Cruise report hydro acoustic survey for blue whiting (Micromesistius poutassou) with R.V. “Tridens”, 17 March - 04 April 2008

Sytse Ybema, Kees Bakker, Thomas Pasterkamp, Eric Armstrong, Dirk Tijssen, Matthias Kloppmann and Joe Freijser.

Report number 08.013

Institute for Marine Resources and Ecosystem Studies

Wageningen IMARES

Location IJmuiden

Publication Date: 30 May

- Wageningen ***IMARES*** conducts research providing knowledge necessary for the protection, harvest and usage of marine and costal areas.
- Wageningen ***IMARES*** is a knowledge and research partner for governmental authorities, private industry and social organisations for which marine habitat and resources are of interest.
- Wageningen ***IMARES*** provides strategic and applied ecological investigation related to ecological and economic developments.

Wageningen IMARES is a cooperative research organisation formed by Wageningen UR en TNO. We are registered in the Dutch trade record Amsterdam nr. 34135929, BTW nr. NL 811383696B04.

A_4_3_2-V5

Contents

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, Faroe Islands 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 is 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 where found throughout the survey area associated with the continental shelf edge but showed a clear increase reaching the northern part of the Tridens survey area.

Although a loss of 24 hours due to bad weather and other circumstances the survey has been very successful in terms of acoustic milage, number of trawl hauls, acoustic data quality and communication.

Effective survey days: 15
Effective nautical miles surveyed: 1419
Successful trawl hauls: 19
Successful CTD downcasts: 17

Achievements:

- Pilot on implementation of ecosystem approach in this survey by focussing on deep sea fish species composition and distribution.
- Pilot on on-line live survey progression information.
- Survey was continuous and more flexible by having no intermediary cruise breaks.

Deviations:

- Max anticipated CTD downcast depth (1000m) was not achieved (832m).

A temporary altered CTD deployment method caused skipping of several downcasts due to bad weather.

1. Introduction

In spring 2008, five research vessels representing the Faroe Islands, Ireland, the Netherlands, Norway and Russia surveyed the spawning grounds of blue whiting west of the British Isles. International co-operation allows for wider and more synoptic coverage of the stock and more rational utilisation of resources than uncoordinated national surveys. The survey was the fifth coordinated international blue whiting spawning stock survey since mid-1990s. The primary purpose of the survey was to obtain estimates of blue whiting stock abundance in the main spawning grounds using acoustic methods as well as to collect hydrographic information. Results of all the surveys are also presented in national reports (Fridtjof Nansen: Oganin et al. 2008; Celtic Explorer: O'Donnell et al. 2008; Gardar: Salthaug et al. 2008; M. Heinason: Jacobsen et al. 2008; Tridens: Ybema et al. 2008).

2. Assignment

Wageningen IMARES, Institute for Marine Resources & Ecosystem Studies 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".

3. Materials and Methods

3.1 Scientific staff

IMARES staff
1. Sytse Ybema
2. Kees Bakker
3. Thomas Pasterkamp
4. Joe Freijser

Guest scientists

5. Eric Armstrong	(Marine Lab, Scotland)
6. Matthias Kloppmann	(BFA, Germany)
7. Dirk Tijssen	(DTU-Aqua, Denmark)

3.2 Narrative

The temporal progression of the survey is shown in figure 3.3.

Week 27-28
Wednesday 13 March, The IMARES research vessel MS Tridens set sail to Cork from Scheveningen in a Gail with enough force to get us on the Dutch evening news. Early arrival in Cork harbour at 8 am due to improving weather conditions during the voyage. Tuesday 18 March At 6 am we sailed out of Cork harbour and set course for Bantry bay in Kerry. We arrived in Bantry bay around 13:30 where we calibrated our transducers. The first days we finished out first transects finding blue whiting on the continental slope. Friday 21 March Today was a day of rest, the waves are 20 ft + .We decided to steer off our easterly course to head into the wind for the night, North, as were 5 Dutch trawlers. We did some comparing fishing with 2 of them the day after. The weather was slightly improving so we continued our transects.

Week 29
Until now everything had gone according to plan, but with one trawl on Monday 24 March it didn't. One of the lines attached to weights that hold the bottom of the net in place had snapped. After being informed about the

latest news concerning Dirk, the deck-crew member that got injured a few days ago, the captain decided to abandon course and set sail for Killybegs harbour in Donegal Bay, Ireland for a visit to the hospital. We set sail back on course Wednesday morning at eight am. We had been discussing for a while to do a deeper deep-sea trawl especially to improve our marine life census: have a plunge into the fascinating environment of Blue whiting. So on our way back to the fishing ground we made a deep sea trawl (~900m) which revealed many deep sea species which were photographed and taken for further analysis. On Saturday 29 March we performed an intercalibration with the Norwegian vessel 'Gardar'. Results were satisfactory. Sunday 30 March we had some troubles when we tried to set out the net for the third time in one day. The brake system that should slowly lower the net to the acquired fishing depth failed. About 400 meters of cable ran off the winch without control. It was descending so fast that smoke was coming off the pulley blocks. There was really nothing they could do but to leave the net hanging there overnight at a depth of 400 meters. When they managed to get the hauling system working again the rig was brought onboard, as it turned out the net was only twisted.

Week 30
Tuesday 1 April, last day of the survey, 20 hauls had been made and over 2000 nautical miles were surveyed. A national record! We sailed for Scotland through the Minch to avoid any more of this 25ft wave torment. In Loch Eriboll we performed a post calibration to make sure our equipment was still OK. Within a few hours we set sail for Scheveningen where we arrived at Thursday 3 April.

3.3 Survey design

The survey was carried out from 17 March to 1 April 2008, covering an area west of Ireland from latitude 51.45° to 58.15° North and from longitude 9° West to 16° West (Fig. 3.1). An adapted survey design was applied this time, based on recommendations made by PGNAPES in 2007. Tridens was to cover the core area assisted by Celtic Explorer and Fridtjof Nansen. Coordinated survey timing- was greatly improved this year as compared to previous years with the entire survey program being undertaken within 4 weeks, as compared to 6 weeks in 2007. Parallel transects along latitudinal lines were used with spacing between the lines set at 30 nm in areas with no interlaced transects where 60 nm were used in the rest of the area. Acoustic data from transects running north-south close to the shelf edge (that is parallel to the depth isolines) were excluded from the dataset.

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. Since no fish was observed in areas with water depth below 250m, all transects were cut of at the 200m depth contour. CTD stations were planned in advance but extra stations were added and removed depending on the weather conditions.
The actual surveyed cruise track and trawl positions are presented in figure 3.2.

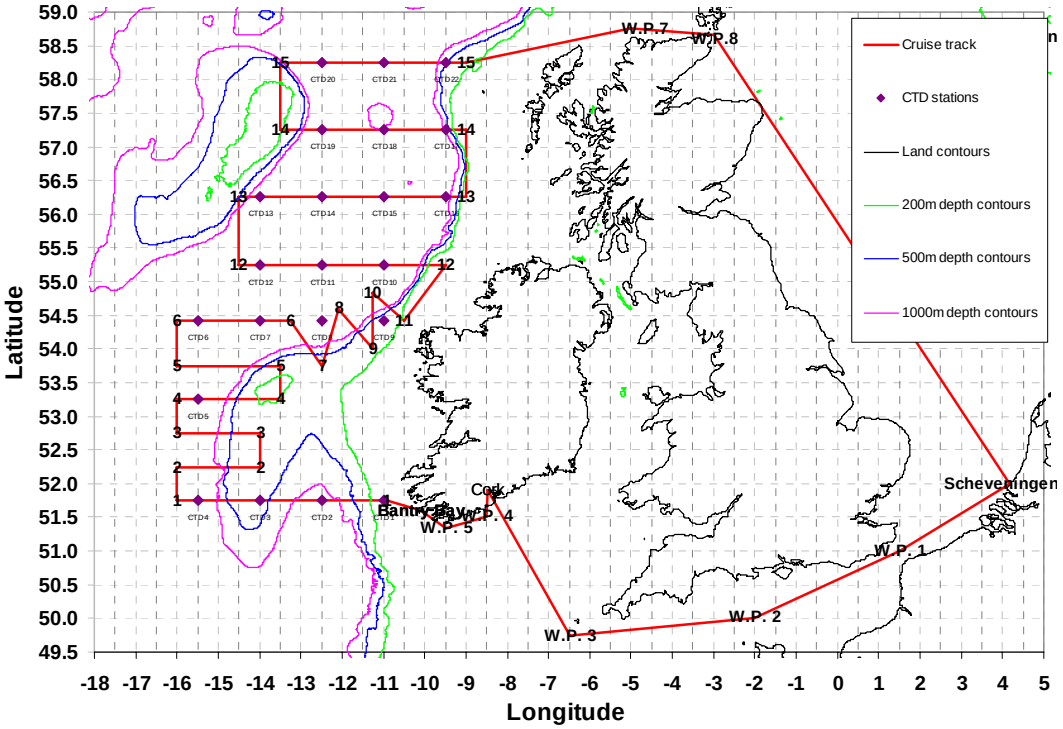


Figure 3.1. Planned cruise tracks and CTD stations. CTD stations are displayed as black dots.

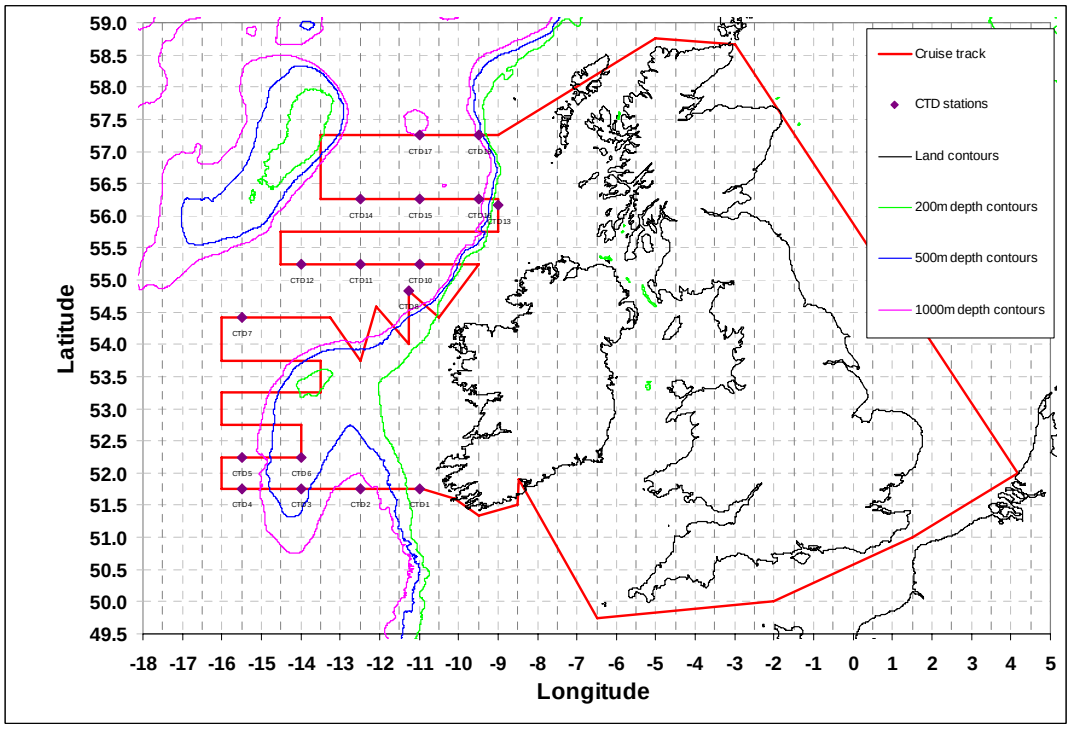


Figure 3.2. Executed cruise track, CTD stations and trawl hauls during the BWHTS 2008.

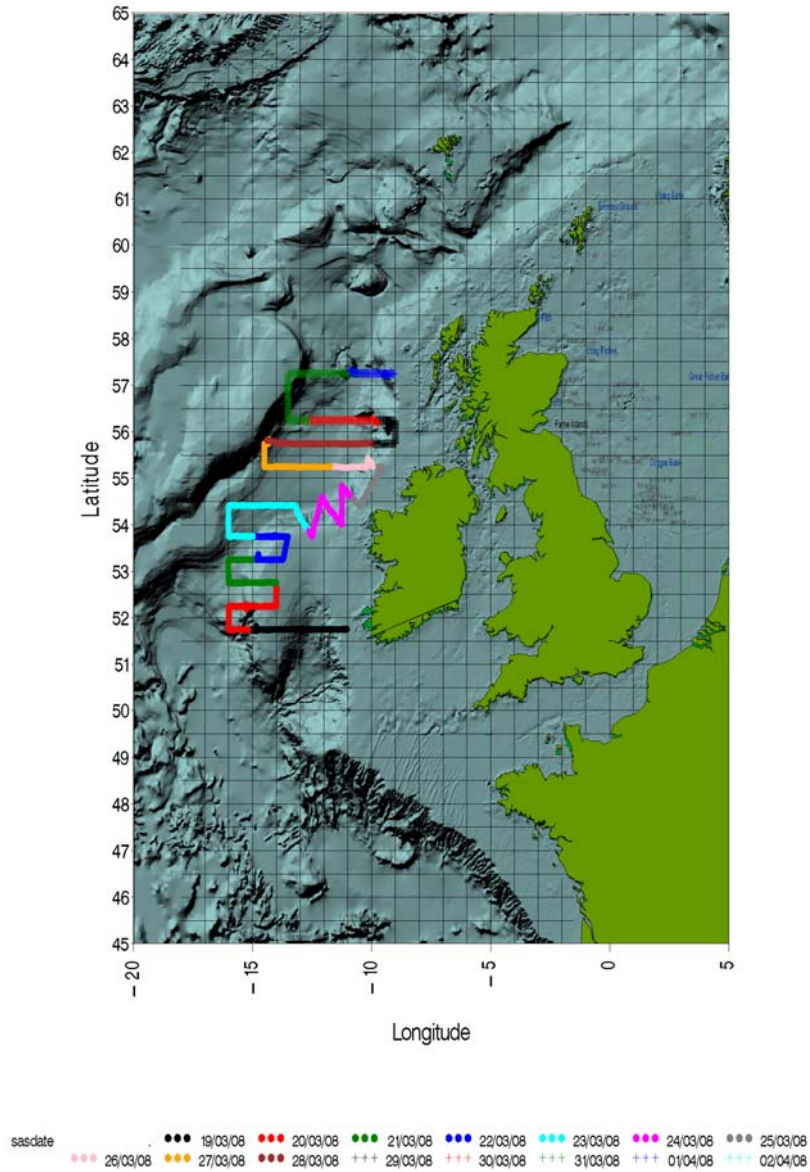


Figure 3.3. Temporal progression of the survey, 17 March – 02 April 2008.

3.4 Acoustic calibrations

Both transducers were calibrated in the Bantry Bay, Ireland, according to standard IMARES procedures. using results from the first run as an input in the next run. Four calibrations were executed successfully although the weather conditions were bad. A post calibration in Loch Eriboll was successfully executed. The calibration results used in this survey are listed in appendix A.

Frequency	**Transducer**	**Results**
38 kHz (2x)	Hull mounted	Good
38 kHz (2x)	Towed body	Good

3.5 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. Acoustic data were collected with a Simrad EK60 scientific echo sounder. The data were logged with Sonardata Echoview software. The EK60 received the position data and vessel speed from the ship's GPS. A variable ping rate was used near the shelf edge avoiding false bottom echoes. 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. The acoustic values (NASC's) from each log interval were only assigned to the category "blue whiting". All echoes were recorded with a threshold of -80dB up to a depth of 750 meters below the transducer.
Eric Armstrong, guest scientist from the Marine Lab in Aberdeen assisted in the use of Sonardata Echoview. The species detection algorithm created in 2007 was further developed. The aim of this exercise was to automated the subjective scrutiny method normally applied.

Acoustic signal check
Two methods were tested for monitoring the stability of all 4 segments of the transducer. If combined, the acoustic system can not just be monitored but also corrected for drop outs and weakening of the signal.

1. Echoview was used as a software monitor tool. An algorithm allows us to monitor the total acoustic energy closely and in real time.

A watchdog setup tested the hardware directly. This method allows us to keep track of signal behaviour of each of the 4 transducer segments.

3.6 Biological data collection

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 sex, maturity, age (otolith extraction) and weight. Age readings were verified at the Norwegian Lab 'IMR'. In all cases, specimens of non-target species, were frozen and photographed for species determination in the lab.

Incorporating the 'Ecosystem approach': Focus on deep sea species
A deep-sea species photo guide has been created during the blue whiting surveys of 2007 and 2008. This photo guide will be available as a stand alone document to all PGNAPES and PGTIPS coordinated surveys. A word of caution is appropriate here: All the determinations have been done on board aided by available literature and equipment. All identifications are based on Muus and Nielsen (1999) and the three volume compilation by Whitihead et al. (1986). If in doubt also http://www.fishbase.org (FishBase 2008) was consulted. Most if not all of the identification are, therefore, correct. However, due to the catch methods some of the species were not in a state that they could be identified immediately, and discriminating features had to be taken from various individuals of a group of specimens of which we were confident to represent one species. It is, thus, possible that inconsistencies might occur. The user of the guide is encouraged not to view it as a final version but as a product in development and help to expand and improve the list of know species of the investigation area. The following references have been used:

1. Froese, R. and D. Pauly. Editors. 2008. FishBase. http://www.fishbase.org version (01/2008). World Wide Web electronic publication.
2. Muus, B.J. and J.G. Nielsen, 1999. Sea fish. Scandinavian Fishing Year Book, Hedehusene, Denmark. 340 p.
3. Whitehead, P.J.P., M.-L. Bauchot, J.-C. Hureau, J. Nielsen and E. Tortonese (eds.), 1986. Fishes of the North-eastern Atlantic and the Mediterranean. UNESCO, Paris. Vols. I-III: 1473 p. (FNAM)

3.7 Hydrographical data collection

All vessels were able to take CTD stations to an average depth of 2000 meter or more, except Tridens who only took CTD stations up to 832 meters. Hydrographical data have been collected in 17 CTD stations, (Figure 3.2). The CTD device was not calibrated specifically for this cruise. 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. Due to insufficient national observations results are only made available in the international cruise report which can be found on the PGNAPES website.

3.8 Data analysis and online presentation

Acoustic – biological and hydrographic data were stored in the PGNAPES format for further analysis at this cruis' post meeting In Kaliningrad, Russia. Scrutinizing acoustic data was sometimes tricky since the algorithm produced some unexpected results. This his been corrected in the final algorithm version.

Based on last years results, semi automated data fusion was used to create a better overview of the survey progress and to be able to share data amongst research vessels (Fig 3.4).This data fusion projects includes not only collected data during the survey but also live environmental data, weather forecasts and other relevant information for this cruise. It has proven to be highly valuable to national and international survey design.

A ship's journal written by Joe Freijser, trainee "Coastal zone Management" of the "Van Hall Larenstein" college in the Netherlands was presented online.

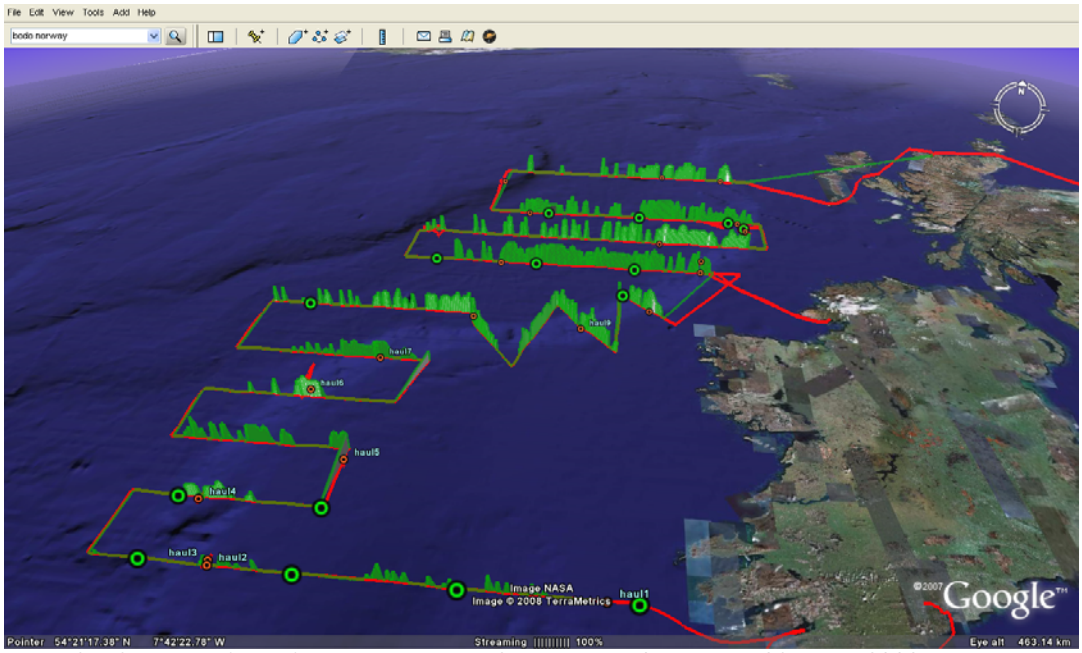


Figure 3.4 Overview of data fusion project using Google Earth, 05 March – 23 March 2008.

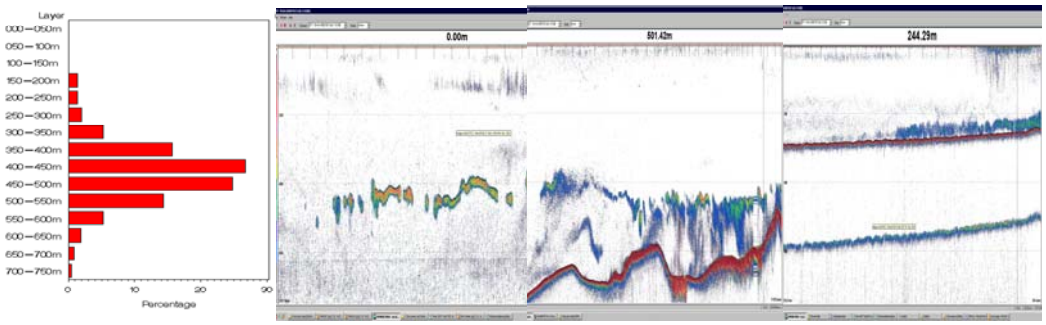
Further analysis of the international data has taken place in Kaliningrad, Russia, 23-25 April 2008 resulted in a combined survey report.

4. Results

4.1 Acoustics

Overall 1419 nautical miles were surveyed which is substantially more than the 839 miles in 2007. The main reason for this increase the relative good weather conditions and not having any mid-cruise breaks.

Detectability
Unlike in previous years, acoustic response of blue whiting was similar shaped in al areas. Some small and dense schools were found (Fig. 4.1 C) but the overall pattern was 'eal-like' (Fig. 4.1 A and B). A special blue whiting detection algorithm was created in Sonardata Echoview. It has been proven being capable of selecting identical schools which would have been selected manually. Overall, the strongest signals of blue whiting were observed at depths of 400-500m, sometimes extending to around 300m depth (or even shallower) on the slope areas (Fig. 4.1 C).



A B C D

Figure 4.1. The overall vertical distribution of blue whiting having most recodings around 450m (A). Echograms showing examples of schools of blue whiting along the shelf edge at 250m depth (D), small dense schools detected at 500m depth (B and C).

Geographical distribution patterns
Like in all previous years, schools were found further off the slope area in the northern part of the survey area.

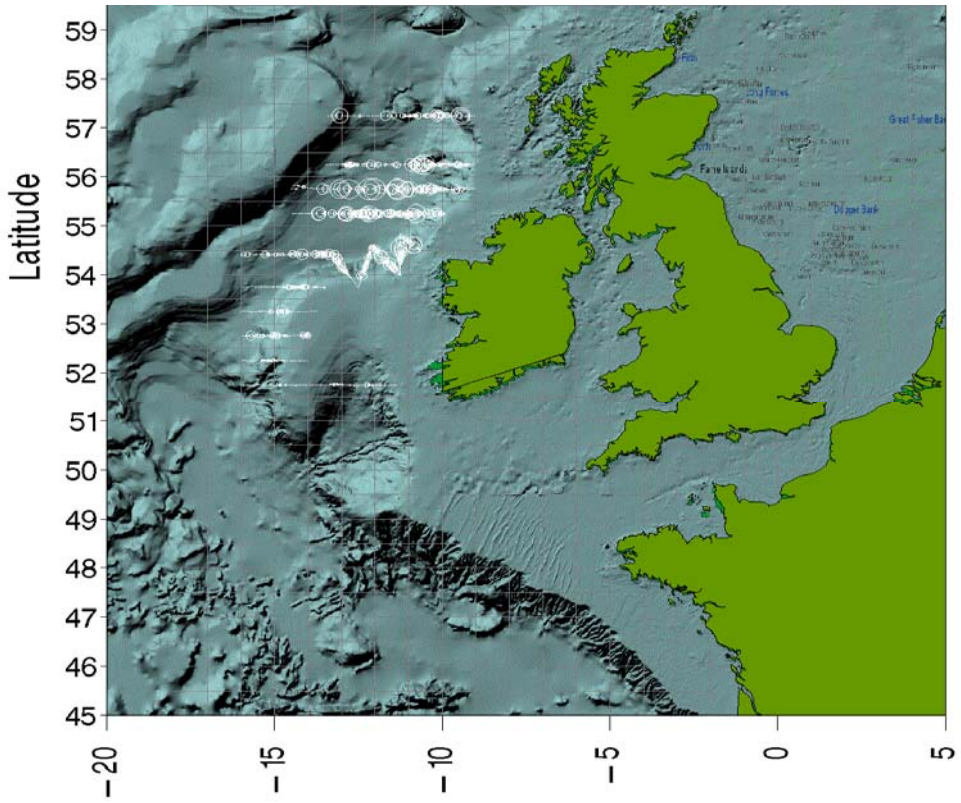


Figure 4.2. Post plot showing the distribution of **total blue whiting** NASC values (on a proportional square root scale relative to the largest value of 24651) obtained during the March 2008 North East Atlantic blue whiting hydro acoustic survey on FRV "Tridens".

4.2 Catch results

In all, 20 trawl hauls, 19 valid and containing blue whiting were conducted (Table 4.1). Most hauls were all strongly dominated by blue whiting as shown in table 4.2. One trawl was aimed at species composition in the water column just below the 'blue whiting zone'. Since no multisampler gear was used it was impossible to pinpoint the exact depth of blue whiting from that catch.

Table 4.1. Details of the trawl hauls taken during the March 2008 North East Atlantic hydro acoustic survey, FRV "Tridens".

haul nr	sample id	validity	ICES	date	time (GMT)	position	haul duration (	depth	gear depth	wind direction (	wind force (	total sample weight (k
1	5400101	valid	32D8	19/03/2008	02:40	51.45N-11.12W	57	180	180	90	4	6055000
2	5400102	valid	32D5	19/03/2008	20:02	51.45N-14.49W	45	520	520	90	2	
3	5400103	valid	32D5	19/03/2008	21:21	51.47N-14.50W	43	540	535	90	2	147000
4	5400104	valid	33D4	20/03/2008	11:42	52.14N-15.16W	36	1180	500	293	4	112000
5	5400105	valid	34D6	20/03/2008	21:30	52.40N-14.00W	14	265	280	293	12	245000
6	5400106	valid	35D5	22/03/2008	07:56	53.20N-14.45W	11	550	500	338	4	3272500
7	5400107	valid	36D5	22/03/2008	19:37	53.45N-14.07W	73	1000	510	315	4	420000
8	5400108	valid	37D6	23/03/2008	19:30	54.22N-13.09W	61	2900	450	338	6	1732500
9	5400109	valid	37D8	24/03/2008	10:03	54.17N-11.43W	38	2000	530	315	6	483000
10	5400110	valid	38D9	24/03/2008	22:06	54.35N-10.50W	58	500	420	338	5	1365000
11	5400111	valid	39D9	25/03/2008	10:05	55.15N-10.05W	67	500	450	293	1	2919000
12	5400112	valid	39D9	26/03/2008	17:00	55.27N-10.03W	44	1000	900	293	8	595000
13	5400113	valid	39D6	27/03/2008	05:40	55.14N-13.01W	70	2000	450	270	3	1085000
14	5400114	valid	40D9	28/03/2008	20:46	55.44N-10.40W	35	2000	410	270	11	2135000
15	5400115	valid	41E0	29/03/2008	12:30	56.05N-09.16W	16	1000	500	225	10	665000
16	5400116	valid	41E0	29/03/2008	18:41	56.14N-09.22W	46	1500	500	359	3	472500
17	5400119	valid	43D9	30/03/2008	00:40	57.16N-10.34W	45	2300	407	225	4	1942500
18	5400117	valid	41D7	30/03/2008	00:48	56.14N-12.49W	50	2500	420	338	4	1417500
19	5400118	valid	42D6	31/03/2008	09:50	56.58N-13.27W	40	490	430	158	11	1802500
20	5400120	valid	43E0	01/04/2008	09:30	57.15N-09.29W	81	700	450	248	8	1225000

Table 4.2. Trawl catches during the March 2008 North East Atlantic hydro acoustic survey, FRV "Tridens" in kg. Scientific and English species names are listed in appendix B.

Haul number	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
English name																				
						3254.0	407.0	1702.7	445.7											
Alfonsino			0.3				0.7													
Argyropelecus hemigymnus									0.0		0.0		0.0		0.0		0.0			
Bean's sawtoothed eel												1.6								
Benthosema glaciale				1.0				0.6												
Birdbeak dogfish												7.1								
Black scabbardfish												4.6								
Blackfish			3.3	21.8		2.8	2.3	4.1	26.0	56.0	110.4	14.7	12.7			23.3	48.3		66.2	
Blue whiting	9.2		85.0	83.1	93.9	3254.0	407.0	1702.7	445.7	1293.0	2868.6	426.4	1057.1	2110.0	634.0	434.0	1402.0	1796.0	1866.0	1219.0
Boarfish	0.8																			
Chauliodus												0.9	0.0				0.0		0.0	
Cubiceps gracilis									0.1											
Deal-fish			5.6	1.7		12.2		15.8	5.4	8.6	5.5	6.6	4.7	7.0		4.8			8.5	
Greater argentine			3.7	0.1				0.0	0.0	0.3		2.9								
Greater forkbeard												7.0								
Grey gurnard											2.6	0.5						0.7		8.0
Hachetfish			0.1	0.2	0.0	0.1	0.0	0.0		0.5	0.1	0.2	0.0		0.1		0.0	0.0		0.1
Hake	19.1		19.6			0.0				3.9	26.8	74.8			1.9					
Horse mackerel	5578.0				49.0					0.3		2.9			0.2	0.3				
Howella sherborni																	0.0			
Lampadena				0.1												0.0			0.0	
Lampanyctus crocodilus														0.1		2.5		0.0	0.9	
Long-finned squid																				
Longtooth anglemouth								0.0		0.9	0.0	0.3		0.1		0.3	0.2		0.5	
Mackerel	453.0		19.1		59.7	1.3	5.1	3.2		1.1									0.3	
Melanostomias biseriatus				0.0																
Myctophidae						0.4				0.6										
Myctophum punctatum			0.0				0.0				0.0	0.0	0.2		0.0					
Nansenia oblita								0.1				0.6					0.1			
Notolepis rissoi			0.1				0.0	0.0	0.0								0.0			
Notoscopelus kroeyeri			52.0	1.1		0.1	0.3	0.4	0.9		0.8	0.8	0.2	0.0	4.7			1.1		0.0
Paralepididae spec1			0.1																	
Paralepis atlantica							0.2													
Pearl side									0.0											
Ray's bream						1.0														
Sagamichthys schnakenbecki												0.1	0.1				0.4			
Sagittal squid																				
Saithe												0.7								
Schnakenbeck's searsid										0.1										
Scopelosaurus lepidus																	0.0			
Silver pomfret									0.9		0.5									
Silvery pout			0.0				0.0			0.2		0.0							0.0	
Slender snipe-eel											0.0	0.8								
Snaggletooth						0.0	0.1		0.1	0.1	0.0				0.0	0.0				
Snake pipefish	0.0		0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0				0.0	0.0
Southern shortfin squid																				
Stomias											0.0		0.1		0.1	0.1	0.1			
Sudis hyalina								0.1												
Velvet belly												0.4								

Length frequency distributions per haul of blue whiting caught are shown in figure 4.3.

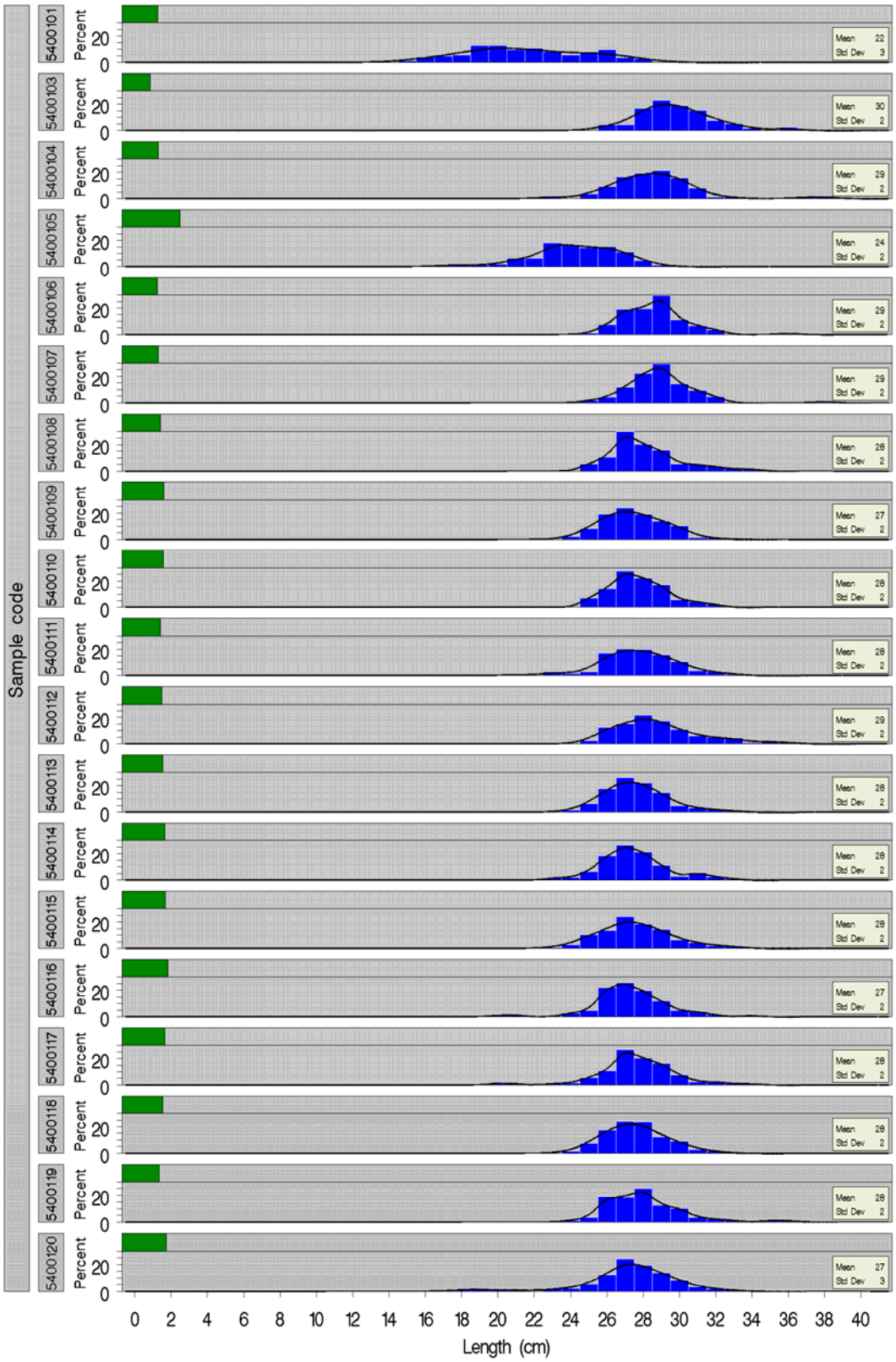


Figure 4.3. Length frequency distributions of blue whiting. Smoothing is obtained by normal kernel density estimates. The green bars indicate the relative amount of samples used.

In total 950 biological samples of blue whiting were collected and used for length, age and maturity keys. An age/maturity structure of these samples is shown below (Figure 4.4). Stock in the Tridens survey area is dominated by age classes 4 and 5 years (year classes 2004 and 2003).

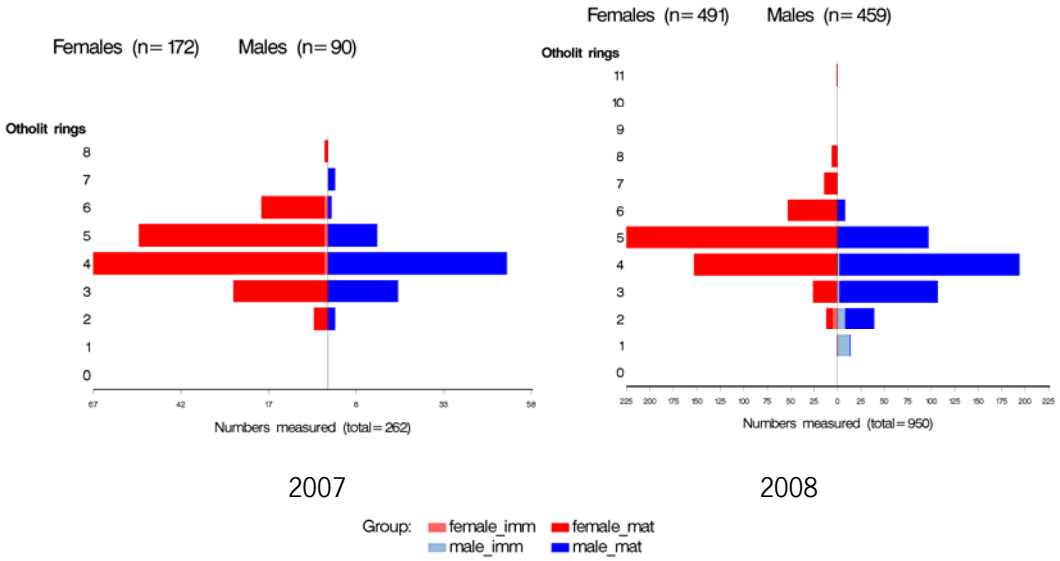


Figure 4.4 Age-maturity structure of collected biological samples of blue whiting by haul during the March 2007 and 2008 North East Atlantic hydro acoustic surveys, FRV "Tridens".

Growth

Just for the record, the 2008 growth curve has been plotted here (Figure 4.5) to be able to compare it to the one obtained in 2007.

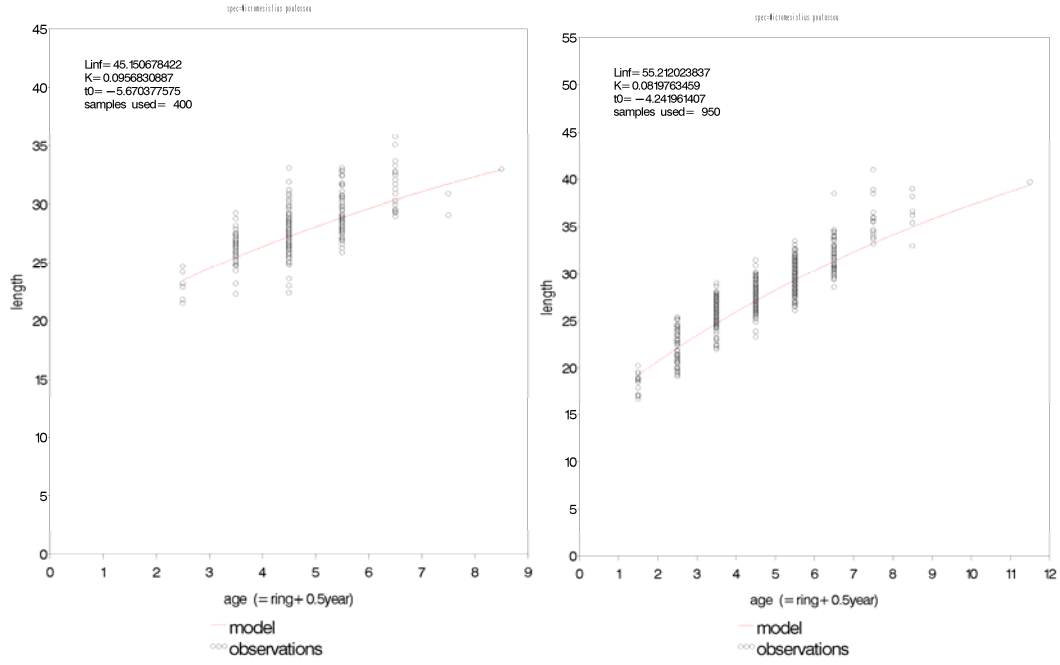


Figure 4.5 Von Bertalanffy growth curve of collected biological samples of blue whiting by haul during the March 2007 and 2008 North East Atlantic hydro acoustic surveys, FRV "Tridens".

Appendix A. Calibration results

Echo Sounder System Calibration

Vessel :	R/V Tridens		Date :	18/03/2008	
Echo sounder :	ER60 PC		Locality :	NL	
		TS_{Sphere}:	-33.60 dB		
Type of Sphere :	CU-64	(**Corrected for soundvelocity o**		Depth(Sea floor) 23	m

Calibration Version 2.1.0.11

Comments:
Bantry bay TB cal #2

Reference Target:			
TS	-33.60 dB	Min. Distance	9.00 m
TS Deviation	3.0 dB	Max. Distance	12.00 m
Transducer: ES38B Serial No. 28887			
Frequency	38000 Hz	Beamtype	Split
Gain	24.93 dB	Two Way Beam Angle	-20.6 dB
Athw. Angle Sens.	21.90	Along. Angle Sens.	21.90
Athw. Beam Angle	6.81 deg	Along. Beam Angle	6.88 deg
Athw. Offset Angle	0.01 deg	Along. Offset Angl	0.02 deg
SaCorrection	-0.66 dB	Depth	0.00 m
Transceiver: GPT 38 kHz 009072017a3b 1 ES38B			
Pulse Duration	1.024 ms	Sample Interval	0.191 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.	4.0	Max. Echolength	180 %
Environment:			
Absorption Coeff.	9.9 dB/km	Sound Velocity	1491.1 m/s
Beam Model results:			
Transducer Gain =	25.06 dB	SaCorrection =	-0.67 dB
Athw. Beam Angle =	7.01 deg	Along. Beam Angle =	6.97 deg
Athw. Offset Angle =	-0.03 deg	Along. Offset Angle=	-0.02 deg

Data deviation from beam model:
RMS = 0.13 dB
Max = 0.39 dB No. = 369 Athw. = 3.3 deg Along = 3.6 deg
Min = -0.47 dB No. = 214 Athw. = 0.4 deg Along = -4.7 deg

Data deviation from polynomial model:
RMS = 0.08 dB
Max = 0.30 dB No. = 169 Athw. = -2.1 deg Along = 2.5 deg
Min = -0.36 dB No. = 126 Athw. = 4.1 deg Along = 2.5 deg

Comments :

Wind Force :	kn.	**Wind Direction :**	degrees
Raw Data File:	D:\Acoustic data\2008 BWHTS\Calibration\bwhts2008cal _-D20080318-T202341.raw		
Calibration File:	H:\2008 BWHTS\Calibration\cal TB 28887 #2		

Calibration responsibles : Sytse Ybema

Appendix B. Species names

Note: not all species caught have been able to put into the database system. Overall 69 species were found of which only 47 are listed here.

3 letter code	NODC code	tsn	Scientific name	English name	Dutch name
	8850020301	172	Aphanopus carbo	Black scabbardfish	Zwarte kousenbandvis
ARG	8756010203	162064	Argentina silus	Greater argentine	Grote zilversmelt
	8759020106	162219	Argyropelecus hemigymnus		Kleine bijlvis
	8759020107	162220	Argyropelecus olfersi	Hachetfish	Bijlvis
	8759030106		Astronesthes gemmifer	Snaggletooth	Astronesthes
	8762140901	162680	Benthosema glaciale		IJslantaarnvis
	8810050101	166155	Beryx decadactylus	Alfonsino	Alfonsino
	8835710102	170290	Brama brama	Ray's bream	Braam
	8811060301	166320	Capros aper	Boarfish	Evervis
	8851010301	172520	Centrolophus niger	Blackfish	Zwarte vis
	8759060100	162278	Chauliodus		Chauliodus spp.
	8851020203	172548	Cubiceps gracilis		C. gracilis
	8710011401	160742	Deania calceus	Birdbeak dogfish	Spitssnuitdoornhaai
AZN	8820022101	166591	Entelurus aequoraeus	Snake pipefish	Adderzeenaald
	8710010510	160670	Etmopterus spinax	Velvet belly	Zwarte doornhaai
GGU	8826020601	167044	Eutrigla gurnardus	Grey gurnard	Grauwe poon
ZIK	8791032101	164772	Gadiculus argenteus	Silvery pout	Zilverkabeljauw
	8759010403	162185	Gonostoma elongatum	Longtooth anglemouth	Gonostoma
	8835181301	168333	Howella sherborni		H. sherborni
	5707150302	82523	Illex coindeti	Southern shortfin squid	Zuidelijke kortvinpijlinktvis
	8762141200	162702	Lampadena		Lampvis
	8762140317	162649	Lampanyctus crocodilus		L. crocodilus
LVUL	5706010105	82375	Loligo vulgaris	Long-finned squid	Langvinpijlinktvis
	8759010501	162187	Maurolicus muelleri	Pearl side	Zalmharing
	8759040602	162259	Melanostomias biseriatus		M. biseriatus
HKE	8791040105	164795	Merluccius merluccius	Hake	Heek
WHB	8791032201	164774	Micromesistius poutassou	Blue whiting	Blauwe wijting
	8762140000	162575	Myctophidae		Lantaarnvissen
	8762141504	162723	Myctophum punctatum		Stippellantaarnvis
	8756010104		Nansenia oblita		N. oblita
	8741210202	161624	Nemichthys scolopaceus	Slender snipe-eel	Slanke snipaal
	8762070201	162471	Notolepis rissoi		Risso's barracudina
	8762140405	162661	Notoscopelus kroeyeri		Kroeyers lantaarnvis
	8762070001		Paralepididae spec1		Paralepididae spec1
	8762070401	162492	Paralepis atlantica		Grote barracudina
	8791031602	164751	Phycis blennoides	Greater forkbeard	Gaffelkabeljauw
POK	8791030901	164727	Pollachius virens	Saithe	Zwarte koolvis
	8835710301	170297	Pterycombus brama	Silver pomfret	Zilverbraam
	8756040401		Sagamichthys schnakenbecki	Schnakenbeck's searsid	Sagamichthys
MAC	8850030302	172414	Scomber scombrus	Mackerel	Makreel
	8762130106	162573	Scopelosaurus lepidus		S. lepidus
	8741200102	161606	Serrivomer beani	Bean's sawtoothed eel	S. beani
	8759070200	162286	Stomias		Stomias
	8762070602	162506	Sudis hyalina		S. hyalina
TSAG	5707150102	82526	Todarodes sagittatus	Sagittal squid	Rode pijlinktvis
DEA	8815020102	166342	Trachipterus arcticus	Deal-fish	Bandvis
HOM	8835280103	168588	Trachurus trachurus	Horse mackerel	Horsmakreel

Appendix C. Length frequency proportions of most abundant species

LF distribution for n>25 BWHTS 2008