

BENEFIT SURVEYS

Cruise Report No 1/2004

Diel vertical migration in gobies

12 – 18 January 2004

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CRUISE REPORTS “DR. FRIDTJOF NANSEN”

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Diel vertical migration in gobies

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by

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TABLE OF CONTENTS

CHAPTER 1. INTRODUCTION.....	1
1.1. BACKGROUND.....	1
1.2. OBJECTIVES OF THE SURVEY.....	1
1.3. PARTICIPATION.....	2
1.4. NARRATIVE.....	2
CHAPTER 2. METHODS.....	3
2.1. 24 H STATIONS.....	3
2.2. MULTIFREQUENCY ACOUSTIC SAMPLING AND ANALYSIS.....	3
2.3. MULTINET PLANKTON SAMPLER.....	3
2.4. TRAWL SAMPLING.....	4
2.5. BEHAVIOURAL EXPERIMENTS.....	5
CHAPTER 3. RESULTS.....	8
3.1. OCEANOGRAPHIC CONDITIONS.....	8
3.2. DIEL VERTICAL MIGRATION.....	10
3.3. SINGLE TARGET DETECTION.....	12
3.4. DIFFERENCES BETWEEN SOUTHERN AND CENTRAL AREA.....	13
3.5. RESPONSE TO HYPOXIC STRESS.....	15

Annex I Instruments and fishing gear used

Annex II Records of fishing stations

CHAPTER 1. INTRODUCTION

1.1. BACKGROUND

An overall goal of BENEFIT is to improve the knowledge and understanding of the important commercial stocks, their environmental conditions, and the linkage between environmental processes and growth, distribution and abundance of the fish stocks.

Nursery grounds of several commercially important fish species coincide with areas overlying the hydrogen sulphide-producing mud belt in the Benguela upwelling ecosystem along Namibia's inner continental shelf. Recent research has led to interest in the role this diatomaceous mud plays in affecting the overlying water column, as emissions of hydrogen sulphide are not only toxic in themselves - hydrogen sulphide being a potent respiratory toxin - but also lead rapidly and directly to anoxic or hypoxic conditions as the hydrogen sulphide reduces oxygen in the overlying water column. Even surface water can be severely hypoxic (0.7 ml/l dissolved oxygen, DO) following an intense hydrogen sulphide event. The animals living in these environments are likely to have adapted, but different groups may show different strategies to cope with such events. And the response to such stress may depend on the distribution of predation risk and feeding opportunities.

The general goal of the present BENEFIT cruise is to study the ecology of small pelagic fish and gobies (*Sufflogobius bibarbatus*) in relation to environmental variables. The research group onboard investigated the ecology and behaviour of gobies with particular emphasis on diel vertical migration and behaviour under simulated upwelling events with hypoxia. This project is part of collaboration between Namibia, Norway and South Africa and funded by the Norwegian and the South African Research Council.

Many marine organisms undertake diel vertical migrations associated with food finding and predator avoidance. These characteristics can be studied using a combination of trawling to catch the fish, and plankton net sampling to catch the prey, and hydro acoustic measurements to monitor up and down migrations of organisms, and all on 24 H stations (i.e. all sampling are done throughout the water columns on the same geographical position).

1.2. OBJECTIVES OF THE SURVEY

The survey had two objectives:

- A) To study the diel vertical migration of gobies in relation to environmental variables such as oxygen concentration, temperature, light and their predators (hake, *Merluccius*

capensis and *M. paradoxus* and horse mackerel, *Trachurus capensis*), competitors and prey (zooplankton) in two sub areas of the Namibian Benguela (central; off Walvis Bay) and south (off Lüderitz).

B) To study behavioural response in gobies to simulated upwelling events.

1.3. PARTICIPATION

The scientific staff consisted of:

From the Department of Biology, University of Bergen, Norway:

Frank Midtøy, Anne Gro Vea Salvanes (Cruise leader) and Anne Christine Utne-Palm.

From NatMIRC, Swakopmund, Namibia:

Chibo Chikilikwa, Johannes Hamukuaya, Jan Kheigob, and Anna Lucia Mukumangeni.

From MCM, Cape Town, South Africa and the NANSEN-program Bergen:

Renge Lungelwa Cordelia.

From Institute of Marine Research, Bergen, Norway:

Jens Otto Krakstad, Tore Mørk and Terje Hovland.

1.4. NARRATIVE

The Dr. Fridtjof Nansen left Walvis Bay at 16:00 GMT (18:00 Local time) on the 12/01-2004 and started steaming south towards the study area at 26°40' S, 14°51' E, this position is outside Lüderitz at 160 m depth (southern sub area). We arrived at 16:05 GMT on the 13/01 and proceeded with the first bottom trawl of the first diel experiment immediately. The first area was aborted after one cycle (bottom trawl, multisampler trawl, multinet plankton haul and CTD) because only small amounts of gobies were found. It was decided to search slightly further north. A new diel cycle was started at 26°00' S 14°25' E at 200 m bottom depth at 03:00 GMT 14/01 (southern sub area). The diel cycle was completed at 07:00 GMT the next day where after the vessel steamed towards Sandwich harbour at 23°23' S 14°17' E. A new diel station (central sub area) was commenced here around 22:00 GMT on the 15th January. The experiment was terminated at 06:00 GMT on the 17th. The vessel then steamed to Walvis Bay where it arrived at 12:30. The last aquarium experiments were conducted in the harbour the same evening.

CHAPTER 2. METHODS

2.1. 24 H STATIONS

Each 24 h stations consist of 4 main cycles starting with a bottom trawl haul, next a pelagic trawl using the multisampler. Afterwards the multinet was used for sampling zooplankton and a CTD-rig with oxygen and light sensors attached, to measure temperature, oxygen concentration and light levels. Each cycle was completed with 1 h acoustic sampling of the vertical positions of the sound scattering layers without interruptions from ship movement.

2.2. MULTIFREQUENCY ACOUSTIC SAMPLING AND ANALYSIS

Hydro acoustic data was collected continuously during the survey by means of two Simrad EK500 connected to the 18, 38, 120 and 200 kHz transducers mounted on the submersible keel. The 38 kHz transducer was calibrated in Senegal 8th of November 2003. The sv transducer gain was recorded at 26.98 dB, while the TS transducer gain was recorded at 27.15 dB, no major deviation in from previous calibration where found. All four transducers where previously calibrated on the 17th of August 2003. The technical specifications and operational settings of the echosounders applied during the survey are given in Annex I

To minimise differences in sampling resolution, the pulse length and band width setting of the 18 and 120 and 200 kHz transducer were set to short/wide (18 kHz), medium/wide (38 kHz) and long/narrow respectively (120 and 200 kHz). Logging of acoustic raw data was done using the Windows based SonarData_Echolog V.20. Analysis and post processing of logged data was done using Sonardata_Echoview V.3.1 software. The horizontal sampling rate was set to 1 ping per 1.2 sec, while the vertical resolution was optimised by the relevant depth in the area of the experiment.

2.3. MULTINET PLANKTON SAMPLER

Zooplankton was sampled with a Multinet plankton sampler from Hydrobios. The plankton sampler has an opening of 0.5 x 0.5 m and five nets with a mesh size of 405 µm. A flow meter was mounted at the opening of each net. A Scanmar depth recorder with acoustic transmission to the vessel was mounted on top of the Multinet. On the southern station (PL 2-5 off Lüderitz), the depth intervals were 0-10 m, 10 – 50 m, 50 – 90 m, 90 – 140 m and 140 – 160 m. On the central station (PL 6-11 off Walvis Bay) the depth intervals were 0-20, 20-40, 40-60, 60-80 and 80-95. Depth intervals 2, 3 and 4 always corresponded to the same depth intervals as used for the multisampler to catch the fish. This was to match samples of prey

availability and gobies for diet studies. The plankton sampler was retrieved at a speed of 0.5 - 1.0 m/sec while the vessel maintained a speed of 2 - 2.5 knots. The plankton samples were preserved on 96% alcohol for studies of food availability for the gobies. The samples are shipped to the University of Western Cape to be analysed by Honours students in Zoology under the supervision of Dr. Mark Gibbons.

2.4. TRAWL SAMPLING

Bottom and Pelagic trawls with the Multisampler were used to study the horizontal and vertical distribution of gobies and to collect individuals for genetic and measurements of length, weight and to sex.

We had two full 24 h stations with trawling for process studies. All depths were sampled throughout day and night to study diel vertical migration pattern and diel rhythms in feeding and predation risk.

2.4.1 Bottom trawl

The bottom trawl was hauled for 15-30 minutes using a speed of 3-4 knots/h. It was hauled slowly to the surface (59 m/min) in order to try to keep gobies alive. Bottom trawling was conducted before the Multisampler.

2.4.2 Pelagic trawl with Multisampler

Three depth ranges were sampled with the pelagic trawl. The Multisampler was used after the bottom trawl. Depth ranges in southern area (off Lüderitz) MS1: 180-120 m, MS2: 120-60 and MS3: 60-0. In the central area (off Walvis Bay) the depth ranges were MS1: 80-60m, MS2: 60-40 and MS3: 60-20. On stations 1458 (MS3-net) the multisampler was broken due to enormous density of jellyfish. The damage was too large to repair it for the next cycle. Therefore we used the smaller pelagic Åkratrawl for the stations 1460, 1462, 1464 and 1466. The smaller trawl has an opening, which is about half the area of the multisampler opening. The catch per unit of effort is therefore multiplied with 1.95 to account for differences in fishing efficiency.

2.4.3 Preservation of trawl samples

Whenever gobies were caught the total catch of all species and of gobies was recorded. 100 randomly chosen individuals were measured for total length (mm) and weighed (g) and individuals larger than 40 mm were sexed. All individuals were measured if less than 100 individuals were caught in the haul. Samples were frozen for genetic and age and growth studies, and others were preserved on 96% alcohol for studies of the diet. The samples on

alcohol and half of the frozen samples are shipped to the University of Western Cape for analysis of diet and age and growth. The other half of the frozen fish were brought to the University of Bergen for further genetic studies and for pilot study of whether otoliths can be used for ageing of the goby.

2.5. BEHAVIOURAL EXPERIMENTS

2.5.1 Experimental aquaria

Alive gobies were removed carefully from the sample and put into well-aerated seawater, from the ships seawater was oversaturated with nitrogen and could not be used directly on the fish as this will cause problems with inflation of gas bladder and gas bubbles in eyes. This water was therefore aerated with pressure air for 6-8h before use. The fish were then carefully transferred to 100 l aquaria with flow through seawater to keep constant temperature and aeration to keep normal nitrogen of the water:



Figure 1. Holding aquaria for housing gobies alive

Four experimental closed aquaria with cooling elements were built and put together in a rack. Each glass aquarium measured 60 x 30 x 30 cm and was sealed by a lexiglass lid with 70% light penetration. The back and sides were painted black. Two cooling coils (ca 200 cm) were attached to the lid. To get fish in and out of the aquarium, the lid had a circular opening ca 20 cm diameter that could be closed. Air-stone was used through this opening when fish had aerated water. The aquaria were also fitted with stopcock inlets and outlets for nitrogen gas and water sampling, respectively. A nitrogen gas bottle was secured next to the aquariums with a regulated flow to all four aquariums.



Figure 2. Aquaria used for the response to decreasing oxygen concentration and recovery from hypoxia on gobies

2.5.2. Experiment

Four or five externally tagged fish were housed in each aquarium filled with well-aerated seawater. Air stone was removed and the aquaria sealed. The dissolved oxygen content was accurately determined at any stage of the experiment by tapping off a sample for Winkler analysis. A water sample was taken to measure oxygen contents using the Winkler method and the background (T0) number of gill beats per minute was recorded for individual fish. Bubbling nitrogen gas deoxygenated the water in the aquariums. Afterwards the nitrogen gas was therefore turned on. It took about 10-15 minutes of observation on all fish each observation point of time. After each observation we waited a further 30 minutes before new water samples and observations of the fish were made. This was done 4 more times (T1-T4) while increasing hypoxic stress (i.e. decreasing the oxygen concentration of the water). Maximum oxygen stress was kept for approximately 30 minutes and water samples was taken twice (T5 and T6) with 15 minutes interval between before the nitrogen gas was turned off, lid removed from the aquaria top and air stone put into the water again to oxygenate the water and observe the recovery of the fish. Recovery was observed and oxygen contents determined 4 times with 10 min intervals.

When we wished to simulate upwelling events that combined hypoxic stress and sulphide concentrations we ran into technical problems. A stock solution of sodium sulphide dissolved in seawater was used to add sulphide as required to the tanks. The ambient sulphide concentration of sulphide in the tanks, as with oxygen, could be sampled at any time.

However, since we had run out of nitrogen gas, and the new bottle that the ships' Agent in Walvis Bay supplied came without a valve, and could therefore not be used, some modifications were tried. We had an attempt to do the same observations with sulphides added to oxygenated water. The fish did not show any response, and the sulphides reacted with the oxygen so this experiment was terminated.

CHAPTER 3. RESULTS

3.1. OCEANOGRAPHIC CONDITIONS

Eleven CTD stations were carried out from surface to bottom on the two major 24 H stations. The whole water column was sampled. Figures for the recorded levels were prepared using Surfer and are shown in Fig. 3.

3.1.1 Temperature

The hydrographical time series consists of the temperature recordings. The temperature was 1 to 3 degrees higher (all through the water column) at the station close to Walvis Bay compared to the other 24 h station. This station had also the lowest oxygen levels (Fig. 3a and b).

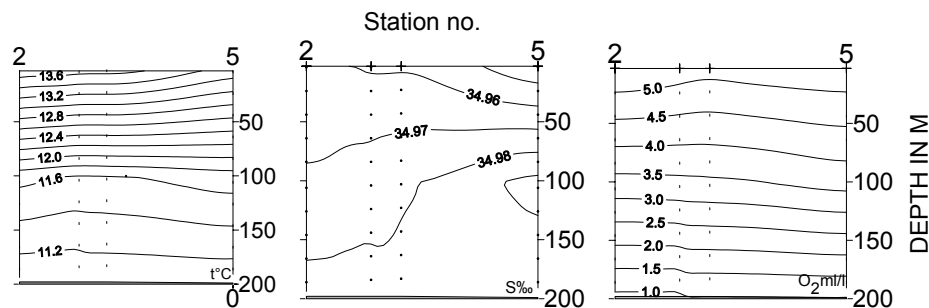
3.1.2 Salinity

Salinity profiles showed similar non-stratified trends to temperature with salinities of about 34.9‰ in the southern area and 35.2‰ in the northern area (Fig. 3).

3.1.3 Oxygen

The dissolved oxygen profiles showed more dramatic changes with depth than did temperature and salinity. The individual station profiles show in general a decrease from 5ml/l O₂ in surface waters to about 3 ml at 150 m. Between 150 and 200 m there was a strong oxycline with a 2 ml/l drop in the concentration of dissolved oxygen (DO) to around 1 ml/l at 200 m. An oxygen minimum of 0.2 - 0.4ml/l DO was evident on the station off Walvis Bay. The oxygen level nearest bottom (oxygen minimum) was higher north and south of Lüderitz (1.23 and 1.12 ml/L respectively), and lowest on the station off Walvis Bay (Fig. 4a, b, and c). The station off Walvis Bay had an oxygen level < 1.2 ml/L (which was the bottom level at the other two 24 h stations) at a depth of 50-60 m.

a) North of Lüderitz



b) South of Walvis Bay

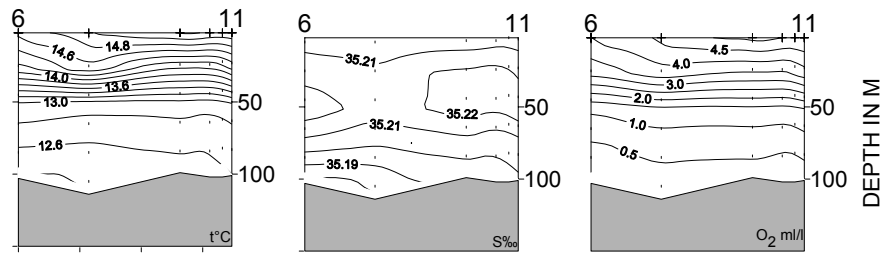


Figure 3. Temperature salinity and oxygen profiles from the two 24 h stations, a) North of Lüderitz, b) south of Walvis Bay.

3.1.4. Light

Light was present down to around 25 - 30 meters at the station south of Luderitz and the two 24 h stations, north of Luderitz and south of Walvis Bay, for light measured between 1 and 5 PM Figure 4a, b and c presents changes in oxygen concentration and light intensity by depth for the main stations.

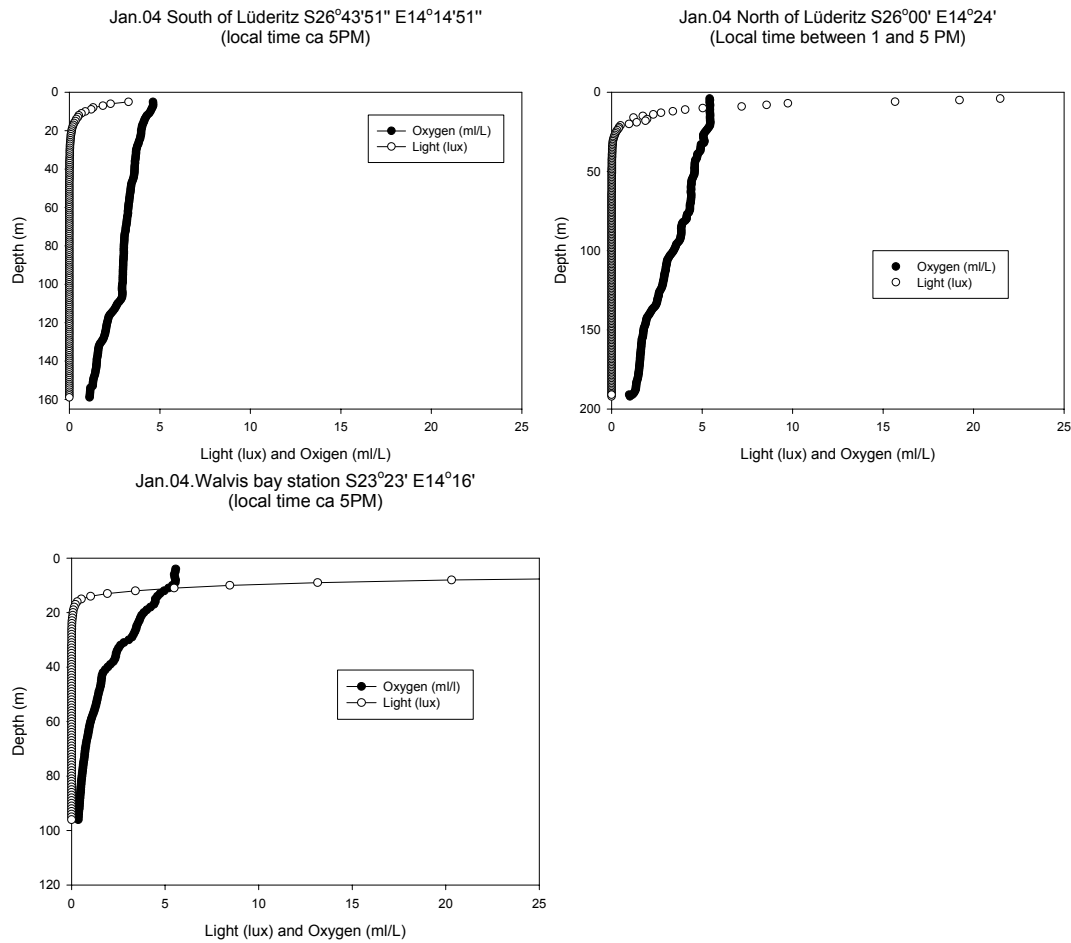


Figure 4. Changes in oxygen concentration and light intensity by depth for the main stations.

3.2. DIEL VERTICAL MIGRATION

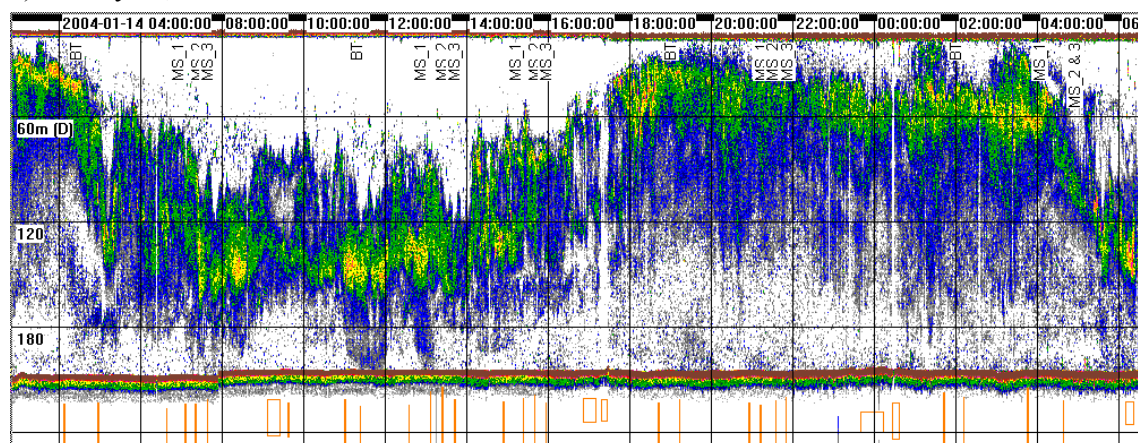
Acoustic observations of the scattering layers on the station off the south (Lüderitz) did not show any indications that could be interpreted as gobies. However, trawl samples demonstrated that gobies stayed on the bottom day and night, and small fish, like gobies, that stay on the bottom, partly occupying the acoustic blind zone, are particularly difficult to identify using the echo sounder under these circumstances. The layer seen on the echogram in midwater consisted predominantly of mesopelagic fish mixed with myctophides and jellyfish (*aequorea aequorea*). Minor concentrations of Cape hake (*M. capensis*) were visible in the lower part of the echogram, lifting somewhat from the bottom at night.

On the station in the central Namibian area (off Walvis Bay) there was a clear pattern that reflected gobies migrating from the bottom 50 m towards the surface at night (Fig. 5b). The

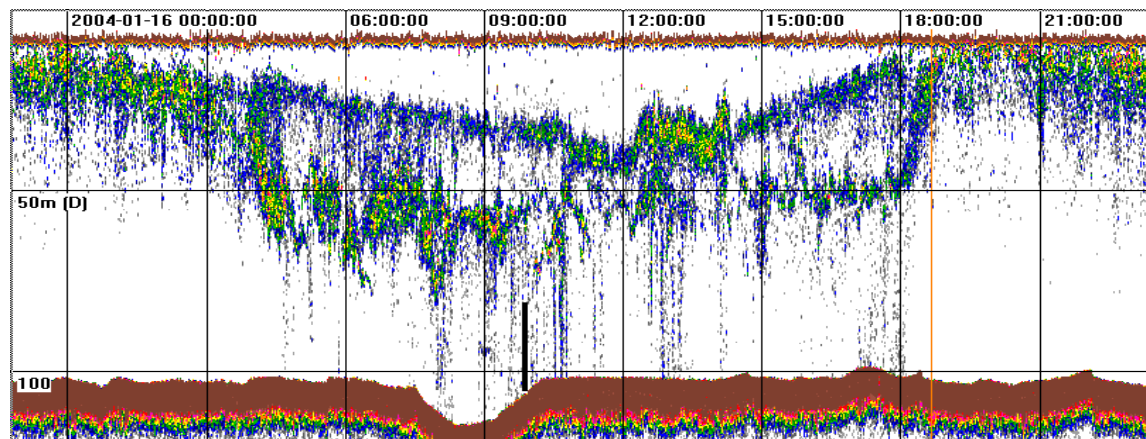
gobies were loosely distributed in tall schools (~40 m high, Figure 5c). The trawl samples reflected this diurnal vertical migration (Table 1). The two layers seen on the echogram occupying midwater during the day consisted mainly of the two dominant Namibian jellyfish species, *Aequorea aequorea* and *Chrysaora hysocella*.

The composites were made by resample the Echolog raw data files (EK5-files) for the 38 kHz transducer per time interval using the virtual variable module in Echoview. This operator in Echoview resample the input variable using a fixed time interval in the time/distance domain, and a specified upper depth, lower depth and number of data points in the depth domain. The raw variable was re-sampled every 110 sec, with the resolution set to 1000 data points in the depth domain, an upper display depth at 0 m and a lower display depth of > than the bottom depth in the area. The displayed echograms all have a colour minimum of -70db, with standard EK 500 colours.

a) Diel cycle; Southern area



b) Diel cycle central area:



c) Gobies migrating down towards the bottom at dawn in central area:

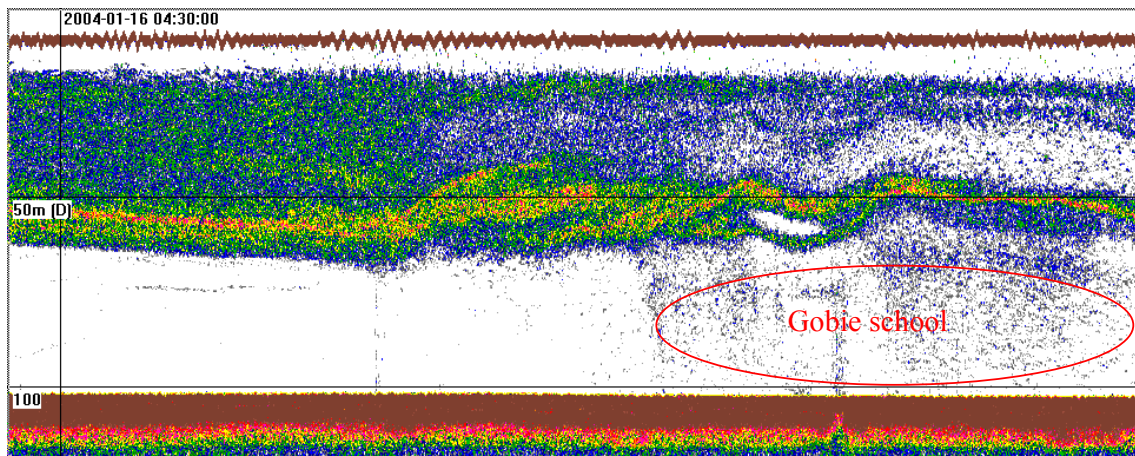


Figure 5. Selected sound scattering layers of organisms.

3.3. SINGLE TARGET DETECTION

Good quality data on single target gobies were collected during experiment II. Preliminary analyses show that TS mean of the 1577 single targets seen in Fig. 6, (box) show a TS mean of $-55, 3\text{db}$, with a st.d. of $0,0000002\text{ db}$, TS max = $-47,3$ while TS min. = -66.6 .

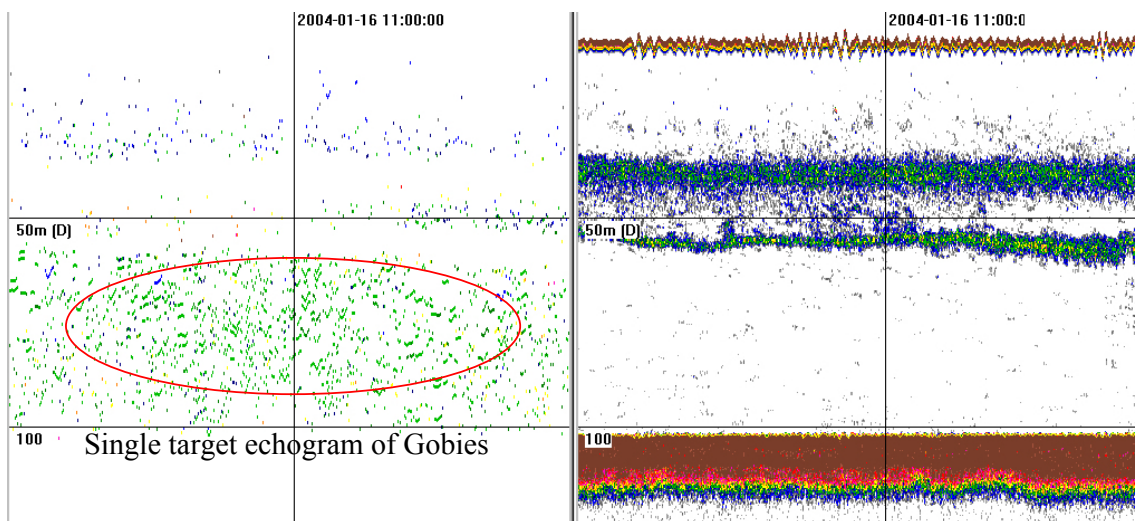


Figure 6. Single target echogram (left) and SV echogram (right) illustrating the single target detections of gobies in the lower part of the echogram (red circle).

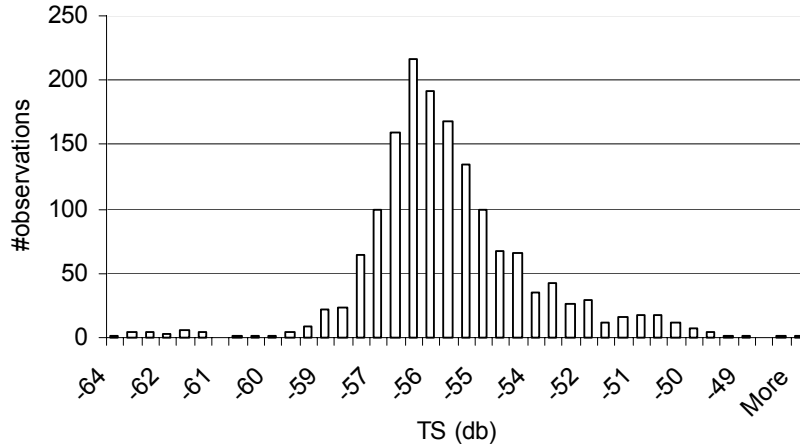


Figure 7. Distribution of single targets from gobies (red circle in figure 6).

3.4. DIFFERENCES BETWEEN SOUTHERN AND CENTRAL AREA

Gobies undertake diel vertical migration that differs in southern and central coastal Namibian areas. In the south the gobies stayed on the bottom day and night. Here there was very high density of their predators, hake and horse mackerel, and the oxygen concentration on the bottom was not lower than 1 ml/l, a concentration that appears tolerable for a prolonged time. In contrast, in the central area there is a clear diel vertical migration with gobies staying on the bottom during the day but rising in the water column during the night. In the north there was a much lower minimum concentration of oxygen with values as low as 0.3 ml dissolved oxygen/litre in the deepest water column. Also, as seen in figure 8, the size distribution of gobies in the southern (diel cycle 1) and northern (diel cycle 2) area was different, with significantly ($p < 0.05$, t-test) larger fish in the southern area.

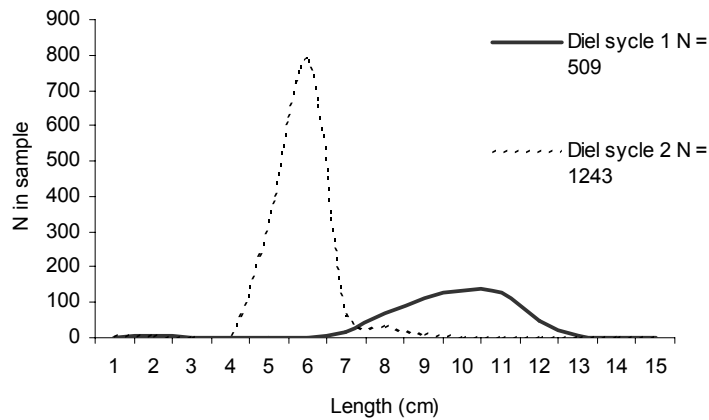


Figure 8. Length frequency of gobies caught in Experiment 1 and 2 respectively

Table 1. Overview over trawl stations

Southern area:

Lüderitz station: S 26°43'51" E 14 °14' 51"

Pel.Trawl no	B. Trawl no	Starttime GMT=Icl-2h	Depth m	O ₂ (ml/l)	T°C	Goby Kg/h	Hake Kg/h	Mesopelagic Kg/h	Horse mackerel Kg/h
	1428	16:55	170	1.116	10.6	3.6	788	100.4	-
1429		18:39	140-90	2.67		0	0	40.8	-
1430		18:55	50-25?			0	0	293.6	-
1431		19:11	50	3.4		0	0	473.6	-

North of Lüderitz station: S 26°00' E 14 °24'

Pel.Trawl no	B. Trawl no	Starttime GMT=Icl-2h	Depth m	O ₂ (ml/l)	T°C	Goby Kg/h	Hake Kg/h	Mesopelagic Kg/h	Horse mackerel Kg/h
	1433	4:18	201	0.83	11	22.2	998	13	0
1434		6:51	120-180	2.12	11.1	0	453	25.2	0
1435		7:09	60-120	3.47	11.8	0	0	286.2	0
1436		7:23	60-0	5.29	13.3	0	0	9	0
	1437	11:02	198	0.98	11.1	18	780	18	0
1438		12:36	120-180	1.77	11.1	0	215	120	0
1441		14:53	120-180	1.77	11.1	0	398	73	0
1442		15:25	60-120	3.84	11.8	0	0	226.8	0
1443		15:42	60-1	5.11	13	0	0	0	0
	1444	18:43	199	1.23	11.1	27	486	19	210.6
1445		20:56	110-180	2.49	11.3	0	97.2	11.7	
1446		21:19	110-60	3.84	11.8	0	82.4	233.6	
1447		21:53	60-0	5.14	13.6	0	109.28	164.1	
	1448	1:42	198	1.255	11.1	18.8	394.2	17.6	174.6
1449		3:46	180-120	1.976	11.5	0	149.7	2.1	0
1450		4:08	120-0	4.16	12.1	0	22	89	0

Central area:

Walvis Bay-station S 23° 23' E 14° 16'

Pel.Trawl no	B. Trawl no	Starttime GMT=Icl-2h	Depth m	O ₂ (ml/l)	T°C	Goby Kg/h	Hake Kg/h	Mesopelagic Kg/h	Horse mackerel Kg/h
	1451	22:37	102	0.24	12.4	3	0.3	0	12
1452		1:41	80-60	0.58	12.7	43.2	0	0	0
1453		1:53	60-40	1.14	13	2.07	0	0	0
1454		2:04	40-20	2.68	13.9	30	0	0	0
	1455	4:55	102	0.28	12.4	10.2	6.2	0	0
1456		6:22	60-80	0.83	12.6	26.4	0	0	0
1457		6:33	60	1.17	12.8	19.8	0	0	0
1458		6:44	40-30	2.52	13.7	4.8	0	0	0
	1459	15:09	102	0.36	12.6	54.67	0	0	0
*1460 trålspreng		16:30				0.2%			
	1461	18:43	102	0.29	12.6	3.3	0	0	0
*1462		20:02	80-20	1.33	12.8	161.7	0	0	0
	1463	22:25	102	0.33	12.6	2	0	0	0
*1464		23:52	80	0.47	12.6	14.43	0	0	0
	1465	2:05	102	0.193	12.6	9	0	0	0
*Trålspreng1466		3:50							

*Small Åkratrål replaced broken multisampler; Catches have been standardized to same opening by multiplication with a factor 1.925

3.5. RESPONSE TO HYPOXIC STRESS

Adult gobies show a remarkably high tolerance to low concentrations of dissolved oxygen. They responded by increasing the gill ventilation volume and frequency and opercula beat rate with decreasing oxygen (increasing hypoxia; less than <0.8 ml DO /l for ca 60 min; Figs. 9 and 10), but recovered rapidly after maximum stress was removed by decreasing ventilation volume and frequency.

Adult and juvenile gobies were tolerant to presence of sulphide in normoxic water in the Benguela ecosystem (ca 5 ml DO /l) and did not show any stress (change in gill ventilation rate or activity) after 24 h in such circumstances. Combined effects of high sulphide concentrations and hypoxic water could unfortunately not be measured due to technical problems with the nitrogen gas.

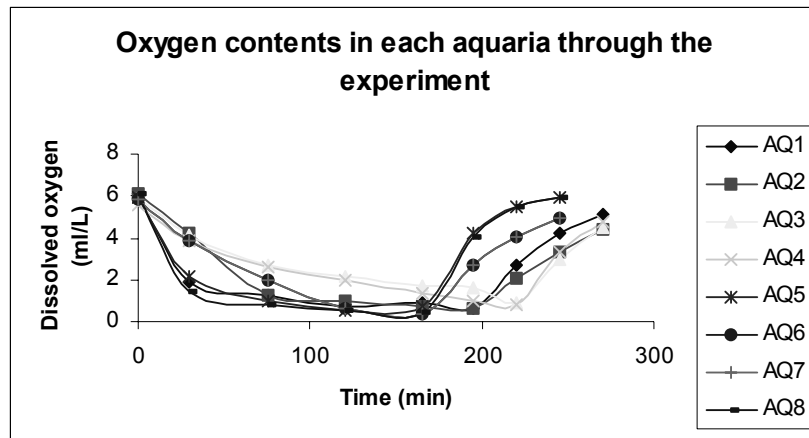


Figure 9. Changes in oxygen concentration throughout the experiment

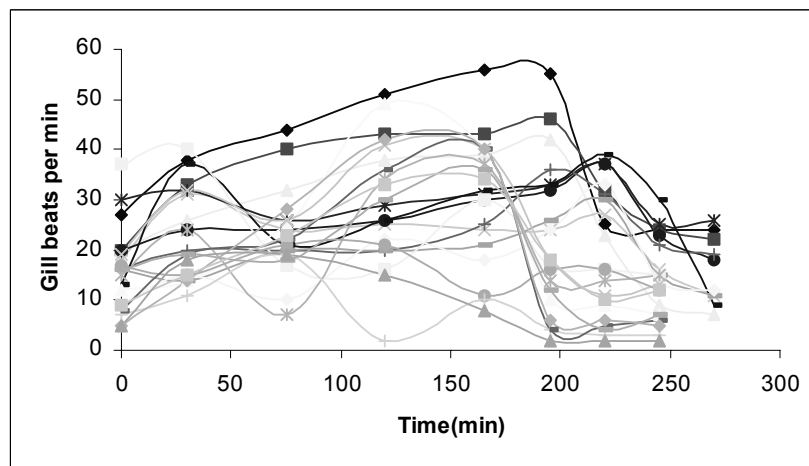


Figure 10. Individual variation in response to changes in oxygen concentration.

Appendix I: Instruments and fishing gear used

The Simrad EK-500 I and II scientific echosounder with 18 kHz, 38kHz, 120 kHz and 200 kHz transducers were used during the survey. Sonardata Echolog V2.0 were logging the echogram raw data from the sounder and used to scrutinize the acoustic records. The details of the settings of the echosounders were as follows:

Transceiver 1 menu_38 kHz

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	27.19 dB
TS transducer gain	27.22 dB
Angle sensitivity	21.9
3 dB beamwidth along.	6.9°
3 dB beamwidth athw.	6.8°
Alongship offset	-0.01°
Athwardship offset	0.03°

Transceiver 2 menu_120 kHz

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	25.74 dB
TS transducer gain	25.96 dB
Angle sensitivity	21.0
3 dB beamwidth along.	7.2°
3 dB beamwidth athw.	7.3°
Alongship offset	-0.07°
Athwardship offset	0.22°

Transceiver 3 menu_ 18 kHz

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	23.73 dB
TS transducer gain	23.45 dB
Angle sensitivity	13.9
3 dB beamwidth along.	11.1°
3 dB beamwidth athw.	11.0°
Alongship offset	-0.21°
Athwardship offset	0.09°

Transceiver 4 menu_ 200 kHz

Transducer depth	5.5 m
Absorption coeff.	53 dB/km
Pulse length	long (0.6ms)
Bandwidth	narrow
Max power	1000 Watt
2-way beam angle	-20.5 dB
SV transducer gain	24.08 dB
TS transducer gain	24.08 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	10 m
Bottom range start	10 m
TVG	20 log R
Sv colour min -	65 dB
TS Colour minimum	-65 dB

Printer- menu

Range	0-50, 0-100, 0-150, 0-250 or 0-500 m
TVG	20 log R
Sv colour min	-67 dB

Bottom detection menu

Minimum level	-40 dB
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Annex II Records of fishing stations

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1428
 DATE:13/ 1/04 GEAR TYPE: BT No: 2 POSITION:Lat S 2643
 start stop duration Long E 1451
 TIME :16:55:46 17:25:42 30 (min) Purpose code: 1
 LOG :8179.10 8180.58 1.47 Area code : 1
 FDEPTH: 170 168 GearCond.code: 1
 BDEPTH: 170 168 Validity code: 1
 Towing dir: 355ø Wire out: 650 m Speed: 30 kn*10
 Sorted: 33 Kg Total catch: 1200.00 CATCH/HOUR: 2400.00

SPECIES	CATCH/HOUR weight numbers	% OF TOT. C	SAMP
Aequorea aequorea	1453.60	60.57	
Merluccius capensis	788.00	32.83	
Diaphus hudsoni	50.20	2.09	
Sufflogobius bibarbatatus	3.60	0.15	
Total	2295.40	95.64	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1433
 DATE:14/ 1/04 GEAR TYPE: BT No: 2 POSITION:Lat S 2600
 start stop duration Long E 1424
 TIME :04:18:13 04:48:38 30 (min) Purpose code: 1
 LOG :8254.60 8256.15 1.77 Area code : 1
 FDEPTH: 201 201 GearCond.code: 3
 BDEPTH: 201 201 Validity code: 3
 Towing dir: 350ø Wire out: 750 m Speed:300 kn*10
 Sorted: 28 Kg Total catch: 800.00 CATCH/HOUR: 1600.00

SPECIES	CATCH/HOUR weight numbers	% OF TOT. C	SAMP
Merluccius capensis	998.00	62.38	
Aequorea aequorea	541.00	33.81	
Sufflogobius bibarbatatus	22.20	1.39	
Diaphus hudsoni	13.00	0.81	
C E F H A L O F O D A	4.40	0.28	
Total	1578.60	98.67	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1429
 DATE:13/ 1/04 GEAR TYPE: PT No: 1 POSITION:Lat S 2643
 start stop duration Long E 1451
 TIME :18:39:54 18:54:48 15 (min) Purpose code: 3
 LOG :8186.84 8187.68 0.84 Area code : 1
 FDEPTH: 140 90 GearCond.code: 1
 BDEPTH: 169 169 Validity code: 1
 Towing dir: 355ø Wire out: 400 m Speed:350 kn*10
 Sorted: Kg Total catch: 40.70 CATCH/HOUR: 162.80

SPECIES	CATCH/HOUR weight numbers	% OF TOT. C	SAMP
Aequorea aequorea	124.00	76.17	
Diaphus hudsoni	40.00	24.57	
Total	164.00	100.74	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1434
 DATE:14/ 1/04 GEAR TYPE: PT No: 1 POSITION:Lat S 2601
 start stop duration Long E 1425
 TIME :06:31:23 07:06:38 15 (min) Purpose code: 1
 LOG :8263.61 8264.35 0.73 Area code : 1
 FDEPTH: 180 120 GearCond.code: 3
 BDEPTH: 201 201 Validity code: 3
 Towing dir: 340ø Wire out: 450 m Speed: 35 kn*10
 Sorted: 36 Kg Total catch: 253.30 CATCH/HOUR: 1013.20

SPECIES	CATCH/HOUR weight numbers	% OF TOT. C	SAMP
Aequorea aequorea	907.20	89.54	
Merluccius capensis	55.60	5.49	
Diaphus hudsoni	50.40	4.97	
Total	1013.20	100.00	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1430
 DATE:13/ 1/04 GEAR TYPE: PT No: 1 POSITION:Lat S 2642
 start stop duration Long E 1451
 TIME :18:55:51 19:10:47 15 (min) Purpose code: 1
 LOG :8187.74 8188.56 0.80 Area code : 1
 FDEPTH: 250 50 GearCond.code: 1
 BDEPTH: 169 168 Validity code: 3
 Towing dir: 355ø Wire out: 190 m Speed:350 kn*10
 Sorted: Kg Total catch: 103.80 CATCH/HOUR: 415.20

SPECIES	CATCH/HOUR weight numbers	% OF TOT. C	SAMP
Diaphus hudsoni	293.60	70.71	
Aequorea aequorea	73.60	17.73	
Thyrsites atun	48.00	11.56	
Total	415.20	100.00	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1435
 DATE:14/ 1/04 GEAR TYPE: PT No: 1 POSITION:Lat S 2402
 start stop duration Long E 1424
 TIME :07:09:10 07:22:27 13 (min) Purpose code: 1
 LOG :8264.55 8265.13 7.25 Area code : 1
 FDEPTH: 120 60 GearCond.code: 3
 BDEPTH: 201 201 Validity code: 3
 Towing dir: 340ø Wire out: 250 m Speed:350 kn*10
 Sorted: Kg Total catch: 72.30 CATCH/HOUR: 333.69

SPECIES	CATCH/HOUR weight numbers	% OF TOT. C	SAMP
Diaphus hudsoni	286.15	85.75	
Krill	47.54	14.25	
Total	333.69	100.00	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1431
 DATE:13/ 1/04 GEAR TYPE: PT No: 1 POSITION:Lat S 2624
 start stop duration Long E 1451
 TIME :19:11:23 19:26:35 15 (min) Purpose code: 1
 LOG :8188.60 8189.45 0.84 Area code : 1
 FDEPTH: 50 50 GearCond.code: 3
 BDEPTH: 168 168 Validity code: 3
 Towing dir: 355ø Wire out: 50 m Speed:350 kn*10
 Sorted: Kg Total catch: 245.40 CATCH/HOUR: 981.60

SPECIES	CATCH/HOUR weight numbers	% OF TOT. C	SAMP
Aequorea aequorea	474.00	48.29	
Diaphus hudsoni	474.00	48.29	
Thyrsites atun	33.40	3.40	
Total	981.40	99.98	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1436
 DATE:14/ 1/04 GEAR TYPE: PT No: 1 POSITION:Lat S 2559
 start stop duration Long E 1424
 TIME :06:40:28 06:41:26 14 (min) Purpose code: 1
 LOG :8265.20 8265.97 0.76 Area code : 1
 FDEPTH: 60 0 GearCond.code: 3
 BDEPTH: 201 202 Validity code: 3
 Towing dir: 340ø Wire out: 80 m Speed:350 kn*10
 Sorted: Kg Total catch: 110.00 CATCH/HOUR: 471.43

SPECIES	CATCH/HOUR weight numbers	% OF TOT. C	SAMP
Aequorea aequorea	462.00	98.00	
Diaphus hudsoni	9.43	2.00	
Total	471.43	100.00	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1432
 DATE:14/ 1/04 GEAR TYPE: BT No: 2 POSITION:Lat S 2624
 start stop duration Long E 1446
 TIME :23:43:01 00:00:49 18 (min) Purpose code: 1
 LOG :8215.99 8216.74 0.75 Area code : 1
 FDEPTH: 164 164 GearCond.code: 3
 BDEPTH: 164 164 Validity code: 3
 Towing dir: 345ø Wire out: 550 m Speed: 30 kn*10
 Sorted: Kg Total catch: 5000.00 CATCH/HOUR: 16666.67

SPECIES	CATCH/HOUR weight numbers	% OF TOT. C	SAMP
Aequorea aequorea	14166.67	85.00	
Merluccius capensis	2500.00	15.00	
Total	16666.67	100.00	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1437
 DATE:14/ 1/04 GEAR TYPE: BT No: 2 POSITION:Lat S 2600
 start stop duration Long E 1425
 TIME :11:02:52 11:24:05 21 (min) Purpose code: 1
 LOG :8273.79 8274.82 1.02 Area code : 1
 FDEPTH: 198 198 GearCond.code: 3
 BDEPTH: 198 198 Validity code: 3
 Towing dir: 345ø Wire out: 700 m Speed: 30 kn*10
 Sorted: 29 Kg Total catch: 570.00 CATCH/HOUR: 1628.57

SPECIES	CATCH/HOUR weight numbers	% OF TOT. C	SAMP
Aequorea aequorea	800.00	49.12	
Merluccius capensis	780.00	47.89	
Sufflogobius bibarbatatus	25.71	1.58	
Krill	5.71	0.35	
Diaphus hudsoni	5.71	0.35	
Total	1617.13	99.29	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1438
 DATE:14/ 1/04 GEAR TYPE: PT No: 2 POSITION:Lat S 2601
 start stop duration Long E 1425
 TIME :12:36:07 13:06:37 31 (min) Purpose code: 1
 LOG :8280.31 8281.82 1.34 Area code : 1
 FDEPTH: 180 120 GearCond.code: 1
 BDEPTH: 198 198 Validity code: 3
 Towing dir: 345ø Wire out: 350 m Speed: 35 kn*10

Sorted: 35 Kg Total catch: 524.90 CATCH/HOUR: 1015.94

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Aequorea aequorea	689.03		67.82	
Merluccius capensis	208.45		20.52	
Diaphus hudsoni	114.77		11.30	
C E P H A L O P O D A	4.45		0.44	
Total	1016.70		100.08	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1439
 DATE:14/ 1/04 GEAR TYPE: PT No: 2 POSITION:Lat S 2600
 start stop duration Long E 1424
 TIME :13:07:10 13:23:24 16 (min) Purpose code: 1
 LOG :8281.85 8282.70 1.04 Area code : 1
 FDEPTH: 120 60 GearCond.code: 1
 BDEPTH: 198 198 Validity code: 9
 Towing dir: 345ø Wire out: 220 m Speed: 35 kn*10

Sorted: Kg Total catch: CATCH/HOUR:

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
N O C A T C H	0.00			
Total				

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1440
 DATE:14/ 1/04 GEAR TYPE: PT No: 2 POSITION:Lat S 2559
 start stop duration Long E 1424
 TIME :13:24:14 13:39:19 15 (min) Purpose code: 1
 LOG :8282.75 8283.64 0.88 Area code : 1
 FDEPTH: 60 1 GearCond.code: 1
 BDEPTH: 198 198 Validity code: 9
 Towing dir: 345ø Wire out: 50 m Speed: 35 kn*10

Sorted: Kg Total catch: CATCH/HOUR:

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
N O C A T C H	0.00			
Total				

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1441
 DATE:14/ 1/04 GEAR TYPE: PT No: 2 POSITION:Lat S 2601
 start stop duration Long E 1425
 TIME :14:53:24 15:23:15 30 (min) Purpose code: 1
 LOG :8291.03 8292.56 1.49 Area code : 1
 FDEPTH: 180 120 GearCond.code: 1
 BDEPTH: 199 198 Validity code: 3
 Towing dir: 345ø Wire out: 500 m Speed: 32 kn*10

Sorted: 63 Kg Total catch: 700.00 CATCH/HOUR: 1400.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Aequorea aequorea	680.40		48.60	
Merluccius capensis	388.40		27.74	
Chrysaora hyoscella	257.40		18.39	
Diaphus hudsoni	72.96		5.21	
C E P H A L O P O D A	0.90		0.06	
Total	1400.06		100.00	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1442
 DATE:14/ 1/04 GEAR TYPE: PT No: 2 POSITION:Lat S 2600
 start stop duration Long E 1424
 TIME :15:25:19 15:40:22 15 (min) Purpose code: 1
 LOG :8292.67 8293.55 1.03 Area code : 1
 FDEPTH: 120 60 GearCond.code: 1
 BDEPTH: 198 199 Validity code: 3
 Towing dir: 345ø Wire out: 200 m Speed: 35 kn*10

Sorted: 2 Kg Total catch: 85.70 CATCH/HOUR: 342.80

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Diaphus hudsoni	226.80		66.16	
Krill	75.60		22.05	
Aequorea aequorea	26.80		7.82	
C E P H A L O P O D A	13.60		3.97	
Thysites atun	9.20	4	2.68	
Total	352.00		102.68	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1443
 DATE:14/ 1/04 GEAR TYPE: PT No: 2 POSITION:Lat S 2559
 start stop duration Long E 1424
 TIME :15:43:07 15:57:31 15 (min) Purpose code: 1
 LOG :8293.66 8294.57 0.92 Area code : 1
 FDEPTH: 60 1 GearCond.code: 1
 BDEPTH: 199 199 Validity code: 3
 Towing dir: 345ø Wire out: 100 m Speed: 35 kn*10

Sorted: Kg Total catch: 304.10 CATCH/HOUR: 1216.40

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Aequorea aequorea	600.00		49.33	
Chrysaora hyoscella	600.00		49.33	
Thysites atun	16.40		1.35	
Total	1216.40		100.01	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1444
 DATE:14/ 1/04 GEAR TYPE: PT No: 2 POSITION:Lat S 2601
 start stop duration Long E 1425
 TIME :18:43:43 19:13:42 30 (min) Purpose code: 1
 LOG :8301.92 8303.45 1.53 Area code : 1
 FDEPTH: 199 199 GearCond.code: 1
 BDEPTH: 199 199 Validity code: 3
 Towing dir: 345ø Wire out: 700 m Speed: 300 kn*10

Sorted: 23 Kg Total catch: 450.00 CATCH/HOUR: 900.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Merluccius capensis	486.60		54.07	
Trachurus capensis	210.60		23.40	
Aequorea aequorea	137.20		15.24	
Sufflogobius bibarbatatus	27.02		3.00	
Diaphus hudsoni	19.32		2.15	
Krill	19.32		2.15	
Total	900.06		100.01	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1445
 DATE:14/ 1/04 GEAR TYPE: PT No: 1 POSITION:Lat S 2601
 start stop duration Long E 1424
 TIME :20:56:32 21:16:30 20 (min) Purpose code: 1
 LOG :8310.02 8311.07 0.68 Area code : 1
 FDEPTH: 180 110 GearCond.code: 1
 BDEPTH: 199 199 Validity code: 3
 Towing dir: 340ø Wire out: 450 m Speed: 350 kn*10

Sorted: 27 Kg Total catch: 91.20 CATCH/HOUR: 273.60

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Aequorea aequorea	126.00		46.05	
Merluccius capensis	97.20		35.53	
Thysites atun	27.00	9	9.87	
Diaphus hudsoni	11.70		4.28	
Krill	11.70		4.28	
Total	273.60		100.01	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1446
 DATE:14/ 1/04 GEAR TYPE: PT No: 1 POSITION:Lat S 2559
 start stop duration Long E 1424
 TIME :21:19:30 21:34:44 15 (min) Purpose code: 1
 LOG :8311.24 8312.06 0.82 Area code : 1
 FDEPTH: 110 600 GearCond.code: 1
 BDEPTH: 199 199 Validity code: 3
 Towing dir: 340ø Wire out: 250 m Speed: 35 kn*10

Sorted: 29 Kg Total catch: 99.93 CATCH/HOUR: 399.72

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Diaphus hudsoni	233.60		58.44	
Merluccius capensis	82.40		20.61	
Aequorea aequorea	73.60		18.41	
Chelidonichthys capensis	4.80	4	1.20	
C E P H A L O P O D A	4.80		1.20	
Total	399.20		99.86	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1447
 DATE:14/ 1/04 GEAR TYPE: PT No: 1 POSITION:Lat S 2559
 start stop duration Long E 1424
 TIME :21:35:33 21:50:02 14 (min) Purpose code: 1
 LOG :8312.11 8312.90 0.78 Area code : 1
 FDEPTH: 60 0 GearCond.code: 1
 BDEPTH: 199 199 Validity code: 3
 Towing dir: 340ø Wire out: 100 m Speed: 35 kn*10

Sorted: 27 Kg Total catch: 243.40 CATCH/HOUR: 1043.14

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Aequorea aequorea	725.14		69.52	
Diaphus hudsoni	164.14		15.74	
Merluccius capensis	109.29		10.48	
Thysites atun	45.00	13	4.31	
Total	1043.57		100.05	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1448
 DATE:15/ 1/04 GEAR TYPE: BT No: 2 POSITION:Lat S 2601
 start stop duration Long E 1425
 TIME :01:42:49 02:12:35 30 (min) Purpose code: 1
 LOG :8323.66 8325.23 1.32 Area code : 1
 FDEPTH: 198 198 GearCond.code: 1
 BDEPTH: 198 198 Validity code: 3
 Towing dir: 345ø Wire out: 700 m Speed: 30 kn*10

Sorted: 32 Kg Total catch: 572.40 CATCH/HOUR: 1144.80

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Aequorea aequorea	532.80		46.54	
Merluccius capensis	394.20		34.43	
Trachurus capensis	174.60		15.25	
Sufflogobius bibarbatatus	19.80		1.73	
Diaphus hudsoni	17.62		1.54	
Krill	5.80		0.51	
Total	1144.82		100.00	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1449
 DATE:15/ 1/04 GEAR TYPE: PT No: 2 POSITION:Lat S 2601
 start stop duration Long E 1425
 TIME :03:46:58 04:07:22 20 (min) Purpose code: 1
 LOG :8332.00 8333.05 1.05 Area code : 1
 FDEPTH: 180 120 GearCond.code: 1
 BDEPTH: 199 198 Validity code: 3
 Towing dir: 345ø Wire out: 300 m Speed: 35 kn*10

Sorted: 27 Kg Total catch: 120.00 CATCH/HOUR: 360.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Aequorea aequorea	207.30		57.58	
Merluccius capensis	148.20		41.17	
Diaphus hudsoni	2.10		0.58	
Lepidopus caudatus	1.50		0.42	
Krill	1.20		0.33	
Total	360.30		100.08	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1450
 DATE:15/ 1/04 GEAR TYPE: PT No: 1 POSITION:Lat S 2600
 start stop duration Long E 1424
 TIME :04:08:44 04:38:07 29 (min) Purpose code: 1
 LOG :8333.13 8334.63 1.49 Area code : 1
 FDEPTH: 120 0 GearCond.code: 1
 BDEPTH: 198 199 Validity code: 3
 Towing dir: 345ø Wire out: 120 m Speed: 35 kn*10

Sorted: 26 Kg Total catch: 400.00 CATCH/HOUR: 827.59

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Aequorea aequorea	609.72		73.67	
Diaphus hudsoni	92.48		11.17	
Chrysaora hysoscella	75.72		9.15	
Thysites atun	23.59	8	2.85	
Merluccius capensis	20.90		2.53	
C E P H A L O P O D A	5.79		0.70	
Total	828.20		100.07	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1451
 DATE:15/ 1/04 GEAR TYPE: BT No: 2 POSITION:Lat S 2323
 start stop duration Long E 1416
 TIME :22:37:19 23:07:27 30 (min) Purpose code: 1
 LOG :8504.75 8506.27 1.53 Area code : 1
 FDEPTH: 102 103 GearCond.code: 1
 BDEPTH: 102 103 Validity code: 3
 Towing dir: 355ø Wire out: 300 m Speed: 30 kn*10

Sorted: 35 Kg Total catch: 530.40 CATCH/HOUR: 1060.80

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
J E L L Y F I S H	1038.00		97.85	
Trachurus capensis	12.00		1.13	
Krill	7.50		0.71	
Sufflogobius bibarbatatus	3.00		0.28	
Merluccius capensis	0.30	10	0.03	
Total	1060.80		100.00	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1452
 DATE:16/ 1/04 GEAR TYPE: PT No: 2 POSITION:Lat S 2322
 start stop duration Long E 1416
 TIME :01:41:39 01:51:18 10 (min) Purpose code: 1
 LOG :8516.79 8517.32 0.53 Area code : 1
 FDEPTH: 80 60 GearCond.code: 1
 BDEPTH: 103 103 Validity code: 3
 Towing dir: 355ø Wire out: 220 m Speed: 35 kn*10

Sorted: Kg Total catch: 34.50 CATCH/HOUR: 207.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
J E L L Y F I S H	161.40		77.97	
Sufflogobius bibarbatatus	43.20		20.87	
C E P H A L O P O D A	0.30		0.14	
Total	204.90		98.98	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1453
 DATE:16/ 1/04 GEAR TYPE: PT No: 2 POSITION:Lat S 2321
 start stop duration Long E 1416
 TIME :01:53:05 02:03:40 11 (min) Purpose code: 1
 LOG :8517.41 8517.99 0.57 Area code : 1
 FDEPTH: 60 40 GearCond.code: 1
 BDEPTH: 103 102 Validity code: 3
 Towing dir: 355ø Wire out: m Speed: kn*10

Sorted: 39 Kg Total catch: 389.38 CATCH/HOUR: 2123.89

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
J E L L Y F I S H	2113.64		99.52	
Sufflogobius bibarbatatus	2.07		0.10	
Total	2115.71		99.62	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1454
 DATE:16/ 1/04 GEAR TYPE: PT No: 2 POSITION:Lat S 2321
 start stop duration Long E 1416
 TIME :02:04:34 02:14:42 10 (min) Purpose code: 1
 LOG :8518.04 8518.58 0.54 Area code : 1
 FDEPTH: 40 20 GearCond.code: 20
 BDEPTH: 102 102 Validity code: 3
 Towing dir: 355ø Wire out: 80 m Speed: 35 kn*10

Sorted: 36 Kg Total catch: 3615.00 CATCH/HOUR: 21690.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
J E L L Y F I S H	21600.00		99.59	
Krill	60.00		0.28	
Sufflogobius bibarbatatus	30.00		0.14	
Total	21690.00		100.01	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1455
 DATE:16/ 1/04 GEAR TYPE: BT No: 2 POSITION:Lat S 2323
 start stop duration Long E 1416
 TIME :04:55:19 05:25:12 30 (min) Purpose code: 1
 LOG :8527.33 8528.69 1.37 Area code : 1
 FDEPTH: 102 103 GearCond.code: 1
 BDEPTH: 102 103 Validity code: 3
 Towing dir: 355ø Wire out: 320 m Speed: 30 kn*10

Sorted: 32 Kg Total catch: 450.00 CATCH/HOUR: 900.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chrysaora hysoscella	593.80		65.98	
Aequorea aequorea	283.20		31.47	
Sufflogobius bibarbatatus	10.20		1.13	
Merluccius capensis	6.20		0.69	
C E P H A L O P O D A	6.20		0.69	
Total	899.60		99.96	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1456
 DATE:16/ 1/04 GEAR TYPE: PT No: 1 POSITION:Lat S 2323
 start stop duration Long E 1416
 TIME :06:22:51 06:32:46 10 (min) Purpose code: 1
 LOG :8533.03 8533.48 0.45 Area code : 1
 FDEPTH: 80 60 GearCond.code: 1
 BDEPTH: 102 102 Validity code: 3
 Towing dir: 354ø Wire out: 200 m Speed: 35 kn*10

Sorted: 30 Kg Total catch: 1000.00 CATCH/HOUR: 6000.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chrysaora hysoscella	5973.60		99.56	
GORSU01	26.40		0.44	
Total	6000.00		100.00	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1457
 DATE:16/ 1/04 GEAR TYPE: PT No: 1 POSITION:Lat S 2322
 start stop duration Long E 1416
 TIME :06:33:37 06:43:30 10 (min) Purpose code: 1
 LOG :8533.52 8534.00 0.48 Area code : 1
 FDEPTH: 60 60 GearCond.code: 1
 BDEPTH: 102 103 Validity code: 3
 Towing dir: 354ø Wire out: 120 m Speed: 35 kn*10

Sorted: 31 Kg Total catch: 2500.00 CATCH/HOUR: 15000.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chrysaora hysoscella	14808.60		98.72	
Aequorea aequorea	162.00		1.08	
Sufflogobius bibarbatatus	19.80	180	0.13	
Total	14990.40		99.93	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1458
 DATE:16/ 1/04 GEAR TYPE: PT No: 1 POSITION:Lat S 2322
 start stop duration Purpose code: 1 Long E 1416
 TIME :06:44:05 06:50:06 6 (min) Area code : 1
 LOG :8534.03 8534.33 0.30 GearCond.code: 1
 FDEPTH: 40 30 Validity code: 3
 BDEPTH: 104 104
 Towing dir: 354ø Wire out: 80 m Speed:350 kn*10
 Sorted: 29 Kg Total catch: 600.00 CATCH/HOUR: 6000.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Aequorea aequorea	5749.00		95.82	
Chrysaora hysoscella	207.00		3.45	
Krill	19.00		0.32	
J E L Y F I S H	17.00	10	0.28	
Sufflogobius bibarbatius	8.00	320	0.13	
Merluccius capensis	0.20	10		
Total	6000.20		100.00	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1462
 DATE:16/ 1/04 GEAR TYPE: PT No: 1 POSITION:Lat S 2323
 start stop duration Purpose code: 1 Long E 1416
 TIME :20:02:40 20:06:28 4 (min) Area code : 1
 LOG :8575.14 8575.26 0.11 GearCond.code: 1
 FDEPTH: 80 20 Validity code: 9
 BDEPTH: 103 103
 Towing dir: 355ø Wire out: 200 m Speed: 35 kn*10
 Sorted: 324 Kg Total catch: 3000.00 CATCH/HOUR: 45000.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chrysaora hysoscella	44100.00		98.00	
Aequorea aequorea	817.50		1.82	
Sufflogobius bibarbatius	82.50		0.18	
Merluccius capensis	1.35			
Total	45001.35		100.00	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1459
 DATE:16/ 1/04 GEAR TYPE: BT No: 2 POSITION:Lat S 2323
 start stop duration Purpose code: 1 Long E 1416
 TIME :15:09:32 15:36:33 27 (min) Area code : 1
 LOG :8559.92 8561.27 1.34 GearCond.code: 1
 FDEPTH: 102 102 Validity code: 3
 BDEPTH: 102 102
 Towing dir: 355ø Wire out: 360 m Speed: 30 kn*10
 Sorted: 30 Kg Total catch: 240.00 CATCH/HOUR: 533.33

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chrysaora hysoscella	447.11		83.83	
Sufflogobius bibarbatius	54.67	780918	10.25	
Aequorea aequorea	29.11		5.46	
C E F H A L O P O D A	2.64		0.50	
Merluccius capensis	0.04		0.01	
Total	533.57		100.05	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1463
 DATE:16/ 1/04 GEAR TYPE: BT No: 2 POSITION:Lat S 2323
 start stop duration Purpose code: 1 Long E 1416
 TIME :22:25:03 22:55:09 30 (min) Area code : 1
 LOG :8579.82 8581.31 1.50 GearCond.code: 1
 FDEPTH: 102 103 Validity code: 3
 BDEPTH: 102 103
 Towing dir: 355ø Wire out: 360 m Speed: 35 kn*10
 Sorted: 39 Kg Total catch: 399.00 CATCH/HOUR: 798.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chrysaora hysoscella	756.00		94.74	
Aequorea aequorea	39.00		4.89	
Sufflogobius bibarbatius	2.00		0.25	
Engraulis capensis	1.00		0.13	
Total	798.00		100.01	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1460
 DATE:16/ 1/04 GEAR TYPE: PT No: 1 POSITION:Lat S 2323
 start stop duration Purpose code: 1 Long E 1416
 TIME :16:30:12 16:35:16 5 (min) Area code : 1
 LOG :8565.37 8565.52 0.13 GearCond.code: 1
 FDEPTH: 80 20 Validity code: 9
 BDEPTH: 102 102
 Towing dir: 355ø Wire out: 200 m Speed: 30 kn*10
 Sorted: 3 Kg Total catch: 32.80 CATCH/HOUR: 393.60

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chrysaora hysoscella	382.80		97.26	
Aequorea aequorea	9.36		2.38	
Sufflogobius bibarbatius	9.36		2.38	
Merluccius capensis	0.12	12	0.03	
C E F H A L O P O D A	0.12	12	0.03	
Total	401.76		102.08	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1464
 DATE:16/ 1/04 GEAR TYPE: PT No: 2 POSITION:Lat S 2323
 start stop duration Purpose code: 1 Long E 1416
 TIME :23:52:22 23:53:55 2 (min) Area code : 1
 LOG :8584.87 8584.95 0.09 GearCond.code: 1
 FDEPTH: 80 80 Validity code: 3
 BDEPTH: 102 102
 Towing dir: 355ø Wire out: 220 m Speed: 35 kn*10
 Sorted: 43 Kg Total catch: 1078.75 CATCH/HOUR: 32362.50

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chrysaora hysoscella	29925.00		92.47	
Aequorea aequorea	2250.00		6.95	
Sufflogobius bibarbatius	187.50		0.58	
Total	32362.50		100.00	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1461
 DATE:16/ 1/04 GEAR TYPE: BT No: 2 POSITION:Lat S 2323
 start stop duration Purpose code: 1 Long E 1416
 TIME :18:43:40 19:13:27 30 (min) Area code : 1
 LOG :8570.02 8571.42 1.39 GearCond.code: 1
 FDEPTH: 102 103 Validity code: 3
 BDEPTH: 102 103
 Towing dir: 350ø Wire out: 340 m Speed: 30 kn*10
 Sorted: 33 Kg Total catch: 500.00 CATCH/HOUR: 1000.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chrysaora hysoscella	944.00		94.40	
Aequorea aequorea	52.80		5.28	
Sufflogobius bibarbatius	3.30	1440	0.33	
Merluccius capensis	0.06		0.01	
Total	1000.16		100.02	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1465
 DATE:17/ 1/04 GEAR TYPE: BT No: 2 POSITION:Lat S 2323
 start stop duration Purpose code: 1 Long E 1416
 TIME :02:05:05 02:29:13 24 (min) Area code : 1
 LOG :8588.66 8589.79 1.12 GearCond.code: 1
 FDEPTH: 102 102 Validity code: 3
 BDEPTH: 102 102
 Towing dir: 355ø Wire out: 360 m Speed: 30 kn*10
 Sorted: 32 Kg Total catch: 388.80 CATCH/HOUR: 972.00

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chrysaora hysoscella	900.00		92.59	
UNIDE99	43.50		4.48	
Aequorea aequorea	19.50		2.01	
Sufflogobius bibarbatius	9.00		0.93	
Total	972.00		100.01	

R/V "DR. FRIDTJOF NANSEN" PROJECT:BE PROJECT STATION:1466
 DATE:17/ 1/04 GEAR TYPE: PT No: 1 POSITION:Lat S 2323
 start stop duration Purpose code: 1 Long E 1416
 TIME :03:50:21 03:50:34 13 (min) Area code : 1
 LOG :8593.29 8593.30 0.01 GearCond.code: 1
 FDEPTH: 80 80 Validity code: 3
 BDEPTH: 102 102
 Towing dir: 355ø Wire out: 220 m Speed: 35 kn*10
 Sorted: 32 Kg Total catch: 3000.00 CATCH/HOUR: 13846.16

SPECIES	CATCH/HOUR		% OF TOT. C	SAMP
	weight	numbers		
Chrysaora hysoscella	13409.08		96.84	
Aequorea aequorea	277.25		2.00	
Sufflogobius bibarbatius	160.29		1.16	