# Cruise Report C-268: Historic Seaports of Western Europe

# Scientific Data Collected Aboard SSV Corwith Cramer

# Cork, Ireland - Douarnenez, France – Lisbon, Portugal – Cádiz, Spain 6 July – 4 August 2016



Sea Education Association Woods Hole, Massachusetts

Cover photo: Final picture of the C-268 crew in Cádiz, Spain (looking epic!)

This document should be cited as:

Sweeney, Edward. 2016. Final report for S.E.A. Cruise C-268. Sea Education Association, Woods Hole, MA 02543. www.sea.edu

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### Introduction:

This report provides a summary of the scientific data collected aboard the *SSV Corwith Cramer* during Cruise C-268 (July 6 – August 4, 2016) between Cork, Ireland and Cádiz, Spain. The fourweek trip was the entirety of SEA's Historic Seaports of Western Europe summer semester program. The primary goal of this program was to examine the major historical transformations in European maritime activity in the eastern North Atlantic, paying particular attention to the development of fisheries (late medieval to the present), trade (early modern to modern), and nautical technology. Three separate port stops in France, Portugal, and Spain during the fourweek cruise offered first-hand interactions with communities intricately tied to ocean resources and maritime trades both historically and today.

The voyage sailed along the coastal waters of Western Europe, combining several short cruise legs with a single longer passage. The scientific goals of this cruise were to contribute to SEA's continuing dataset specifically with hourly sea surface temperature (SST), sea surface salinity (SSS) and surface fluorescence data, current velocity data, neuston and meter net tows, and Conductivity-Temperature-Depth (CTD) profiles. The CTD was additionally equipped with a profiling Seapoint chlorophyll-*a* fluorometer to measure fluorescence data in the water column and a dissolved oxygen sensor. The students all participated fully in the collection and processing of scientific data, though they did not conduct individual research projects as part of their course requirements.

The brief summary of data contained in this report is not intended to represent final data interpretation and should not be excerpted or cited without written permission from SEA.

Ed Sweeney First Assistant Scientist, C-268

# **Data Description:**

This section provides a record of all oceanographic data collected aboard the *SSV Corwith Cramer* Cruise C-268 (U.S. State Department Cruise Number F2016-001). This cruise sailed from Cork, Ireland to Cádiz, Spain with port stops in Douarnenez, France and Lisbon, Portugal (Figure 1).



Figure 1. Hourly positions along the C-268 cruise track (July 6 – August 4, 2016).

During the four-week cruise, 19 distinct oceanographic stations were conducted (Table 1). Surface water samples were collected (surface samples) during neuston tows; 17 samples were analyzed to determine chlorophyll-*a* concentration (Table 2, Figure 2). In addition to discrete oceanographic stations, data were collected continuously using a CHIRP system to measure bottom depth and sub-bottom structure, a sea water flow-through system to measure sea surface chlorophyll-*a* fluorescence (Figure 3), temperature (Figure 4), salinity (Figure 4), colored dissolved organic matter (CDOM) and transmittance. An ADCP system was used to measure upper ocean currents (Figure 5). CTD profiles were collected at 7 sampling locations, to depths ranging from 130 to 2000 meters (see 'CTD' column of Table 1). Contoured cross-sections made from vertical temperature and salinity CTD profiles are presented in Figure 6 and water column chlorophyll-*a* fluorescence are shown in Figure 7. Data from the 17 neuston tows collected are given in Table 3. Voluminous CTD, CHIRP, ADCP and flow-through data are not fully presented here. All unpublished data can be made available by arrangement with the SEA data archivist (contact information, pg. 2).

Table 1. C-268 oceanographic sampling stations. Type of deployment marked by **X**, or by maximum wire out (in meters). NT indicates neuston tow, MN indicates meter net, CTD indicates free CTD, SS indicates surface station associated with the oceanographic station. Surface station data (water temperature, salinity and extracted chlorophyll-*a* content) are given in Table 2.

Station	Date	Local Time	UTC Time	Latitude	Longitude N		MN	CTD	SS-	General Locale	
C268-001	10-Jul-16	1042	0942	48°37.6' N	6°48.0' W	x		130	001	Celtic Shelf	
C268-002	16-Jul-16	2332	2132	48°09.1' N	5°05.9' W	х			002	French Shelf	
C268-003	17-Jul-16	1621	1421	48°28.1' N	6°44.0' W			145		French Shelf	
C268-004	17-Jul-16	2334	2134	48°04.8' N	7°00.6' W	х			003	French Shelf	
C268-005	18-Jul-16	1103	0949	47°17.7' N	7°31.7' W	х		250	004	Bay of Biscay	
C268-006	18-Jul-16	2330	2130	46°35.6' N	8°17.6' W	х			005	Bay of Biscay	
C268-007	19-Jul-16	1038	0938	46°20.4' N	8°34.7' W	х		500	006	Bay of Biscay	
C268-008	19-Jul-16	2342	2242	45°58.4' N	8°50.8' W	х			007	Bay of Biscay	
C268-009	20-Jul-16	1135	1035	45°24.4' N	9°23.0' W	x			800	Bay of Biscay	
C268-010	20-Jul-16	2332	2232	44°55.4' N	9°39.3' W	х			009	Bay of Biscay	
C268-011	21-Jul-16	1123	1023	44°50.5' N	9°31.8' W	х			010	Bay of Biscay	
C268-012	21-Jul-16	2330	2230	44°41.6' N	10°11.1' W	х			011	Bay of Biscay	
C268-013	22-Jul-16	0953	0853	43°53.3' N	10°47.1' W			1000		East Atlantic Basin	
C268-014	22-Jul-16	2330	2230	43°07.2' N	11°29.1' W	х			012	Galicia Bank	
C268-015	23-Jul-16	0949	0849	42°29.0' N	11°39.5' W	х	200	200	013	Galicia Bank	
C268-016	25-Jul-16	1147	1047	38°57.6' N	10°41.1' W	х			014	East Atlantic Basin	
C268-017	30-Jul-16	1132	1032	38°35.4' N	10°41.1' W	x			015	Outside Lisbon Harbor	
C268-018	30-Jul-16	2338	2238	37°58.9' N	10°19.4' W	х			016	East Atlantic Basin	
C268-019	31-Jul-16	0756	0656	37°25.1' N	10°13.4' W	x		2000	017	East Atlantic Basin	

Table 2. C-268 surface sampling station data. Water samples were collected through the flow-through system. The flow-through system pumps water from about 3m below the surface into the lab where it passes though instruments to measure temperature, salinity, chlorophyll- $\alpha$  fluorescence, colored dissolved organic matter and water clarity. Extracted chlorophyll- $\alpha$  samples were filtered through a 0.45µm filter and measured with a Turner Design Model 10AU fluorometer. Chlorophyll- $\alpha$  data are shown in Figure 2.

Station	Date	Local Time	UTC Time	Latitude	Longitude	Temp (°C)	Sal (PSU)	Chl- <i>a</i> (µg/l)
SS-001	10-Jul-16	1143	1043	48°38.5' N	6°47.5' W	17.1	35.423	0.164
SS-002	16-Jul-16	2334	2134	48°09.0' N	5°05.9' W	16.4	35.320	0.147
SS-003	17-Jul-16	2341	2141	48°04.5' N	7°09.7' W	18.2	35.514	0.065
SS-004	18-Jul-16	1200	1000	47°16.6' N	7°31.2' W	18.2	35.580	0.153
SS-005	18-Jul-16	2338	2238	46°35.3' N	8°17.7' W	19.1	35.590	0.076
SS-006	19-Jul-16	1141	1041	46°19.7' N	8°35.9' W	19.4	35.591	0.082
SS-007	19-Jul-16	2344	2244	45°58.4' N	8°50.5' W	19.7	35.610	0.070
SS-008	20-Jul-16	1140	1040	45°24.5' N	9°22.9' W	19.6	35.611	0.016
SS-009	20-Jul-16	2332	2232	44°55.3' N	9°39.2' W	19.7	35.630	0.058
SS-010	21-Jul-16	1128	1028	44°50.6' N	9°31.8' W	19.6	35.620	0.075
SS-011	21-Jul-16	2332	2232	44°41.7' N	10°10.9' W	19.6	35.567	0.054
SS-012	22-Jul-16	2332	2232	43°07.17' N	11°29.1' W	19.6	35.320	0.056
SS-013	23-Jul-16	1050	0950	42°27.6' N	11°38.6' W	19.8	35.800	0.055
SS-014	25-Jul-16	1156	1056	38°56.7' N	10°40.2' W	20.3	35.980	0.051
SS-015	30-Jul-16	1137	1037	38°35.3' n	9°26.6' W	18.0	35.590	0.517
SS-016	30-Jul-16	2340	2240	37°58.9' N	10°19.2' W	19.7	35.870	0.020
SS-017	31-Jul-16	1119	1019	37°22.4' N	10°12.0' W	19.9	35.970	0.147



Figure 2. Extracted chlorophyll-*a* concentration (measured in  $\mu$ g/L) from surface station water samples collected during the C-268 cruise track. All the data are given in Table 2.



Figure 3. Surface in-situ chlorophyll-*a* fluorescence (measured in raw voltage). Measurements recorded hourly using a Seapoint fluorometer in the flow-through seawater system during SEA Cruise C-268.



Figure 4. Surface water temperature (measured in degrees Celsius) and surface water salinity (measured in practical salinity units), as recorded hourly from a SeaBird Electronics thermosalinograph in the flow-through seawater system during SEA Cruise C-268.



Figure 5. Surface current velocity (direction and magnitude) measured with the ADCP during SEA Cruise C-268.



Figure 6. Salinity (top, right) and temperature (bottom, right) cross sections created from CTD data collected at seven stations during SEA Cruise C-268. Blue dots on chart (bottom left) indicate locations of stations included in the sections; profile locations are shown with fine vertical dotted lines in sections. Section distance (x-axes) refers to distance from start of cruise in Cork, Ireland. Data were gathered utilizing a SeaBird Electronics 19plus CTD.



Figure 7. Chlorophyll-*a* fluorometer profiles (measured in raw voltage) in cross-section collected along SEA Cruise C-268 cruise track. Blue dots on chart (left) indicate locations of stations included in the sections; profile locations are shown with fine vertical dotted lines in sections. Section distance (x-axis) refers to distance from start of cruise in Cork, Ireland.

Table 3. C-268 neuston tow (NT) data. Station date, time, locations and general locales are given in Table 1. More details about types of >2cm nekton recovered, and quantitative zooplankton 100-count data are available from SEA. Additional explanatory footnotes are given at the bottom of this table.<sup>1,2</sup>

Station	Moon Phase (%)	Risen or Set	Cloud Cover (%)	Tow Area (m²)	Zoopl Biomass (mL)	Zoopl Density (mL/m²)	Other Nekton (#)	Total Nekton (#)	Total Nekton (mL)	Plastic Pieces (#)	Surface Station
C268-001-NT	32%	set	30%	1627.0	23.0	0.0141	0	0	0.0	1	SS-001
C268-002-NT	88%	risen	0%	1370.0	88.0	0.0642	0	0	0.0	5	SS-002
C268-004-NT	93%	risen	15%	2205.8	72.0	0.0326	0	1	0.3	61	SS-003
C268-005-NT	98%	set	0%	1973.1	1.2	0.0006	1	1	0.5	9	SS-004
C268-006-NT	98%	risen	0%	1922.1	5.0	0.0026	0	1	1.0	3	SS-005
C268-007-NT	100%	set	100%	1770.6	1.9	0.0011	0	0	0.0	7	SS-006
C268-008-NT	100%	risen	100%	1101.1	4.0	0.0036	0	0	0.0	16	SS-007
C268-009-NT	100%	set	85%	1721.4	30.0	0.0174	1	1	12.0	19	SS-008
C268-010-NT	100%	risen	15%	1576.1	16.0	0.0102	0	0	0.0	8	SS-009
C268-011-NT	97%	set	80%	1896.0	6.0	0.0032	2	2	0.3	4	SS-010
C268-012-NT	97%	risen	12%	1441.9	68.0	0.0472	15	15	20.0	4	SS-011
C268-014-NT	92%	risen	10%	1699.2	4.0	0.0024	0	0	0.0	1	SS-012
C268-015-NT	86%	set	100%	1685.5	3.0	0.0018	0	0	0.0	9	SS-013
C268-016-NT	67%	set	0%	2125.7	3.0	0.0014	0	0	0.0	1	SS-014
C268-017-NT	14%	set	90%	1670.8	26.0	0.0156	0	0	0.0	0	SS-015
C268-018-NT	14%	set	85%	1835.6	76.0	0.0414	1	1	0.5	3	SS-016
C268-019-NT	7%	risen	10%	1810.3	3.2	0.0018	0	0	0.0	0	SS-017

<sup>1</sup>Tow area calculated using distance (meters) summation between successive GPS sample positions (every minute). The neuston net opening measures 1.0m (wide) by 0.5m (tall) with a  $333\mu$ m net mesh size. Zooplankton density was measured using a wet volume displacement of biomass per tow area (mL/m<sup>2</sup>).

<sup>2</sup>No spiny lobster larvae (Phyllosoma), eel larvae (Leptocephali) or water striders (Halobates) were recovered in any of the C-268 net tows. A Myctophid, a cephalopod, other nekton >2cm, and gelatinous organisms >2cm were removed from the net and measured for biomass (mL). Plastic pieces were also removed and counted from the net tows. A potential tar sample was also removed for further analysis. Further data descriptions are available from SEA (www.sea.edu).