MINISTRY OF AGRICULTURE, FISHERIES AND FOOD, FISHERIES LABORATORY, LOWESTOFT, SUFFOLK, NR33 OHT, ENGLAND

1990 RESEARCH PROGRAMME

REPORT RV CIROLANA 10/90

STAFF:						
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	S J Malcolm			(c)		
	K J Medler	(a)	(b)	(c)	(d)	
	N D Pearson					(e)
	J W Reed					
	J M Rees	(a)	(b)	(c)		(e)
	D C Denoon	(a)	(b)	(c)		
	J Cooper			(c)	(d)	
	A Reeve	(a)	(b)	(c)	(d)	(e)
	N Faber	(a)	(b)	(c)	(d)	
	R Fichez (UEA)	(a)	(b)			
	C Vincent (UEA)					(e)
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	M Green (UC)					(e)
	J Atherton (UC)					(e)
	M Mason (UC)					(e)
	Z Luo (UC)					(e)

DURATION: 29 October-16 November, 1990

(a) 29 October-1 November
(b) 1-3 November
(c) 3-6 November
(d) 6-8 November
(e) 8-16 November

LOCATION: Wash, Humber Estuary and North Sea

AIMS:

1. To identify and quantify the fate of river-borne nutrients entering the Wash and Humber Estuaries, examine nutrient distributions and critical processes from the river inputs through to the North Sea in sub-tidal and inter-tidal sediments and the overlying waters.
2. To study the sheer stresses and current spectra near the sea-bed over a muddy sand and a sandy site.
3. To work 25h anchor stations measuring suspended load and particle size distributions over complete tidal cycles.
4. To examine settling velocities near the sea bed using the QUISSET tube.
5. To undertake a trial deployment of the Quadrapod and a selection of ancillary sensors (supplied by VIMS, USA).

NARRATIVE :

The major part of the programme for this third cruise of the Joint Nutrient Study (JONUS) was designed to be carried out coincidentally with a supporting

shore-based programme of sediment and water sampling in the Wash and Humber.

CIROLANA sailed from Lowestoft at 1800 hrs on 29 October collecting surface water samples en-route to the Wash. During the morning of 30 October, current meter moorings were laid to the north and to the south of the entrance channel of the Wash and in the vicinity of the Bar Flat Buoy (to assist in validating the Wash model). On completion of these operations, CTD transects were made across the mouth and inner area of the Wash. On-board processing of surface and bottom water on these transects provided partly completed analyses for suspended load, salinity, nutrients and chlorophyll (surface only). Additional samples were collected for a French scientist (R Finchez), based at UEA, who prepared samples on-board for subsequent analysis for organic carbon, organic nitrogen, chloropigments, carbohydrates, proteins, lipids and $^{12}C/^{13}C$. At 2300hrs CIROLANA anchored at the entrance to the Wash (site A6) to commence a 25 hour CTD anchor station with samples being collected at hourly intervals for analyses similar to those described for the transect except the organic carbon work.

In the early hours of 31 October, a fault in the CTD trigger control unit brought work briefly to a halt but was corrected by exchange for the spare control unit. On completion of the first anchor station a second 25 hour CTD station adjacent to the Bar Flat Buoy (site A1) was worked. During the afternoon of 1 November, the Boston Port Authority survey vessel SEEKER, which was on hire for the shore-based intertidal sampling programme, brought samples for analysis of staff on board CIROLANA. Provisional plans to use the Sea-rider for collecting some additional samples could not be carried out because of unsuitable weather conditions.

Two further CTD anchor stations, each of 12 hour duration were undertaken on the following two days at sites near the King's Lynn Buoy (A2) and in the Boston Deep (site A3). At these locations a direct reading current meter (DRCM) deployed from the ship, provided a continuous record of tidal data for use in conjunction with the logged CTD data. SEEKER again brought samples for analysis on 3 November and assisted with an exchange of scientific staff. The sea rider was also dispatched to Boston to collect J Cooper who had brought urgently-needed replacement auto-analyser equipment from Lowestoft and was to join CIROLANA for a brief period in order to assist with a very heavy sampling schedule in the Humber.

Subsidiary work on the first part of the cruise included the testing of a new ultra-filtration cartridge of 800 Daltons nominal pore-size in a Filtron cross-flow ultra filtration system lent for the purpose by Elga Ltd. The opportunity was also taken (in the absence of large temperature gradients at the four Wash anchor stations) to assess the relative performance of fourteen reversing thermometers (DSRM's) mounted on the Rosette CTD Niskin bottles. This information will be used to check the calibration of the logged temperatures from the recently installed, hull-mounted Chelsea Instruments sensor on CIROLANA. With the Wash intertidal sampling programme completed, the Sensordata mini CTD, which had been used for that work, was mounted on the Rosette CTD frame and deployed during several subsequent days to check its calibration against the larger unit.

On the morning of 4 November, coring work commenced with the collection of samples using both Reineck and Calvert box corers (site WSP1). These were sub-sampled for a number of experiments on board including incubation at site

water temperature in an attempt to measure the fluxes across the sediment /water interface and the determination of the rate of denitrification (reduction of NO_3^- to N_2). Other sub-samples were used to obtain X-ray photo-graphs of core structure and to provide interstitial water for the analysis of nutrients, sulphide/sulphate, alkalinity, manganese and iron. To complete the work in the Wash area the two CTD transects were repeated and CIROLANA then proceeded to the Inner Dowsing during the evening of 4 November collecting surface water for analysis at three locations en-route.

Attempts to obtain sediment cores in the area of the Inner Dowsing and at a grid of water sampling stations at the mouth of the Humber (sites OSPI and HOSI to HOS8) proved fruitless because of the hard clay-type bed material. The ship therefore anchored at the Bull anchorage overnight and here a set of cores, suitable for experimentation similar to that carried out in the Wash, were obtained.

Early on the morning of 6 November CIROLANA was moved, with the assistance of a pilot, to an anchorage off the Killingholme Jetty (site A4) where she remained for the next 25 hours whilst hourly CTD sampling of surface and bottom water was carried out as on previous anchor stations. The DRCM, deployed as in the Wash from the port-side life-boat derick, had to be removed when the tidal velocity increased to almost 4 knots causing the cable to "steam" aft beyond the launch position of the Rosette CTD on the after-deck. Sediment cores obtained at this location again provided sub-samples for the study of processes affecting the behaviour of nutrients and other ions both across the sediment/water interface and within the sea-bed itself. In the middle of the afternoon, three scientific staff transferred to Hull via the Sea-rider from where they planned to carry out two days of shore-based sampling on chartered vessels as part of the Humber intertidal sediment and water sampling programme.

A repeat set of hourly CTD stations, worked over a complete tidal cycle at Killingholme on 7 November, enabled the DRCM to be operated successfully - this time from the "A" frame on the starboard side of the ship. A brief visit by the chartered vessel WYKE, bringing samples for analysis from the shore-based operations, caused minimal loss of time for the collection of tidal data by the DRCM. A piloted evening move took CIROLANA back to the Bull anchorage for an early morning start of a 12 hour CTD station (site A5) on 8 November. On completion of this work CIROLANA docked briefly at the western Jetty Immingham in order to exchange scientific staff and to take on board computing and other equipment from the University of Cambridge for the second part of the cruise.

The ship sailed overnight to Alnmouth Bay north of Tyne to begin work for the COSEDS programme. Friday 9 november was spent preparing the DFR Tetrapod and the University of Cambridge Quadrapod near-bed sampling rigs for 24 hour trial deployments. The first deployments took place during the evening of that day following a preliminary Day Grab and TV survey of the bed. Among the instruments being tested on the Tetrapod were two State-of-the-Art optical devices for the precise monitoring of suspended sediment concentrations. One, an Optical Backscatterance Sensor array (OBS), had been brought from the US by J Boon (Virginia Institute of Marine Sciences), the other an array of Miniature Optical Backscatterance Sensors (MOBS) developed by the University of Cambridge. J Boon also brought a digital sonar altimeter and a passive-mode suspended solids collection tube for testing on the Quadrapod.

SEEN IN DRAFT :

Captain:

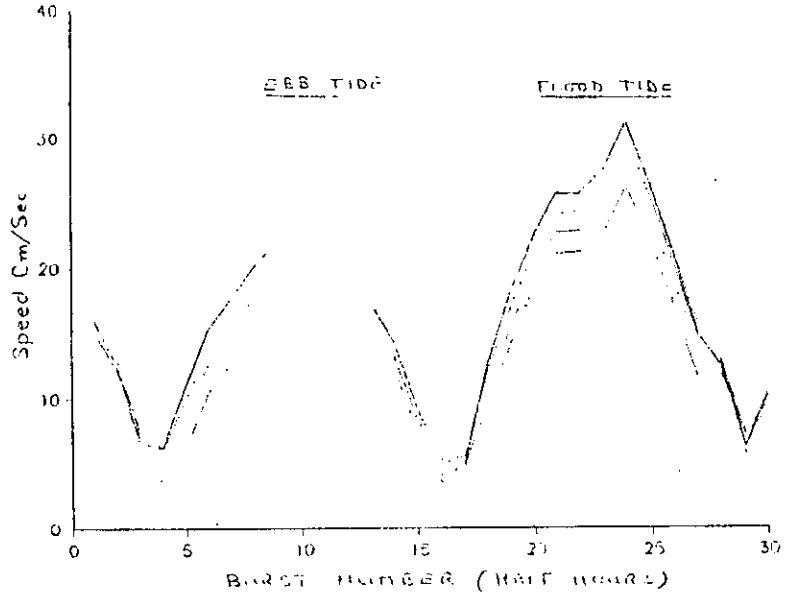
Fishing Skipper:

INITIALLED : C E P

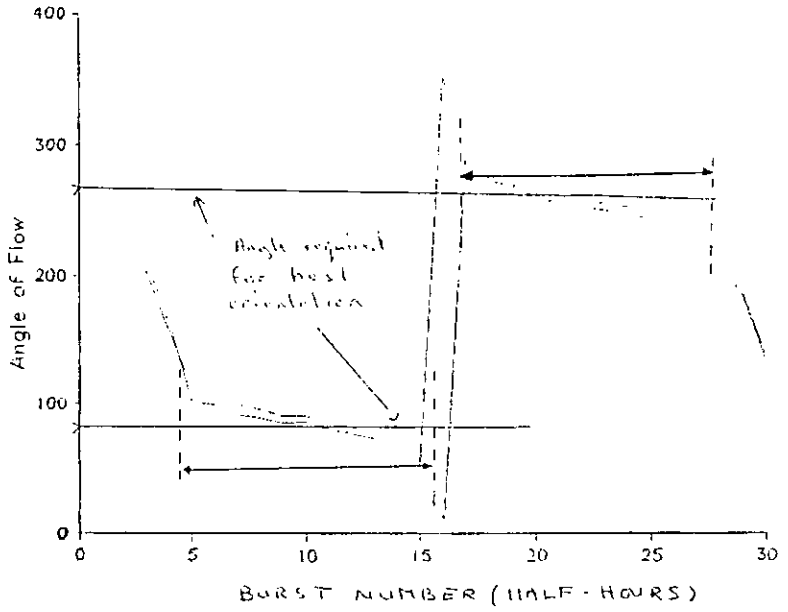
CIRCULATION :

Basic list +
B R Harvey
D S Kirkwood
K S Leonard
S J Malcolm
K J Medler
N D Pearson
J W Reed
J M Rees
D C Dencon
J Cooper
A Reeve
N Faber
R Fichez
C Vincent
J Boon
M Green
J Atherton
M Mason
Z Luo

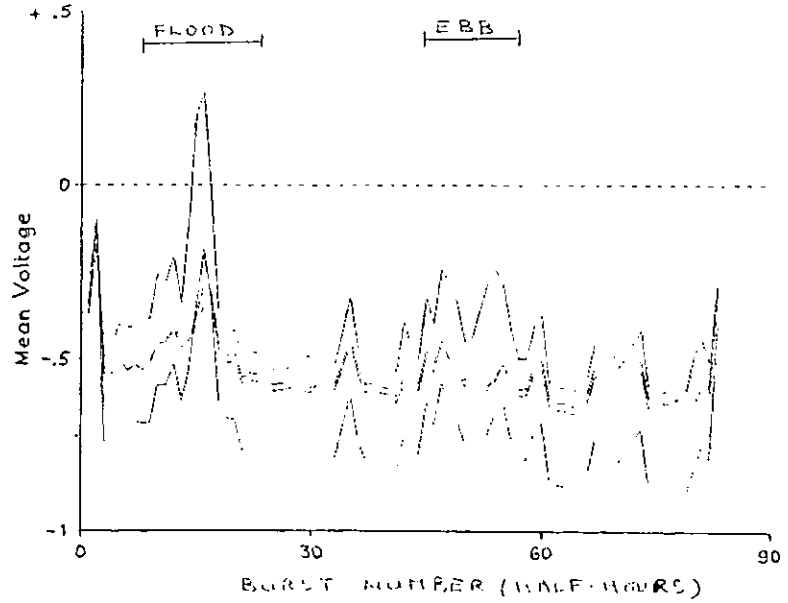
FIGURE 1 EXAMPLE OF DATA OBTAINED FROM TETRAPOD DURING CRUISE



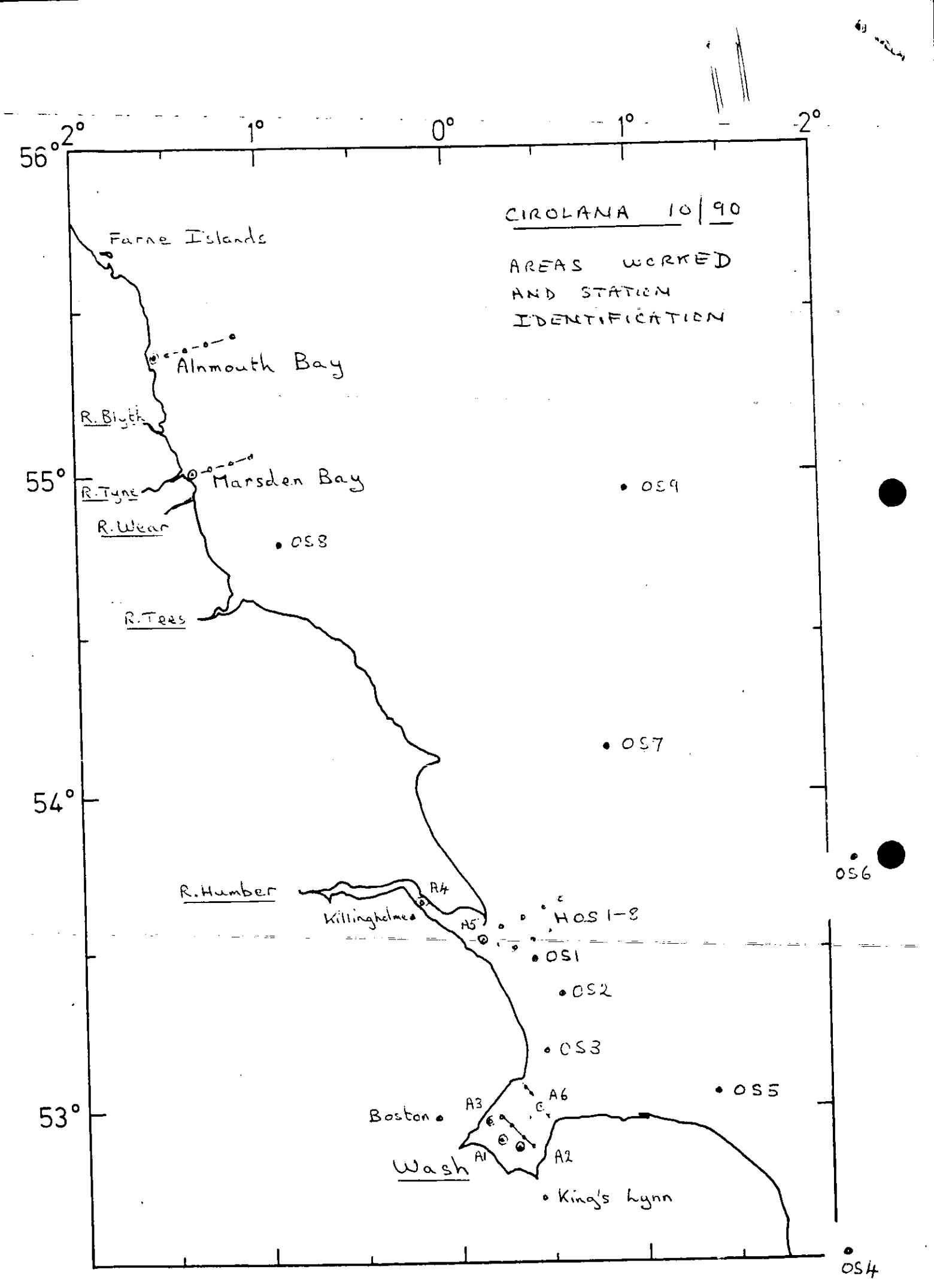
A Velocity profiles on Deployment 69 showing an Ebb and Flood Tide



B Angle of Flow of currents on deployment 69 demonstrating that that Acoustic Telemetry of the compass on the Tetrapod was within the required limits (rig orientated so as to have "clean" flows past the sensors)



C Burst means of the MOBS data showing the stronger flood tide (deployment 67) Coherent structures are visible on all 4 MOBS with heights above the seabed of 25 cm to 1m


2°
1°
0°
1°
2°
56°
55°
54°
53°
CIROLANA 10/90
AREAS WORKED AND STATION IDENTIFICATION
Farne Islands
Alnmouth Bay
R. Blyth
R. Tyne
Marsden Bay
R. Wear
R. Tees
R. Humber
Killingholme
Boston
Wash
King's Lynn
OS1
OS2
OS3
OS4
OS5
OS6
OS7
OS8
OS9
HOS 1-8
A1
A2
A3
A4
A5
A6
C