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Internal Report

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Cruise report of the hydro acoustic survey for blue whiting (*Micromesistius poutassou*) with R.V. "Tridens", 13 - 31 March 2006

Sytse Ybema

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Samenvatting

Dit is het verslag van de Nederlandse deelname aan de Noord Atlantische akoestische survey voor blauwe wijting in 2006. Deze, door ICES gecoördineerde survey wordt jaarlijks uitgevoerd. Naast Nederland nemen Ierland, Denemarken, Farøer, Rusland, IJsland en Noorwegen deel aan de survey.

Het doel van de survey is het maken van een schatting van de grootte van de Noord Atlantische blauwe wijting populatie. Deze schatting wordt gebruikt als een "tuning index" door ICES om de omvang van de populatie vast te stellen.

Voor de survey wordt gebruik gemaakt van een Simrad 38kHz splitbeam transducer met een EK60 echolood. De toegepaste methode is echo-integratie. Door transecten te varen in het gebied wordt het totale akoestische oppervlak per oppervlakte-eenheid bepaald. Door het uitvoeren van vistrekken wordt de soortsaamenstelling bepaald. Van blauwe wijting worden daarnaast biologische monsters genomen om leeftijd en rijpheid te bepalen. Voor deze soort kan aldus een schatting van de populatie, uitgesplitst naar leeftijd en rijpheid, gemaakt worden. Blauwe wijting is overal gevonden in de nabijheid van het continentale plat.

Summary

This is the report of the Dutch part of the international North East Atlantic hydro acoustic survey for blue whiting. The survey is coordinated by ICES and has been executed annually. Ireland, Russia, Iceland, Denmark, Faroese and Norway also participate in the survey.

The purpose of the survey is to estimate the blue whiting stock of the North East Atlantic. The ICES uses this estimation as a "tuning index" to assess the North East Atlantic blue whiting stock.

For this survey a Simrad 38kHz splitbeam transducer was used together with a Simrad EK60 echo sounder. The applied method was echo integration. By sailing transects over the survey area, the total acoustic cross-section can be calculated by surface area sampled. Trawling identified species composition of localized schools. The length composition of each species was determined. Blue whiting was examined on age and fecundity from which a split up stock structure was made. Blue whiting were found throughout the survey area associated with the continental shelf edge.

1. Introduction

The Netherlands Institute for Fisheries Research (RIVO) participates in the international North East Atlantic hydro acoustic survey for blue whiting since 2004. The survey is part of the EU data collection framework. The aim of this survey is to provide an abundance estimate of the whole North East Atlantic blue whiting population as well as to determine the spatial distribution at this time of year. This estimate is used as a tuning index by ICES to determine the size of the population. In this report the results are presented of the survey west of Ireland, carried out by FRV "Tridens".

2. Methods

2.1 Scientific Staff

RIVO staff

1. Sytse Ybema (cruise leader) (whole survey period)
2. Ronald Bol (whole survey period)
3. Kees Bakker (whole survey period)
4. Pablo Tjoe-Awie (whole survey period)

Guest researchers

1. Jan Pedersen (DIFRES), Denmark, whole survey period)

2.2 Narrative

Week 26

On Monday 13 March at 11:40h local time Tridens left the port of Scheveningen and headed towards the Bantry Bay, Ireland. Arrival at Bantry Bay was Wednesday at 09.20 GMT. Both 38kHz and 200kHz transducers were calibrated (for more detailed information see section "Calibration" in the main report). The last calibration was finished at 16:50h and Tridens steamed towards the beginning of the first transect while recording from 51-30N / 10-33W. On the way we came across the Dutch trawler "Zeeland" which had been fishing between 54/55N and 13/14W. The next day we had some difficulties with the trawl sonar winch which resulted in a non valid haul. All 51.15N, 51.45N, 52.15N, 52.45N transects were covered on Thursday and Friday before conducting a second haul along the shelf edge. Schools of blue whiting in this area were elongated as expected and their distribution was closely related to the shelf edge.

Week 27

It was decided to focus on the shelf edge and it wasn't till 54.15N that we found blue whiting further away from the shelf. On the more northern transects blue whiting schools were not as elongated as in the south; the schools were dense and small. Surprisingly many Dealfish were observed amongst the blue whiting. Arrival in Killybegs at Wednesday 22 March 14:00h. Departure from Killybegs Friday morning 10:00h. On Friday and Saturday much blue whiting was recorded on the 55.15N and 55.45N transects, an area where we also encountered the Dutch trawling fleet. In contradiction to more southern transects, presence of fish was not as closely related to the shelf edge and no small, dense schools were observed in this area.

Week 28

On Sunday 26 March the tow cable of the transducer broke and the signal cables from the spare got damaged shortly after. Furthermore, the CTD device was also severely damaged. The internal alarm had not warned for hitting the ocean floor. Monday 27 March it was decided to abort the survey prematurely because of these technical problems and steam back to Scheveningen with reduced speed. Arrival in Scheveningen on 31 March at 09.00.

The survey has been successful; a wider area was covered, more trawl hauls and CTD downcasts were performed than during the 2004 and 2005 surveys.

2.3 Survey design

The survey was carried out from 13 March to 31 March 2006, covering an area west of Ireland from latitude 51.15° to 54.45° North and from longitude 9° West to 17° West (Fig. 2.1). A slightly adapted survey design was applied this time, partly based on the blue whiting distribution seen during the survey. Parallel transects along latitudinal lines were used with spacing between the lines set at 30 nm. Acoustic data from transects running north-south close to the shelf edge (that is parallel to the depth isolines) were excluded from the dataset.

After consultation of with the scientific crew of the R/V G.O. Sars it was decided to compress some transects where no blue whiting was to be expected. Since no fish was observed in areas with water depth below 250m, all transects were cut off at the 200m depth contour. Furthermore, as previous surveys show fish closely related to the shelf edge west of Porcupine Bank, west going transects in this area were clipped when no fish was observed for several hours. CTD stations were planned in advance but extra stations were added at trawling stations to have all stations equally distributed over the research area.

The actual surveyed cruise track and trawl positions are presented in figure 2.2.

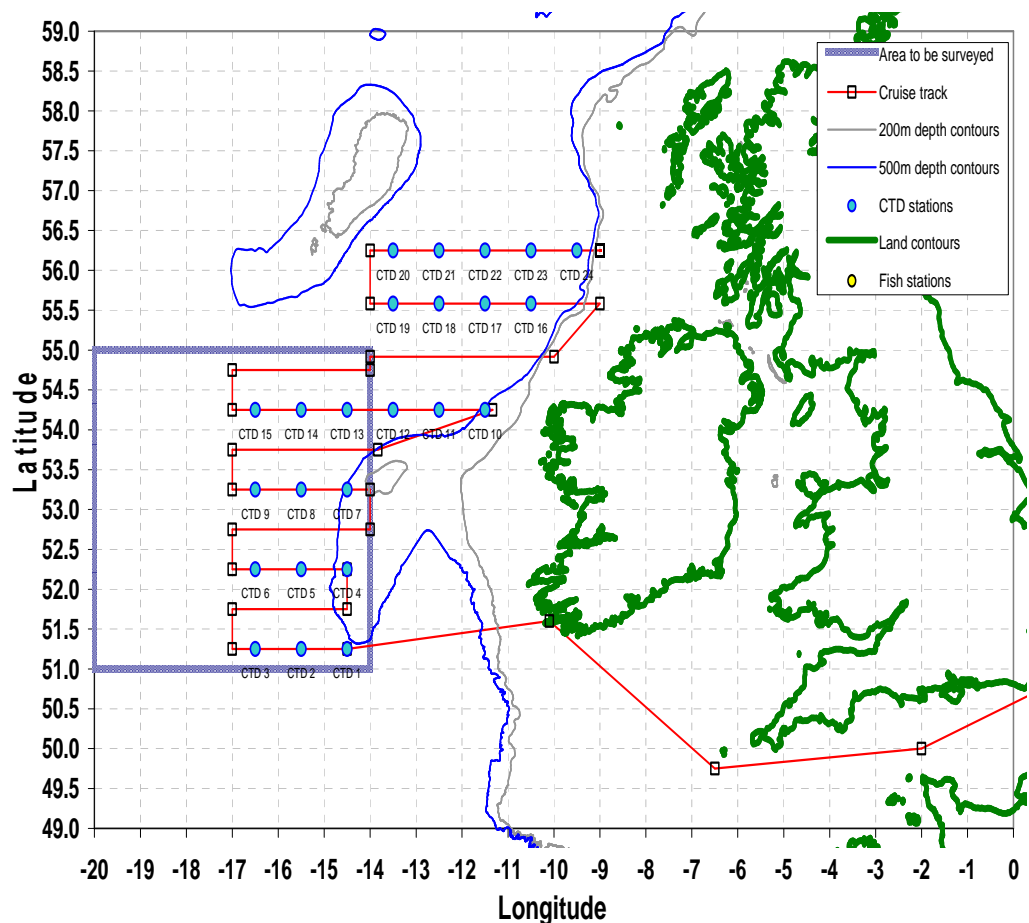


Figure 2.1. Planned cruise tracks and CTD stations. CRD stations are displayed as red dots.

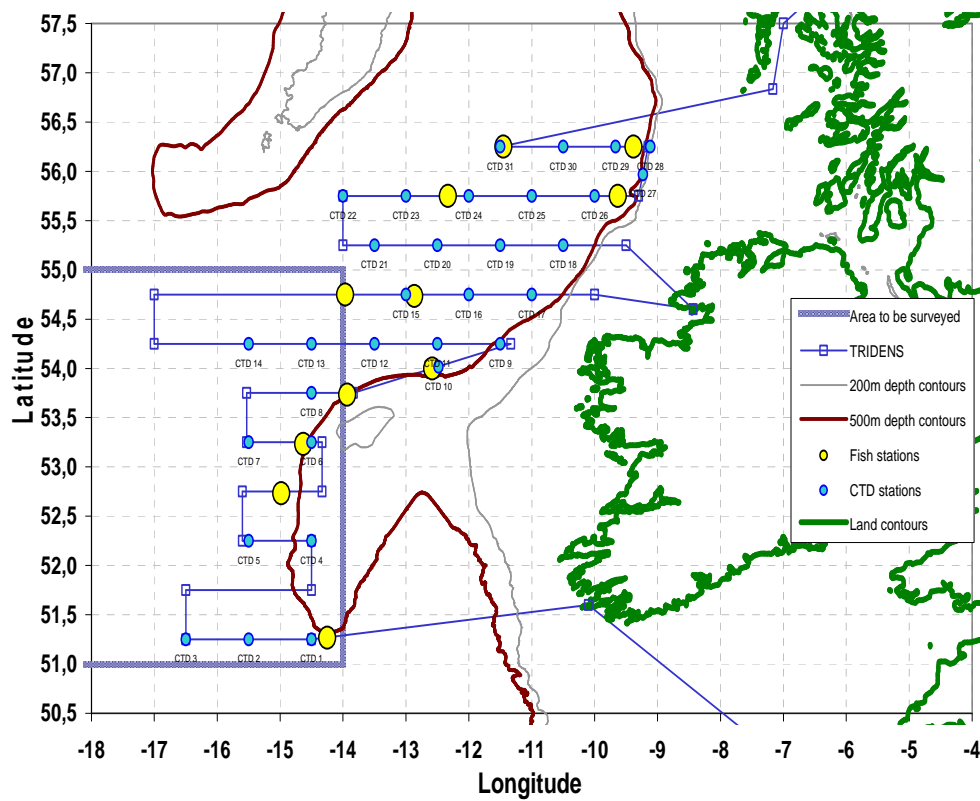


Figure 2.2. Executed cruise track, CTD stations and trawl hauls during the BWHTS 2006.

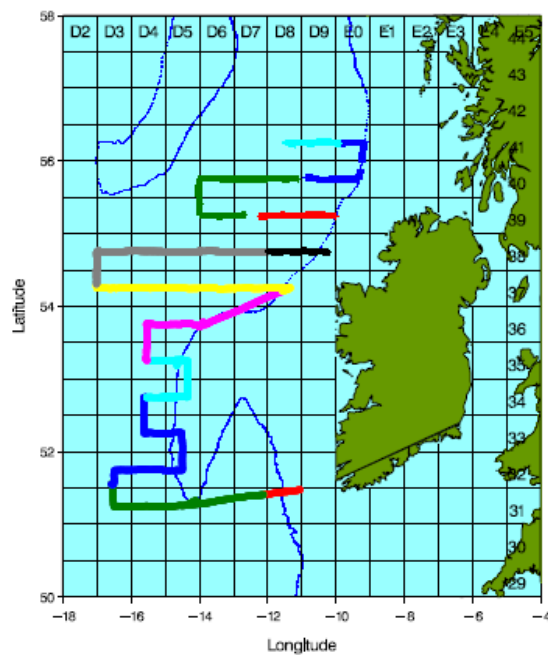


Figure 2.3.1. Temporal progression of the survey, 15 March – 27 March 2006.

2.4 Calibrations

Four calibrations were executed successfully:

1. 38 kHz in the towed body: 45min, good results.
2. 38 kHz in the towed body (second calibration): 20minutes, good results.
3. 38kHz in the hull mounted: 5 hours, good results.
4. 200 kHz in the towed body: 30minutes, good results.

Calibration nr 2. was used for this survey. The results are listed in Appendix A.

The planned inter-ship calibration together with the Norwegian R/V “G.O. Sars” was not conducted. Heavy weather and a broken cable of the Tridens towed body made it impossible to perform an intership calibration.

2.5 Acoustic data collection

A Simrad 38 kHz split beam transducer was operated in a towed body (type “Shark”) 6-7 m under the water surface. The settings of the EK60 are listed in appendix B. Acoustic data were collected with a Simrad EK60 scientific echo sounder. The data were logged with Sonardata Echoview software. The EK60 received the vessel speed from the ship’s GPS. A maximum ping rate was used. The data were logged in 1 nautical mile intervals. A vessel speed of 11 knots was used on one engine without disturbing the acoustic image.

2.6 Biological data

The acoustic recordings were verified by fishing with a 5600 mesh pelagic trawl with 20 mm meshes in the cod-end. Fishing was carried out when there was doubt about the species composition of recordings observed on the echo sounder and to obtain biological samples of blue whiting. In general, after it was decided to make a tow with a pelagic trawl, the vessel turned and fished back on its track line.

Fish samples were divided into species by weight. Length measurements were taken to the 1.0 cm below for all species. For blue whiting length representative samples were taken for maturity, age (otolith extraction) and weight. In some cases, specimens of non-target species, were frozen for species determination in the lab.

2.7 Hydrographical data

Hydrographical data have been collected in 31 CTD stations, (Figure 2.2). In addition, some environmental variables were continuously measured by the ships own “Data acquisition system” (DAS). The continuous measuring sensors had not been calibrated and are therefore not used for further analysis.

2.8 Data analysis

The acoustic values (NASC’s) from each log interval were assigned to the following categories: “blue whiting” and “other”.

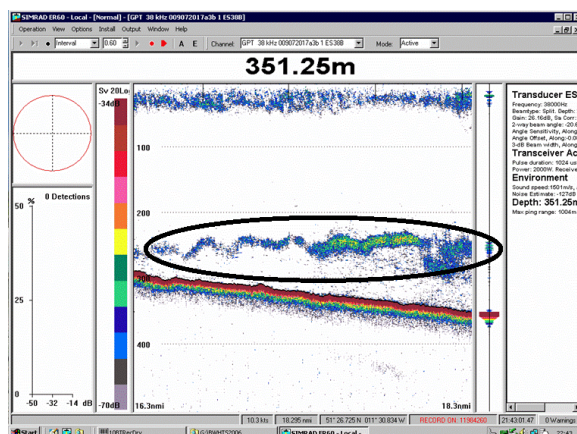
Hydro acoustic – biological and hydrographic data are being stored in the PGNAPES format. Further analysis of the international data will take place in Torshavn, Faeroese, end of April 2006.

3. Results

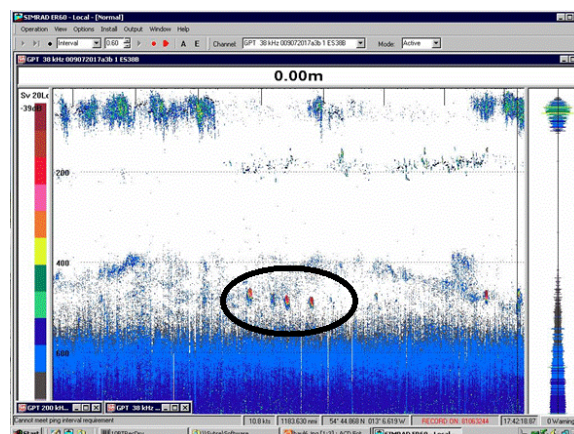
3.1 Acoustic data results

All echoes were recorded with a threshold of -80dB up to a depth of 750 meters below the transducer.

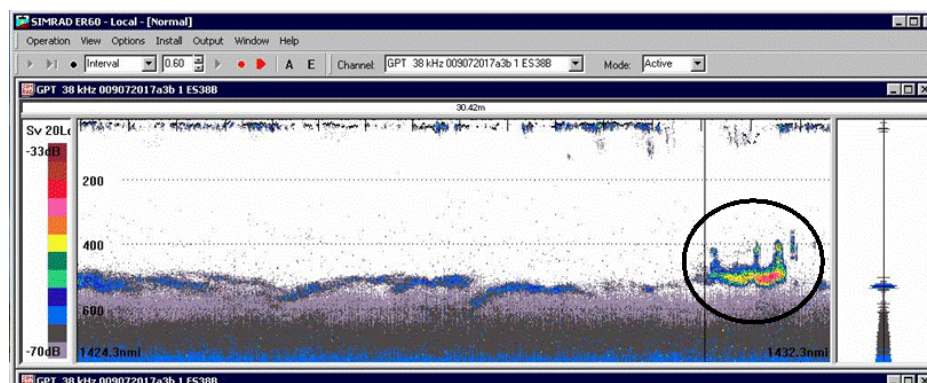
West of Porcupine Bank, acoustic response of blue whiting was quite distinct; schools were small and dense. 'Eel-like' school patterns (Fig. 3.1.1 A and C) were more observed north of Porcupine Bank.



A



B

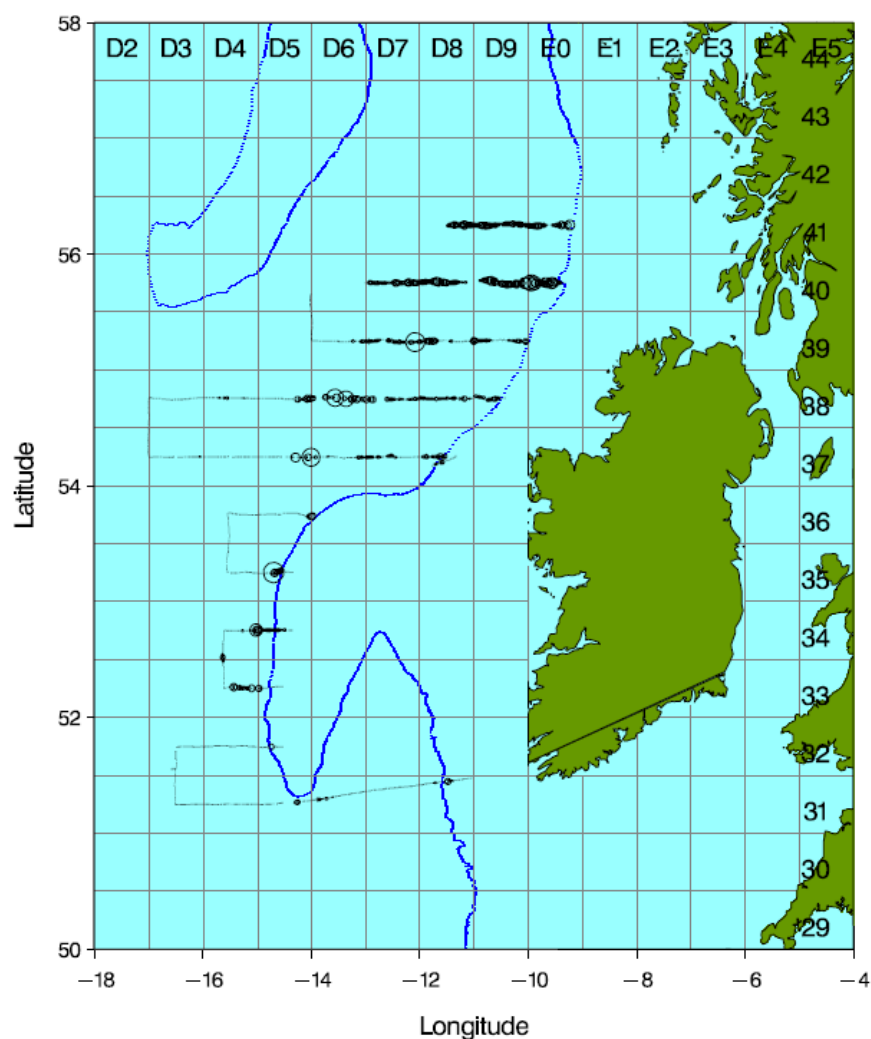


C

Figure 3.1.1 Echogram showing an example of small schools of blue whiting along the shelf edge at 250m depth in the southern region of the survey area (panel A), small dense schools detected at 500m depth in the middle region of the survey area (panel B) and large schools detected (Sa value of 25000 m²/nm²) also at 500m depth further north of Porcupine Bank (panel C). Recorded at respectively 51°26'N – 11°30'W at 15 March, 55°44'N – 13°06'W at 21 March and 55°14'N – 12°07'W at 24 March 2006.

Horizontal and vertical distribution patterns

Overall, the strongest signals of blue whiting were observed at depths of 400-600m, sometimes extending to around 300m depth (or even shallower) on the slope areas (Fig. 3.1.2). Like in 2004 and 2005 schools were found further off the slope area in the northern part of the survey area.



Legend

maximum nasc value to which is scaled = 24060

Figure 3.1.2. Post plot showing the distribution of **total blue whiting** NASC values (on a proportional square root scale relative to the largest value of 24060) obtained during the March 2006 North East Atlantic blue whiting hydro acoustic survey on FRV "Tridens". The blue line indicates the 500m depth contour.

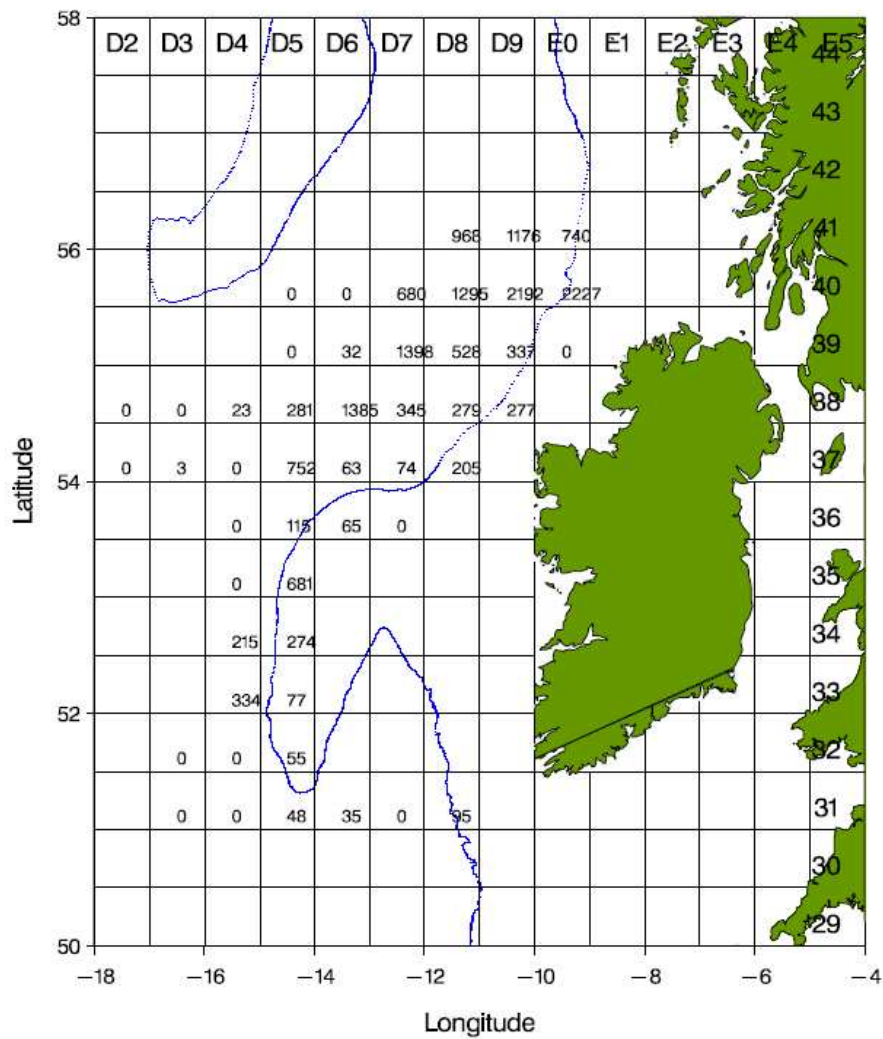


Figure 3.1.3. Mean acoustic density (s_A , m^2/nm^2) **blue whiting** per ICES rectangle obtained during the March 2006 North East Atlantic blue whiting hydro acoustic survey on FRV "Tridens". The blue line indicates the 500m depth contour.

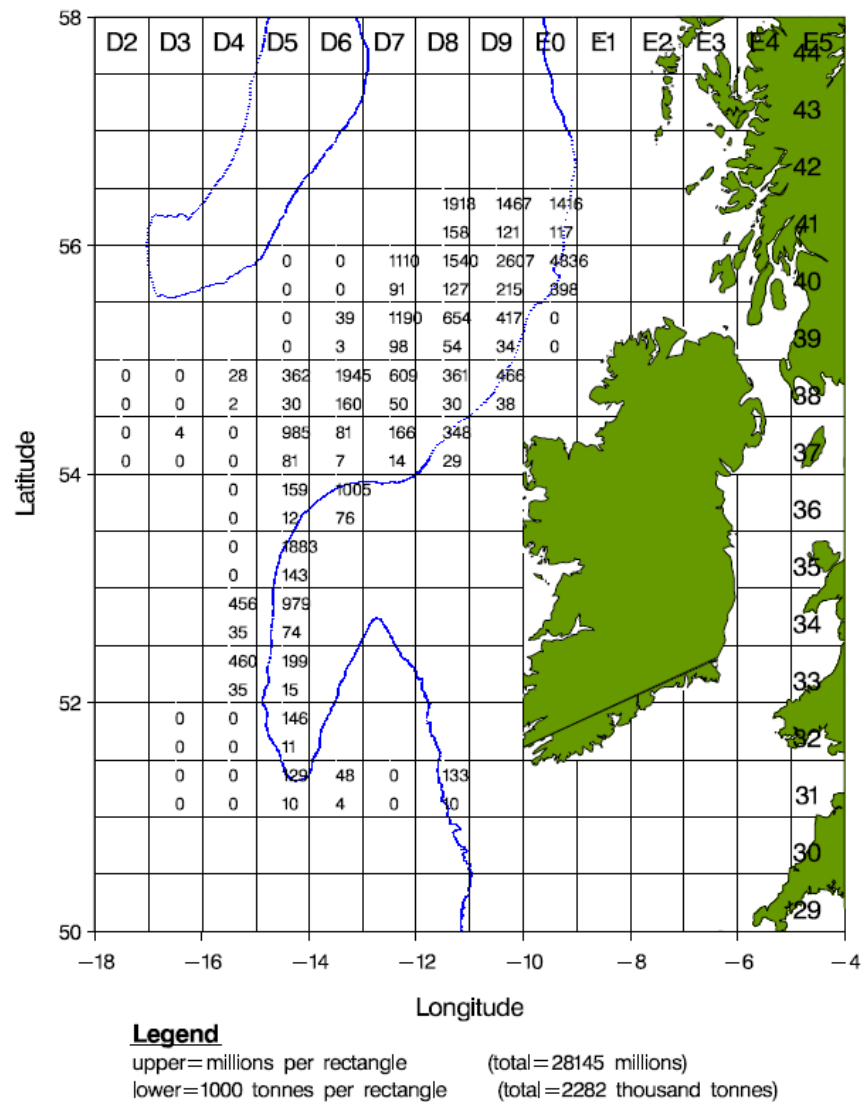


Figure 3.1.4. Total numbers (millions) and total biomass (thousand tonnes) of **blue whiting** per ICES rectangle obtained during the March 2006 North East Atlantic blue whiting hydro acoustic survey on FRV "Tridens". The blue line indicates the 500m depth contour.

3.2 Trawl data

In all, 11 trawl hauls were conducted (Table 3.2.1). Blue whiting was found in 10 hauls. From every haul containing blue whiting, 50 specimens were taken randomly for measurements of length, weight, sex, maturity and age (otoliths). Most hauls were all strongly dominated by blue whiting as shown in table 3.2.2. Remarkably, many Deal fish were observed throughout the catches.

haul	sample	validity	ICES rectangle	date	time (GMT)	position	haul duration (min)	depth (m)	geardepth (m)	wind direction	wind force (m/s)	total sample weight (kg)
1	5400111	invalid	31D5	15/03/2006	08:33	51.16N-14.15W	117	528	430	90	9	
2	5400112	valid	34D5	18/03/2006	07:32	52.44N-14.59W	103	1080	450	90	16	1373000
3	5400113	valid	35D5	18/03/2006	18:45	53.14N-14.38W	36	616	395	90	7	7218
4	5400114	valid	36D6	19/03/2006	10:35	53.44N-13.56W	106	621	450	90	7	901142
5	5400115	valid	37D7	19/03/2006	17:58	54.00N-12.35W	100	750	450	90	7	164184
6	5400116	valid	38D6	21/03/2006	13:05	54.45N-13.58W	85	2500	550	90	7	13798
7	5400117	valid	38D7	21/03/2006	19:50	54.44N-12.52W	100	2600	500	90	7	78292
8	5400118	valid	40D7	25/03/2006	16:10	55.45N-12.20W	80	2800	550	359	2	181634
9	5400119	valid	40E0	26/03/2006	07:23	55.45N-09.38W	42	1200	500	45	16	350924
10	5400120	valid	41E0	26/03/2006	18:00	56.15N-09.23W	60	1127	480	225	7	382636
11	5400121	valid	41D8	27/03/2006	07:17	56.15N-11.27W	133	1200	500	45	16	133586

	5400111	5400112	5400113	5400114	5400115	5400116	5400117	5400118	5400119	5400120	5400121
Argyrolepelecus hemigymnus				0,0	0,0	0,0	2,1				0,0
Blue whiting		1.372,3	2,7	878,0	16,8	8,5	57,4	105,6	345,6	360,3	3,0
Cephalopoda						0,0	0,1				
Common clubhook squid											0,0
Deal-fish		30,1	4,8	18,1	146,1	4,5	18,2	75,8	2,5	21,3	129,9
Grey gurnard								0,0			
Hachettfish			0,0	0,0	0,0	0,1	0,0		0,0		0,0
Horse mackerel										0,1	
Lesser octopus							0,2				0,5
Mackerel					3,1				0,1	0,7	
Notoscopelus kroeyeri		0,1	0,5	2,3	0,2	0,7	2,1	0,1	0,1	0,1	0,1
Paralepididae spec1			0,1								
Ray's bream				2,7				1,2			
Sea lamprey									2,5		
Snake pipefish		0,0	0,1	0,0	0,0	0,0	0,1	0,0	0,1	0,1	0,1

[illegible]

Length frequency distributions per haul of blue whiting caught are shown in figure 3.2.1.

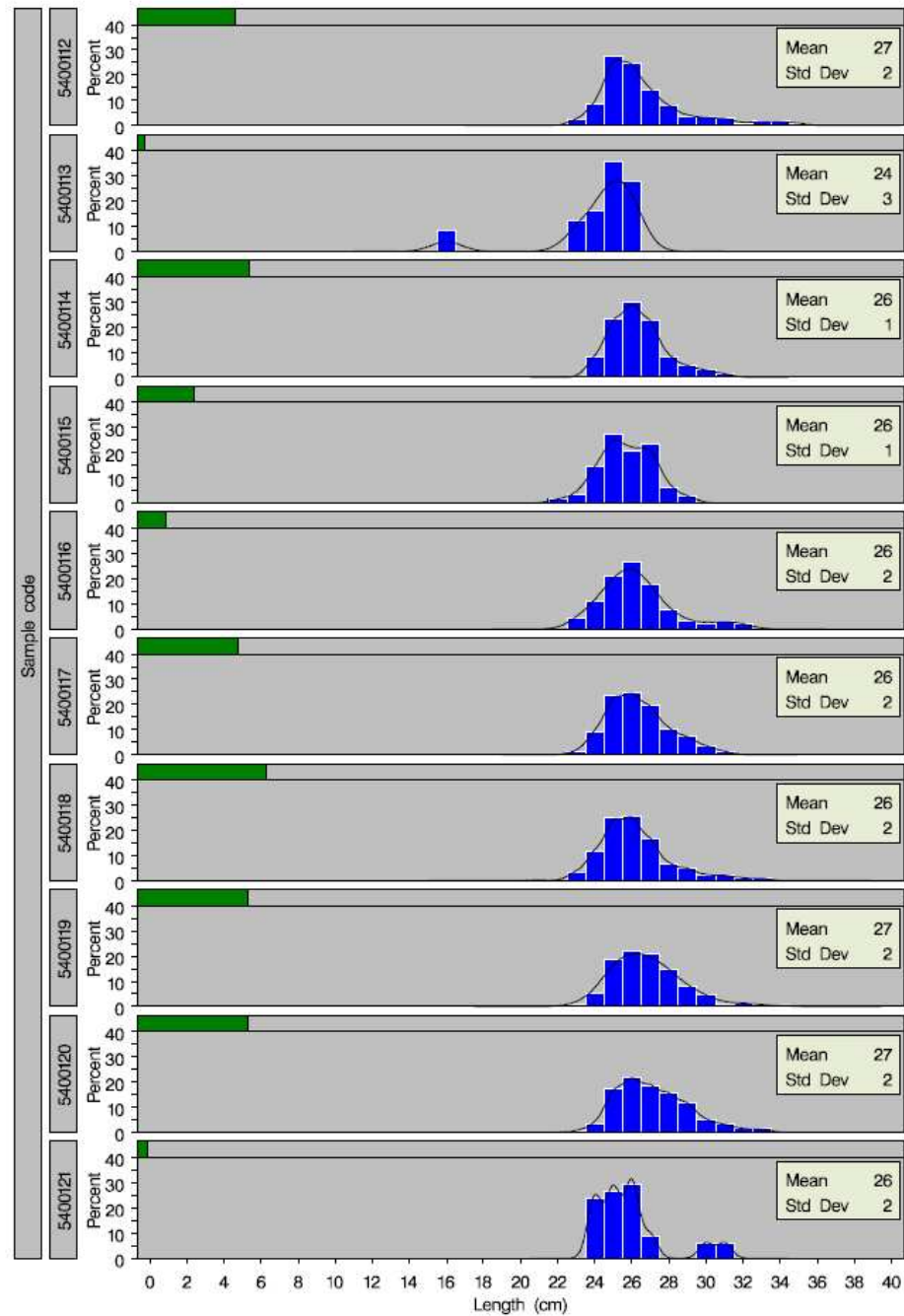


Figure 3.2.1. Length frequency distributions of blue whiting. Smoothing is obtained by normal kernel density estimates. The green bars indicate the relative amount of samples used.

3.3 Biological data

In total, 400 biological samples were collected and used for length, age and maturity keys. An overview of these samples is shown below (Table 3.3.1). Overall, most of the blue whiting were mature 3 year olds (60%).

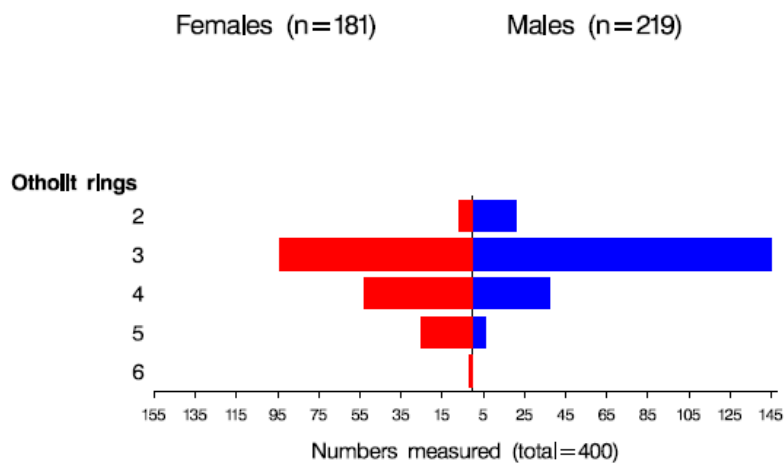


Figure 3.3.1 Overview of collected biological samples of blue whiting by haul during the March 2006 North East Atlantic hydro acoustic survey, FRV "Tridens".

Growth

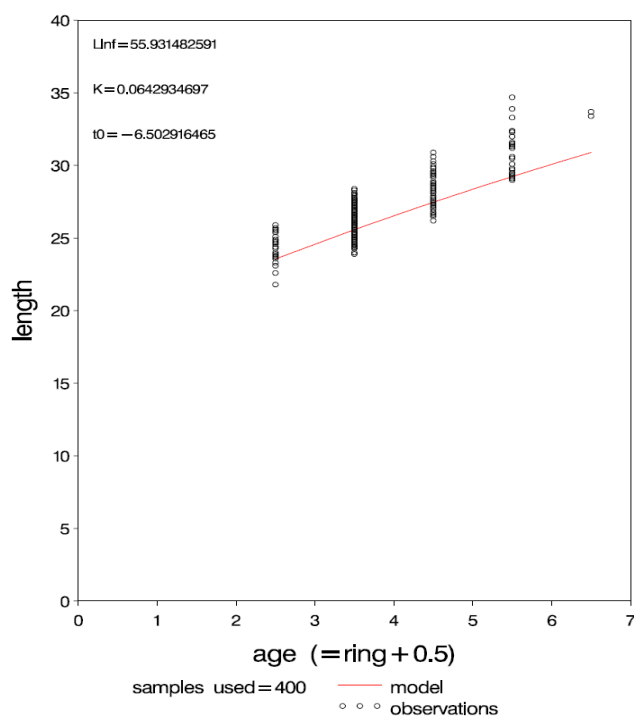


Figure 3.3.2 Von Bertalanffy growth curve.

3.4 CTD data & data acquisition system

CTD measurements show a slight gradient in temperature from relative warm water in the south to colder water in the northern survey area (Fig. 3.4.1).

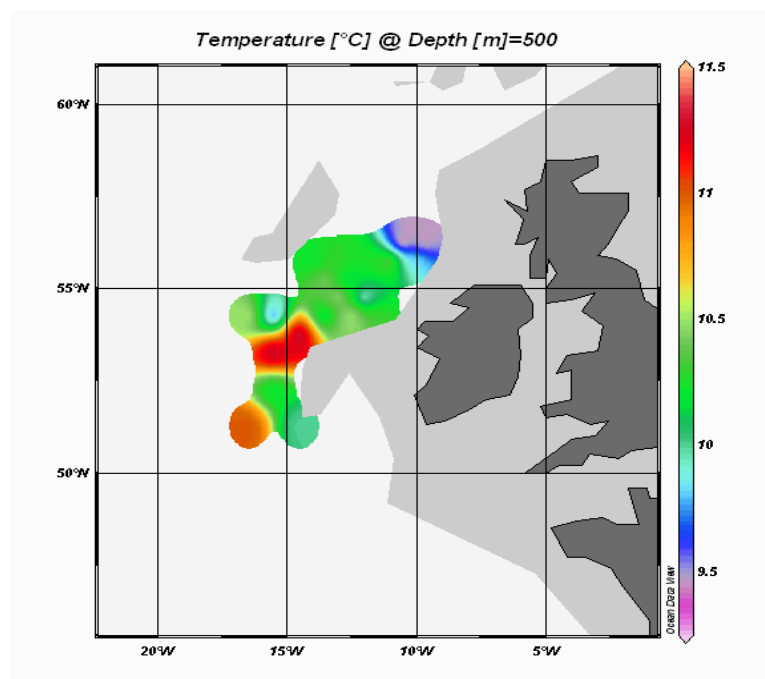


Figure 3.4.1. Temperature at 500m depth collected with the CTD during the March 2006 North East Atlantic hydro acoustic survey for blue whiting, FRV "Tridens".

3.5 Concluding remarks

In order to be able to collect relevant hydrographic data, it should be possible to do CTD measurements up to a depth of 1000m.

Furthermore, Tridens is still not able to do trawling samples at night. Because blue whiting often occur patchily, good trawl sample coverage can only be achieved if all vessels could fish at any time of the day.

Appendix A. Calibration results

```

# Calibration Version      2.1.0.11
#
# Date:   3/15/2006
#
# Comments:
#   38kHz TB 2nd calibration Bantry Bay (correct sound velocity value)
#
# Reference Target:
#   TS          -33.60 dB          Min. Distance      15.00 m
#   TS Deviation    4.0 dB          Max. Distance      20.00 m
#
# Transducer:  ES38B  Serial No.  30501
#   Frequency      38000 Hz          Beamtype          Split
#   Gain           25.87 dB          Two Way Beam Angle -20.6 dB
#   Athw. Angle Sens.  21.90          Along. Angle Sens.  21.90
#   Athw. Beam Angle  7.16 deg          Along. Beam Angle   7.02 deg
#   Athw. Offset Angle -0.04 deg          Along. Offset Angle  0.00 deg
#   SaCorrection     -0.59 dB          Depth              2.00 m
#
# Transceiver:  GPT  38 kHz 009072017a3b 1 ES38B
#   Pulse Duration   1.024 ms          Sample Interval     0.192 m
#   Power            2000 W             Receiver Bandwidth   2.43 kHz
#
# Sounder Type:
#   EK60 Version  2.1.1
#
# TS Detection:
#   Min. Value      -50.0 dB          Min. Spacing        100 %
#   Max. Beam Comp.   6.0 dB          Min. Echolength     80 %
#   Max. Phase Dev.   8.0             Max. Echolength     180 %
#
# Environment:
#   Absorption Coeff. 9.2 dB/km          Sound Velocity       1500.5 m/s
#
# Beam Model results:
#   Transducer Gain   = 26.16 dB          SaCorrection          = -0.59 dB
#   Athw. Beam Angle   = 7.04 deg          Along. Beam Angle     = 6.85 deg
#   Athw. Offset Angle = -0.08 deg          Along. Offset Angle   = -0.08 deg
#
# Data deviation from beam model:
#   RMS = 0.20 dB
#   Max = 0.41 dB  No. = 293  Athw. = 2.6 deg  Along = 2.6 deg
#   Min = -1.04 dB  No. = 313  Athw. = 2.9 deg  Along = 0.8 deg
#
# Data deviation from polynomial model:
#   RMS = 0.19 dB
#   Max = 0.43 dB  No. = 265  Athw. = -0.1 deg  Along = 3.1 deg
#   Min = -1.10 dB  No. = 313  Athw. = 2.9 deg  Along = 0.8 deg

```

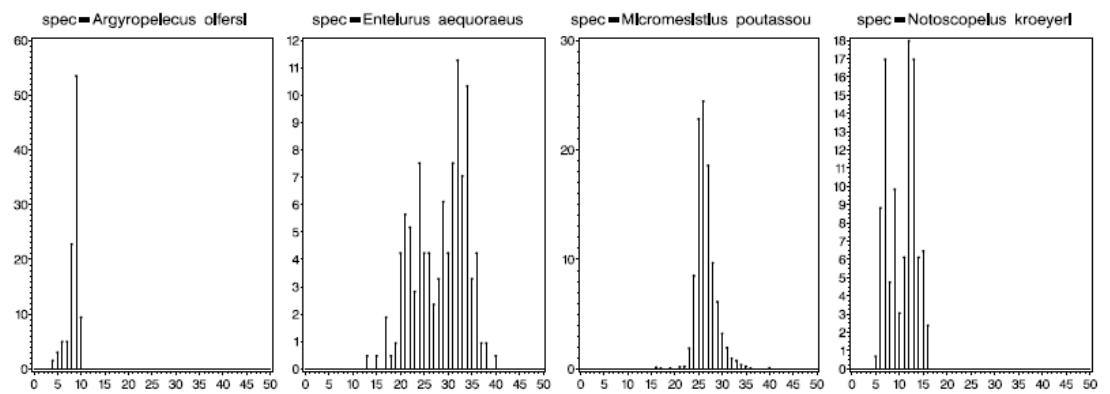

Appendix B. EK60 settings

Transceiver menu	
Absorption coefficient	9.6 dB/km
SA correction	-0.59 dB
Pulse length	1.024 ms
Bandwidth	2.43 kHz
Max Power	2000 W
Two-way beam angle	-20.6 dB
3 dB Beam width	7.16 dg
Calibration details	
TS of sphere	-33.6 dB
Range to sphere in calibration	10.00 m
Transducer gain	25.87 dB
Calibration factor for NASC's	-
Log/Navigation Menu	
Speed, position, vessel log	Serial from ship's GPS
Operation Menu	
Ping interval (s)	0.6
Display/Printer Menu	
TVG	20 log R
Integration line	N/A
TS colour min.	-50 dB
Sv colour min.	-70 dB

Appendix C. Species names

NODC_code	Dutch name	Scientific_name	English_name
8759020106	Kleine bijlvis	Argyropelecus hemigymnus	
8759020107	Bijlvis	Argyropelecus olfersi	Hachetfish
8835710102	Braam	Brama brama	Ray's bream
5700000000	Inktvissen	Cephalopoda	
5708010501	Eledone	Eledone cirrhosa	Lesser octopus
8820022101	Adderzeenaald	Entelurus aequoraeus	Snake pipefish
8826020601	Grauwe poon	Eutrigla gurnardus	Grey gurnard
8791032201	Blauwe wijting	Micromesistius poutassou	Blue whiting
8762140405	Kroeiers lantaarnvis	Notoscopelus kroeyeri	
5707050201	Knuppelhaakinktvis	Onychoteuthis banksi	Common clubhook squid
8762070001	Paralepididae spec1	Paralepididae spec1	
8603010301	Zeeprik	Petromyzon marinus	Sea lamprey
8850030302	Makreel	Scomber scombrus	Mackerel
8815020102	Bandvis	Trachipterus arcticus	Deal-fish
8835280103	Horsmakreel	Trachurus trachurus	Horse mackerel

Appendix D. Length frequency proportions of most abundant species



Drs. E. Jagtman

Signature:

Date:

9 January 2007