E 1716
TIME	:14:32:05	15:02:02	30	(min)	Purpose code: 3	
LOG	:9184.47	9185.99	1.51		Area code : 1	
FDEPTH:	466	474			GearCond.code:	
BDEPTH:	466	474			Validity code:	

Towing dir: 350ø Wire out:1150 m Speed: 30 kn*10

Sorted: 455 Kg Total catch: 1325.19 CATCH/HOUR: 2650.38

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	2196.00	10980	82.86	9737
Merluccius paradoxus	292.80	312	11.05	9736
Bassanago albescens	50.00	66	1.89	
Caelorinchus simorhynchus	38.20	382	1.44	
Helicolenus dactylopterus	32.00	136	1.21	9738
Lophius vomerinus	26.00	10	0.98	9739
Brama brama	6.00	4	0.23	9740
Notacanthus sexspinis	3.52	6	0.13	
Malacocephalus laevis	2.10	6	0.08	
Tripterophycis gilchristi	1.52	114	0.06	
Parapagurus pilosimanus	1.06	50	0.04	
Stereomastis sp.	0.34	38	0.01	
Lucigadus ori	0.32	38	0.01	
Rossia enigmatica	0.26	6	0.01	
Paracallionymus costatus	0.20	26	0.01	
Physiculus capensis	0.06	6		
Total	2650.38		100.01	

PROJECT STATION:1124

DATE: 2/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 3311

	start	stop	duration			Long E 1723
TIME	:16:47:48	17:08:05	20	(min)	Purpose code: 3	
LOG	:9195.78	9196.83	1.03		Area code : 1	
FDEPTH:	412	408			GearCond.code:	
BDEPTH:	412	408			Validity code: 1	

Towing dir: 360ø Wire out:1150 m Speed: 31 kn*10

Sorted: 128 Kg Total catch: 200.72 CATCH/HOUR: 602.16

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	250.80	1458	41.65	9743
Lophius vomerinus	75.00	33	12.46	9745
Caelorinchus simorhynchus	72.00	720	11.96	
Bassanago albescens	57.00	78	9.47	
Parapagurus dimorphus	46.20		7.67	
Helicolenus dactylopterus	33.00	228	5.48	9744
Todaropsis eblanae - females	19.80	126	3.29	9748
Merluccius capensis	15.00	6	2.49	9741
Merluccius paradoxus	12.00	12	1.99	9742
Todaropsis eblanae - males	11.82	93	1.96	9747
Zeus capensis	2.10	3	0.35	9746
Raja miraletus	2.01	6	0.33	
Cyttus traversi	1.80	3	0.30	
Bathypolypus valdiviae	1.26	12	0.21	
RAJIDAE	0.99	6	0.16	
Psychrolutes macrocephalus	0.90	6	0.15	
Raja leopardus	0.33	3	0.05	
Epigonus telescopus	0.06	6	0.01	
Maurolicus muelleri	0.06		0.01	
Paracallionymus costatus	0.03	6		
Total	602.16		99.99	

PROJECT STATION:1125

DATE: 3/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 3248

	start	stop	duration			Long E 1643
TIME	:09:13:10	09:49:31	36	(min)	Purpose code: 3	
LOG	:9286.08	9287.89	1.79		Area code : 1	
FDEPTH:	529	507			GearCond.code:	
BDEPTH:	529	507			Validity code:	

Towing dir: 340ø Wire out:1300 m Speed: 30 kn*10

Sorted: 523 Kg Total catch: 523.23 CATCH/HOUR: 872.05

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	535.00	1503	61.35	9750
Merluccius paradoxus	200.00	167	22.93	9749
Chaceon sp.	30.00	362	3.44	
Helicolenus dactylopterus	30.00	273	3.44	9751
Todaropsis eblanae - females	23.00	102	2.64	9754
Notacanthus sexspinis	13.33	165	1.53	
Todaropsis eblanae - males	10.67	63	1.22	9753
Coelorinchus braueri	10.00	357	1.15	
Bassanago albescens	9.33	27	1.07	
Holohalaelurus regani	2.22	10	0.25	
Raja caudaspinosa	1.83	3	0.21	
Myxine capensis	1.67	23	0.19	
Lophius vomerinus	1.37	2	0.16	9752
Funchalia woodwardi	0.83	53	0.10	
Caelorinchus simorhynchus	0.67	15	0.08	
Psychrolutes macrocephalus	0.43	3	0.05	
Lycoteuthis lorigera	0.40	13	0.05	
Lucigadus ori	0.38	28	0.04	
Photichthys argenteus	0.33	7	0.04	
Hoplostethus mediterraneus	0.15	2	0.02	
Symbolophorus boops	0.13	2	0.01	
Epigonus sp.	0.13	10	0.01	
Diaphus effulgens	0.07	2	0.01	
Nezumia sp.	0.05	2	0.01	
Physiculus capensis	0.05	3	0.01	
Total	872.04		100.01	

PROJECT STATION:1126

DATE: 3/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 3248

	start	stop	duration			Long E 1658
TIME	:11:50:20	12:21:10	31	(min)	Purpose code: 3	
LOG	:9303.43	9305.03	1.88		Area code : 1	
FDEPTH:	354	351			GearCond.code:	
BDEPTH:	354	351			Validity code:	

Towing dir: 150ø Wire out: 875 m Speed: 30 kn*10

Sorted: 208 Kg Total catch: 207.87 CATCH/HOUR: 402.33

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	315.48	2508	78.41	9756
Helicolenus dactylopterus	19.35	101	4.81	9758
Zeus capensis	15.48	33	3.85	9761
Caelorinchus simorhynchus	13.55	205	3.37	
Thyrsites atun	12.58	4	3.13	9760
Lampanyctodes hectoris	9.68		2.41	
Merluccius capensis	4.84	4	1.20	9755
Holohalaelurus regani	4.06	17	1.01	
Lophius vomerinus	2.90	2	0.72	9759
Rochinia sp.	1.43	75	0.36	
Ornithoteuthis antillarum	0.60	2	0.15	
Malacocephalus laevis	0.54	4	0.13	
Parapagurus pilosimanus	0.52	37	0.13	
Rossia enigmatica	0.46	15	0.11	
Merluccius paradoxus, juvenile	0.27	68	0.07	9757
Exodromedia sp.	0.19	19	0.05	
Mursia cristimanus	0.15	29	0.04	
Myxine capensis	0.12	2	0.03	
Stereomastis sp.	0.04	6	0.01	
Sepia officinalis hierredda	0.02	4		
Paracallionymus costatus	0.02	2		
Emmelichthys nitidus	0.02	2		
Total	402.30		99.99	

PROJECT STATION:1127

DATE: 3/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 3241

	start	stop	duration			Long E 1722
TIME	:16:10:35	16:45:10	35	(min)	Purpose code: 3	
LOG	:9330.27	9331.91	1.62		Area code : 1	
FDEPTH:	269	263			GearCond.code:	
BDEPTH:	269	263			Validity code:	

Towing dir: 125ø Wire out: 625 m Speed: 30 kn*10

Sorted: 93 Kg Total catch: 93.32 CATCH/HOUR: 159.98

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	106.29	1473	66.44	9763
Callorhinchus capensis	15.43	5	9.64	
Parapagurus dimorphus	11.14		6.96	
Caelorinchus simorhynchus	10.29	177	6.43	
Trachurus capensis	3.94	12	2.46	9765
Lampanyctodes hectoris	3.43		2.14	
Maurolicus muelleri	1.71		1.07	
Paracallionymus costatus	1.11	141	0.69	
Etrumeus whiteheadi	1.11	15	0.69	
Merluccius capensis	1.05	2	0.66	9762
Lepidopus caudatus	0.98	17	0.61	
Lophius vomerinus	0.86	2	0.54	9768
Todaropsis eblanae - females	0.62	5	0.39	9770
Todaropsis eblanae - males	0.51	7	0.32	9769
Cynoglossus zanzibarensis	0.48	3	0.30	9767
Helicolenus dactylopterus	0.39	17	0.24	9766
Holohalaelurus regani	0.27	3	0.17	
Merluccius paradoxus, juvenile	0.21	65	0.13	9764
Rochinia sp.	0.09	2	0.06	
Rossia enigmatica	0.03	2	0.02	
Champsodon capensis	0.03	5	0.02	
Total	159.97		99.98	

PROJECT STATION:1128

DATE: 4/10/05 GEAR TYPE: BT No:16 POSITION:Lat S 3212
start stop duration Long E 1712
TIME :07:08:13 07:40:15 32 (min) Purpose code: 3
LOG :9421.52 9423.08 1.53 Area code : 1
FDEPTH: 227 227 GearCond.code:
BDEPTH: 227 227 Validity code:
Towing dir: 330ø Wire out: 600 m Speed: 30 kn*10

Sorted: 109 Kg Total catch: 183.54 CATCH/HOUR: 344.14

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	110.63	2153	32.15	9772
Etrumeus whiteheadi	95.63	1367	27.79	
Merluccius paradoxus, juvenile	53.44	4275	15.53	9773
Paracallionymus costatus	17.81	1273	5.18	
Thyrsites atun	16.88	8	4.90	9777
Lophius vomerinus	11.25	53	3.27	9776
Callorhinchus capensis	6.75	2	1.96	
Parapagurus dimorphus	5.27		1.53	
Brama brama	4.88	4	1.42	9779
Raja straeleni	4.69	4	1.36	
Todaropsis eblanae	4.31	83	1.25	9780
Merluccius paradoxus	2.63	2	0.76	9771
Caelorinchus simorhynchus	2.57	83	0.75	
Trachurus capensis	1.50	4	0.44	9774
Helicolenus dactylopterus	1.35	167	0.39	9775
Zeus capensis	1.13	4	0.33	9778
Holohalaelurus regani	0.94	11	0.27	
Congiopodus spinifer	0.83	8	0.24	
Genypterus capensis	0.75	4	0.22	9781
Jasus lalandii	0.26	2	0.08	
Notacanthus sexspinis	0.19	2	0.06	
Exodromedia sp.	0.15	8	0.04	
Rochinia sp.	0.11	8	0.03	
Champsodon capensis	0.09	11	0.03	
Emmelichthys nitidus	0.09	8	0.03	
Squilla acuelata calmani	0.04	4	0.01	
Total	344.17		100.02	

PROJECT STATION:1129

DATE: 4/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 3222
start stop duration Long E 1641
TIME :13:39:27 14:09:04 30 (min) Purpose code: 3
LOG :9456.76 9458.35 1.56 Area code : 1
FDEPTH: 351 351 GearCond.code:
BDEPTH: 351 351 Validity code:
Towing dir: 330ø Wire out: 875 m Speed: 30 kn*10

Sorted: 372 Kg Total catch: 1000.83 CATCH/HOUR: 2001.66

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	1848.00	14548	92.32	9784
Caelorinchus simorhynchus	36.00	428	1.80	
Merluccius capensis	26.00	16	1.30	9782
Merluccius paradoxus	18.00	26	0.90	9783
Octopus magnificus	16.00	2	0.80	
Helicolenus dactylopterus	16.00	80	0.80	9786
Raja straeleni	14.00	4	0.70	
Zeus capensis	12.00	18	0.60	9788
Brama brama	6.00	4	0.30	9789
Thyrsites atun	5.40	2	0.27	9787
Trachurus capensis	1.68	12	0.08	9785
Bassanago albescens	1.00	2	0.05	
Todaropsis eblanae - males	0.84	6	0.04	9790
Rossia enigmatica	0.64	18	0.03	
Rochinia sp.	0.10	6		
Total	2001.66		99.99	

PROJECT STATION:1130

DATE: 4/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 3225
start stop duration Long E 1628
TIME :16:32:56 17:04:27 32 (min) Purpose code: 3
LOG :9473.95 9475.57 1.60 Area code : 1
FDEPTH: 502 498 GearCond.code:
BDEPTH: 502 498 Validity code:
Towing dir: 330ø Wire out:1300 m Speed: 30 kn*10

Sorted: 385 Kg Total catch: 2434.84 CATCH/HOUR: 4565.33

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	4241.25	27516	92.90	9792
Merluccius paradoxus	145.13	163	3.18	9791
Lophius vomerinus	58.50	43	1.28	9795
Chaceon sp.	38.46	549	0.84	
Helicolenus dactylopterus	23.10	278	0.51	9793
Caelorinchus simorhynchus	17.63	366	0.39	
Lophius vomerinus	11.25	2	0.25	9794
Raja leopardus	8.04	43	0.18	
Malacocephalus laevis	6.28	30	0.14	
Todaropsis eblanae - males	5.44	30	0.12	9796
Myxine capensis	4.39	58	0.10	
Todaropsis eblanae - females	3.08	15	0.07	9797
Coelorinchus braueri	1.58	88	0.03	
Parapagurus pilosimanus	0.39	15	0.01	
Lucigadus ori	0.38	58	0.01	
Holohalaelurus regani	0.19	15		
Munida sp. *	0.15	15		
Paracallionymus costatus	0.11	30		
Total	4565.35		100.01	

PROJECT STATION:1131

DATE: 8/10/05 GEAR TYPE: BT No:16 POSITION:Lat S 3151
start stop duration Long E 1704
TIME :19:04:44 19:35:18 31 (min) Purpose code: 3
LOG :9869.25 9870.93 1.66 Area code : 1
FDEPTH: 236 236 GearCond.code:
BDEPTH: 236 236 Validity code:
Towing dir: 170ø Wire out: 700 m Speed: 30 kn*10

Sorted: 88 Kg Total catch: 87.82 CATCH/HOUR: 169.97

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	129.68	2003	76.30	9799
Paracallionymus costatus	11.07	923	6.51	
Merluccius capensis	5.81	8	3.42	9798
Caelorinchus simorhynchus	5.50	120	3.24	
Holohalaelurus regani	5.28	95	3.11	
Helicolenus dactylopterus	4.35	161	2.56	9802
Lophius vomerinus	2.13	4	1.25	9804
Todaropsis eblanae	1.51	15	0.89	9806
Exodromedia sp.	1.30	50	0.76	
Trachurus capensis	0.68	6	0.40	9801
Rossia enigmatica	0.52	33	0.31	
Etrumeus whiteheadi	0.52	6	0.31	
Genypterus capensis	0.50	2	0.29	9805
Cynoglossus zanzibarensis	0.35	4	0.21	9803
Mursia cristimanus	0.14	12	0.08	
Sepia sp.	0.14	19	0.08	
Myxine capensis	0.14	2	0.08	
Squilla acuelata calmani	0.10	12	0.06	
Sepia hieronis	0.10	4	0.06	
Merluccius paradoxus, juvenile	0.10	6	0.06	9800
Rochinia sp.	0.04	2	0.02	
Physiculus capensis	0.04	2	0.02	
Shrimps, small, non comm.	0.00	2		
Total	170.00		100.02	

PROJECT STATION:1132

DATE: 9/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 3216
start stop duration Long E 1619
TIME :07:40:59 08:13:13 32 (min) Purpose code: 3
LOG :9935.85 9937.54 1.69 Area code : 1
FDEPTH: 567 571 GearCond.code:
BDEPTH: 567 571 Validity code:
Towing dir: 150ø Wire out:1425 m Speed: 30 kn*10

Sorted: 479 Kg Total catch: 478.75 CATCH/HOUR: 897.66

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	326.25	879	36.34	9808
Merluccius paradoxus	215.63	154	24.02	9807
Notacanthus sexspinis	198.75	1988	22.14	
Funchalia woodwardi	54.38	3883	6.06	
Chaceon sp.	28.13	563	3.13	
Raja leopardus	16.88	30	1.88	
Lophius vomerinus	14.06	4	1.57	9810
Malacocephalus laevis	13.13	41	1.46	
Coelorinchus braueri	9.19	296	1.02	
Lithodes ferox	7.50	4	0.84	
Helicolenus dactylopterus	4.82	28	0.54	9809
Todaropsis eblanae	2.10	8	0.23	9811
Hydrolagus sp.	1.88	4	0.21	
Photichthys argenteus	1.59	38	0.18	
Lycoteuthis lorigera	0.75	28	0.08	
Epigonus sp.	0.53	21	0.06	
Lucigadus ori	0.51	54	0.06	
Scopelosaurus herwigi	0.38	2	0.04	
Myxine capensis	0.32	4	0.04	
Lycoteuthis lorigera	0.28	2	0.03	
Symbolophorus boops	0.21	13	0.02	
Bathypolypus valdiviae	0.15	2	0.02	
Selachophidium guentheri	0.13	2	0.01	
Rossia enigmatica	0.09	6	0.01	
Tripterophycis gilchristi	0.06	2	0.01	
Total	897.70		100.00	

PROJECT STATION:1133

DATE: 9/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 3212
start stop duration Long E 1623
TIME :09:31:48 10:01:44 30 (min) Purpose code: 3
LOG :9945.15 9946.77 1.57 Area code : 1
FDEPTH: 426 429 GearCond.code:
BDEPTH: 426 429 Validity code:
Towing dir: 350ø Wire out:1160 m Speed: 30 kn*10

Sorted: 999 Kg Total catch: 4282.71 CATCH/HOUR: 8565.42

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	6610.00	52010	77.17	9814
Brama brama	1222.00	800	14.27	9818
Lepidopus caudatus	316.00	354	3.69	
Merluccius paradoxus	146.00	116	1.70	9813
Merluccius capensis	72.00	62	0.84	9812
Helicolenus dactylopterus	69.80	418	0.81	9815
Caelorinchus simorhynchus	51.20	1118	0.60	
Todaropsis eblanae	43.76	280	0.51	9819
Lophius vomerinus	17.00	10	0.20	9816
Genypterus capensis	10.00	6	0.12	9817
Octopus magnificus	6.00	2	0.07	
Bassanago albescens	1.20	2	0.01	
Beryx splendens	0.46	2	0.01	
Total	8565.42		100.00	

PROJECT STATION:1134

DATE: 9/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 3146
start stop duration Long E 1602
TIME :13:42:20 14:12:16 30 (min) Purpose code: 3
LOG :9976.78 9978.32 1.54 Area code : 1
FDEPTH: 530 526 GearCond.code:
BDEPTH: 530 526 Validity code:
Towing dir: 335ø Wire out:1484 m Speed: 30 kn*10

Sorted: 422 Kg Total catch: 711.55 CATCH/HOUR: 1423.10

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	1100.00	5110	77.30	9821
Merluccius paradoxus	112.00	88	7.87	9820
Helicolenus dactylopterus	100.00	412	7.03	9822
Chaceon sp.	36.00	782	2.53	
Lophius vomerinus	32.00	8	2.25	9823
Raja leopardus	12.00	12	0.84	
Hydrolagus sp.	10.00	14	0.70	
Selachophidium guentheri	4.22	52	0.30	
Coelorinchus braueri	4.00	116	0.28	
Notacanthus sexspinis	2.04	20	0.14	
Raja leopardus	1.88	20	0.13	
Holohalaelurus regani	1.28	4	0.09	
Bathypolypus valdiviae	1.08	12	0.08	
Bassanago albescens	1.04	4	0.07	
Malacocephalus laevis	1.00	4	0.07	
Myxine capensis	0.92	16	0.06	
Todaropsis eblanae - females	0.92	4	0.06	9824
Ornithoteuthis antillarum	0.68	4	0.05	

Photichthys argenteus	0.60	20	0.04
Lampanyctodes hectoris	0.40		0.03
Maurolicus muelleri	0.40		0.03
Lucigadus ori	0.24	20	0.02
Rossia enigmatica	0.12	4	0.01
Epigonus sp.	0.12	12	0.01
Lycoteuthis lorigera	0.08	12	0.01
Tripterophycis gilchristi	0.04	4	
Munida sp.	0.02	4	
Teuthowenia pellua	0.02	4	
Total	1423.10		100.00

PROJECT STATION:1135

DATE: 9/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 3140
start stop duration Long E 1621
TIME :16:39:56 17:09:21 29 (min) Purpose code: 3
LOG :9997.95 9999.47 1.51 Area code : 1
FDEPTH: 374 373 GearCond.code: 8
BDEPTH: 374 373 Validity code: 2
Towing dir: 150ø Wire out:1000 m Speed: 31 kn*10

Sorted: 255 Kg Total catch: 615.45 CATCH/HOUR: 1273.35

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	905.17	7359	71.09	9827
Champsodon capensis	68.79	782	5.40	
Zeus capensis	68.28	91	5.36	9831
Genypterus capensis	64.14	29	5.04	9830
Helicolenus dactylopterus	43.45	240	3.41	9828
Merluccius capensis	28.97	19	2.28	9825
Merluccius paradoxus	21.72	21	1.71	9826
Caelorinchus simorhynchus	20.28	188	1.59	
Lophius vomerinus	18.62	6	1.46	9829
Malacocephalus laevis	10.55	12	0.83	
Octopus magnificus	8.69	2	0.68	
Raja pullopunctata	8.28	2	0.65	
Todaropsis eblanae - females	2.83	23	0.22	9832
Holohalaelurus regani	1.47	8	0.12	
Cyttus traversi	1.37	8	0.11	
Rossia enigmatica	0.43	23	0.03	
Lucigadus ori	0.12	8	0.01	
Merluccius paradoxus, juvenile	0.08	8	0.01	9833
Champsodon capensis	0.06	8		
Mursia cristimanus	0.04	8		
Total	1273.34		100.00	

PROJECT STATION:1136

DATE:10/10/05 GEAR TYPE: 2T No:15 POSITION:Lat S 3052
start stop duration Long E 1646
TIME :16:12:32 16:35:11 23 (min) Purpose code: 3
LOG : 141.70 142.94 1.23 Area code : 1
FDEPTH: 233 234 GearCond.code:
BDEPTH: 233 234 Validity code: 1
Towing dir: 330ø Wire out: 699 m Speed: 32 kn*10

Sorted: 91 Kg Total catch: 365.02 CATCH/HOUR: 952.23

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	667.83	11293	70.13	9835
Parapagurus dimorphus	213.91		22.46	
Merluccius paradoxus, juvenile	17.97	2191	1.89	9836
Etrumeus whiteheadi	5.53	78	0.58	
Chelidonichthys capensis	5.22	8	0.55	9842
Lophius vomerinus	5.22	18	0.55	9841
Paracallionymus costatus	4.85	350	0.51	
Merluccius capensis	4.70	5	0.49	9834
Todaropsis eblanae - males	4.64	78	0.49	9844
Sepia australis	3.39	193	0.36	
Lepidopus caudatus	3.16	57	0.33	
Cynoglossus zanzibarensis	3.05	34	0.32	9840
Holohalaelurus regani	3.00	13	0.32	
Caelorinchus simorhynchus	1.46	68	0.15	
Todaropsis eblanae - females	1.46	23	0.15	9845
Cynoglossus zanzibarensis	1.43	18	0.15	9839
Raja leopardus	1.36	8	0.14	
Helicolenus dactylopterus	1.04	10	0.11	9837
Helicolenus dactylopterus	1.02	68	0.11	9838
Chelidonichthys queketti	0.78	5	0.08	9843
Squilla acuelata calmani	0.68	68	0.07	
Raja confundens	0.52	3	0.05	
Total	952.22		99.99	

PROJECT STATION:1137

DATE:11/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 3122
start stop duration Long E 1544
TIME :04:48:58 05:18:31 30 (min) Purpose code: 3
LOG : 216.49 218.03 1.54 Area code : 1
FDEPTH: 601 599 GearCond.code:
BDEPTH: 601 599 Validity code:
Towing dir: 345ø Wire out:1500 m Speed: 32 kn*10

Sorted: 119 Kg Total catch: 118.66 CATCH/HOUR: 237.32

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Coelorinchus braueri	78.00	886	32.87	
Merluccius paradoxus	72.00	234	30.34	9847
Merluccius paradoxus	32.00	42	13.48	9846
Chaceon sp.	14.00	182	5.90	
Centrophorus squamosus	8.00	2	3.37	
Shrimps, small, non comm.	6.00		2.53	
Nezumia sp.	4.34	82	1.83	
Selachophidium guentheri	4.00	38	1.69	
Coelorinchus matamua	3.44	36	1.45	
Trachyscorpia capensis	3.08	6	1.30	
Malacocephalus laevis	2.48	10	1.05	
Photichthys argenteus	2.00	82	0.84	
Notacanthus sexspinis	1.68	42	0.71	
Photonectes braueri	1.12	14	0.47	
Etmopterus brachyurus	1.10	12	0.46	
Helicolenus dactylopterus	0.72	2	0.30	9849
Hydrolagus sp.	0.58	4	0.24	
Gymnoscopelus sp.	0.52	8	0.22	
Raja leopardus	0.46	4	0.19	
Rossia enigmatica	0.34	16	0.14	
Psychrolutes macrocephalus	0.30	8	0.13	
Bassanago albescens	0.20	2	0.08	
Bathypolypus valdiviae	0.18	2	0.08	
Neoscopelus macrolepidotus	0.18	8	0.08	
Epigonus sp.	0.16	2	0.07	
Myxine capensis	0.10	2	0.04	
Chauliodus sloani	0.08	4	0.03	
Argentina euchus	0.08	2	0.03	
Kuronezumia leonis	0.06	2	0.03	
Paracallionymus costatus	0.04	2	0.02	
Merluccius paradoxus, juvenile	0.02	2	0.01	9848
Megalocranchia sp.	0.02	2	0.01	
Spirula spirula	0.02	2	0.01	
Lucigadus ori	0.02	2	0.01	
Total	237.32		100.01	

PROJECT STATION:1138

DATE:11/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 3113
start stop duration Long E 1559
TIME :07:49:47 08:06:52 17 (min) Purpose code: 3
LOG : 236.94 237.84 0.89 Area code : 1
FDEPTH: 460 453 GearCond.code:
BDEPTH: 460 453 Validity code:
Towing dir: 303ø Wire out:1250 m Speed: 32 kn*10

Sorted: 337 Kg Total catch: 1267.63 CATCH/HOUR: 4473.99

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	4225.41	25274	94.44	9850
Caelorinchus simorhynchus	57.88	642	1.29	
Bassanago albescens	38.82	67	0.87	
Helicolenus dactylopterus	38.82	265	0.87	9852
Merluccius paradoxus	22.94	25	0.51	9851
Lepidopus caudatus	17.65	21	0.39	
Epigonus sp.	14.47	173	0.32	
Todaropsis eblanae - females	12.71	116	0.28	9855
Todaropsis eblanae - males	10.94	102	0.24	9854
Malacocephalus laevis	10.59	56	0.24	
Lophius vomerinus	7.06	4	0.16	9853
Parapagurus pilosimanus	4.06	219	0.09	
Coelorinchus braueri	3.88	102	0.09	
Raja leopardus	1.84	11	0.04	
Holohalaelurus regani	1.76	7	0.04	
Hoplostethus mediterraneus	1.31	28	0.03	
Rossia enigmatica	1.16	28	0.03	
Myxine capensis	0.99	14	0.02	
Tripterophycis gilchristi	0.56	42	0.01	
Beryx splendens	0.56	4	0.01	
Lucigadus ori	0.28	42	0.01	
Stereomastis sp.	0.14	14		
Sepia sp.	0.14	28		
Total	4473.97		99.98	

PROJECT STATION:1139

DATE:11/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 3057
start stop duration Long E 1534
TIME :11:13:24 11:43:25 30 (min) Purpose code: 3
LOG : 264.10 265.61 1.50 Area code : 1
FDEPTH: 518 526 GearCond.code:
BDEPTH: 518 526 Validity code:
Towing dir: 315ø Wire out:1414 m Speed: 30 kn*10

Sorted: 226 Kg Total catch: 225.59 CATCH/HOUR: 451.18

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	290.00	1256	64.28	9857
Raja caudaspinosa	40.00	48	8.87	
Chaceon sp.	24.00	240	5.32	
Squalus mitsukurii	18.00	4	3.99	
Lophius vomerinus	12.00	6	2.66	9859
Photichthys argenteus	9.14	366	2.03	
Genypterus capensis	7.76	138	1.72	
Coelorinchus braueri	7.00	140	1.55	
Helicolenus dactylopterus	7.00	38	1.55	9858
Merluccius paradoxus	7.00	8	1.55	9856
Lithodes ferox	4.60	6	1.02	
Raja leopardus	3.60	22	0.80	
Hydrolagus sp.	3.28	6	0.73	
Funchalia woodwardi	2.66	134	0.59	
Malacocephalus laevis	2.26	12	0.50	
Plesionika martia	2.00		0.44	
Todaropsis eblanae - females	1.84	14	0.41	9861
Nezumia sp.	1.70		0.38	
Myxine capensis	1.56	20	0.35	
Todaropsis eblanae - males	1.04	6	0.23	9860
Psychrolutes macrocephalus	0.96	12	0.21	
Beryx splendens	0.54	2	0.12	
Holohalaelurus regani	0.52	2	0.12	
Lucigadus ori	0.46	42	0.10	
Raja leopardus	0.46		0.10	
Notacanthus sexspinis	0.24	4	0.05	
Caelorinchus simorhynchus	0.24	6	0.05	
Tripterophycis gilchristi	0.22	12	0.05	
Physiculus capensis	0.20	8	0.04	
Epigonus sp.	0.18	12	0.04	
Hoplostethus mediterraneus	0.16	2	0.04	
Gymnoscopelus sp.	0.16	20	0.04	
Bathypolypus valdiviae	0.14	2	0.03	
Bassanago albescens	0.08	2	0.02	
Stereomastis sp.	0.06	6	0.01	
Caristius groenlandicus	0.06	2	0.01	
Etmopterus brachyurus	0.06	2	0.01	
Rossia enigmatica	0.00	8		
Careproctus griseldea	0.00	2		
Paraliparis australis	0.00	2		
Total	451.18		100.01	

PROJECT STATION:1140

DATE:11/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 3055
start stop duration Long E 1536
TIME :14:58:33 15:29:17 31 (min) Purpose code: 3
LOG : 277.24 278.94 1.68 Area code : 1
FDEPTH: 430 417 GearCond.code:
BDEPTH: 430 417 Validity code:
Towing dir: 340ø Wire out:1241 m Speed: 30 kn*10

Sorted: 381 Kg Total catch: 380.73 CATCH/HOUR: 736.90

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	398.71	1941	54.11	9864
Merluccius paradoxus	203.23	246	27.58	9863
Notacanthus sexspinis	92.90	1328	12.61	
Lophius vomerinus	12.19	8	1.65	9866
Merluccius capensis	5.23	2	0.71	9862
Helicolenus dactylopterus	4.45	21	0.60	9865
Myxine capensis	3.87		0.53	
Caelorinchus simorhynchus	3.52		0.48	
Genypterus capensis	2.90	2	0.39	9867
Stereomastis sp.	2.26	226	0.31	
Todaropsis eblanae - females	1.57	8	0.21	9869
Todarodes angolensis	1.45	2	0.20	9870
Malacocephalus laevis	1.24	6	0.17	
Tripterophycis gilchristi	0.72	68	0.10	
Todaropsis eblanae - males	0.45	4	0.06	9868
Rossia enigmatica	0.43	14	0.06	
Paracallionymus costatus	0.33	52	0.04	
Physiculus capensis	0.25	15	0.03	
Bathynectes piperitus	0.21	6	0.03	
Mursia cristimanus	0.14	10	0.02	
Epigonus sp.	0.14	14	0.02	
Sepia hieronis	0.12	2	0.02	
Lucigadus ori	0.12	21	0.02	
Rochinia sp.	0.10	2	0.01	
Chaceon sp.	0.08	2	0.01	
Symbolophorus boops	0.08	4	0.01	
Funchalia woodwardi	0.06	4	0.01	
Coelorinchus braueri	0.06	6	0.01	
Raja caudaspinosa	0.06	2	0.01	
Photichthys argenteus	0.04	2	0.01	
Raja leopardus	0.02	2		
Abraliopsis gilchristi	0.00	2		
Paraliparis australis	0.00	6		
Leptocephalus	0.00	2		
Emmelichthys nitidus	0.00	2		
Diaphus sp.	0.00	2		
Hoplostethus mediterraneus	0.00	2		
Total	736.93		100.02	

PROJECT STATION:1141

DATE:13/10/05 GEAR TYPE: PT No: 2 POSITION:Lat S 3048
start stop duration Long E 1528
TIME :07:53:09 08:22:29 29 (min) Purpose code: 1
LOG : 551.85 553.79 1.89 Area code : 1
FDEPTH: 45 46 GearCond.code:
BDEPTH: 469 467 Validity code:
Towing dir: 154ø Wire out: 250 m Speed: 40 kn*10

Sorted: Kg Total catch: 0.34 CATCH/HOUR: 0.70

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Trachurus capensis	0.48	968	68.57	9871
Emmelichthys nitidus	0.21	215	30.00	9872
Todarodes angolensis	0.02	8	2.86	9873
Centrolophus niger	0.00	4		
Maurolicus muelleri	0.00	2		
Leptocephalus	0.00	2		
Brama brama	0.00	2		
Total	0.71		101.43	

PROJECT STATION:1142

DATE:14/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 3007
start stop duration Long E 1459
TIME :04:46:03 05:16:14 30 (min) Purpose code: 3
LOG : 687.09 688.91 1.81 Area code : 1
FDEPTH: 453 454 GearCond.code:
BDEPTH: 453 454 Validity code:
Towing dir: 353ø Wire out:1250 m Speed: 36 kn*10

Sorted: 235 Kg Total catch: 707.13 CATCH/HOUR: 1414.26

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	1176.00	14112	83.15	9875
Merluccius paradoxus	66.00	74	4.67	9874
Helicolenus dactylopterus	52.00	270	3.68	9876
Epigonus sp.	25.20	436	1.78	
Parapagurus pilosimanus	20.40	618	1.44	
Bassanago albescens	20.00	36	1.41	
Lophius vomerinus	16.00	8	1.13	9877
Caelorinchus simorhynchus	13.20	202	0.93	
Hydrolagus africanus	8.00		0.57	5
Beryx splendens	4.00	10	0.28	
Squalus mitsukurii	3.40	2	0.24	
Todarodes angolensis - females	2.68	2	0.19	9878
Raja caudaspinosa	2.28	4	0.16	
Holohalaelurus regani	1.72	6	0.12	
Stereomastis sp.	0.92	184	0.07	
Rossia enigmatica	0.68	26	0.05	
Selachophidium guentheri	0.42	8	0.03	
Paracallionymus costatus	0.42	76	0.03	
Lucigadus ori	0.42	50	0.03	
Sepia sp.	0.16	26	0.01	
Hoplostethus mediterraneus	0.16	16	0.01	
Mursia cristimanus	0.08	8	0.01	
Tripterophycis gilchristi	0.08	8	0.01	
Stoloteuthis sp.	0.04	8		
Total	1414.26		100.00	

PROJECT STATION:1143

DATE:14/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 3005
start stop duration Long E 1447
TIME :09:49:40 10:20:47 31 (min) Purpose code: 3
LOG : 705.09 706.75 1.65 Area code : 1
FDEPTH: 490 489 GearCond.code:
BDEPTH: 490 489 Validity code:
Towing dir: 145ø Wire out:1300 m Speed: 30 kn*10

Sorted: 321 Kg Total catch: 567.59 CATCH/HOUR: 1098.56

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	749.81	4130	68.25	9880
Merluccius paradoxus	96.77	124	8.81	9879
Torpedo nobiliana	60.00	4	5.46	
Helicolenus dactylopterus	60.00	314	5.46	9881
Lepidopus caudatus	42.58	62	3.88	
Hydrolagus africanus	19.35	27	1.76	
Lophius vomerinus	17.42	10	1.59	9882
Squalus mitsukurii	9.68	8	0.88	
Holohalaelurus regani	7.74	19	0.70	
Caelorinchus simorhynchus	6.10	66	0.56	
Coelorinchus braueri	5.79	135	0.53	
Brama brama	3.87	2	0.35	9883
Raja caudaspinosa	3.48	6	0.32	
Selachophidium guentheri	2.83	45	0.26	
Coelorinchus matamua	2.21	6	0.20	
Malacocephalus laevis	2.17	10	0.20	
Beryx splendens	1.94	4	0.18	
Photichthys argenteus	1.92	116	0.17	
Parapagurus dimorphus	1.41	70	0.13	
Lucigadus ori	1.41	116	0.13	
Epigonus sp.	1.20	60	0.11	
Rossia enigmatica	0.66	35	0.06	
Paracallionymus costatus	0.31	56	0.03	
Chaceon sp.	0.06	6	0.01	
Sepia sp.	0.04	6		
Total	1098.75		100.03	

PROJECT STATION:1144

DATE:14/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 3010
start stop duration Long E 1443
TIME :13:14:07 13:44:10 30 (min) Purpose code: 3
LOG : 718.36 719.94 1.58 Area code : 1
FDEPTH: 538 537 GearCond.code:
BDEPTH: 538 537 Validity code:
Towing dir: 335ø Wire out:1488 m Speed: 30 kn*10

Sorted: 243 Kg Total catch: 243.42 CATCH/HOUR: 486.84

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	164.00	568	33.69	9885
Merluccius paradoxus	144.00	202	29.58	9884
Helicolenus dactylopterus	88.00	398	18.08	9886
Lepidopus caudatus	28.00	28	5.75	
Coelorinchus braueri	18.00	268	3.70	
Coelorinchus matamua	9.40	96	1.93	
Selachophidium guentheri	8.52	126	1.75	
Malacocephalus laevis	6.40	28	1.31	
Chaceon sp.	6.00	200	1.23	
Holohalaelurus regani	4.00	12	0.82	
Hydrolagus africanus	2.72	8	0.56	
Beryx splendens	1.40	4	0.29	
Bassanago albescens	1.10	4	0.23	
Nezumia sp.	1.00	38	0.21	
Lucigadus ori	0.92	96	0.19	
Notacanthus sexspinis	0.82	14	0.17	
Rossia enigmatica	0.64	34	0.13	
Photichthys argenteus	0.64	34	0.13	
Paracallionymus costatus	0.34	4	0.07	
Tripterophycis gilchristi	0.24	10	0.05	
Raja leopardus	0.18	2	0.04	
Epigonus sp.	0.18	8	0.04	
Myxine capensis	0.16	2	0.03	
Gymnoscopelus sp.	0.08	6	0.02	
Paracallionymus costatus	0.04	4	0.01	
Symbolophorus boops	0.04	4	0.01	
Munida sp.	0.02	2		
Stoloteuthis sp.	0.00	2		
Diaphus sp.	0.00	2		
Total	486.84		100.02	

PROJECT STATION:1145

DATE:14/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 2956
start stop duration Long E 1434
TIME :16:15:40 16:44:49 29 (min) Purpose code: 3
LOG : 738.49 740.09 1.58 Area code : 1
FDEPTH: 527 525 GearCond.code:
BDEPTH: 527 525 Validity code:
Towing dir: 150ø Wire out:1499 m Speed: 33 kn*10

Sorted: 149 Kg Total catch: 148.75 CATCH/HOUR: 307.76

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	82.76	325	26.89	9888
Merluccius paradoxus	72.41	93	23.53	9887
Raja caudaspinosa	24.83	19	8.07	
Chaceon sp.	18.62	310	6.05	
Raja leopardus	18.62	120	6.05	
Funchalia woodwardi	16.55	919	5.38	
Lophius vomerinus	16.55	19	5.38	9890
Helicolenus dactylopterus	11.17	48	3.63	9889
Selachophidium guentheri	10.76	188	3.50	
Coelorinchus braueri	8.96	1194	2.91	
Notacanthus sexspinis	8.07	124	2.62	
Malacocephalus laevis	4.34	23	1.41	
Myxine capensis	2.83		0.92	
Nezumia sp.	2.73	68	0.89	
Etmopterus brachyurus	2.67	23	0.87	
Psychrolutes macrocephalus	1.55	12	0.50	
Lithodes ferox	0.89	2	0.29	
Rossia enigmatica	0.81	37	0.26	
Lucigadus ori	0.72	64	0.23	
Bassanago albescens	0.48	2	0.16	
Photichthys argenteus	0.46	19	0.15	
Hydrolagus africanus	0.39	2	0.13	
Tripterophycis gilchristi	0.17	12	0.06	
Epigonus sp.	0.14	6	0.05	
Plesionika martia	0.10	14	0.03	
Persparsia kopua	0.08	2	0.03	
Paracallionymus costatus	0.04	6	0.01	
Dibranchus sp.	0.02	2	0.01	
Diaphus effulgens	0.02	6	0.01	
Total	307.74		100.02	

PROJECT STATION:1146

DATE:15/10/05 GEAR TYPE: BT No: POSITION:Lat S 2902
start stop duration Long E 1428
TIME :06:48:45 07:15:42 27 (min) Purpose code: 3
LOG : 822.40 823.81 1.40 Area code : 1
FDEPTH: 330 338 GearCond.code:
BDEPTH: 330 338 Validity code:

Towing dir: 330ø Wire out: 920 m Speed: 31 kn*10

Sorted: 570 Kg Total catch: 1217.02 CATCH/HOUR: 2704.49

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	1415.56	16829	52.34	9893
Zeus capensis	531.11	982	19.64	9899
Epigonus sp.	120.00	4000	4.44	
Caelorinchus simorhynchus	120.00	1482	4.44	
Helicolenus dactylopterus	100.00	480	3.70	9894
Merluccius capensis	91.11	62	3.37	9891
Holohalaelurus regani	71.11	224	2.63	
Malacocephalus laevis	66.00	169	2.44	
Thyrsites atun	53.33	20	1.97	9897
Brama brama	40.00	27	1.48	9900
Merluccius paradoxus	24.44	38	0.90	9892
Raja wallacei	12.67	2	0.47	
Parapagurus pilosimanus	12.00	444	0.44	
Helicolenus dactylopterus	12.00		0.44	
Lophius vomerinus	6.67	4	0.25	9896
Lepidopus caudatus	5.16	49	0.19	
Todaropsis eblanae - males	4.91	49	0.18	9901
Genypterus capensis	4.44	2	0.16	9898
Cyttus traversi	3.49	24	0.13	
Raja straeleni	3.11	2	0.11	
Galeus polli	2.16	11	0.08	
Rossia enigmatica	1.44	71	0.05	
Paracallionymus costatus	1.20	84	0.04	
Todaropsis eblanae - females	1.20	11	0.04	9902
Cynoglossus zanzibarensis	0.78	11	0.03	
Raja caudaspinosa	0.60	2	0.02	
Total	2704.49		99.98	

PROJECT STATION:1147

DATE:15/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 2903
start stop duration Long E 1424
TIME :09:39:39 10:09:20 30 (min) Purpose code: 3
LOG : 834.76 836.31 1.53 Area code : 1
FDEPTH: 466 482 GearCond.code:
BDEPTH: 466 482 Validity code:
Towing dir: 335ø Wire out:1250 m Speed: 30 kn*10

Sorted: 373 Kg Total catch: 373.18 CATCH/HOUR: 746.36

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	480.00	1900	64.31	9903
Merluccius paradoxus	120.00	148	16.08	9895
Genypterus capensis	42.00	26	5.63	9909
Caelorinchus simorhynchus	18.24	364	2.44	
Bassanago albescens	14.00	32	1.88	
Helicolenus dactylopterus	12.60	32	1.69	9904
Raja pullopunctata	12.00	2	1.61	
Raja leopardus	9.00	6	1.21	
Thyrsites atun	8.00	2	1.07	9906
Squalus acanthias	6.00	4	0.80	
Malacocephalus laevis	4.56	20	0.61	
Raja caudaspinosa	4.00	4	0.54	
Parapagurus pilosimanus	2.98		0.40	
Lucigadus ori	2.92	206	0.39	
Photichthys argenteus	2.14	92	0.29	
Lophius vomerinus	2.00	2	0.27	9905
Rossia enigmatica	1.48	68	0.20	
Zeus capensis	0.80	2	0.11	9907
Myxine capensis	0.62	8	0.08	
Selachophidium guentheri	0.48	6	0.06	
Galeus polli	0.42	2	0.06	
Rochinia sp.	0.40	46	0.05	
Tripterophycis gilchristi	0.38	12	0.05	
Todaropsis eblanae - females	0.36	2	0.05	9908
Lycoteuthis lorigera	0.26	14	0.03	
Symbolophorus boops	0.16	14	0.02	
Holohalaelurus regani	0.12	2	0.02	
Epigonus sp.	0.08	2	0.01	
Diaphus effulgens	0.08	6	0.01	
Nezumia sp.	0.06	2	0.01	
Coelorinchus braueri	0.06	6	0.01	
Bathynectes piperitus	0.04	2	0.01	
Hoplostethus mediterraneus	0.04	4	0.01	
Abraliopsis gilchristi	0.02	6		
Paracallionymus costatus	0.02	2		
Physiculus capensis	0.02	2		
Gymnoscopelus sp.	0.02	2		
Electrona risso	0.00	2		
Lampanyctodes hectoris	0.00	2		
Total	746.36		100.01	

PROJECT STATION:1148

DATE:15/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 2855
start stop duration Long E 1419
TIME :11:34:11 12:05:31 31 (min) Purpose code: 3
LOG : 844.99 846.60 1.60 Area code : 1
FDEPTH: 628 636 GearCond.code:
BDEPTH: 628 636 Validity code:
Towing dir: 346ø Wire out:1688 m Speed: 30 kn*10

Sorted: 156 Kg Total catch: 156.50 CATCH/HOUR: 302.90

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	56.13	58	18.53	9910
Coelorinchus braueri	42.58	654	14.06	
Notacanthus sexspinis	39.68	945	13.10	
Merluccius paradoxus	38.71	153	12.78	9911
Nezumia sp.	36.77	2044	12.14	
Chaceon sp.	31.94	252	10.54	
Raja leopardus	10.26	10	3.39	
Hoplostethus cadenati	9.68	294	3.20	
Coelorinchus matamua	5.81	48	1.92	
Selachophidium guentheri	5.13	81	1.69	
Photichthys argenteus	4.63	139	1.53	
Shrimps, small, non comm.	3.87		1.28	
Opistotheutis rossi	2.54	8	0.84	
Lithodes ferox	2.32	2	0.77	
Neocyttus rhomboidalis	1.78	6	0.59	
Myxine capensis	1.63	19	0.54	
Bathyraja smithii	1.35	2	0.45	
Psychrolutes macrocephalus	1.28	15	0.42	
Etmopterus brachyurus	1.20	27	0.40	
Synaphobranchus kaupii	0.81	8	0.27	
Xenodermichthys copei	0.74	31	0.24	
Lucigadus ori	0.50	54	0.17	
Allocyttus verrucosus	0.41	8	0.14	
Gymnoscopelus sp.	0.31	48	0.10	
Neoscopelus macrolepidotus	0.31	17	0.10	
Lepidion capensis	0.31	2	0.10	
Lycoteuthis lorigera	0.23	14	0.08	
Lycodes agulhensis	0.23	2	0.08	
Photonectes braueri	0.21	4	0.07	
Rossia enigmatica	0.19	14	0.06	
Chaunax pictus	0.19	2	0.06	
Kuronezumia leonis	0.17	2	0.06	
Coloconger cadenati	0.15	2	0.05	
Avocettina acuticeps	0.12	4	0.04	
Careproctus griseldea	0.12	2	0.04	
Tripterophycis gilchristi	0.10	4	0.03	
Trachyscorpia capensis	0.08	2	0.03	
Aristeus varidens	0.08	2	0.03	
Raja caudaspinosa	0.06	4	0.02	
Stereomastis sp.	0.06	4	0.02	
Gymnoscopelus sp.	0.04	4	0.01	
Epigonus sp.	0.04	8	0.01	
Abraliopsis gilchristi	0.04	8	0.01	
Symbolophorus boops	0.02	2	0.01	
Diaphus sp.	0.02	4	0.01	
Nemichthys curvirostris	0.02	2	0.01	
Rochinia sp.	0.02	2	0.01	
Teuthowenia pellucida	0.02	2	0.01	
Raja leopardus	0.02	2	0.01	
Cryptopsaras couesii	0.02	2	0.01	
Total	302.93		100.06	

PROJECT STATION:1149

DATE:15/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 2843
start stop duration Long E 1422
TIME :16:04:08 16:34:35 30 (min) Purpose code: 3
LOG : 867.18 868.80 1.61 Area code : 1
FDEPTH: 466 476 GearCond.code:
BDEPTH: 466 476 Validity code:
Towing dir: 2ø Wire out:1288 m Speed: 32 kn*10

Sorted: 457 Kg Total catch: 457.10 CATCH/HOUR: 914.20

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	844.00	3608	92.32	9913
Merluccius paradoxus	44.00	34	4.81	9912
Funchalia woodwardi	4.60		0.50	
Raja caudaspinosa	2.40	4	0.26	
Raja leopardus	2.00	2	0.22	
Hydrolagus africanus	2.00	2	0.22	
Todarodes angolensis - females	1.74	2	0.19	9915
Nezumia sp.	1.50	66	0.16	
Notacanthus sexspinis	1.36	32	0.15	
Bassanago albescens	1.34	10	0.15	
Lucigadus ori	1.18	116	0.13	
Coelorinchus braueri	1.02	38	0.11	
Helicolenus dactylopterus	1.00	4	0.11	9914
Rossia enigmatica	0.90	38	0.10	
Todarodes angolensis - males	0.86	2	0.09	9916
Lycoteuthis lorigera	0.78	28	0.09	
Psychrolutes macrocephalus	0.56	10	0.06	
Tripterophycis gilchristi	0.54	38	0.06	
Myxine capensis	0.50	10	0.05	
Diaphus effulgens	0.30	28	0.03	
Photichthys argenteus	0.28	24	0.03	
Parapagurus pilosimanus	0.24	14	0.03	
Allocyttus verrucosus	0.24	4	0.03	
Selachophidium guentheri	0.24	4	0.03	
Malacocephalus laevis	0.22	4	0.02	
Lampanyctodes hectoris	0.16	60	0.02	
Avocettina acuticeps	0.12	4	0.01	
Raja leopardus	0.06	4	0.01	
Abraliopsis gilchristi	0.02	4		
Stoloteuthis sp.	0.02	10		
Rochinia sp.	0.02			
Total	914.20		99.99	

PROJECT STATION:1150

DATE:16/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 2809
start stop duration Long E 1428
TIME :06:48:42 07:04:42 16 (min) Purpose code: 3
LOG : 924.81 925.55 0.73 Area code : 1
FDEPTH: 568 578 GearCond.code:
BDEPTH: 568 578 Validity code: 1
Towing dir: 17ø Wire out:1500 m Speed: 32 kn*10

Sorted: 165 Kg Total catch: 164.88 CATCH/HOUR: 618.30

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	472.50	2359	76.42	9918
Merluccius paradoxus	78.75	64	12.74	9917
Coelorinchus braueri	41.25	825	6.67	
Psychrolutes macrocephalus	9.71	79	1.57	
Nezumia sp.	7.76	236	1.26	
Selachophidium guentheri	1.58	23	0.26	
Lithodes ferox	1.50	8	0.24	
Lycoteuthis lorigera	1.09	38	0.18	
Lophius vomerinus	0.98	4	0.16	9919
Notacanthus sexspinis	0.75	19	0.12	
Plesionika martia	0.68	120	0.11	
Photichthys argenteus	0.60	19	0.10	
Myxine capensis	0.34	4	0.05	
Nemichthys curvirostris	0.34	4	0.05	
Lucigadus ori	0.23	23	0.04	
Tripterophycis gilchristi	0.11	11	0.02	
Rossia enigmatica	0.08	4	0.01	
Epigonus sp.	0.08	15	0.01	
Total	618.33		100.01	

PROJECT STATION:1151

DATE:16/10/05 GEAR TYPE: BT No:15 POSITION:Lat S 2804

start stop duration Long E 1436

TIME :10:34:49 11:04:43 30 (min) Purpose code: 3

LOG : 940.66 942.34 1.67 Area code : 1

FDEPTH: 445 450 GearCond.code:

BDEPTH: 445 450 Validity code:

Towing dir: 215ø Wire out:1242 m Speed: 30 kn*10

Sorted: 370 Kg Total catch: 471.17 CATCH/HOUR: 942.34

SPECIES	CATCH/HOUR weight	numbers	% OF TOT. C	SAMP
Merluccius paradoxus	236.00	228	25.04	9921
Merluccius paradoxus	186.00	848	19.74	9922
Caelorinchus simorhynchus	175.00	3070	18.57	
Genypterus capensis	120.00	50	12.73	9925
Notacanthus sexspinis	77.00	928	8.17	
Lophius vomerinus	32.00	14	3.40	9924
Centrolophus niger	28.00	8	2.97	
Scyliorhinus capensis	22.00	18	2.33	
Raja caudaspinosa	16.00	10	1.70	
Rochinia sp.	12.46	390	1.32	
Brama brama	7.00	4	0.74	9926
Epigonus sp.	5.74	820	0.61	
Merluccius capensis	5.00	2	0.53	9920
Raja wallacei	4.00	2	0.42	
Bassanago albescens	3.44	8	0.37	
Lycoteuthis lorigera	2.56	182	0.27	
Helicolenus dactylopterus	2.20	10	0.23	9923
Lucigadus ori	1.68	224	0.18	
Todarodes angolensis - females	1.36	2	0.14	9927
Stereomastis sp.	1.34	22	0.14	
Coelorinchus braueri	1.34	22	0.14	
Holohalaelurus regani	1.00	2	0.11	
Plesionika martia	0.66	154	0.07	
Parapagurus pilosimanus	0.48	36	0.05	
Abraliopsis gilchristi	0.04	14		
Squilla acuelata calmani	0.02	8		
Stoloteuthis sp.	0.02	8		
Total	942.34		99.97	

Annex 2 Instruments and fishing gear

The Simrad EK-500, 38 kHz scientific echosounder was used for abundance estimation during the survey, in addition data from the 18 kHz, 120 kHz and 200 kHz transducers where logged for possible future multi frequency target estimation. The Bergen Echo Integrator system (BEI) were logging the echogram raw data from the sounder and used to scrutinize the acoustic records, and to allocate integrator data to fish species. All raw data were stored to tape, and a backup of the database of scrutinized data, stored. The details of the settings of the echosounders were as follows:

Transceiver 1 menu

Transducer depth	5.5 m
Absorption coeff.	10 dB/km
Pulse length	medium (1ms)
Bandwidth	wide
Max power	2000 Watt
2-way beam angle	-21.0 dB
SV transducer gain	26.91dB
TS transducer gain	27.05
Angle sensitivity	21.9
3 dB beamwidth along.	7.0
3 dB beamwidth athw.	6.9
Alongship offset	0.01
Athwardship offset	0.02

Transceiver 2 menu

Transducer depth	5.5 m
Absorption coeff.	38 dB/km
Pulse length	long (1ms)
Bandwidth	narrow
Max power	1000 Watt
2-way beam angle	-20.6 dB
SV transducer gain	25.95dB
TS transducer gain	26.00dB
Angle sensitivity	21.0
3 dB beamwidth along.	7.2
3 dB beamwidth athw.	7.0
Alongship offset	0.10
Athwardship offset	-0.06

Transceiver 3 menu

Transducer depth	5.5 m
Absorption coeff.	3 dB/km
Pulse length	short (0.7ms)
Bandwidth	wide
Max power	2000 Watt
2-way beam angle	-17.2 dB
SV transducer gain	23.87dB
TS transducer gain	23.82B
Angle sensitivity	13.9
3 dB beamwidth along.	10.9
3 dB beamwidth athw.	10.7
Alongship offset	0.04
Athwardship offset	0.09

Transceiver 4 menu (default settings used)

Transducer depth	5.5 m
Absorption coeff.	53 dB/km
Pulse length	Long
Bandwidth	Narrow
Max power	1000 Watt
2-way beam angle	-20.5 dB
SV transducer gain	23.84 dB
TS transducer gain	24.8 dB
Angle sensitivity	0.0
3 dB beamwidth along.	0.0°
3 dB beamwidth athw.	0.0°
Alongship offset -	0.00°
Athwardship offset	0.00°

Display menu

Echogram	1
Bottom range	15 m
Bottom range start	10 m
TVG	20 log R
Sv colour min -	67 dB
TS Colour minimum	-50 dB

Printer- menu

Range	0-50, 0-100, 0-150, 0-250 or 0-500 m
TVG	20 log R
Sv colour min	-63 dB

Bottom detection menu

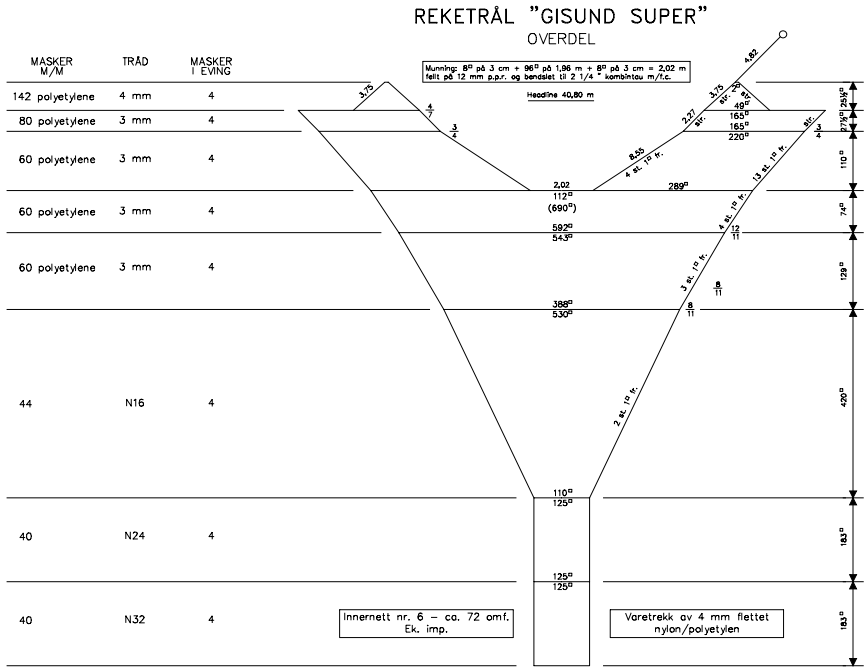
Minimum level	-50 dB

Calibration

A calibration of the acoustic equipment was conducted during the survey in Angola in August 2005.

Fishing gear

The vessel has two different sized "Åkrahamn" pelagic trawls and one "Gisund super" bottom trawl. For all trawls, the Tyborøn, 7.8m² (1670 kg) trawl doors were used.



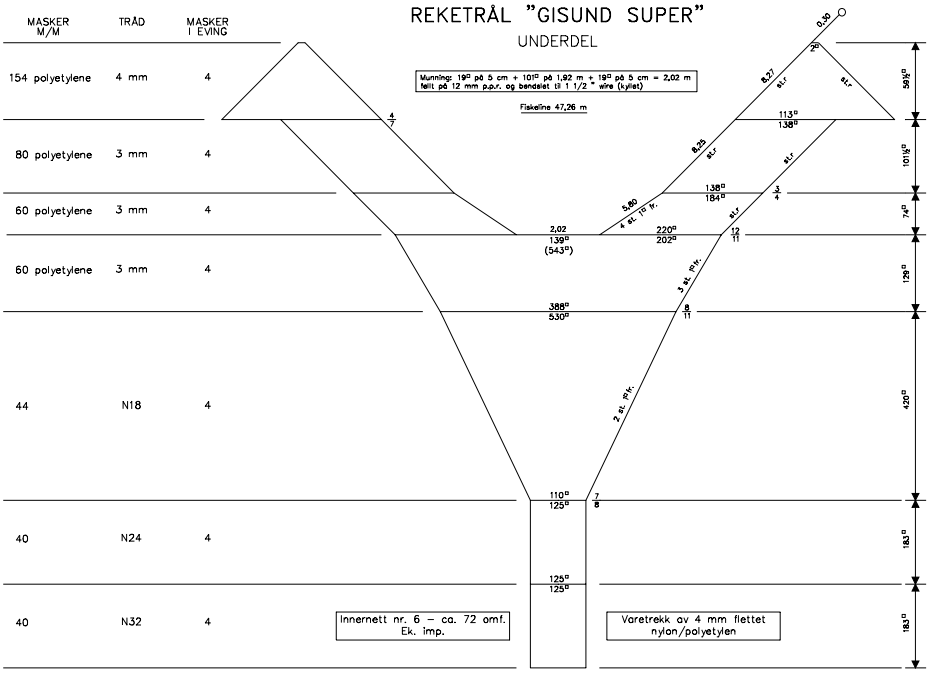


Figure 1 Design of the trawl used.

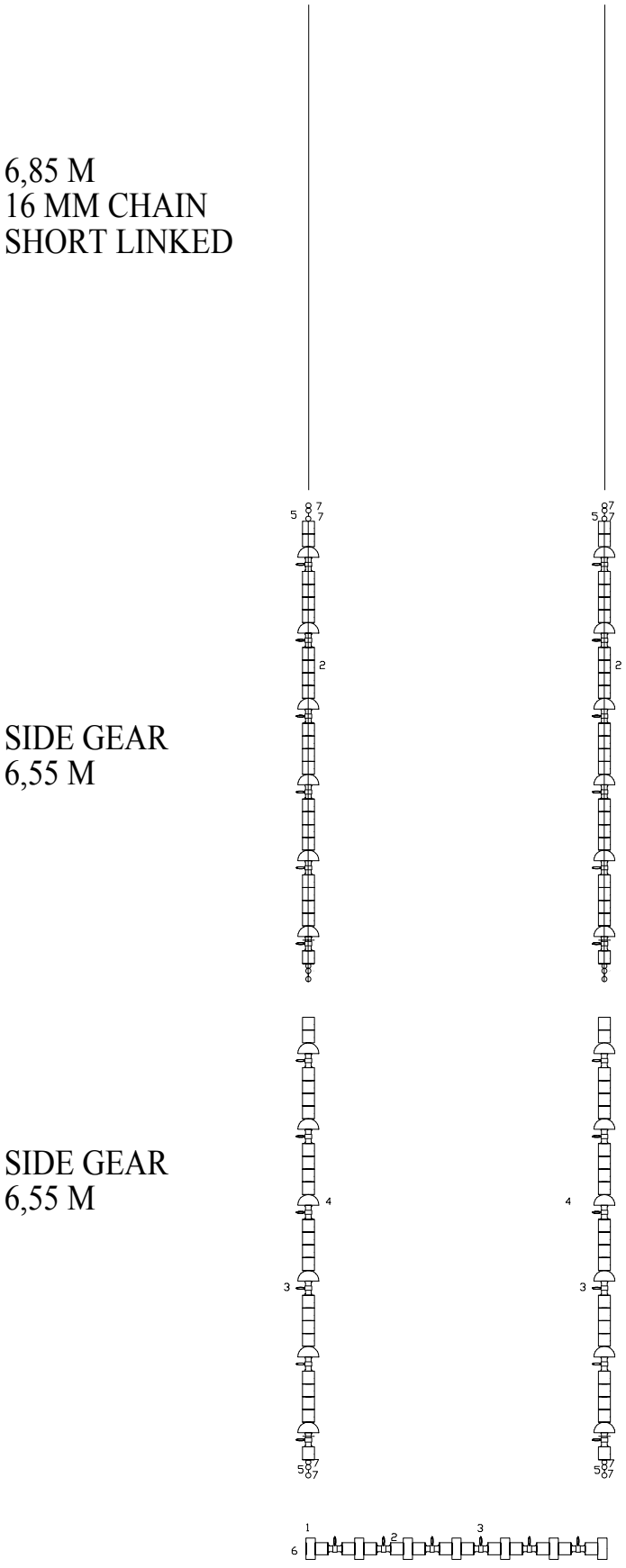


Figure 2 Schematic drawing of the ground gear used in the experiment.

Annex 3 Depth strata in MN^2 by latitude in Namibia and South Africa.

NAMIBIA. Depth strata by 1° latitude in NM^2

(Based on echo soundings from Nansen surveys 1996-2003. Depths from surface to bottom). 02.02.2003 OBA

	0-50 m	50-100 m	100-200m	200-300m	300-400m	400-500m	500-600m	600-700m	700-800m	800-900m	900-1000m	Total	0-600m
17°15'-18°	47	162	490	243	95	63	65	46	46	54	47	1360	1165
18-19°	287	324	783	822	154	128	119	101	100	87	128	3033	2618
19-20°	186	435	1259	810	1090	328	287	266	*192*	*241*	*220*	5314	4396
20-21°	229	401	1378	883	987	286	265	258	*272*	*281*	*280*	5519	4429
21-22°	372	547	1644	563	893	257	201	200	*199*	*184*	*179*	5238	4477
22-23°	479	709	2196	1086	929	154	126	127	108	97	*142*	6153	5678
23-24°	244	376	2006	1074	670	238	153	175	139	*136*	*130*	5340	4760
24-25°	394	433	1343	822	753	238	149	161	162	166	144	4764	4131
25-26°	204	415	1580	1102	529	227	166	155	161	153	*125*	4817	4223
26-27°	216	184	894	986	1408	744	140	*133*	*139*	*131*	*119*	5095	4573
27-28°	119	244	1269	527	858	480	205	170				3872	3702
28-29°	211	390	4207	*391*	153	123	164					5639	5639
29-30°	0	0	1042	533	327	276	162	167	107	121	121	2859	2341
30°-S	0	0	0	0	0	0	0	0	0	3	5	8	0
North	750	1322	3911	2759	2326	806	736	670	610	663	675	15226	12608
Central	1489	2064	7189	3544	3245	887	627	664	608	582	595	21494	19046
South	750	1234	8992	3540	3276	1850	837	625	408	407	371	22290	20478
Total	2988	4620	20091	9842	8848	3543	2200	1960	1625	1652	1642	59003	52132

Areas in *Italics*: few soundings, interpolated

Open areas: no or very few soundings

South Africa. Depth strata by 1° latitude in NM²

(Based on echo soundings from Nansen surveys 1996-2004. Depths from surface to bottom). *10.03.2004 OBA*

	0-100 m	100-200m	200-300m	300-400m	400-500m	500-600m	600-700m	700-800m	800-900m	900-1000m	Total	0-500 m	0-600m
28°40'-29°	186	303	0	0	0	0	0	0	0	0	489	489	489
29-30°	359	4348	451	195	202	23	7	2	0	0	5588	5556	5579
30-31°	200	2481	3443	460	465	262	177	135	193	149	7965	7049	7311
31-32°	288	2187	1794	1209	894	493	211	173	180	149	7577	6371	6864
32-33°	839	1308	1318	1303	432	156	122	111	109	116	5815	5201	5357
33-34°	654	833	546	375	381	247	243	117	120	102	3617	2789	3036
34-35°	1280	1376	662	496	259	134	80	69	53	66	4475	4074	4208
35-36°	25	1901	778	168	143	131	89	86	59	84	3464	3015	3146
36-37°													
Total	3830	14737	8992	4207	2777	1446	929	692	714	666	38989	34543	35989

South Africa. Depth strata by regions in NM² *26.08.2005 OBA*

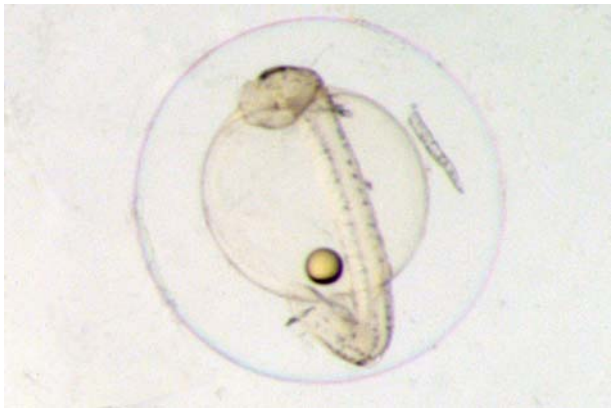
	0-100 m	100-200m	200-300m	300-400m	400-500m	500-600m	600-700m	700-800m	800-900m	900-1000m	Total	0-500 m	0-600m
Oranjemund-S. Hondeklip Bay	742	6835	4262	1062	1152	634	314	262	282	230	15776	14054	14688
S. Hondeklip Bay-n Saldanha	1169	3593	2685	2257	1088	454	392	224	242	230	12333	10792	11245
n Saldanha-C. of Good Hope	746	982	935	598	325	154	89	83	59	77	4047	3586	3740
C. of Good Hope-C. Agulhas	1131	3098	998	473	202	167	104	81	58	87	6397	5901	6068
Total	3787	14508	8881	4390	2767	1409	898	650	641	624	38554	34333	35741

Annex 4 Photographs of ichthyoplankton

Maurolicus muelleri

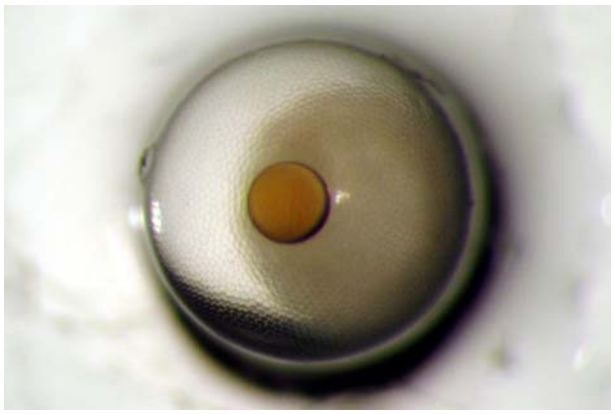
Thysanoteuthis rhombus

Merluccius sp. Stage 14



Sardinops sagax - advanced

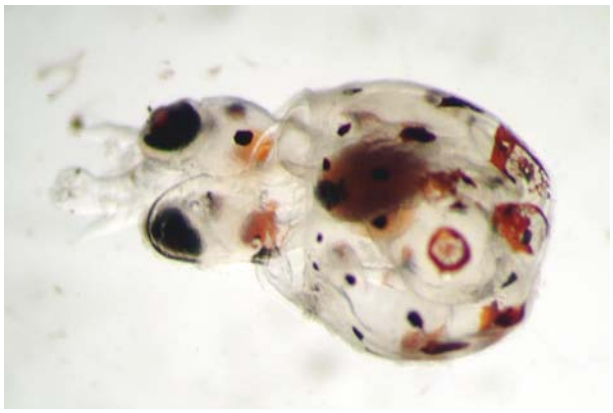
Merluccius sp. - 4 mm



Macrouridae

Thysites atun

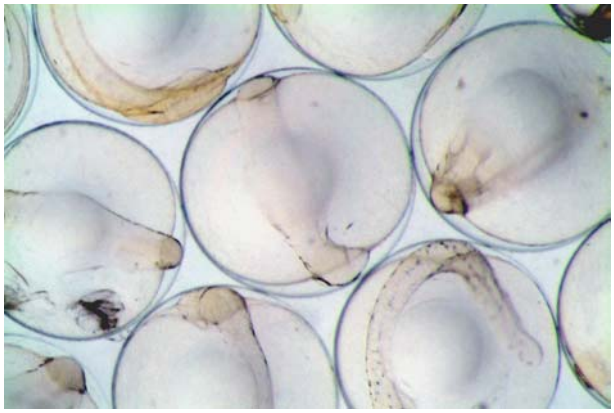
Merluccius sp. and unidentified egg



Unidentified

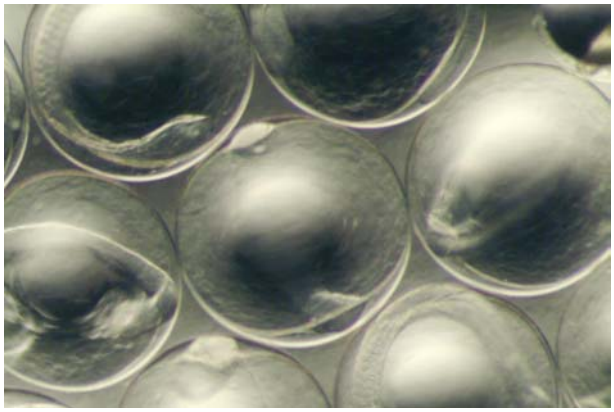
Etrumeus whiteheadi

Unidentified

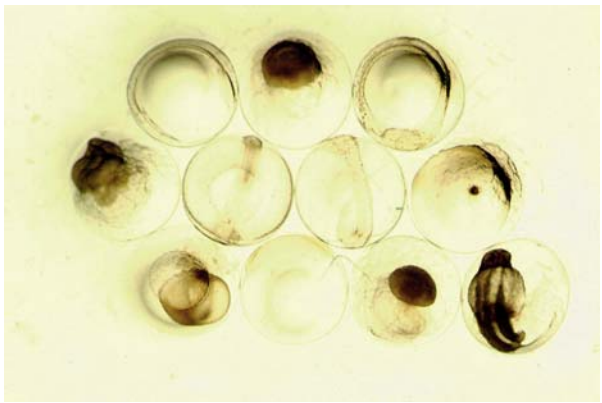


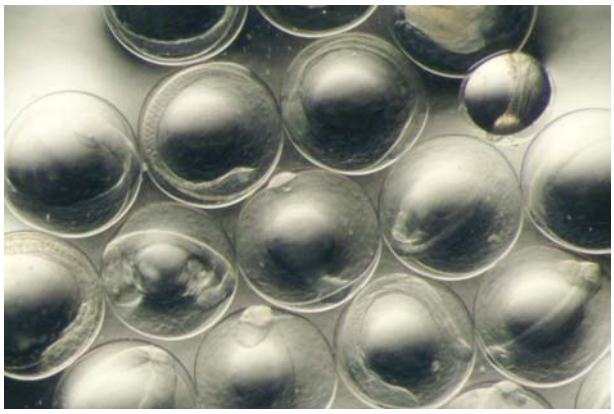
Etrumeus whiteheadi

Paracallionymus costatus

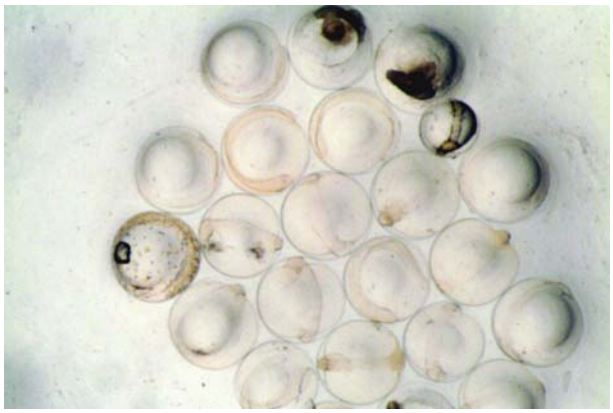


Etrumeus whiteheadi

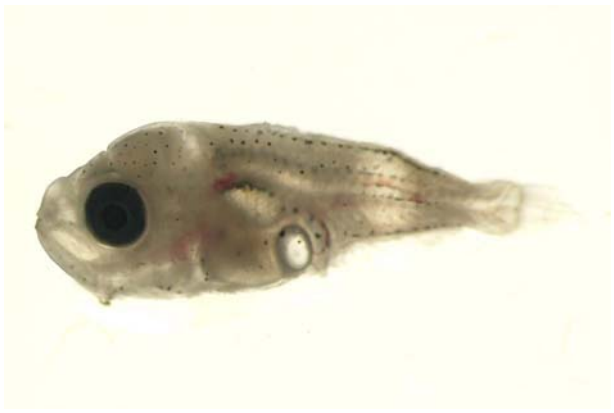




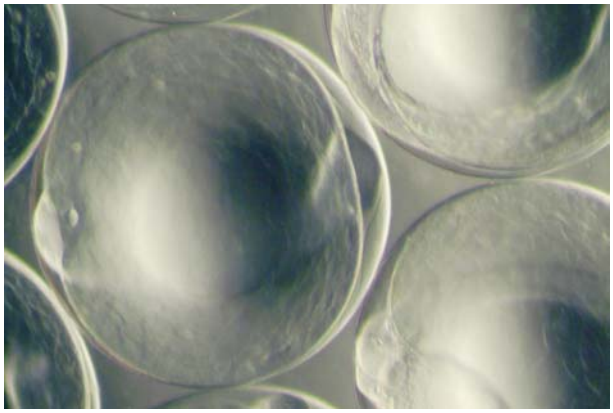
Etrumeus whiteheadi



Etrumeus whiteheadi



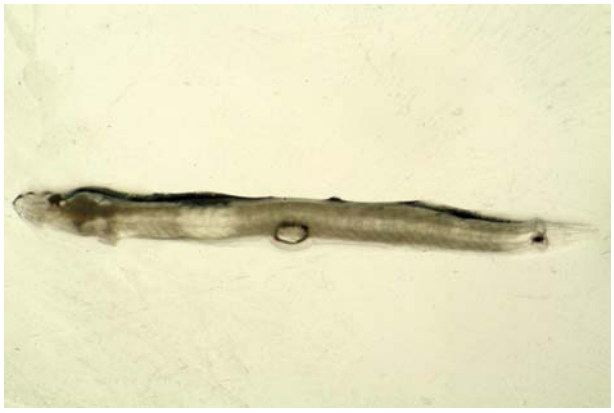
Trachurus capensis



Etrumeus whiteheadi

Trachurus capensis

Maurolicus muelleri



Vinciguerria poweriae

Maurolicus muelleri

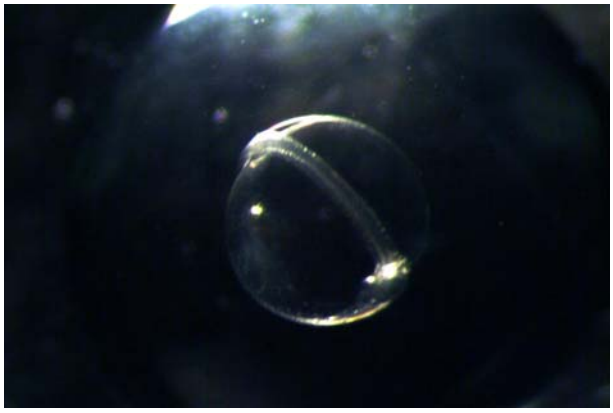
Vinciguerria poweriae

Unidentified

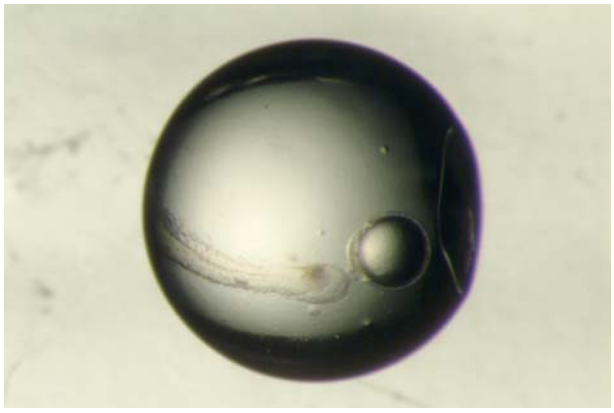
Myctophidae

Genypterus capensis

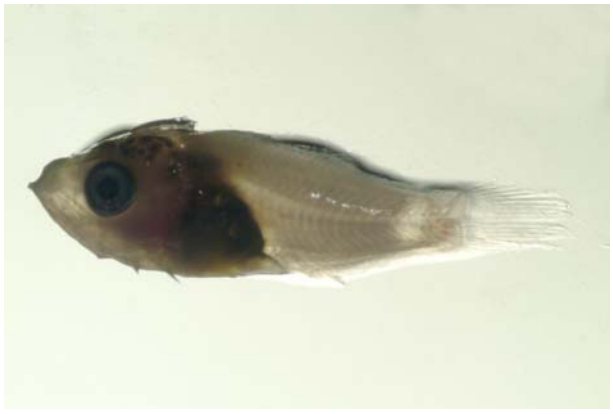
Unidentified – 1.9 mm, oil gl. 0.3mm



Genypterus capensis

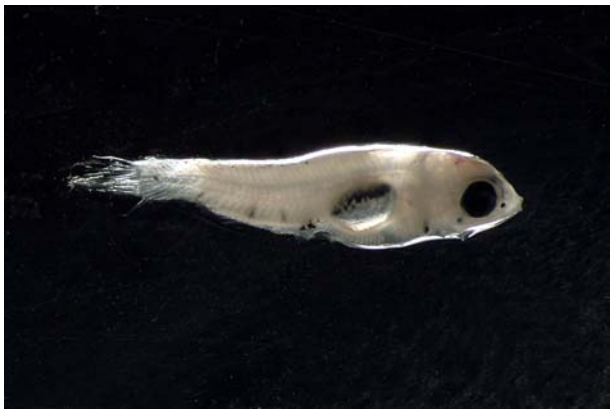


Unidentified – 1.9 mm, oil gl. 0.3mm



Helicolenus dactylopterus

Myctophidae – 8 mm

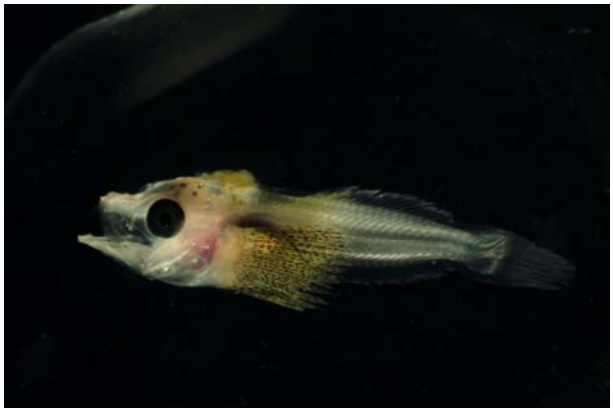


Myctophidae – 8 mm

Parathemisto gaudichaudi having supper

Chelidonichthys sp.

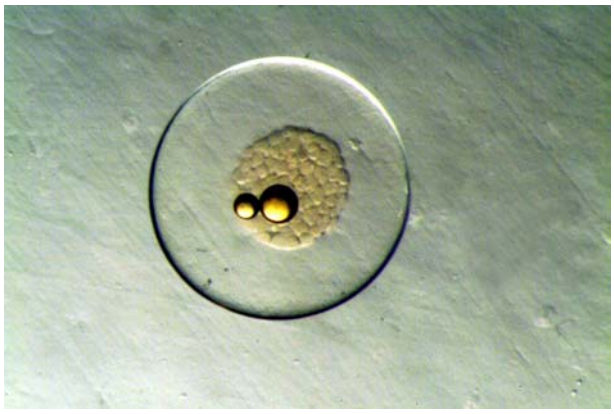
Parathemisto gaudichaudi with eggs



Chelidonichthys sp.

Merluccius sp. – 5.5 mm

Merluccius sp. ?



Unidentified – 2.2 mm

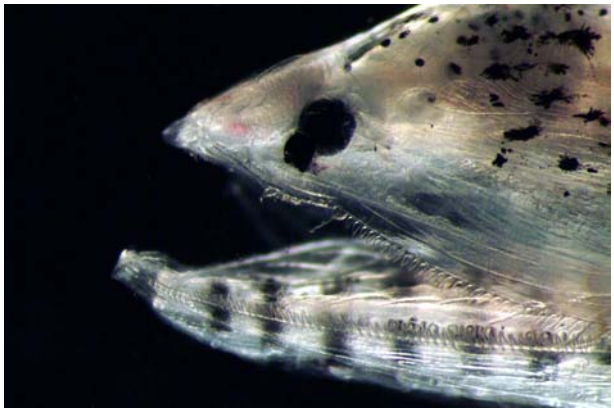
Lophius vomerinus – 8 mm

Lepidopus caudatus – 5.4 mm

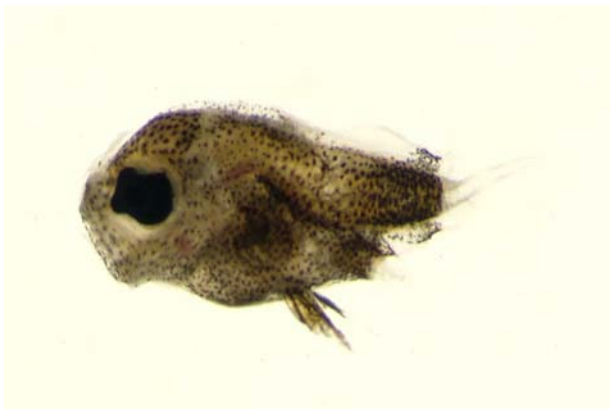
Lophius vomerinus – 8 mm

Stomiformes - 25 mm

Zeus capensis – 4 mm



Stomiformes - 25 mm



Zeus capensis – 4 mm

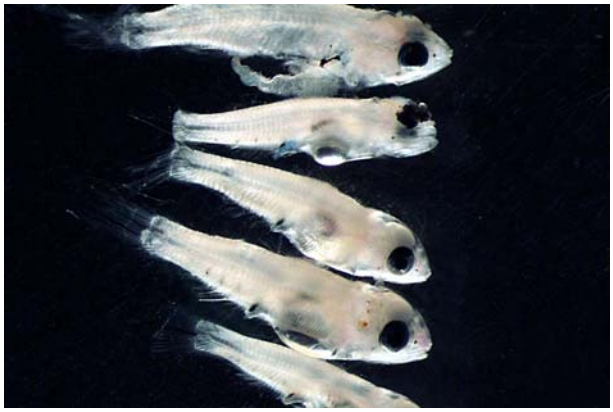
Stomiformes - 25 mm

Zeus capensis – 7 mm

Merluccius sp. – 5.8 mm

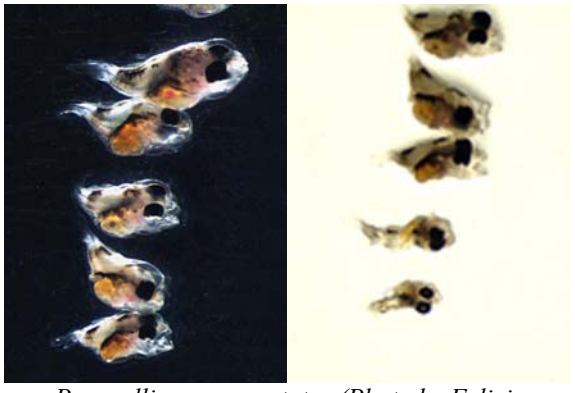
Helicolenus dactylopterus – 12 mm

Merluccius sp. – 5.8 mm



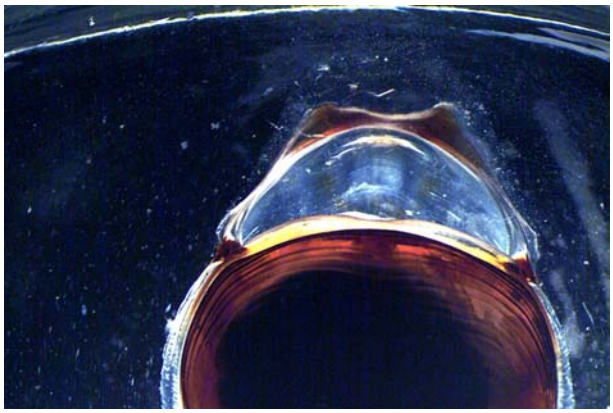
Myctophids (Photo by Felicia Keulder)

Lobster

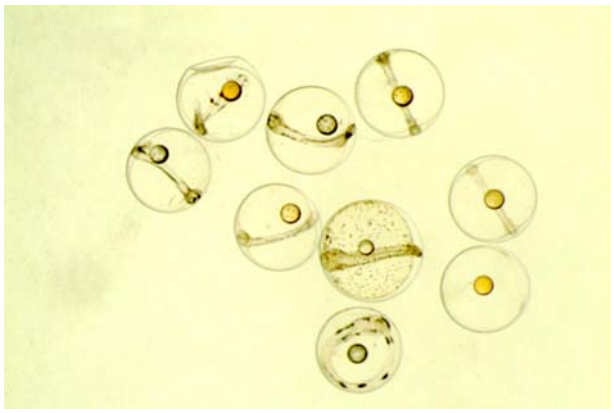


Paracallionymus costatus (Photo by Felicia Keulder)

Lobster

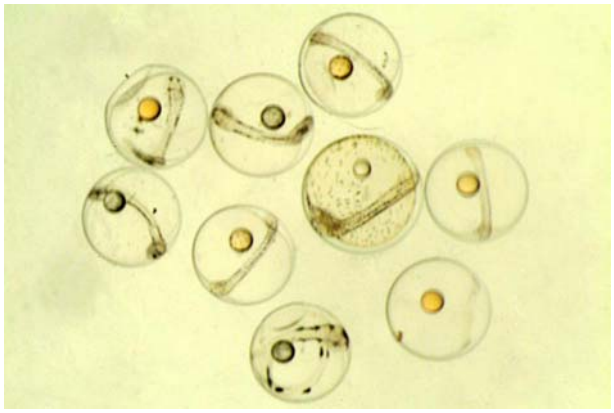


Alien from deeper sea (Photo by Felicia Keulder)

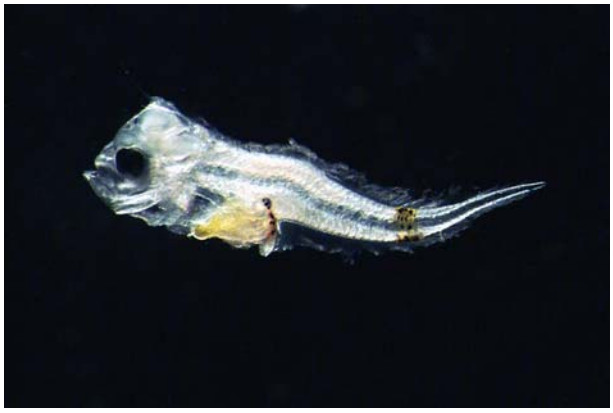


Various eggs

Sole – 5.4 mm



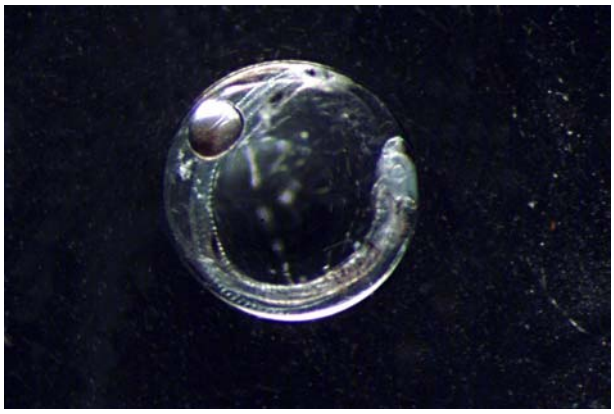
Various eggs



Sole – 5.4 mm

Lepidopus caudatus

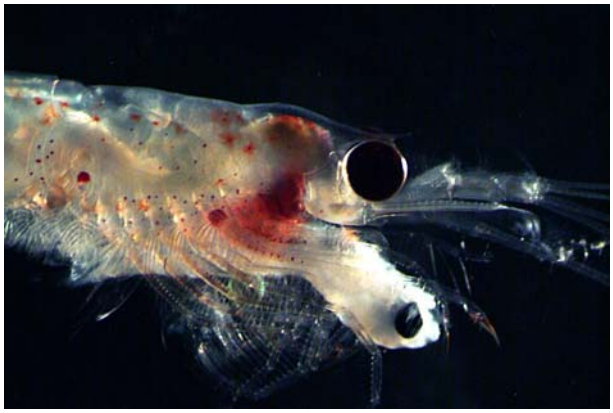
Ostracoda – length 1.3 mm



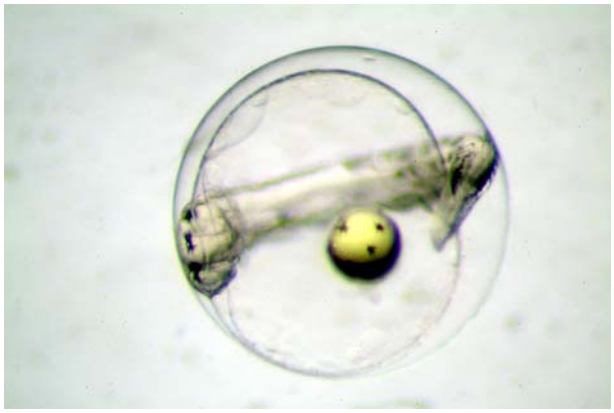
Lepidopus caudatus

Euphausia hanseni having supper

Unidentified larvae



Euphausia hanseni having supper

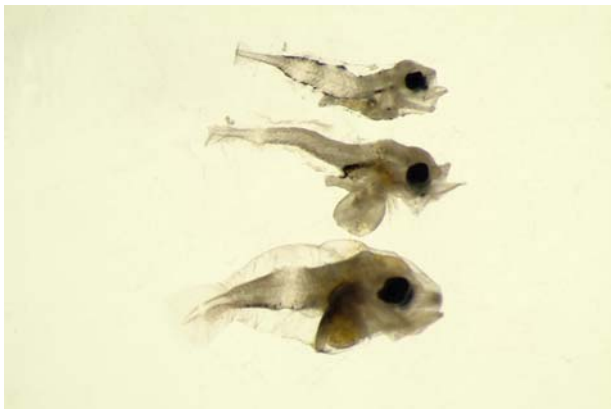


Unidentified egg – 1.0 mm

Unidentified larvae

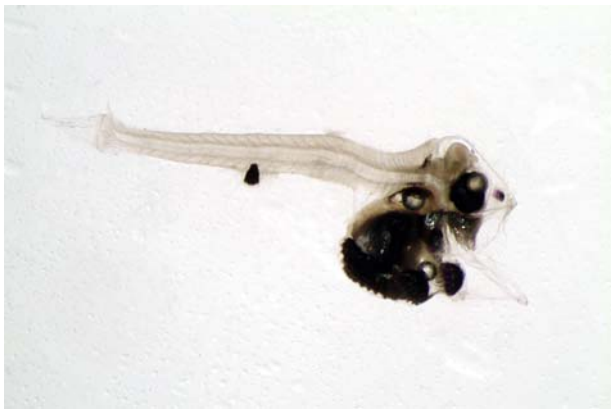
Unidentified egg – 1.0 mm

Unidentified larvae



Unidentified larvae – 3.0-4.5 mm

Unidentified larvae – 3.0-4.5 mm



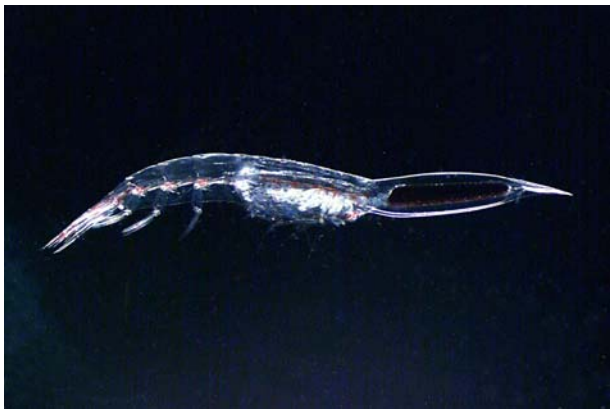
Argyropelecus sp. – 9 mm

Hyperid amphipod

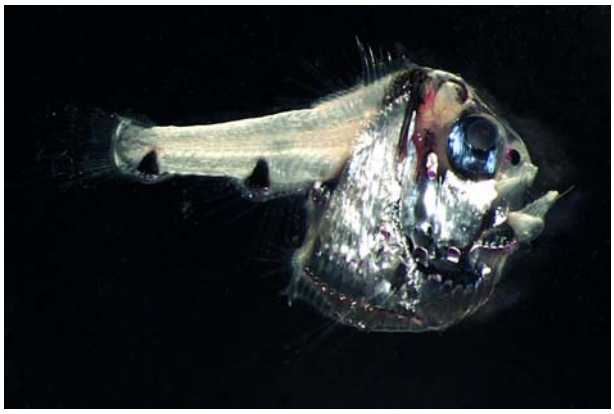
Argyropelecus sp. – 9 mm

Hyperid amphipod

Argyropelecus sp. – 11 mm



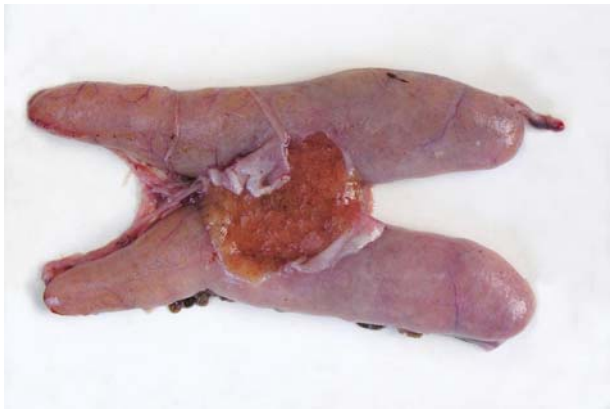
Hyperid amphipod



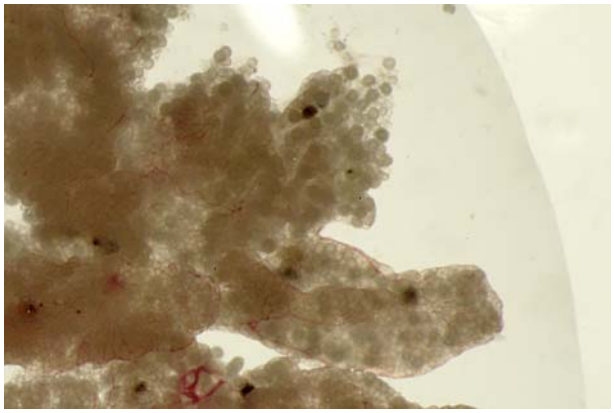
Argyropelecus sp. – 11 mm

Hake ? – 2.5 mm

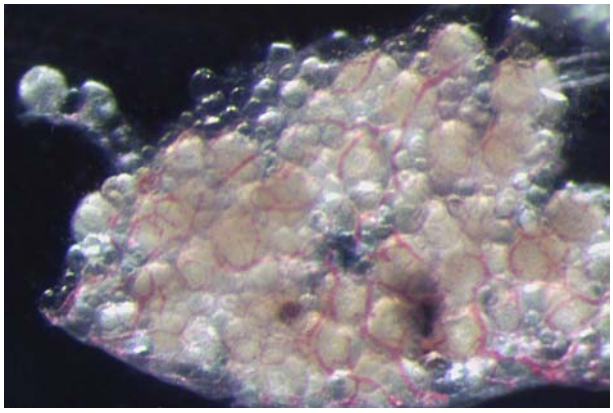
Spent *Merluccius paradoxus*



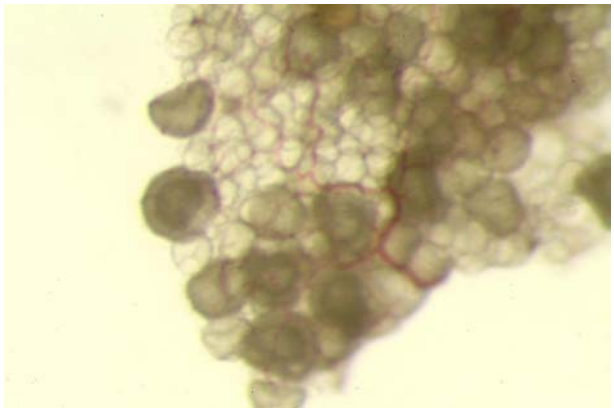
Spent *Merluccius paradoxus*



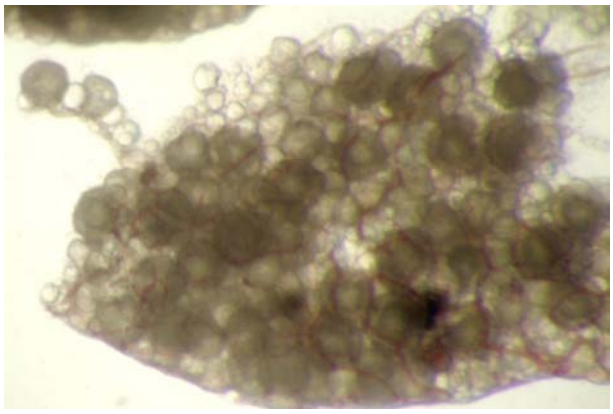
Spent *Merluccius paradoxus*



Spent *Merluccius paradoxus*



Spent *Merluccius paradoxus*



Spent *Merluccius paradoxus*