Thünen Institute
of Baltic Sea Fisheries

Alter Hafen Süd 2, 18069 Rostock Telefon 0381 8116-102 Telefax 0381 8116-199 19.07.2015 uwe.boettcher@ti.bund.de

Cruise Report

FRV "Walther Herwig III" Cruise 384
01.05. – 20.05.2015

Hydroacoustic survey for the assessment of small pelagics in the Baltic Sea

Scientist in charge: Dr. Uwe Böttcher

1 Background

The main objective of the cruise no. 384 of FRV " Walther Herwig III" was to assess the sprat stock in the Baltic proper.

The cruise is part of the ICES Baltic International Acoustic Spring Survey (BASS). Timing, survey area and the principal methods of investigations are co-ordinated by the ICES Baltic International Fish Survey Working Group (WGBIFS). This survey is conducted every year to supply the ICES Baltic Fisheries Assessment Working Group (WGBFAS) with an index value for the stock size of sprat in the Baltic area.

Following the recommendation of WGBIFS, the German survey covered the ICES-Subdivisions 24, 25 and the Polish and Swedish parts of Subdivisions 26 and 28. Other areas in the Baltic Sea were covered by Lithuania and Latvia. In recent years there were indications that the main distribution area of the Baltic sprat stock moved to more northern areas. Therefore the standard survey area was extended by covering Subdivision 27 and 29 (Figure 1).

Distribution list:
BLE, Hamburg
Schiffsführung FFS „"W. Herwig"
BMEL, Ref. 614
Thünen-Institut - Präsidialbüro (M. Welling)
Fahrtteilnehmer
Thünen-Institut für Seefischerei
Thünen-Institut für Fischereiökologie
Thünen-Institut für Ostseefischerei
Thünen-Institut - FIZ-Fischerei
Schiffseinsatzplanung, Herr Dr. Rohlf
BFEL Hamburg, FB Fischqualität
IFM-GEOMAR, Kiel
Institut für Fischerei der Landesforschungsanstalt
LA für Landwirtschaft, Lebensmittels. u. Fischerei
BSH, Hamburg
Deutscher Fischerei-Verband e. V., Hamburg
Leibniz Institut für Ostseeforschung
Doggerbank GmbH
Mecklenburger Hochseefischerei Sassnitz
Kutter- und Küstenfisch Sassnitz
Landesverband der Kutter- und Küstenfischer
Sassnitzer Seefischer
Deutsche Fischfang Union Cuxhaven
Euro-Baltic Mukran

Katarzyna.kaminska@minrol.gov.pl
bhmw@mw.mil.pl
lena@mir.gdynia.pl

2 Narrative

FRV “W. Herwig” was equipped with all hydroacoustic equipment and biological sampling gear on 30th April in Bremerhaven and left the port on afternoon of the 1st May with heading for the western Baltic. After crossing the Kiel Canal the hydroacoustic equipment was calibrated off Kühlungsborn.

On 3st Mai FRV “W. Herwig” entered the port of Warnemünde for embarkation of the rest of the scientific crew. The ship left the port on the same day and the hydroacoustic survey operations commenced 4st May at 06:00 AM in SD 24.

Overall seventeen days were necessary to cover the intended survey area (calibration of the transducer, acoustic tracks, fishing hauls and hydrographical measurements). Additional four days were used to cross between the home port Bremerhaven and the area of investigation.

On 19st May at 05:00 PM the scientific program was finished north of the Hoburg bank (Gotland Sea) and the FRV “W. Herwig” left the area to steam back to Warnemünde port (disembarking of the scientific crew) and onward to Bremerhaven port, where the ship arrived on 21st May, 03:00 PM.

3 Survey design

The investigation of FRV”W. Herwig” covered the whole Subdivisions 24 and 25 as well the Polish and Swedish waters of Subdivisions 26 and 28. It was possible to cover also ICES rectangles 46G9 and 47G9 of Subdivision 29 and 45G8 and 46G8 of Subdivision 27 additionally (Fig. 1).

The sampling stratification is based on ICES statistical rectangles. The size of these rectangles is 0.5 degrees in latitude and 1 degree in longitude, whereby only areas with water deeper than 10 m were taken into account. The daily surveyed distance amounted to approximately 85 - 100 nautical miles. The acoustic measurements were conducted on parallel transects with a distance of 15 - 18 nautical miles.

The acoustic investigations and the fishing hauls were carried out at daylight from 4:00 - 18:00 UTC (6:00 and 20:00 local time). During the survey, hydroacoustic data were recorded at a standard ship speed of 10 kn.

In general, each ICES-rectangle was covered by two transects, corresponding to acoustic measurements of approx. 60 nautical miles per statistical rectangle

For some parts of applied transects including planned CTD-stations in Swedish waters no license was granted by the Swedish authorities (Fig. 1). Due to these restrictions the area coverage remained below recommended requirements in ICES rectangles 42G8, 42G9, 45G9, 46G9 and 46G9 of ICES Subdivision 28 and 29.

4 Calibration

The hull mounted 38 kHz transducer was calibrated on 15 May in the coastal area of the Mecklenburg Bay off Kühlungsborn. The calibration procedure was carried out as described in the Manual for International Baltic Acoustic Surveys (IBAS) (ICES 2014).

5 Hydroacoustic data collection

Hydroacoustic data were recorded with a Simrad EK60 scientific echosounder with hullmounted 38 kHz transducer. The transducer settings applied were in accordance with the specifications provided by the IBAS-manual (ICES 2014).

6 Biological data – fishing hauls

Trawling was done with the pelagic gear “PSN205” in the midwater as well as near the bottom to identify the echo signals. The intention was to conduct at least two hauls per ICES statistical rectangle. The trawling time lasted usually 30 minutes by using a trawling speed of ca. 4 knots. According to the IBAS-manual the following codend-inlets with stretched mesh sizes were used:

- 20 mm in Subdivision 24 and
- 12 mm in Subdivision 25 to 28.

The trawling depth and the net opening were controlled by a Scanmar net probe. Generally a net opening of about 11 to 13 m was achieved. The trawl depth (headrope below the surface) was chosen

in accordance to ‘characteristic indications’ of the echogram and ranged from 10 to 73 m. The bottom depth at the trawling positions varied from 30 to 215 m.

Samples were taken from each haul in order to determine the length and weight distribution of fish. Sub-samples of cod, herring and sprat were investigated concerning sex, maturity and age. Samples of whole fishes and parts of different organs/tissues were taken for later investigations in the lab. Detailed biological analyses were made according to the standard procedure (i.e. sex, maturity, otolith dissection).

7 Hydrography

A Seabird-CTD-probe with a carousel water sampler and oxygen sensor was used for hydrographical measurements. Vertical profiles were taken on a fixed station grid along the track and after each trawl station. The profiles covered the entire water column to about 2 m above the sea bottom. Additionally, water samples were taken once per day from different depths to check the oxygen data by Winkler titration and to collect reference salinity samples. The hydrological row data were aggregated to 1 m depth strata. Additional meteorological observations of air temperature, atmospheric pressure, wind speed and direction were recorded during all hydrographical investigations.

8 First Results

The tracks of the acoustic measurements and the geographical distribution of trawl hauls and CTD-stations are presented in Figures 1 and 2. The results of the trawl hauls are given in Table 1 and Figure3.

Summarized activities during the survey:

Hydroacoustic transects	1.314 nm
Pelagic trawl hauls valid/invalid	58/0
CTD vertical profiles	120
Water bottle samples for oxygen measurements (Winkler titration)	71

Presence of species in trawl hauls and corresponding number of investigated individuals

Species	No. of trawl hauls with the species	No. of length measurements	No. of individual measurements
CLUPEA HARENGUS	57	12.549	1.149
CYCLOPTERUS LUMPUS	9	13	
ENGRAULIS ENCRASICOLUS	7	45	
GADUS MORHUA	40	688	500
GASTEROSTEUS ACULEATUS	31	1.630	
HYPEROPLUS LANCEOLATUS	4	4	
MERLANGIUS MERLANGUS	9	442	
PLATICHTHYS FLESUS	11	21	
PUNGITIUS PUNGITIUS	1	1	
SCOMBER SCOMBRUS	4	21	
SPRATTUS SPRATTUS	58	14.511	654

Overall 11 fish species were recorded in 58 pelagic trawl hauls. The CPUE ranged from 2 to 2224 kg/0.5h. The mean catch reached with 398 kg/0.5h, which represents medium catch level related to the preceding years of the time series.

As in the previous years, the CPUE were significantly higher in SD 25 compared to the other areas (Fig 3).

The catch composition was dominated by sprat. Herring was also caught regularly in the trawl catches. Cod was present in 69 % of the hauls. Overall the numbers and biomass of species other than herring, sprat and cod was negligible.

Most cod was caught in SD 25 and SD 26 but a few cod were even recorded in the most northern part of the investigated area. Whiting in SD 24 occurred in noticeable numbers.

The length distributions of herring and sprat per Subdivision compared to previous year and the length distributions of sprat of the total time series (1999-2015) are presented in Figure 4 and 5. The contribution of the new incoming year-class of sprat (<10 cm) is very high especially in SD 27, 28 and 29 indicating a strong year class 2014. The results of the length distributions of herring in Subdivisions 25 and 28 also indicate a strong incoming year class 2014 (Fig.4).

The echo distribution along the hydroacoustic track is shown in Figure 6. The mean NASC values in investigated part of the index area significantly exceeding previous years and the long-time average.

Very high NASC values were found especially in the eastern Bornholm basin, and in the investigated parts of SD 27 and 29. As in other years the NASC were slightly lower in SD 24 than in the other Subdivisions.

At spring survey time sprat in the Baltic basins are usually concentrated below the halocline. This distribution pattern could again be recorded in the Bornholm basin in 2015. In the Gotland basin sprat schools were distributed in the whole water column between 10 and 80 m water depth (Fig.7).

The seawater temperature in the surface layer ranged at about 7 ºC (Fig. 8). The intermediate water layer about the halocline (old winter water) was characterized by exceptionally high temperatures (4-5 ºC). Normally the temperature of this layer varies between 2 and 4 °C. Water layers with temperature < 3.5 ° C can prevent the migration of sprat in upper water layer. The absence of this layer in 2014 and 2015 could explain abnormal vertical distribution pattern of sprat in some parts of the investigated area. The final analysis of hydroacoustic data will be accomplished by end of 2015.

Relating to previous year's the oxygen content in the deep water of the Bornholm basin and eastern Gotland basin has increased significantly resulting from major inflows events in 2014. Aerobic conditions were recorded in the bottom layer in the whole area of the Bornholm basin and Stolpe Channel as well as in the eastern Gotland basin at water depth of about 120 m (Fig. 8 and 9).

9 Cruise Participants

Master: H.- O. Janßen

Scientific staff participating:

	Name	Institute	Function
1	Dr. U. Böttcher	TI-OF, Rostock	Hydrography, Cruise leader
2	M. Koth	TI-OF, Rostock	Fishery biology
3	B. Preuß	TI-OF, Rostock	Fishery biology
4	D. Stephan	TI-OF, Rostock	Fishery biology
5	E. Bethke	TI-SF, Hamburg	Hydroacoustics (01.-03.05.)
6	T. Kirchner	TI-OF, Rostock	Student assistant
7	M. Drenckow	TI-SF, Hamburg	Hydroacoustics
8	J. Friedl	TI-OF, Rostock	Student assistant

Dr. Uwe Böttcher
(Scientist in charge)

10 Figures and Tables

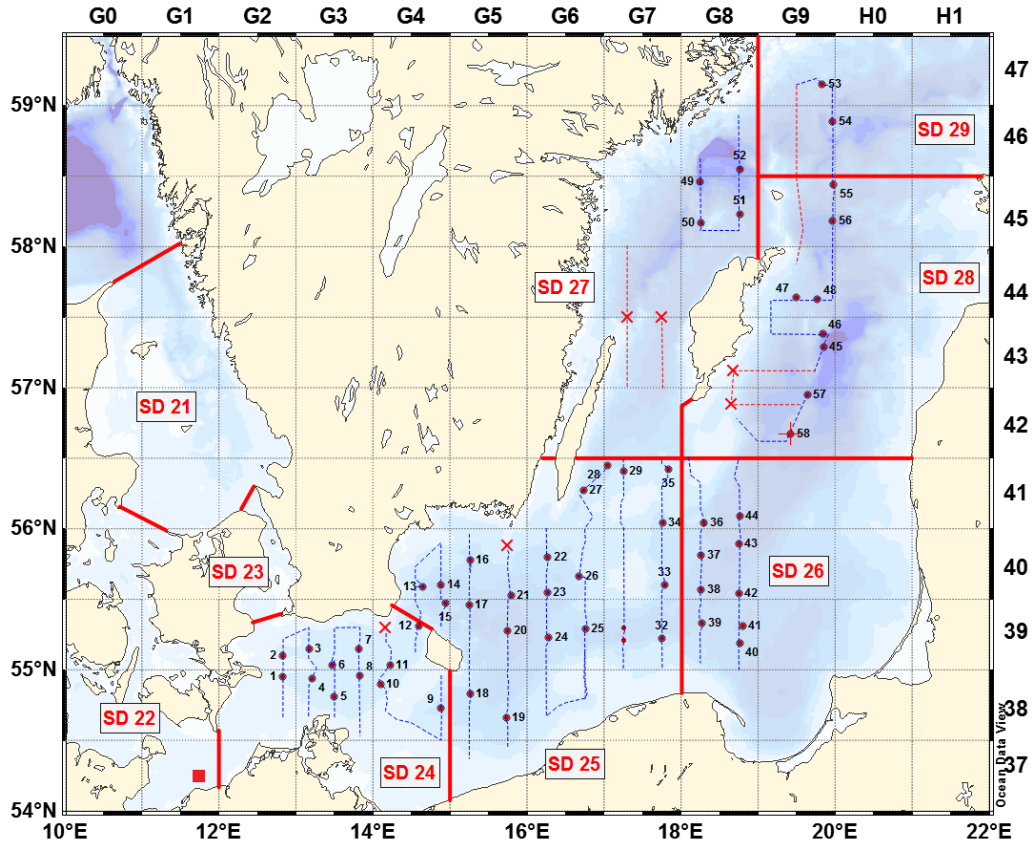

Figure 1: FRV “W. Herwig” cruise 384/2015. Cruisetrack (blue), fishery hauls (dots) and position of the calibration (red square). Applied but not approved CTD stations (X) and cruisetrack (red) in the Swedish waters. ICES statistical rectangles are indicated in the top and right axis. Thick red lines separate ICES subdivisions (SD).

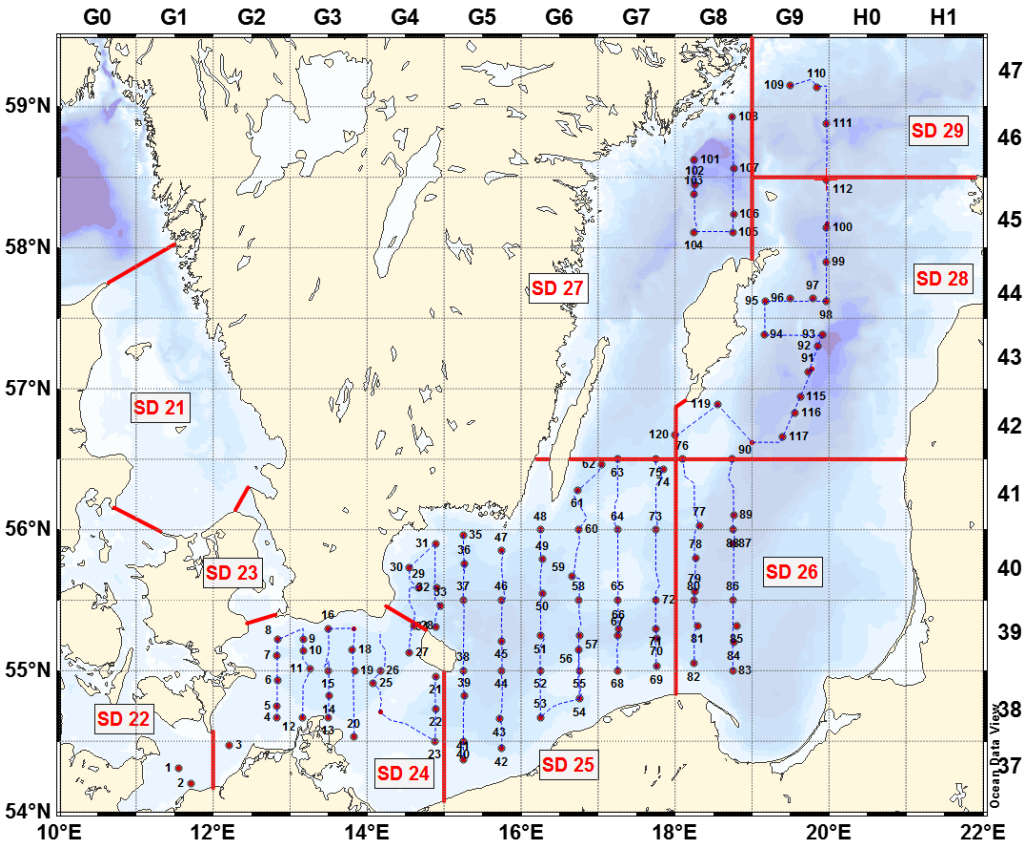

Figure 2: FRV “W. Herwig” cruise 384/2015. Cruisetrack (blue) and CTD-stations (dots). ICES statistical rectangles are indicated in the top and right axis. Thick red lines separate ICES subdivisions (SD).

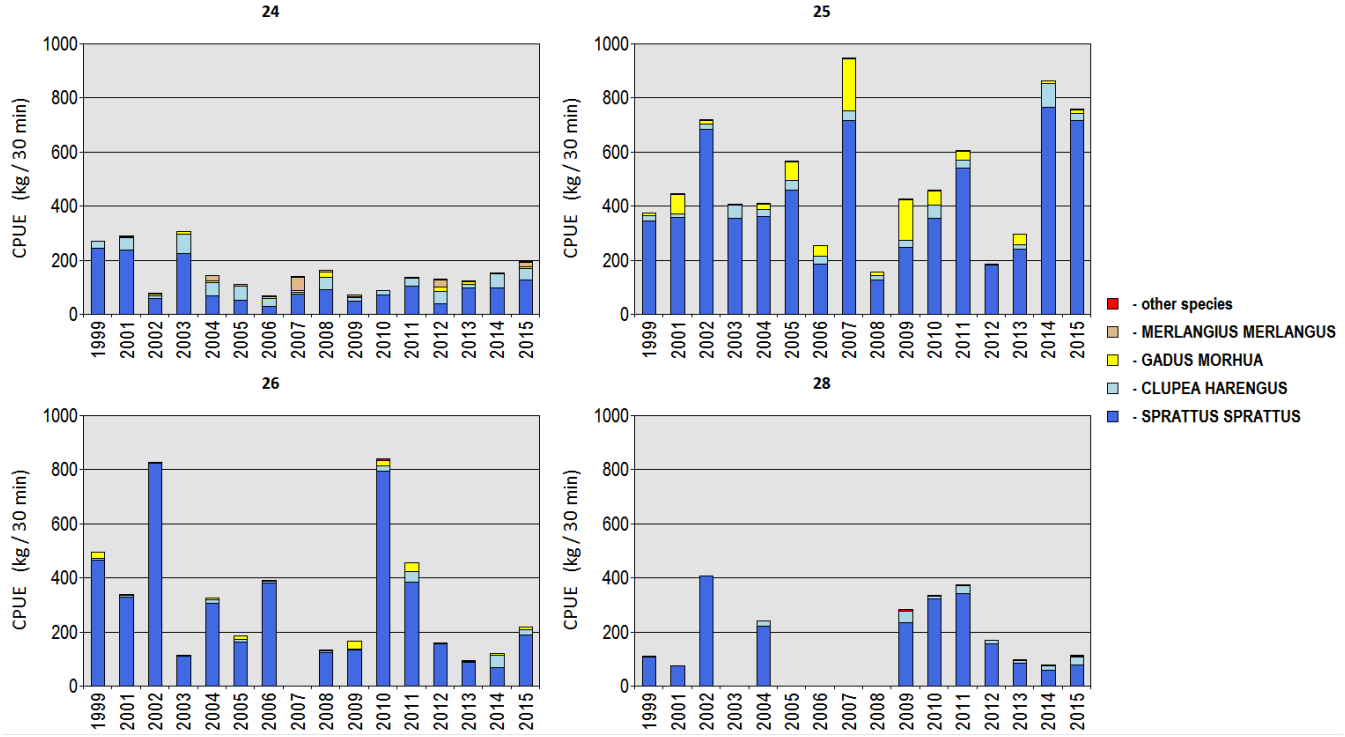

Figure 3: FRV "W. Herwig" cruise 384/2015. CPUE (kg/0,5 hour) compared to previous years (1999-2014).

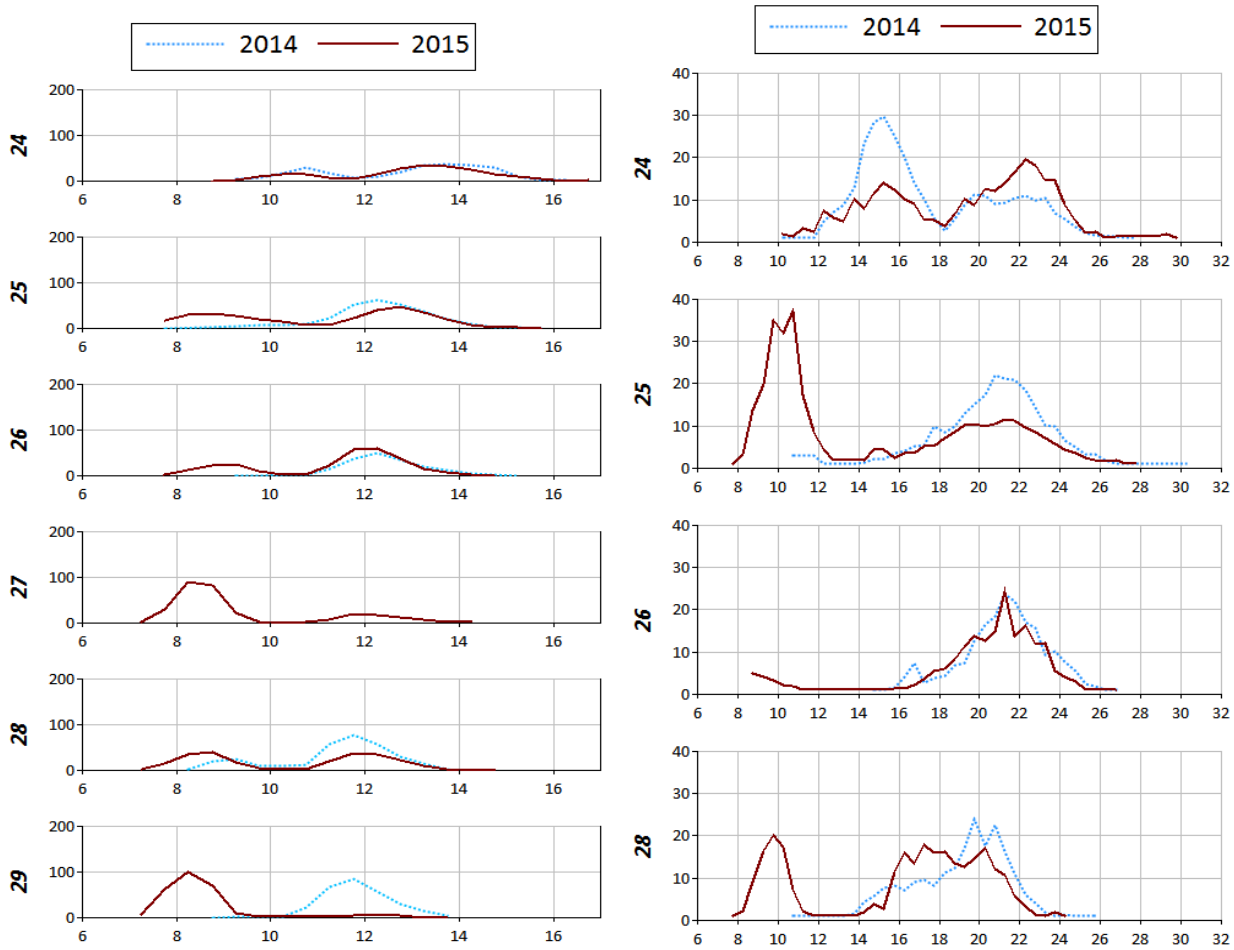

Figure 4: FRV "W. Herwig" cruise 384/2015. Sprat (left) and herring (right) length-frequency distribution (in numbers) compared to previous year (374/2014).

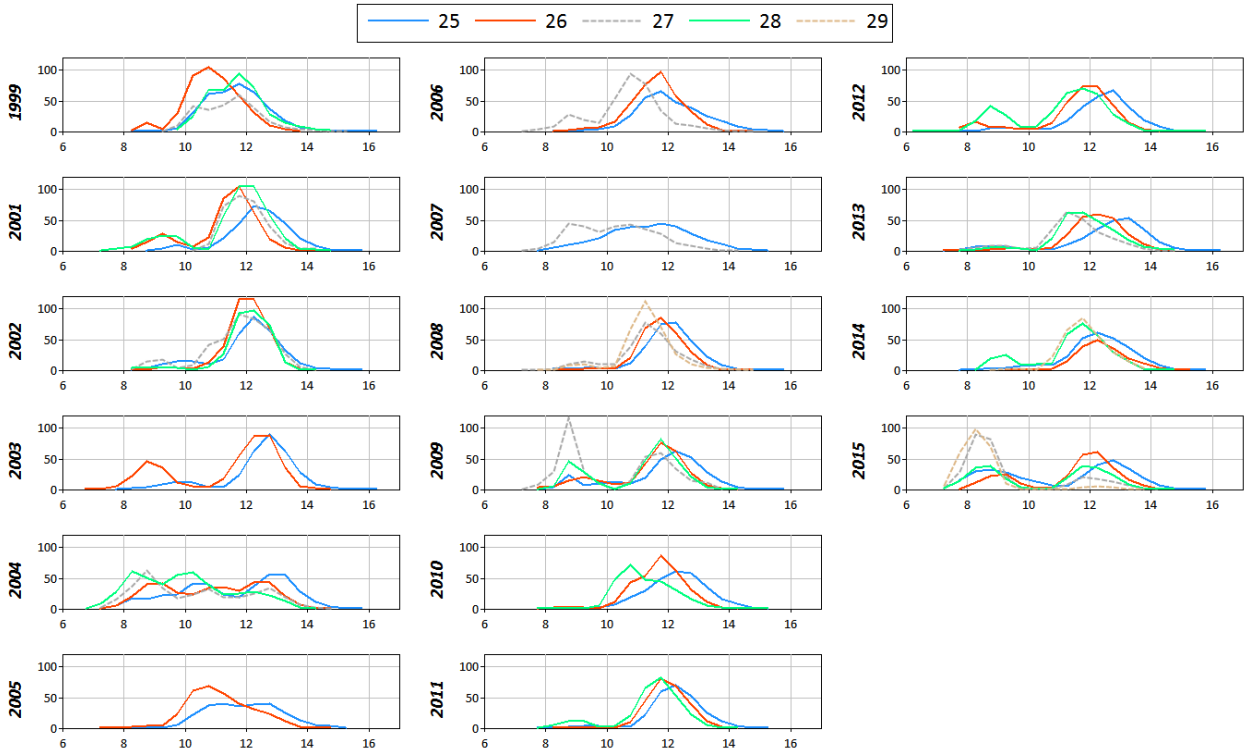

Figure 5: FRV "W. Herwig" cruise 384/2015. Sprat length distribution (in numbers) in Subdivisions 25, 26 and 28 compared to previous years (1999-2014).

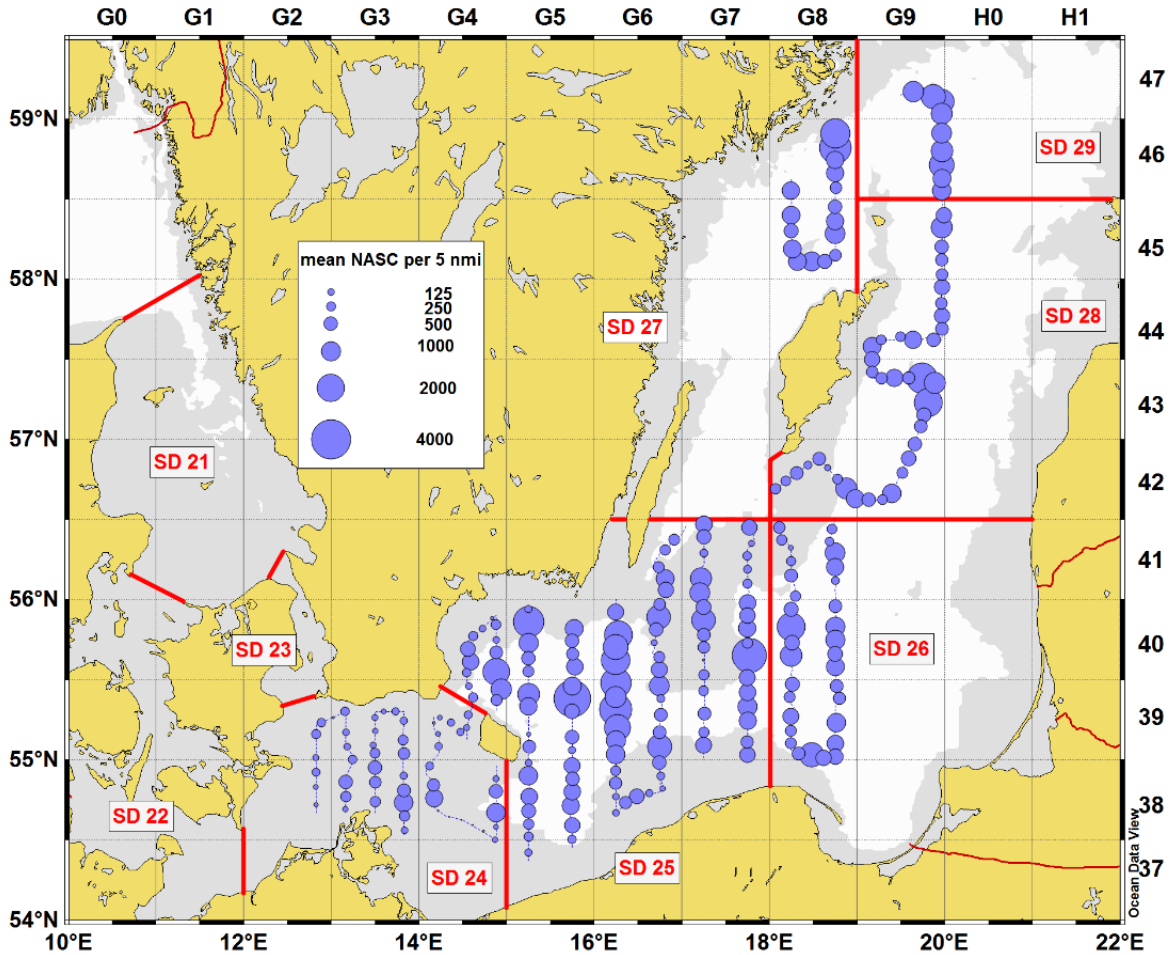

Figure 6: FRV "W. Herwig" cruise 384/2015. Cruisetrack (lines) and mean NASC (5nm intervals, dots). ICES statistical rectangles are indicated in the top and right axis. Thick dashed lines separate ICES subdivisions (SD).

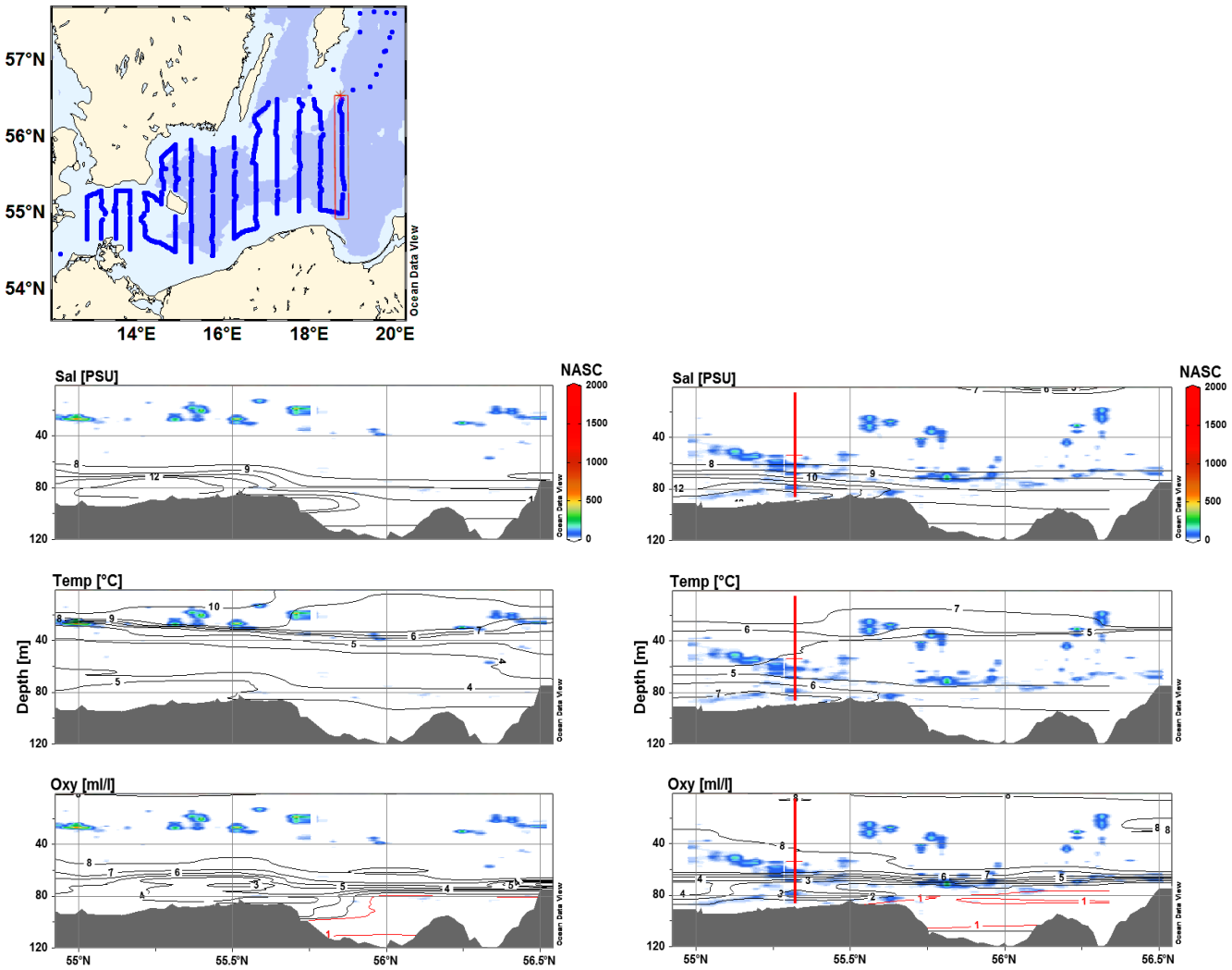

Figure 7: FRV “W. Herwig” cruise 384/2015. Vertical distribution of salinity, temperature and oxygen related to the echogram of fish (blue clouds) on a south to north transect along the southern Gotland sea (right) compared to previous year (left, 374/2014).

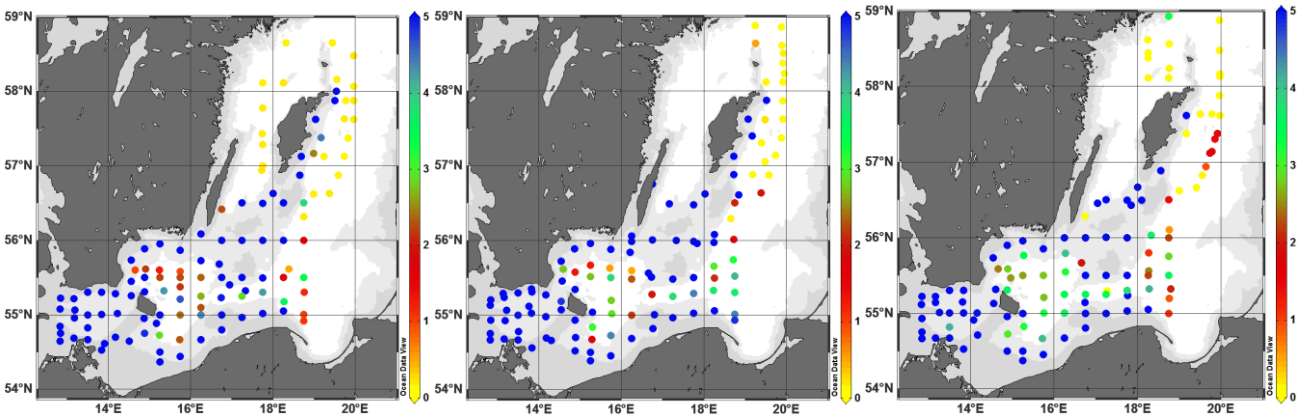

Figure 8: FRV “W. Herwig” cruise 384/2015. Oxygen content in the bottom-near water on the CTD-stations (right) compared to previous two years (left: SB672/2013; middle: 374/2014).

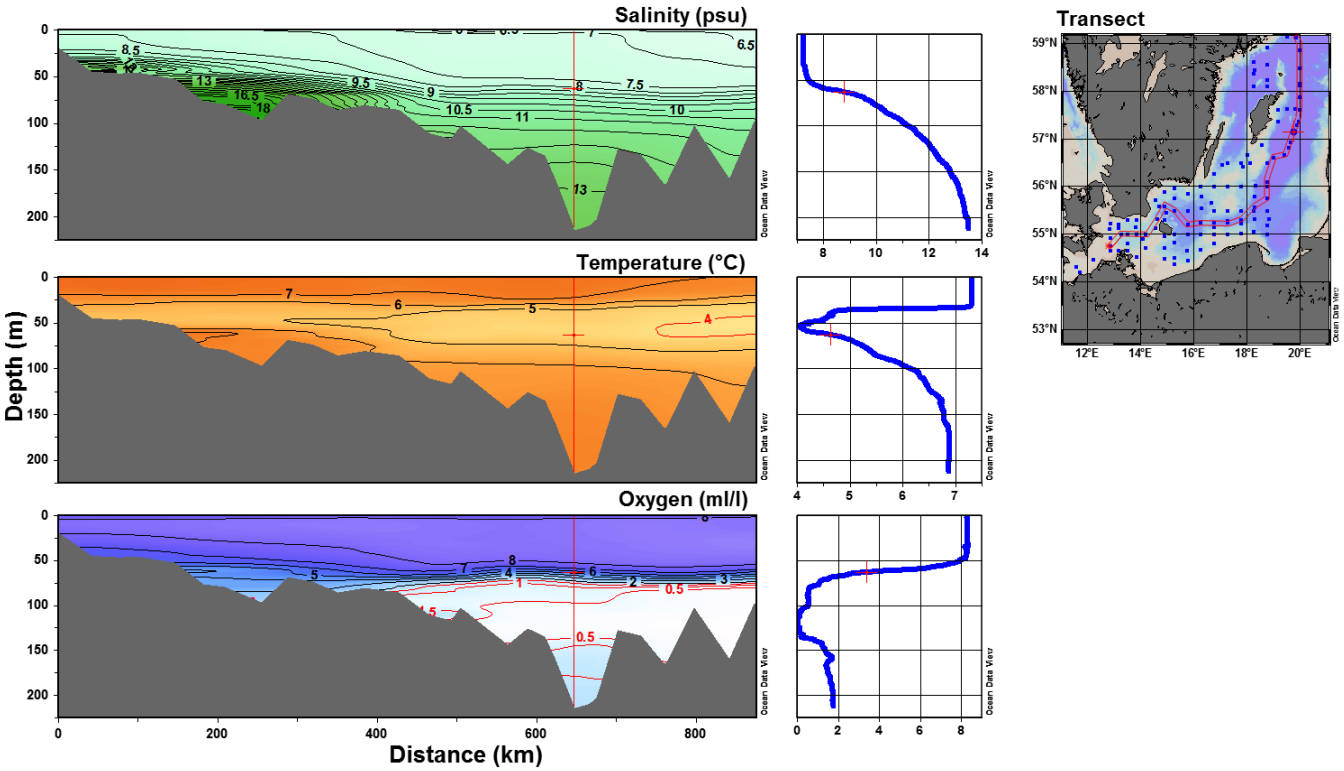

Figure 9: FRV “W. Herwig” cruise 384/2015. Vertical distribution of the hydrographical parameters salinity, temperature and oxygen on a transect along the Arcona basin to the north (chosen transect is shown at the top right). The line plots (right) show the corresponding parameters of a station in the eastern Gotland deep.

Table 1: FRV “W. Herwig” cruise 384/2015. Catch composition (kg/0.5 h) by haul.

station	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
ICES-subdivision	24	24	24	24	24	24	24	24	24	24	24	24	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
rectangle	38G2	39G2	39G3	38G3	38G3	39G3	39G3	38G3	38G4	38G4	39G4	39G4	40G4	40G4	39G4	40G5	39G5	38G5	38G5	39G5	40G5	40G6	40G6	39G6	39G6	40G6	41G6	41G7	41G7
trawl-typ	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205
# cod-end	10	10	10	10	10	10	10	10	10	10	10	10	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
trawl-time	30	30	31	30	30	46	40	30	30	40	30	30	30	30	30	30	20	30	30	20	30	30	20	15	30	30	30	30	30
bottom-depth	30	31	37	46.5	44	45	44.5	47	57	40	47	53.5	69	77.5	74.5	54.5	85.5	68.5	61	95	81.5	58	74	72.5	74.5	56	58	62	50
mean-headlineDepth	10	9.5	14	25	22.5	24.5	22	28.5	43	20	26	35.5	48.5	62.5	53	38.5	68	51.5	44	73	61.5	41	55	54.5	49.5	38	31	43.5	32
trawl-distance	1.87	1.90	1.91	1.84	1.77	2.56	2.25	1.70	1.90	2.51	1.69	1.95	1.82	1.68	1.81	1.81	1.19	1.80	1.83	1.14	1.57	1.67	1.23	0.91	1.72	1.72	1.83	1.72	1.85
CLUPEA HARENGUS	18.77	7.28	2.11	45.42	10.76	11.20	23.19	24.70	68.50	12.78	89.50	203.55	42.88	19.75	20.68	66.48	27.38	56.79	25.51	10.02	13.91	50.89	13.31	9.45	23.01	58.70	5.25	17.89	35.70
CYCLOPTERUS LUMPUS		0.22		0.35		0.55	0.26	0.27			0.58	1.39							0.27					0.99					
ENGRAULIS ENCRASICOLUS													0.27				0.05	0.71			0.29		0.44	1.08		0.10			
GADUS MORHUA				6.42		0.50	2.06	19.79	9.77	0.18	3.40	1.94	0.69	1.38	1.27	6.06		18.75	35.49	2.13			0.68	0.78	11.40	0.46			
GASTEROSTEUS ACULEATUS													1.11	0.35		0.26						0.56					7.25	2.47	2.30
HYPEROPLUS LANCEOLATUS					0.04			0.02																			0.04		
MERLANGIUS MERLANGUS				40.84	0.29	1.64	53.14	24.90	1.21		0.29							3.35	1.19										
PLATICHTHYS FLESUS								0.13				0.48																	
PUNGITIUS PUNGITIUS																											0.00		
SCOMBER SCOMBRUS																		7.50	4.96				0.49	2.33					
SPRATTUS SPRATTUS	2.93	0.48	0.02	11.30	218.81	30.34	17.30	183.32	808.15	92.89	108.35	55.62	563.31	387.18	1 538.53	708.55	1 149.57	620.64	507.75	1 452.75	765.69	374.46	2 208.63	2 215.86	441.59	697.93	102.12	257.05	282.11
total	21.70	7.98	2.13	104.33	229.89	44.23	95.95	253.13	887.63	105.85	202.11	262.98	608.24	408.65	1 560.47	781.36	1 177.00	707.75	575.17	1 464.90	779.89	425.91	2 223.54	2 230.49	476.00	757.18	114.66	277.41	320.11

station	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	49	50	51	52	45	46	47	48	55	56	57	58	53	54
ICES-subdivision	25	25	25	25	25	25	26	26	26	26	26	26	26	26	26	27	27	27	27	28	28	28	28	28	28	28	28	29	29
rectangle	39G7	39G7	39G7	40G7	41G7	41G7	41G8	40G8	40G8	39G8	39G8	39G8	40G8	40G8	41G8	45G8	45G8	45G8	46G8	43G9	43G9	44G9	44G9	45G9	45G9	42G9	42G9	47G9	46G9
trawl-typ	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205	PSN205
# cod-end	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
trawl-time	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
bottom-depth	75	88.5	57.5	60	61.5	52	70.5	79	87.5	80.5	92.5	91	85.5	112.5	111.5	169.5	105.5	106	197	215.5	200	91.5	117	100.5	171.5	170	128	82	154
mean-headlineDepth	51	68	33	37	38	33.5	49.5	40.5	62	49	65.5	48.5	61.5	61.5	68	54.5	57.5	60	58.5	64.5	22.5	57.5	15.5	67	62.5	63	64.5	49	62.5
trawl-distance	1.65	1.68	1.78	1.91	1.77	1.95	1.81	1.87	1.81	1.86	1.77	1.79	1.76	1.75	1.69	1.75	1.78	0.70	1.74	1.67	1.90	1.71	1.90	1.79	1.81	1.83	1.83	1.83	1.80
CLUPEA HARENGUS	10.97	34.65	25.14	1.85	18.89	14.97	69.66	0.53	11.80	29.95	1.36		11.50	4.30	29.06	17.01	113.57	76.13	46.21	33.84	2.02	55.60	0.06	72.06	22.52	43.28	7.45	59.57	58.48
CYCLOPTERUS LUMPUS																													
ENGRAULIS ENCRASICOLUS																													
GADUS MORHUA	48.07	10.53				0.80	0.23		1.18	0.54	36.30	1.65	19.12	6.60	2.38		0.34	1.12	0.47	9.54		1.69		0.20	0.20	4.04	3.72	0.01	
GASTEROSTEUS ACULEATUS	0.02		0.01		0.11	0.05	0.06	0.08		0.01			0.01	0.19	0.16	0.83	0.24	0.50	0.42	0.37	1.10	0.85	10.70	1.26	0.31	0.36	0.07	0.93	0.59
HYPEROPLUS LANCEOLATUS																							0.01						
MERLANGIUS MERLANGUS																													
PLATICHTHYS FLESUS											0.27	0.27			0.33			0.30		0.39		0.11		0.31		0.27	0.43		
PUNGITIUS PUNGITIUS																													
SCOMBER SCOMBRUS																													
SPRATTUS SPRATTUS	170.10	226.52	496.56	943.86	247.53	155.60	118.43	279.61	60.66	185.40	25.36	398.42	117.18	292.32	235.01	23.61	147.08	34.78	31.61	77.14	185.60	35.48	9.82	108.97	27.44	25.61	157.39	53.97	71.63
total	229.16	271.70	521.70	945.71	266.54	171.43	188.39	280.21	73.64	215.90	63.29	400.33	147.80	303.41	266.94	41.46	261.22	112.83	78.71	121.28	188.71	93.73	20.59	182.80	50.46	73.55	169.05	114.48	130.70