

IMER C/5/78

RVS Ref. No. 1/78 (P16/10)

VESSEL: MV STEIGEN (NERC Charter)

CRUISE PERIOD: 15-30 August 1978

PERSONNEL:	R. Williams	PSO (Senior Scientist)
	J. Aiken	SSO
	R.J.M. Howland	SO
	Miss S. Gent	SO
	T.F. Kendall	SO
	Mrs M. Brinsley	ASO
	D. Robins	ASO
	A.J. Pomroy	ASO
	D.M. Baars	NIOZ (Netherlands)
	J. Taylor	RVS

ITINERARY:	15 August	06.00	Departed Barry.
	16 "	07.35	Equipped and set up laboratories.
	17 "	06.00	Departed Barry.
		07.35	Deployed Plankton sampler (LDUOR)
		09.53	Recovered " " " "
		10.05	Deployed " " "
		16.10	Recovered " " "
		17.30	Entered Milford Haven.
		17.45	Berthed and unloaded equipment.
	18 "	06.00	J. Aiken left ship and travelled to Plymouth.
		06.35	Cast off and left Milford Haven.
		12.40	Arrived Celtic Sea site.
		14.45	Commenced Survey 1 (Appendix Ia).
		17.10	Set course for Milford.
		22.35	Entered west channel.
	19 "	07.00	Alongside at Milford.
		18.45	Cast off.
		19.40	Anchored Dale Roads.
		23.50	Weighed anchor and set course for CS site.
	20 "	04.00	Arrived location.
		06.25	Commenced Survey 2 (Appendix Ib).
		17.30	Completed grid survey.
	21 "	13.50	Vertical profiles at Station 31 (Appendix Id).
		16.50	" " " Station 6.
		22.10	" " " Station 30.
		23.15	Started zooplankton feeding experiments (Appendix If).
	22 "	07.30	Primary production of phytoplankton using ^{14}C & ^{15}N .
		09.10	Vertical profiles at Station 1.
		13.00	" " " Station 25.
		19.52	LHPR 1 (Appendix Ie).
		22.00	Started NH_4^+ and urea excretion experiment.
		23.00	Zooplankton feeding experiment.
	23 "	00.58	LHPR 2.
		07.02	LHPR 3.
		09.00	Primary production experiment with phytoplankton (^{14}C + ^{15}N).
		13.05	LHPR 4.
		14.00	Started MULEX excretion experiment.
		18.50	LHPR 5.
		20.15	Microbial heterotrophic activity experiment.
	24 "	06.49	LHPR 6.
		07.40	Set course for Carmarthen Bay.
		09.00	Microbial heterotrophic activity experiment.

24	August	10.30	NH ₄ ⁺ and urea excretion experiment.
		14.30	Started CB survey 1 (Appendix IIa).
25	"	00.05	Completed survey 1.
		10.15	Vertical profiles at Station 1 (Appendix II d).
		12.25	" " " Station 5
		15.45	" " " Station 25.
		20.45	" " " Station 29.
		22.20	" " " Station 31.
26	"	10.30	Primary production of phytoplankton experiment (¹⁴ C and ¹⁵ N).
		14.00	Sediment pore waters experiment.
		14.00	Zooplankton feeding experiment (Appendix II f).
		15.00	Oxygen consumption experiment across sediment water interface.
		17.15	Zooplankton feeding experiment.
		21.30	Zooplankton feeding experiment.
27	"	17.15	Completed feeding experiment.
		21.30	" " "
28	"	06.45	Vertical profiles from anchor station (Appendix II e).
		10.30	Primary production experiment with phytoplankton (¹⁴ C and ¹⁵ N).
		15.15	Microbial heterotrophic activity experiment.
		17.45	Completed vertical profiles.
29	"	10.00	Primary production experiment with phytoplankton (¹⁴ C and ¹⁵ N).
		14.00	Completed zooplankton feeding experiment.
30	"	00.08	Started CB survey 2 (Appendix II b).
		09.28	Completed survey 2.
		10.00	Set course for Barry.
		16.20	Entered lock.
		17.25	Docked Barry.
31	"		Equipment and personnel to Plymouth.

OBJECTIVES:

Programme Objectives

1. To compare the rates and processes which control the seasonal development of two species of copepod at two contrasting sites; one a near-shore embayment (Carmarthen Bay), the other, offshore with a seasonally stratified water column (Celtic Sea site).
2. To compare seasonal differences in the rates of nutrient turnover at the two sites with emphasis on sediment-water column interactions at the Carmarthen Bay site.

Cruise Objectives

1. To measure levels of nutrients, chlorophyll, total suspended matter, organic matter and the zooplankton and phytoplankton populations.
2. To characterise the hydrographic conditions at the two sites.
3. To measure the feeding rates and development times of two species of copepod at the two sites.
4. To measure uptake and release of nutrients by micro-organisms.
5. To measure the release of nutrients by zooplankton.

- PROCEDURES AND METHODS: As outlined in the Cruise Programme. The grids and station positions were amended to suit the prevailing conditions (Appendices I and II).
- EQUIPMENT AND OTHER FAILURES: The thermosalinograph supplied by RVS was defective. One and a half days were lost from the programme by returning to Milford Haven to repair this equipment. The remaining period of four days in the Celtic Sea was too short to conduct any effective copepod development work. Problems were encountered, as expected, with the deployment and recovery of the Lowestoft 20" net from such a small "A" frame but these were compounded by the heavily tarred wire which RVS had spooled on their winch. This wire soiled equipment, nets, ship and personnel.
- RESULTS: The weather conditions allowed a comprehensive sampling programme to be carried out at each sampling site.
- One part and one complete grid surveys (Appendix Ia and b) were completed at the Celtic Sea site and two complete grid surveys (Appendix IIa and b) at the Carmarthen Bay site. The surveys will be used to investigate the temporal and spatial distribution of particulate organic carbon, nitrate, nitrite, reactive phosphate, reactive silicate, phytoplankton species, chlorophyll, particle size, microseston and net zooplankton. A series of vertical stations (Appendices Ic and IIc,d) together with a 12-hour anchor station were also successfully completed. The profiles were accomplished with a pumped water supply using the Flygt pump system. Six LHPR oblique hauls were taken in the Celtic Sea site, as part of a 24 hour diurnal migration study, giving 150 separate samples.
- A series of feeding experiments was carried out at the Celtic Sea and Carmarthen Bay sites (Appendices Id and IIe) with Calanus helgolandicus copepodite stages I-IV, V-VI, a variety of mixed small copepod species and siphonophores, under the ambient conditions of temperature and food, using the Coulter Counter.
- Three experiments were completed with the MULEX (Multiple Exudation) system on the excretion of NH_4^+ , urea and primary amines by Calanus helgolandicus.
- Five primary production incubation experiments (2 Celtic Sea, 3 Carmarthen Bay) were completed using labelled ^{14}C and ^{15}N ; three experiments to examine microbial heterotrophic activity using ^{14}C amino acids were also successfully completed. Undisturbed sediment samples obtained by the use of the Craib corer were used to estimate the NH_4^+ levels in the sediment pore water and to measure the rate of O_2 consumption over the sediment/water interface.
- Calanus helgolandicus were rare in the zooplankton of Carmarthen Bay so work on this species was very restricted.

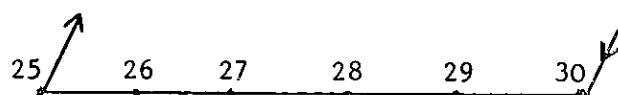
Prepared by : R. Williams
 Approved by : R.S. Glover
 Date : 8 September 1978

IMER C5/78 Cruise Report

APPENDIX Ia

Celtic Sea Site - Cruise track and Station Positions

18 August 1978



Station Positions

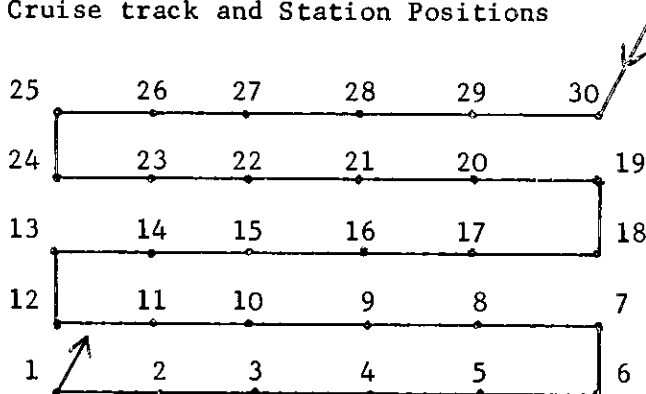
<u>Station</u>	<u>Time</u> (BST)	<u>Decca Positions</u>	
730	14.59	J 30.6	I 52.4
729	15.20	J 33.1	I 51.2
728	15.42	J 35.6	H 79.9
727	16.10	J 39.1	H 78.0
726	16.32	J 41.7	H 76.5
725	16.54	J 44.2	H 75.0

Chlorophyll, microseston, particle size analysis, POC and phytoplankton species counts were measured.

APPENDIX Ib

Celtic Sea Site - Cruise track and Station Positions

20 August 1978



Station Positions

<u>Station</u>	<u>Time</u> (BST)	<u>Decca Positions</u>		<u>Station</u>	<u>Time</u> (BST)	<u>Decca Positions</u>	
830	06.22	J 47.8	I 52.8	814	12.35	J 43.6	H 69.5
829	06.55	J 31.1	I 51.2	813	12.54	J 46.3	H 68.3
828	07.15	J 35.7	H 79.7	812	13.23	J 47.3	H 65.0
827	07.33	J 39.1	H 77.9	811	13.43	J 44.8	H 66.1
826	08.05	J 41.7	H 76.2	810	14.08	J 41.8	H 67.5
825	08.26	J 44.3	H 74.8	809	14.34	J 38.2	H 69.3
824	09.00	J 45.1	H 71.9	808	15.00	J 35.5	H 70.6
823	09.20	J 42.4	H 73.4	807	15.14	J 32.9	H 72.3
822	09.40	J 39.9	H 74.5	806	15.37	J 33.7	H 68.4
821	10.06	J 36.4	H 76.6	805	15.56	J 36.4	H 67.0
820	10.27	J 33.9	H 77.9	804	16.18	J 39.2	H 65.6
819	10.47	J 31.4	H 79.3	803	16.45	J 42.8	H 63.9
818	11.10	J 32.1	H 76.0	802	17.08	J 45.6	H 62.7
817	11.26	J 34.7	H 74.4	801	17.32	J 30.4	H 61.4
816	11.43	J 37.3	H 72.9				
815	12.06	J 40.9	H 71.0				

Nutrients, chlorophyll, salinity, temperature, microseston, particle size were measured at all stations and selected samples were taken for salinity checks, phytoplankton species counts and POC.

IMER C5/78 Cruise Report

APPENDIX Ic

Celtic Sea Site - 18 August 1978 and 20 August 1978

Lowestoft 20" net

<u>Haul No.</u>		<u>Time (BST)</u>		<u>Decca Positions</u>			
		<u>Shot</u>	<u>Recovered</u>	<u>Shot</u>		<u>Recovered</u>	
1	18.8.78	15.30	16.00	J 33.3	I 51.6	J 37.5	H 78.9
1	20.8.78	07.00	08.05	J 31.1	I 51.3	J 41.7	H 76.2
2		09.05	10.48	J 45.1	H 71.9	J 31.4	H 79.3
3		11.20	12.00	J 34.6	H 74.9	J 40.9	H 71.4
4		12.43	13.34	J 44.3	H 39.0	J 46.1	H 65.5
5		13.55	14.53	J 42.9	H 66.8	J 36.6	H 70.1
6		15.43	16.22	J 34.6	H 67.9	J 39.6	H 65.4
7		16.29	17.09	J 40.6	H 65.0	J 45.6	H 62.7

APPENDIX Id

Celtic Sea Site - Vertical Profiles

21-22 August 1978

<u>Station</u>	<u>Time Cast</u>		<u>Decca Positions</u>		<u>Depths (m)</u>
	<u>Start</u>	<u>Finish</u>			
831	13.50	15.40	J 39.3	H 72.0	67,60,50,40,30,20,10,surface
832	16.50	18.00	J 33.7	H 68.8	65,50,40,30,24,10,surface
833	21.00	22.15	J 30.6	I 52.0	55,40,32,14,surface
834	09.10	10.15	A 30.4	H 61.3	70,49,33,20,8,surface
835	13.00	14.15	J 44.2	H 75.0	75,61,41,26,10,surface

Nutrients, chlorophyll, temperature, salinity, microseston, particle size phytoplankton species counts, particulate organic carbon and fluorescence were measured at all depths.

APPENDIX Ie

Celtic Sea Site - Longhurst Hardy Plankton Recorder Hauls

<u>Haul No.</u>	<u>Date</u>	<u>Time (BST)</u>	<u>Shooting Position</u>		<u>Hauling Position</u>		<u>Number of Samples</u>
836	22.8.78	19.53	J 38.2	H 68.5	J 38.7	H 70.0	29
837	23.8.78	00.58	J 40.1	H 71.8	J 40.1	H 71.2	23
838	23.8.78	07.02	J 39.1	H 71.2	J 39.25	H 71.5	15
839	23.8.78	13.05	J 39.5	H 71.8	J 39.9	H 71.7	22
840	23.8.78	18.50	J 39.0	H 71.7	J 39.2	H 72.4	21
841	24.8.78	06.49	J 39.9	H 71.8	J 38.3	H 73.7	34

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APPENDIX If

Celtic Sea Site - Feeding Experiment

Experiment	Date and Time Started (Initial seawater count)	Date and Time Finished	Vol. of seawater (ml)	INCUBATION TIME IN HOURS													
				CONTROLS				FEEDING BOTTLES									
				1	2	3	4	1	2	3	4	5	6	7	8	9	
CSF (1)	21.8.78 23.15	22.8.78 23.15	250	24	24	24	24	24	24	24	24	24	24	24	24	24	24
CSF (2)	22.8.78 22.00	23.8.78 22.00	250	12	12	24	24	12	12	12	12	24	24	24	24	24	-

Copepods used:

Calanus helgolandicus V-VI

Calanus helgolandicus I-IV

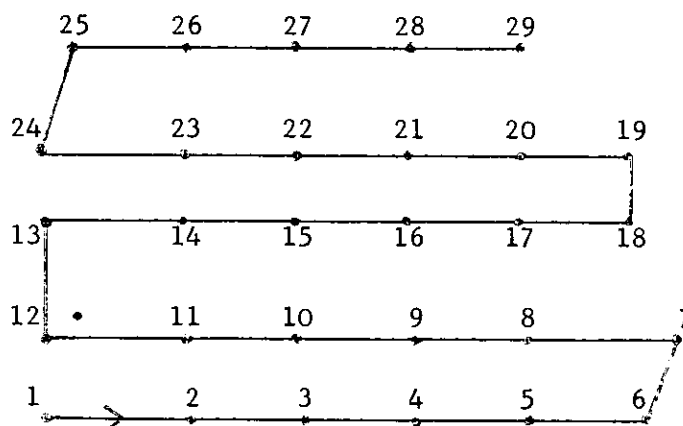
Small copepods of mixed species

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APPENDIX IIa

Carmarthen Bay Site - Cruise track and station positions

24/25 August 1978



Stations Positions

<u>Station</u>	<u>Time</u> (BST)	<u>Decca Positions</u>	<u>Station</u>	<u>Time</u> (BST)	<u>Decca Positions</u>
501	14.45	F 42.3 J 67.8	516	19.57	F 34.8 A 56.0
502	15.10	F 39.4 J 71.2	517	20.15	F 32.1 A 59.7
503	15.36	F 36.6 J 74.8	518	20.23	F 30.8 A 61.6
504	15.58	F 33.8 J 78.2	519	20.45	F 31.3 A 65.0
505	16.18	F 31.0 A 51.6	520	20.55	F 31.5 A 63.0
506	16.28	E 47.6 A 53.4	521	21.17	F 35.2 A 59.1
507	16.51	E 46.9 A 59.5	522	21.42	F 37.9 A 55.8
508	17.10	F 31.6 A 55.4	523	22.03	F 40.5 A 52.6
509	17.31	F 34.3 A 52.0	524	22.29	F 43.4 J 79.1
510	17.54	F 37.1 J 78.5	525	22.49	F 42.8 A 53.9
511	18.15	F 39.8 J 75.5	526	23.02	F 40.9 A 56.4
512	18.34	F 42.9 J 72.2	527	23.21	F 38.3 A 59.3
513	19.05	F 43.1 J 75.6	528	23.45	F 35.6 A 63.1
514	19.25	F 40.2 J 78.9	529	00.04	F 33.0 A 66.7
515	19.42	F 37.5 A 52.6			

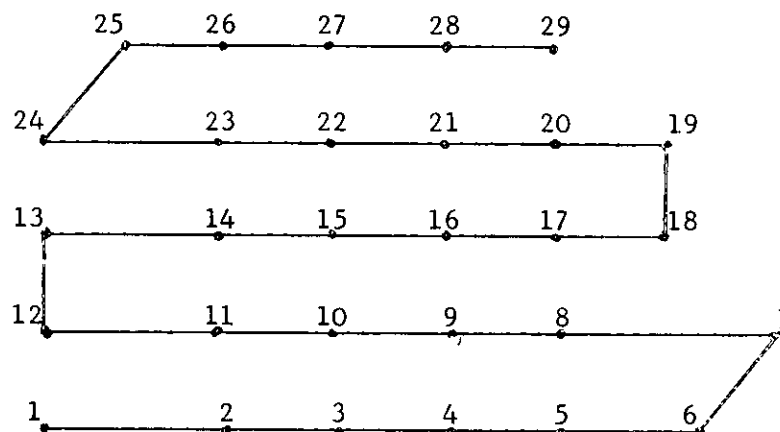
Nutrients, chlorophyll, salinity, temperature, particle size, microseston and fluorescence were measured at all stations; POC, phytoplankton species counts and salinity checks were taken at selected stations.

IMER C5/78 Cruise Report

APPENDIX IIb

Carmarthen Bay Site - Cruise track and station positions

30 August 1978



Station Positions

<u>Station</u>	<u>Time</u> (BST)	<u>Decca Positions</u>	<u>Station</u>	<u>Time</u> (BST)	<u>Decca Positions</u>
629	00.08	F 33.1 A 66.2	614	04.45	F 40.2 J 79.1
628	00.30	F 35.8 A 62.6	613	05.04	F 43.0 J 75.6
627	00.53	F 38.3 A 59.7	612	05.24	F 42.6 J 71.8
626	01.14	F 40.8 A 56.0	611	05.43	F 39.8 J 75.0
625	01.33	F 42.9 A 53.8	610	06.04	F 37.1 J 78.3
624	01.56	F 43.4 J 79.2	609	06.33	F 34.3 A 52.2
623	02.15	F 40.4 A 53.1	608	07.05	F 31.5 A 56.1
622	02.30	F 37.9 A 56.1	607	07.35	E 46.9 A 59.1
621	02.47	F 35.2 A 59.1	606	08.05	E 47.8 A 52.8
620	03.05	F 32.6 A 63.1	605	08.15	F 31.3 A 50.8
619	03.12	F 31.3 A 64.7	604	08.31	F 33.8 J 77.9
618	03.30	F 30.7 A 61.4	603	08.50	F 36.7 J 74.3
617	03.43	F 32.0 A 58.9	602	09.09	F 39.5 J 70.9
616	04.04	F 34.8 A 55.8	601	09.28	F 42.35 J 67.7
615	04.25	F 37.5 A 53.5			

Nutrients, chlorophyll, salinity, temperature, particle size, microseston and fluorescence were measured at all stations; POC, phytoplankton species counts and salinity checks were taken at selected stations.

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APPENDIX IIc

Carmarthen Bay Site - 24 August 1978

Lowestoft 20" net

<u>Haul No.</u>	<u>Time (BST)</u>		<u>Decca Positions</u>			
	<u>Shot</u>	<u>Recovered</u>	<u>Shot</u>		<u>Recovered</u>	
1	14.50	15.14	F 41.7	J 68.5	F 39.0	J 71.6
2	15.25	15.43	F 38.0	J 72.9	F 35.6	J 76.0
3	16.55	17.16	E 47.7	A 58.3	F 32.5	A 54.3
4	17.31	18.03	F 34.3	A 52.0	F 38.4	J 77.0
5	18.38	19.05	F 42.9	J 72.2	F 43.1	J 75.6
6	19.16	19.38	F 41.4	J 77.4	F 37.8	A 52.2
7	19.52	20.08	F 35.5	A 55.0	F 33.2	A 58.3
8	20.58	21.26	F 33.0	A 62.3	F 36.4	A 57.7
9	21.40	22.12	F 37.8	A 55.8	F 41.5	A 51.4
10	23.00	23.38	F 41.1	A 56.1	F 36.3	A 62.1

Carmarthen Bay Site - 30 August 1978

1	00.44	01.15	F 36.9	A 61.4	F 40.8	A 56.0
2	02.03	02.51	F 42.4	A 50.6	F 34.8	A 59.6
3	03.37	04.28	F 31.4	A 59.8	F 37.5	A 52.3
4	05.29	06.38	F 42.0	J 72.5	F 33.9	A 52.7
5	08.10	09.00	F 30.5	A 52.0	F 38.2	J 72.4

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APPENDIX II d

Carmarthen Bay Site - Vertical Profiles

25 August 1978

<u>Station</u>	<u>Time (BST)</u>		<u>Decca Positions</u>	<u>Depth (m)</u>
	<u>Start</u>	<u>Finish</u>		
531	10.15	10.40	F 42.2 A 68.4	19,9,surface
532	12.25	12.45	F 31.1 A 51.5	21,9,surface
533	15.45	16.00	F 43.8 A 53.9	11,surface
534	20.45	21.00	F 33.0 A 66.7	6,surface
535	22.20	22.40	F 36.0 A 54.0	24,11,surface

Nutrients, chlorophyll, temperature, salinity, microseston, particle size analysis, phytoplankton species counts, POC and fluorescence were measured at all depths.

APPENDIX II e

Carmarthen Bay Site - Anchor Station

28 August 1978

<u>Station</u>	<u>Time (BST)</u>		<u>Decca Positions</u>	<u>Depth (m)</u>
	<u>Start</u>	<u>Finish</u>		
536/1	05.45	06.50	F 36.3 A 53.9	27,20,15,10,5,1
536/2	07.15	07.50	" "	25,20,15,10,5,1
536/3	08.20	09.05	" "	25,20,15,10,5,1
536/4	09.15	09.55	" "	25,20,15,10,5,1
536/5	10.20	11.00	F 36.25 A 53.9	26,20,15,10,5,1
536/6	11.15	12.00	F 36.25 A 54.0	25,20,15,10,5,1
536/7	12.30	13.10	F 36.2 A 54.0	"
536/8	13.25	14.05	" "	"
536/9	14.20	15.05	" "	"
536/10	16.00	16.45	" "	"
536/11	17.00	17.45	" "	"

Nutrients, chlorophyll, temperature, salinity, microseston, particle size, phytoplankton species counts, POC, POC with 280 µm filter, and fluorescence were measure at all depths; Phytoplankton species counts were measured only at 1 m.

APPENDIX IIf

Carmarthen Bay Site - Feeding Experiments: all experiments carried out in dark conditions unless stated otherwise.

Experiment	Date and Time Started (initial sea-water count)	Date and Time Finished	Vol. of seawater (ml)	INCUBATION TIME IN HOURS														
				CONTROLS					FEEDING BOTTLES									
				1	2	3	4	5	1	2	3	4	5	6	7	8	9	10
CBF (1)	26.8.78 14.00	29.8.78 14.00	250	6	12	24	72	72	6	6	12	12	24	24	24	24	72	72
CBF (2)	26.8.78 17.15	27.8.78 17.15	250 500	24	24	24	-	-	24	24	24	-	-	-	-	-	-	-
CBF (3)	26.8.78 21.30	27.8.78 21.30	500 500	24	24	-	-	-	24	24	24	24	-	-	-	-	-	-
																		light conditions

Animals used: Decapods, Temora, Acartia (various)
Siphonophores

Experiment 4. Particle growth in plastic and glass containers
Started 26.8.78 09.15
Finished 29.8.78 09.15

Internal

Glover
Hamilton

Robinson
Fay

Notice Board/M B Jordan
Bottrell Burkhill

File

External

NERC

Foxton
Director, STS

BRISTOL UNIVERSITY

Dineley
Eglinton

IOS

Mrs Edwards (^{MAS}BOSS)
Cartwright (Bidston)
Laughton (Wormley)
Tucker (Taunton)

UNIVERSITY COLLEGE CARDIFF

Bellamy
Hammond

IGS

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Denton

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Nelson-Smith

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Currie

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Lee
Cushing
Wood

IMPERIAL COLLEGE OF SCIENCE & TECHNOLOGY

Webb

DAFS

Parrish

UNIVERSITY OF LIVERPOOL

Abdullah

RVS

Skinner (2)

WATER AUTHORITIES

Welsh National
Severn-Trent
Wessex
South West

DOE

Graham, London

NETHERLANDS INSTITUTE FOR SEA RESEARCH

WRC

Eden, Stevenage

Zijstra
Baars

Welsh Office

Naylor Firth (4)

ICI

Pearson