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1970 RESEARCH VESSEL PROGRAMME

REPORT: RV CLIONE: CRUISE 14

(Provisional: Not to be quoted without prior reference to the author)

STAFF

J W Talbot
G C Baxter
B H Holford) 6-9 and 20 November
M R Vince)
L Emerson 6-9 November
R Keable 20 November
T C Doddington) From 9 November
J W Read)
R A Hurst (Fleetwood) 9-20 November

DURATION

Left Lowestoft 1530 hours 6 November

Arrived Lowestoft 0625 hours 23 November

All times are British Standard Time

LOCALITY

Irish Sea

AIMS

The cruise was planned to contribute to the programme of investigations being carried out by the MHLG Working Party on the disposal of sewage sludge in Liverpool Bay and in particular to measure diffusion rates and related hydrographic features in the area. RV CORELLA collaborated with RV CLIONE in carrying out the work. The individual objectives were:-

1. To make and survey one or more releases of Rhodamine-B in the vicinity of the Mid-Grid buoy.
2. To lay and recover a network of 8 current meter stations in the eastern Irish Sea.
3. To change the current meters at the Mid-Grid buoy.
4. To monitor hydrographic conditions in the area of the diffusion experiment by means of serial observations.
5. To supplement the records of the moored current meters using direct reading current meters from the ship.
6. To attempt recovery of the two recording current meters that were left south west of Anglesey from Cruise 12.

7. To attempt recovery of the equipment lost in the area in September by the Water Pollution Research Laboratory and by the Hydraulics Research Station.

NARRATIVE

CLIONE first proceeded to the position of the two meters remaining from Cruise 12. The position of these $53^{\circ}03'N$ $5^{\circ}08'W$, was reached at 2220 hours 8 November and the ship dodged near this position until daylight. Although the buoy marking this station was missing the pellet on the current meter line was seen at 0900 hours on 9 November. However a heavy swell prevented any attempt at meter recovery. The ship therefore proceeded to Holyhead where Messrs Holford, Vince and Emerson disembarked and Messrs Doddington, Read and Hurst joined. A quantity of Rhodamine-B was also collected at Holyhead and the ship took on water. The bad weather that had prevented attempts to recover the two meters persisted into the evening so the ship remained in Holyhead overnight, leaving at 0720 hours 10 November.

On leaving Holyhead CLIONE proceeded to Liverpool Bay and worked until 1145 hours 11 November laying a grid of 7 current meter stations and replacing the meters on the Mid Grid buoy. One moored meter station less than originally planned was laid because these 7 stations used all the available meters. The next operation was the working of a grid for salinity, temperature and suspended load over a three dimensional array in the vicinity of the moored meters. This work continued until 0120 hours 12 November and the ship then steamed to Dulas Bay for shelter. The next morning the Rhodamine-B tank was first filled with 180 gallons of 20% Rhodamine-B solution and the ship then proceeded to the Sludge Buoy where the dye release was to take place. By this time RV CORELLA had reached the area and it was intended that she should collaborate in surveying a dye release to be made that afternoon. However a westerly wind of 25 knots produced rough seas at this time and the release of dye was postponed. The following morning brought no improvement in the sea conditions, the wind being south westerly 25-30 knots with a heavy swell running. CLIONE therefore returned to Dulas Bay for shelter and to await better conditions. The next morning, 14 November, brought much improved weather and the dye release was made at 0915 hours. The release was at a depth of 2 fathoms.

Following the dye release CORELLA and CLIONE worked in close collaboration until 0800 hours 16 November when CORELLA had to leave for Liverpool in order that a fault in her refrigeration system could receive attention. The initial period of survey of the dye patch, from release until 0800 hours 16 November included measurement of the dye distribution in the surface layer by both ships and also the distribution at 10 fathoms depth by CORELLA. At various times during this period both ships also measured the vertical distribution of salinity, temperature, suspended load and water velocity near the dye patch, the velocity measurements being made by Direct Reading Current Meters.

At the time CORELLA left the survey area CLIONE was surveying the dye patch and she continued to do so until 2146 hours that evening, 16 November; after this she dodged during the night. Next morning a line of stations from the Sludge Buoy to the mouth of the Mersey was worked for salinity, temperature and suspended load. That afternoon two moored current meter stations were recovered, stations H and D, and a survey of the dye patch was then made from 1657 hours 17 November until 0020 hours 18 November. By this time CORELLA had returned from Liverpool and she cooperated in this survey. On completion of the survey CLIONE dodged for the rest of that night.

From this time on CLIONE had to concentrate on recovery of the remaining moored current meters but further surveys of the dye patch were carried out by CORELLA. By 1730 hours 18 November a further three meter stations had been recovered, the meters on the Mid Grid buoy had been changed and a replacement buoy and subsurface float laid at this station. A 30 knot north easterly wind and a rough sea made further meter recovery that night impossible and the ship therefore dodged. Next morning conditions were even more unfavourable, the wind being north westerly 30-35 knots with a heavy swell. Needing fresh water and being unable to work the ship proceeded to Douglas, Isle of Man, which she reached by 1545 hours. During the visit to Douglas, contact was made with the Port Erin laboratory and a current meter buoy was collected together with some other items of equipment that needed transport to Lowestoft.

CLIONE left Douglas at 2020 hours 19 November and, in much improved conditions proceeded to recover the remaining two meter stations, one of whose buoys had capsized. This work was completed by 0225 hours 20 November and course was then set for Holyhead.

After reaching Holyhead at 0845 hours that morning, Mr Hurst was transferred to CORELLA in exchange for Mr Keable, Messrs Holford and Vince also joined, having travelled overland from Lowestoft. The ship then proceeded again to the position of the two meters remaining to be recovered from Cruise 12. The weather at this time was most unfavourable with an easterly gale giving a very disturbed sea. However it was ascertained that the meters were still in position because the pellet was seen at 1630 hours. With no possibility of recovery of the meters that day the ship returned to Holyhead, disembarked Messrs Holford, Vince and Keable and then sailed at 2030 hours for Lowestoft.

RESULTS

The work carried out should substantially achieve aims 1 to 5 of the cruise. Bad weather combined with the limited time available prevented recovery of any of the lost equipment.

Much of the data collected will not be available for some time when the recording current meter results have been processed and the various samples collected analysed. At this stage it appears from the few results that are available that, under the conditions experienced during the surveys, diffusion in the Liverpool Bay area, near the Sludge Buoy, is controlled by two main factors. These are the vertical shear diffusion process associated with the tidal oscillation and the outflow of water from the river Mersey. The importance of the latter was suggested particularly by the results obtained during a survey of the dye patch on 16 November. At that time, at about the time of low water both CORELLA and CLIONE measured very low surface concentrations over the whole area of the dye patch. Later during the flood tide the concentrations rose again to a reasonable level. This was at a time of Spring tides and after appreciable rainfall. The most probable explanation is that the Mersey out flow was, at this time, sufficiently strong to cover almost the whole of the dye patch in a similar fashion to that previously observed for the Yare outflow off Yarmouth.

The development of the dye patch was recorded over a period of more than 140 hours after release and at its maximum extent the patch covered some 50 square miles of sea. During this time the centre of the patch moved nearly 8 miles to the southwest, more than half the distance to the Great Orme. This corresponds to a mean velocity of about 3 cm/sec but the movement is thought

to have been more rapid in the early stages, becoming slower as the patch approached the Welsh coast.

J W Talbot
26.11.70

Seen in Draft: M R Sutcliffe (Master)

INITIALLED: AJL

DISTRIBUTION

Basic List

J W Talbot
G C Baxter
B H Holford
M R Vince
L Emerson
R Keable
T C Doddington
J W Read
R A Hurst
Director, WPRL
" HRS
Mr R Henry, MHLG

