

Thünen-Institute of Baltic Sea Fisheries

Cruise report FRV Clupea, Cruise 303 27.06. to 14.07.2016

Ichthyoplankton and fish in the central Baltic

Person in charge: Dr. Daniel Oesterwind

Cruise leaders: Dr. Paul Kotterba (part 1), Thomas Høgh (part 2)

Background

The objective of the first leg of the cruise was to observe the abundance and distribution of fish species in the Bornholm Sea. In detail we focused on the abundance, vertical and horizontal distribution and feeding ecology of herring, sprat and especially cod. In parallel data about hydrography were recorded.

The objective of the second cruise leg was to determine the density and abundance of phytoplankton, zooplankton, ichthyoplankton and gelatinous plankton in the Bornholm Sea in order to analyse their dependence on local hydrographic features in the area, including seawater salinity, temperature and oxygen saturation. The study was the fourth cruise of FFS Clupea following this specific design, which was set up to fundamentally increase the knowledge on growth condition of early life stages of cod and of other important fish species in the central Baltic Sea and is since 2014 a part of the BONUS financed Bio-C³ Project.

Part 1

Cruise schedule and preliminary results

The days between the 27th and 30th of June 2016 were used to prepare the ship for the cruise to the Bornholm Basin. The preparation included the removal of the equipment of the previous cruise (#

302; RHLS 2016) and the installation and storage of the equipment needed on both parts of cruise # 303 (hydro acoustic part in the first week and ichthyoplankton part in the second week).

In the morning of Friday, 1st of July, Clupea was shifted to the deep water port of Rostock to perform a calibration of the hydro acoustic system of the ship. The calibration was successfully finished at the early afternoon and the vessel returned to its regular moorage at the port of Rostock-Marienehe.

On Monday, 4th of July, final preparations of the equipment were finished in the morning and the vessel departed from the harbour in Rostock-Marienehe at approximately 07:30 a.m. (UTC), heading towards the Bornholm Basin.

The original plan to start the investigation at the most-eastern hydro acoustic transect was skipped in the light of the weather forecast predicting increasing wind speeds during the following days. Instead, the longest of the three transects at the western edge of the Basin (Transect 01) was completed on the first day (Tuesday, 5th of July, starting at 04:00 a.m. (UTC)) since stable weather conditions were strongly required to accomplish this long transect (approximately 80 nautical miles) during one single working day. In total, 4 reference fishery hauls and 11 hydrographic measurements were performed during the first day. Fish catches per haul are given in table 1. A subsample of each species per haul was measured recording individual total lengths and weights. Furthermore, cod was examined in more detail, including measurements on maturity, gonad weight, liver weight, stomach contents and gutted weights. From these individuals otolith samples were taken for age determination (see table 1 for individual numbers analysed).

After accomplishing the first transects in the evening, Clupea moved on to the most-eastern and shortest of three transects (transect 03). The hydro acoustic transect was started on 05:00 a.m. (UTC) and accomplished on the early afternoon. Due to increasing wind speeds gaining storm characteristics in the course of the day, only two reference fishing hauls (and 7 ctd measurements) were possible on this day. Nevertheless, the catches were analysed in the same standardised way as on the previous day (table 1). The planned subsequent 24hrs-investigation of vertical fish migration had to be cancelled in the evening when the wind force exceeded 8 Bft making reliable hydrographic measurements and reference fishing hauls impossible. Clupea was shifted into sheltered water in the proximity of Bornholm in order to wait for the storm to pass by.

Weather conditions remained stormy during the whole following day (7th of July) but in the late evening Clupea was able to leave the sheltered area heading towards the beginning of the last remaining transect (transect 02) crossing the centre of the Bornholm Basin. On July 8th, investigations were started at 04:00 a.m. (UTC) at the northern tip of the transect and they were finished at the afternoon this day after having conducted a total of 8 ctd measurements and 3 reference fishing hauls. See table 1 for further details on catch composition and samples taken.

Having finished the work on transect 02, Clupea headed back to the port of Sassnitz, Rügen. During the return to Germany, the vessel was already prepared for the next cruise part in the following week. The vessel arrived at Sassnitz port on Saturday, 9th of July 2016.

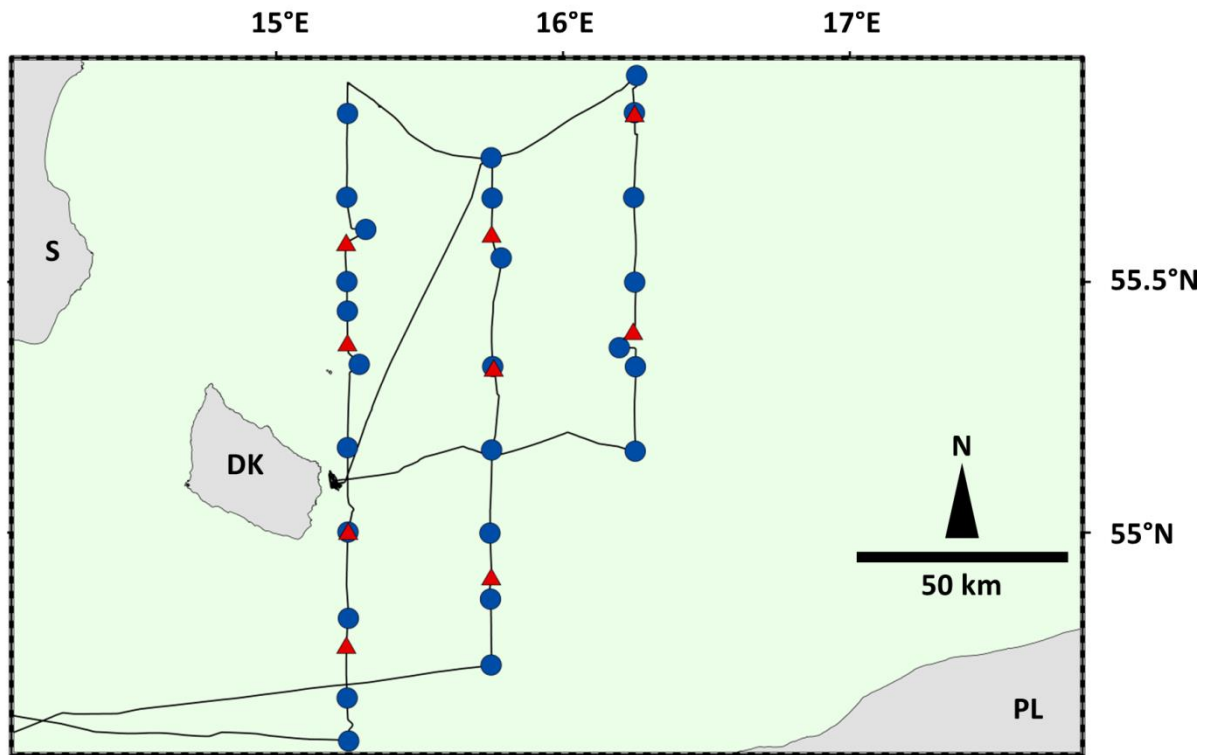
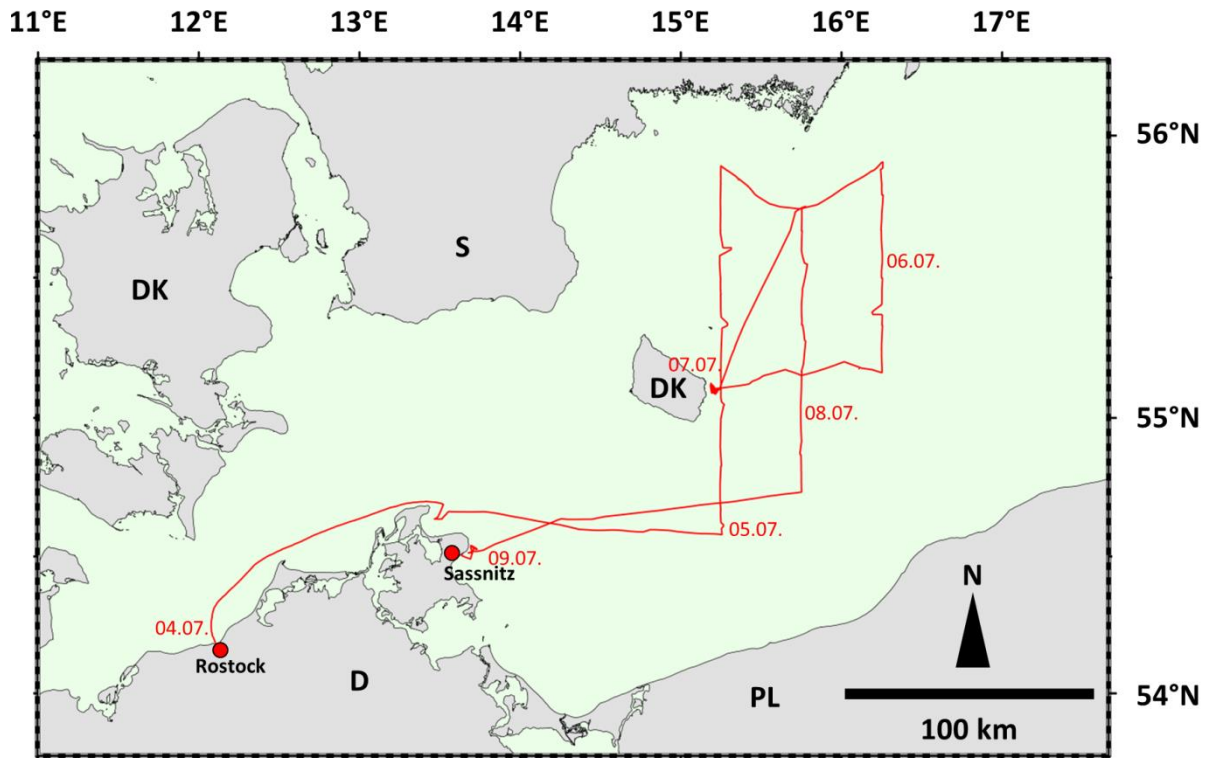


Figure 1. Cruise track of part I of the 303rd cruise of FRV Clupea. Upper panel: overview of the Southern Baltic sea including the study area and the cruise track of the entire first part of the cruise. Lower panel: Detailed map of the study area Bornholm Basin including the cruise track, ctd stations (blue circles) and fishery stations (red triangles).

Table 1: Catch composition of reference fishing hauls during the hydro acoustic survey. Note: distinct hauls are distinguished by a running number for each transect.

date	transect #	transect haul #	species	scientific name	total catch [kg]	total catch [n]
05.07.2016	01	1	Herring	Clupea harengus	36,29	479
05.07.2016	01	1	Sprat	Sprattus sprattus	32,71	2751
05.07.2016	01	1	Cod	Gadus morhua	44,40	101
05.07.2016	01	1	Whiting	Merlangius merlangus	0,99	4
05.07.2016	01	2	Herring	Clupea harengus	745,43	20031
05.07.2016	01	2	Sprat	Sprattus sprattus	105,28	12224
05.07.2016	01	3	Herring	Clupea harengus	12,12	252
05.07.2016	01	3	Sprat	Sprattus sprattus	67,78	5678
05.07.2016	01	3	Cod	Gadus morhua	0,61	1
05.07.2016	01	3	Scholle	Pleuronectes platessa	0,11	1
05.07.2016	01	3	Rockling	Enchelyopus cimbrius	0,03	1
05.07.2016	01	4	Herring	Clupea harengus	86,76	2712
05.07.2016	01	4	Sprat	Sprattus sprattus	15,29	1163
05.07.2016	01	4	Cod	Gadus morhua	45,80	169
06.07.2016	03	1	Herring	Clupea harengus	100,36	13905
06.07.2016	03	1	Sprat	Sprattus sprattus	191,60	26546
06.07.2016	03	1	Stickleback	Gasterosteus aculeatus	0,04	27
06.07.2016	03	2	Herring	Clupea harengus	16,32	286
06.07.2016	03	2	Sprat	Sprattus sprattus	135,18	11218
06.07.2016	03	2	Cod	Gadus morhua	4,50	13
06.07.2016	03	2	Lumpsucker	Cyclopterus lumpus	0,06	2
08.07.2016	02	1	Herring	Clupea harengus	8,88	316
08.07.2016	02	1	Sprat	Sprattus sprattus	14	1103
08.07.2016	02	1	Cod	Gadus morhua	14	34
08.07.2016	02	1	Stickleback	Gasterosteus aculeatus	0	5
08.07.2016	02	2	Herring	Clupea harengus	9,6	348
08.07.2016	02	2	Sprat	Sprattus sprattus	20,5	1512
08.07.2016	02	2	Cod	Gadus morhua	37,4	120
08.07.2016	02	2	Lumpsucker	Cyclopterus lumpus	0,004	1
08.07.2016	02	3	Herring	Clupea harengus	1,27	24
08.07.2016	02	3	Cod	Gadus morhua	382,73	1184

Part 2

Cruise schedule and preliminary results

The second part started in the morning of the 11th of July in Sassnitz harbor. FRV Clupea steamed directly to the Bornholm Basin and reached the south western stations within the research area around 15:00 in the afternoon and sampling begun immediately. During the next day's all samples were taken by running two shifts and included a CTD- and bongo-station except station BB23 were additionally three WP2, three *Apstein* and several water samples were taken for the IOW in Rostock. Due to friendly weather condition a continuous sampling was possible and last samples were performed on the afternoon of the 13th of July. The research area was left in the northern parts and an additional station (TF0113) in the Arkona Basin was fulfilled for the IOW in Rostock. The survey ended in Rostock Marienehe in the morning of the 14th of July and the equipment was removed from the vessel.

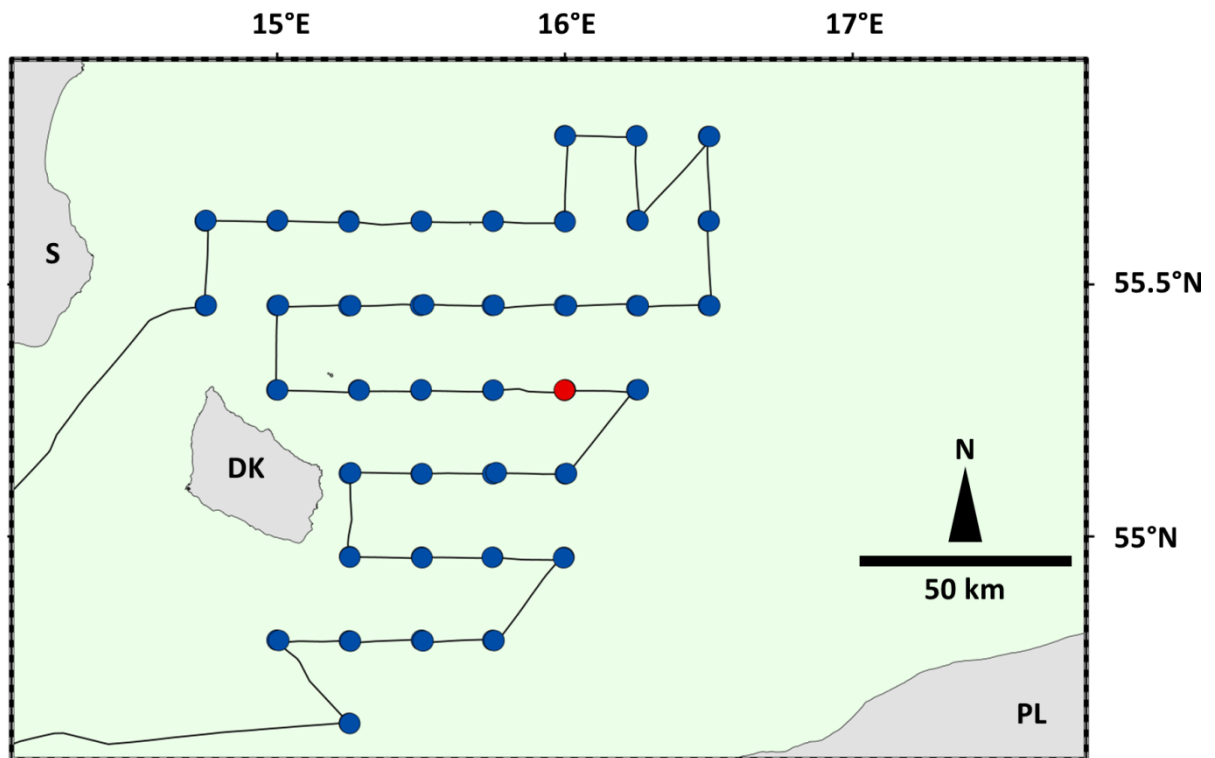
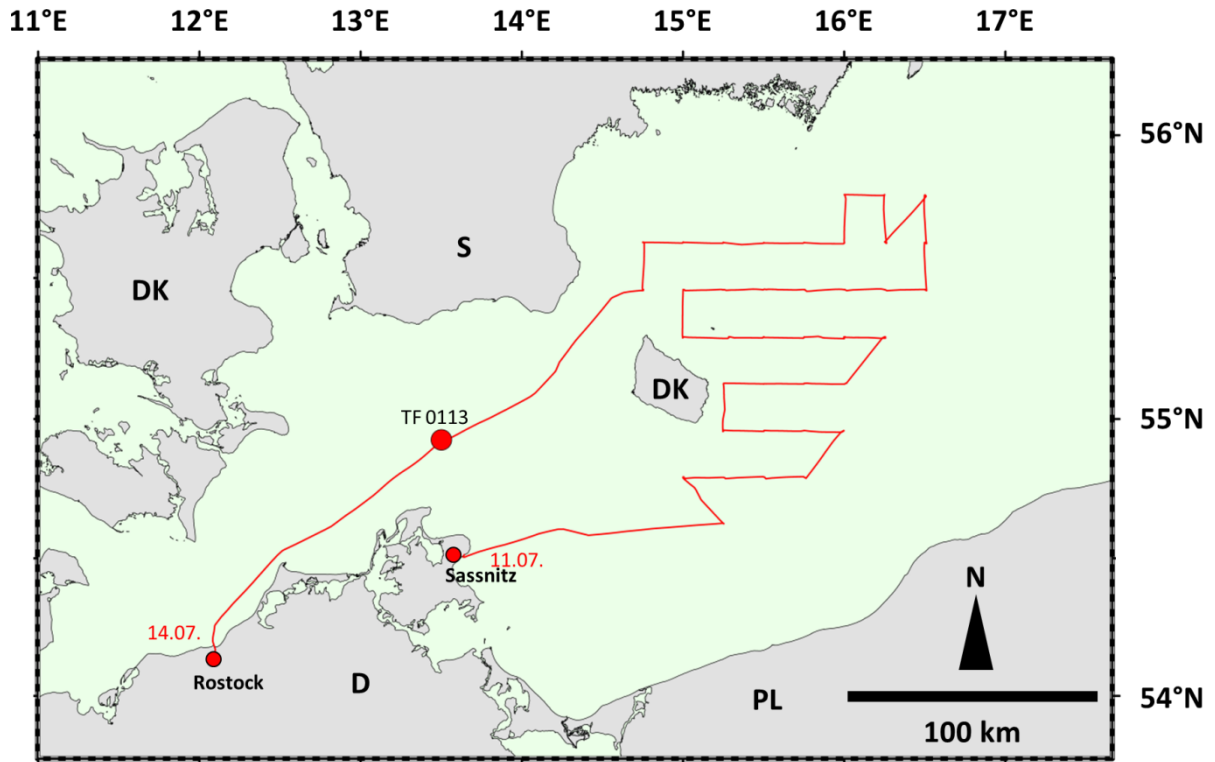


Figure 2. Cruise track of part II of the 303rd cruise of FRV Clupea. Upper panel: overview of the Southern Baltic sea including the study area and the cruise track of the entire second part of the cruise. The red dot in the Arkona sea indicates a station of additional sampling (vertical plankton net hauls). Lower panel: Detailed map of the study area Bornholm Basin including the cruise track, bongo + ctd stations (blue circles). Red dot indicates station with additional samplings (vertical plankton net hauls).

Cruise participants

1. leg	Dr. Paul Kotterba Robert Herrmann	Post-doc MSc. Student	(TI-OF) (TI-OF)
2. leg	Thomas Høgh Farivar Azour	Technician Technician	(TI-OF) (DTU-Aqua)

I hereby thank all participants, the captain and the crew of FRV Clupea for their cooperation and support.

Some of the survey results from the former years were included in the following publication and BONUS Bio-C³ Task Report:

Köster, F.W., Huwer, B., Hinrichsen, H.-H., Neumann, V., Makarchouk, A., Eero, M., von Dewitz, B., Hüsey, K., Tomkiewicz, J., Margonski, P., Temming, A., Hermann, J.P., **Oesterwind, D.**, Kotterba, P., Plikshs, M., (2016). Eastern Baltic cod recruitment revisited – dynamics and impacting factors. ICES Journal of Marine Science, doi:10.1093/icesjms/fsw172

Winder, M., Berghoff, L., Burian, A., Clemmesen, C., Dutz, J., Fey, D., Golz, A., Huwer, B., Margonski, P., Middelboe, A. L., Neuenfeldt, S., Nielsen, J., Oesterwind, D., Kock Rasmussen, E., Siebert, V., Skov, H., Szymanek, L., Temming, A., Tomkiewicz, J., Uhrenholdt, T. and Zydalis, R. (2016) Report on effects of changing drivers on pelagic and benthic species composition and production . BIO-C3 Deliverable, D2.1 . EU Bonusproject BIO-C3, 20 pp. DOI 10.3289/BIO-C3_D2.1.

Rostock, 19.01.2017

Dr. Daniel Oesterwind
(Scientist in charge)

Appendix 1. Cruise stations

Cruise Number	Station	Station/year	Device	Date	Time	latitute	longitude
303	1	1693	CTD SBE19+	05.07.16	04:06:23	54°34,759N	015°15,185E
303	2	1694	CTD SBE19+	05.07.16	04:55:39	54°39,992N	015°14,868E
303	3	1695	OTM Krake	05.07.16	05:55:48	54°47,235N	015°14,768E
303	4	1696	CTD SBE19+	05.07.16	06:51:57	54°49,646N	015°15,123E
303	5	1697	CTD SBE19+	05.07.16	08:04:30	55°00,058N	015°15,036E
303	6	1698	OTM Krake	05.07.16	08:20:46	55°00,793N	015°15,291E
303	7	1699	CTD SBE19+	05.07.16	09:59:22	55°10,200N	015°14,927E
303	8	1700	CTD SBE19+	05.07.16	11:12:15	55°20,170N	015°17,393E
303	9	1701	OTM Krake	05.07.16	11:53:39	55°23,908N	015°14,902E
303	10	1702	CTD SBE19+	05.07.16	12:54:52	55°26,496N	015°14,939E
303	11	1703	CTD SBE19+	05.07.16	13:24:38	55°30,035N	015°14,802E
303	12	1704	OTM Krake	05.07.16	14:13:08	55°35,047N	015°15,874E
303	13	1705	CTD SBE19+	05.07.16	15:09:56	55°36,225N	015°18,767E
303	14	1706	CTD SBE19+	05.07.16	15:53:00	55°40,035N	015°14,795E
303	15	1707	CTD SBE19+	05.07.16	17:00:13	55°49,936N	015°14,943E
303	16	1708	CTD SBE19+	06.07.16	05:05:33	55°54,417N	016°15,426E
303	17	1709	CTD SBE19+	06.07.16	05:45:51	55°50,036N	016°14,958E
303	18	1710	OTM Krake	06.07.16	06:04:26	55°49,253N	016°15,011E
303	19	1711	CTD SBE19+	06.07.16	07:53:10	55°40,019N	016°14,813E
303	20	1712	CTD SBE19+	06.07.16	09:08:53	55°29,970N	016°15,014E
303	21	1713	OTM Krake	06.07.16	10:11:45	55°23,889N	016°14,179E
303	22	1714	CTD SBE19+	06.07.16	11:12:06	55°22,164N	016°11,798E
303	23	1715	CTD SBE19+	06.07.16	11:46:08	55°19,886N	016°15,166E
303	24	1716	CTD SBE19+	06.07.16	12:54:44	55°09,776N	016°15,118E
303	25	1717	CTD SBE19+	08.07.16	04:01:33	55°44,720N	015°44,988E
303	26	1718	CTD SBE19+	08.07.16	04:46:36	55°39,948N	015°45,183E
303	27	1719	OTM Krake	08.07.16	05:30:39	55°34,895N	015°45,305E
303	28	1720	CTD SBE19+	08.07.16	06:24:41	55°32,849N	015°47,096E
303	29	1721	CTD SBE19+	08.07.16	07:53:59	55°19,909N	015°45,316E
303	30	1722	OTM Krake	08.07.16	08:11:29	55°18,976N	015°45,713E
303	31	1723	CTD SBE19+	08.07.16	09:48:47	55°09,923N	015°45,091E
303	32	1724	CTD SBE19+	08.07.16	10:58:13	54°59,927N	015°44,738E
303	33	1725	OTM Krake	08.07.16	11:44:40	54°54,026N	015°44,855E
303	34	1726	CTD SBE19+	08.07.16	12:38:39	54°51,964N	015°44,839E
303	35	1727	CTD SBE19+	08.07.16	13:38:07	54°43,985N	015°44,984E
303	36	1728	CTD SBE19+	11.07.16	12:52:46	54°37,514N	015°15,112E
303	37	1729	Bongo	11.07.16	13:02:05	54°37,519N	015°14,980E
303	38	1730	CTD SBE19+	11.07.16	14:36:37	54°47,550N	015°00,097E
303	39	1731	Bongo	11.07.16	14:46:38	54°47,395N	015°00,418E
303	40	1732	CTD SBE19+	11.07.16	15:45:33	54°47,442N	015°15,146E
303	41	1733	Bongo	11.07.16	15:53:20	54°47,361N	015°15,476E
303	42	1734	CTD SBE19+	11.07.16	16:57:20	54°47,520N	015°30,240E
303	43	1735	Bongo	11.07.16	17:08:39	54°47,342N	015°30,580E
303	44	1736	CTD SBE19+	11.07.16	18:08:16	54°47,501N	015°45,063E
303	45	1737	Bongo	11.07.16	18:18:11	54°47,384N	015°45,461E
303	46	1738	CTD SBE19+	11.07.16	19:52:55	54°57,496N	015°59,841E

Cruise Number	Station	Station/year	Device	Date	Time	latitute	longitude
303	47	1739	Bongo	11.07.16	20:03:27	54°57,355N	015°59,633E
303	48	1740	CTD SBE19+	11.07.16	21:06:06	54°57,503N	015°44,968E
303	49	1741	Bongo	11.07.16	21:17:49	54°57,462N	015°44,648E
303	50	1742	CTD SBE19+	11.07.16	22:20:01	54°57,498N	015°30,203E
303	51	1743	Bongo	11.07.16	22:30:07	54°57,391N	015°30,072E
303	52	1744	CTD SBE19+	11.07.16	23:32:17	54°57,578N	015°15,164E
303	53	1745	Bongo	11.07.16	23:39:28	54°57,471N	015°15,132E
303	54	1746	CTD SBE19+	12.07.16	00:51:37	55°07,564N	015°15,083E
303	55	1747	Bongo	12.07.16	01:00:45	55°07,618N	015°15,474E
303	56	1748	CTD SBE19+	12.07.16	01:58:39	55°07,479N	015°30,083E
303	57	1749	Bongo	12.07.16	02:08:08	55°07,519N	015°30,479E
303	58	1750	CTD SBE19+	12.07.16	03:08:38	55°07,543N	015°45,073E
303	59	1751	Bongo	12.07.16	03:23:34	55°07,626N	015°45,916E
303	60	1752	CTD SBE19+	12.07.16	04:24:51	55°07,500N	016°00,193E
303	61	1753	Bongo	12.07.16	04:34:43	55°07,613N	016°00,567E
303	62	1754	CTD SBE19+	12.07.16	06:02:59	55°17,513N	016°15,135E
303	63	1755	Bongo	12.07.16	06:11:33	55°17,384N	016°15,322E
303	64	1756	CTD SBE19+	12.07.16	07:21:37	55°17,437N	015°59,994E
303	65	1757	CTD SBE19+	12.07.16	07:30:53	55°17,476N	016°00,005E
303	66	1758	CTD SBE19+	12.07.16	07:35:59	55°17,509N	016°00,126E
303	67	1759	CTD SBE19+	12.07.16	07:41:59	55°17,467N	015°59,901E
303	68	1760	CTD SBE19+	12.07.16	07:45:36	55°17,495N	015°59,981E
303	69	1761	CTD SBE19+	12.07.16	07:48:34	55°17,514N	016°00,057E
303	70	1762	CTD SBE19+	12.07.16	07:52:00	55°17,477N	015°59,949E
303	71	1763	CTD SBE19+	12.07.16	07:53:50	55°17,485N	015°59,992E
303	72	1764	WP 2	12.07.16	07:58:06	55°17,507N	016°00,102E
303	73	1765	WP 2	12.07.16	08:06:50	55°17,498N	015°59,997E
303	74	1766	WP 2	12.07.16	08:15:19	55°17,497N	015°59,958E
303	75	1767	Apstein	12.07.16	08:23:39	55°17,485N	015°59,989E
303	76	1768	Apstein	12.07.16	08:41:46	55°17,493N	016°00,011E
303	77	1769	Apstein	12.07.16	08:57:07	55°17,494N	015°59,967E
303	78	1770	Bongo	12.07.16	09:16:23	55°17,313N	015°59,999E
303	79	1771	CTD SBE19+	12.07.16	10:30:34	55°17,471N	015°45,041E
303	80	1772	Bongo	12.07.16	10:39:27	55°17,356N	015°44,966E
303	81	1773	Bongo	12.07.16	11:44:21	55°17,497N	015°30,000E
303	82	1774	Bongo	12.07.16	11:55:12	55°17,395N	015°29,803E
303	83	1775	CTD SBE19+	12.07.16	12:53:14	55°17,473N	015°17,080E
303	84	1776	Bongo	12.07.16	13:02:40	55°17,333N	015°16,972E
303	85	1777	CTD SBE19+	12.07.16	14:13:58	55°17,489N	015°00,022E
303	86	1778	Bongo	12.07.16	14:21:04	55°17,388N	015°00,025E
303	87	1779	CTD SBE19+	12.07.16	15:33:25	55°27,531N	015°00,061E
303	88	1780	Bongo	12.07.16	15:42:26	55°27,467N	015°00,535E
303	89	1781	CTD SBE19+	12.07.16	16:44:54	55°27,492N	015°15,045E
303	90	1782	Bongo	12.07.16	16:56:14	55°27,468N	015°15,636E
303	91	1783	CTD SBE19+	12.07.16	17:55:12	55°27,563N	015°30,056E
303	92	1784	Bongo	12.07.16	18:06:10	55°27,581N	015°30,655E
303	93	1785	CTD SBE19+	12.07.16	19:03:15	55°27,534N	015°45,019E
303	94	1786	Bongo	12.07.16	19:17:01	55°27,331N	015°45,644E

Cruise Number	Station	Station/year	Device	Date	Time	latitute	longitude
303	95	1787	CTD SBE19+	12.07.16	20:14:37	55°27,531N	016°00,031E
303	96	1788	Bongo	12.07.16	20:25:40	55°27,430N	016°00,512E
303	97	1789	CTD SBE19+	12.07.16	21:24:47	55°27,498N	016°15,081E
303	98	1790	Bongo	12.07.16	21:34:55	55°27,422N	016°15,489E
303	99	1791	CTD SBE19+	12.07.16	22:32:32	55°27,527N	016°29,990E
303	100	1792	Bongo	12.07.16	22:41:24	55°27,429N	016°30,316E
303	101	1793	CTD SBE19+	12.07.16	23:55:22	55°37,483N	016°29,982E
303	102	1794	Bongo	13.07.16	00:04:15	55°37,381N	016°30,264E
303	103	1795	CTD SBE19+	13.07.16	01:18:28	55°47,459N	016°30,035E
303	104	1796	Bongo	13.07.16	01:27:13	55°47,335N	016°30,295E
303	105	1797	CTD SBE19+	13.07.16	03:02:49	55°37,574N	016°15,103E
303	106	1798	Bongo	13.07.16	03:12:12	55°37,457N	016°15,370E
303	107	1799	CTD SBE19+	13.07.16	04:24:00	55°47,537N	016°14,994E
303	108	1800	Bongo	13.07.16	04:30:03	55°47,457N	016°14,889E
303	109	1801	CTD SBE19+	13.07.16	05:29:43	55°47,531N	016°00,026E
303	110	1802	Bongo	13.07.16	05:36:10	55°47,405N	016°00,199E
303	111	1803	CTD SBE19+	13.07.16	06:44:14	55°37,437N	016°00,006E
303	112	1804	Bongo	13.07.16	06:51:12	55°37,316N	015°59,945E
303	113	1805	CTD SBE19+	13.07.16	07:51:13	55°37,486N	015°45,030E
303	114	1806	Bongo	13.07.16	07:57:52	55°37,398N	015°44,885E
303	115	1807	CTD SBE19+	13.07.16	08:58:28	55°37,460N	015°30,065E
303	116	1808	Bongo	13.07.16	09:04:29	55°37,381N	015°29,964E
303	117	1809	CTD SBE19+	13.07.16	10:07:47	55°37,512N	015°14,977E
303	118	1810	Bongo	13.07.16	10:24:22	55°37,353N	015°14,835E
303	119	1811	CTD SBE19+	13.07.16	11:24:52	55°37,549N	015°00,029E
303	120	1812	Bongo	13.07.16	11:32:06	55°37,476N	014°59,977E
303	121	1813	CTD SBE19+	13.07.16	12:35:29	55°37,530N	014°45,046E
303	122	1814	CTD SBE19+	13.07.16	12:43:29	55°37,440N	014°45,349E
303	123	1815	CTD SBE19+	13.07.16	13:56:30	55°27,501N	014°45,120E
303	124	1816	Bongo	13.07.16	14:03:34	55°27,426N	014°45,240E
303	125	1817	CTD SBE19+	13.07.16	19:59:39	54°55,509N	013°30,050E
303	126	1818	WP 2	13.07.16	20:08:29	54°55,544N	013°30,171E
303	127	1819	WP 2	13.07.16	20:14:34	54°55,563N	013°30,238E
303	128	1820	WP 2	13.07.16	20:20:02	54°55,584N	013°30,311E