

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

1993 RESEARCH VESSEL PROGRAMME

REPORT: RV CIROLANA: CRUISE 7b

STAFF:	Dr J Brown	Mr S Jones
	Mrs A Reeve	Ms H Emerson
	Mr D Sivyver	Ms K Prastka (UEA)
	Dr R Goddard (PML)	Dr A James (UMIST)
	Dr D Stevens (UEA)	Mr M Sparrow (UEA)

DURATION (all times GMT):

Left Lowestoft 1400h 26 July
Arrived Lowestoft 0830h 2 August

LOCALITY: North Sea, Wash and Humber

AIMS:

1. To identify and quantify the fate of river-borne nutrients entering the Wash and Humber estuary, examining nutrient distributions and critical processes from the river inputs through to the North Sea in subtidal sediments and overlying waters.
2. To measure factors affecting benthic nutrient recycling in subtidal sediments along a transect across the North Sea.
3. To test new instrumentation designed to determine *in-situ* the geotechnical properties of sediment.
4. To take nutrient samples over a grid in the southern North Sea to improve knowledge of the seasonal signal (particularly phosphate) and subsequently compare with historic data.
5. To collect samples for a later chlorophyll intercomparison exercise. Five JoNuS co-workers will be issued with triplicate samples from five stations, of diverse chlorophyll levels.

NARRATIVE (all times GMT):

After departing Lowestoft, Cirolana made for the Wash sediment sampling site WSS8 (Fig. 1), poor weather postponing work at the planned station (OS Pit). Coring commenced at anchor (0500h 27/7), with 9 cores collected. A subsequent CTD had to be repeated as the rosette bottles failed to fire. Some cleaning and adjustment cured this. A 20 l surface sample was collected as part of the chlorophyll intercomparison exercise. Following this (~0830h), we made for the northern of the Humber grid stations (HOS11). As for Cir7a, the Chelsea Instruments cell was under reading salinity by ~1.2 psu at the beginning of the trip and by more than 1.5 psu by the end. This may be attributable to biological growth on the conductivity cell, sediment

trapped in the cell or another factor, something that can not be determined owing to the inaccessibility of the cell.

The Humber grid was started at 1450h, breaking off at EC1 (1900h) to pick up the pilot and pass up to Killingholme and sediment site A4. Coring was carried out at anchor (0510h 28/7) and followed by a CTD. The Humber grid was restarted at ~1300h, including a sample for the chlorophyll intercomparison exercise at HOS6, finishing at OS16 (~2130h) and anchoring over night in the southern Wash. The Wash grid was started at 0600h and finished at 2030h.

At 0500h (30/7) the sediment station at OS Pit was occupied, taking 12 cores, one CTD and a sample for the chlorophyll intercomparison. As expected the water column was strongly stratified. At 0800h a portion of the phosphate grid was begun, breaking off at 2000h in order to be in position for coring at BELS2, started at 0500h (31/7). On completion, including a CTD, Cirolana made for NS4, sampling en route as a continuation of the phosphate grid. The remainder of the work was devoted to the phosphate grid and a portion of the North Sea grid. In addition, two further chlorophyll intercomparison samples were taken at NS7 and NS16.

RESULTS (preliminary):

The cruise is a component of JoNuS, therefore aims 1 and 2 will ultimately be met within the programme as a whole. Given this, the sampling aims for the cruise were successfully met, with 53 CTD and 74 surface water stations completed for nutrient, chlorophyll, suspended load, C:N:P (Carbon: Nitrogen: Phosphorus) and water column structure analysis.

A preliminary inspection of the nutrient data indicates levels to be low, typical of mid-summer. Closer inspection may show levels in the Wash to differ when compared to previous JoNuS years. Riverine discharges appear higher than previous years, with a degree of stratification of the water column. This was largely confined to the Norfolk side of the Wash, with the less dense surface waters consistent with an estuarine circulation.

Denitrification/Nitrification N_2O flux estimates were carried out at the four coring sites by use of G.C. (Gas Chromatography). For each of the sites sampled, 9 sediment subsamples were collected from a large volume NIOZ box core using 5 cm I.D. x 25 cm acrylic core liners. Of these, three each were treated respectively with overlying water containing 10 % acetylene (to inhibit microbial conversion of denitrified N_2O to N_2) and Allythiourea (to arrest microbial nitrification), with the remainder left untreated to act as controls. Samples were incubated in the dark at *in situ* temperature for periods of 6-8 hours, during which time aliquots of overlying water were removed at intervals and analysed for their N_2O content on the G.C., following a head space equilibration technique. Further aliquots were collected for subsequent onboard nutrient analysis. At the end of each experiment a core from each site was subsectioned into 1 cm intervals and frozen for later determinations of its C:N:P and major element compositions.

No major analytical problems were encountered during the cruise.

The four sites examined were of contrasting sediment type; Humber sediments were extremely fine-grained silts with high porosity and no observable macro fauna, whereas Wash sediments were more cohesive with a significant sand fraction, lower porosity and significant surface fauna. Sediments from OS Pit and BELS2 approximated sandy silts but were finer grained than those from The Wash, and contained significant numbers of worm casts ~ 4-8 cm in length.

Denitrification (Nitrification) N_2O fluxes, $\mu\text{mol N m}^{-2} \text{d}^{-1}$, were: The Wash, ~ 23 (< 0.2); The Humber, ~ 114 (0.2); OS PIT, ~ 18 (0.4); BELS2, ~ 5 (~0). All nutrient samples were analysed on board ship but these data have not yet been evaluated.

AIM 3: Dr James, a member of the COSEDS group (AE0207A0) tested a prototype deck rheometer on samples from the coring sites. The instrument is designed to investigate the material properties of cohesive sediments. Approximately 100 samples of volume ~5 ml were tested, with a number of digital filters used to ascertain the most effective strategy for coping with shipboard vibrations and movement. High frequencies are readily dealt with, but those of order 1 Hz proved difficult to eliminate. Sediment samples will be analysed in more detail on return.

AIM 4: The phosphate grid was completed, providing data to augment the analysis of Dickson and Kirkwood (1992). To date, it is suggested that there is a strong and consistent seasonal cycle with no evidence of a background trend over the period 1930 to 1993.

AIM 5: Completed successfully, with analysis to be undertaken ashore.

REFERENCE:

Dickson, R.R. and Kirkwood, D.S., 1992. An analysis of historical phosphate data for the southern North Sea. Quality Status Report, North Sea.

Juan Brown
(Scientist-in-Charge)
2 August 1993

SEEN IN DRAFT: B Chapman (Master)
J Harper (S.F.M.)

INITIALLED: *PWGS*

DISTRIBUTION:

BASIC LIST+

Dr J Brown x 10	Mr S Jones
Mrs A Reeve	Mr D Sivyer
Ms H Emerson	

CIROLANA 7B/1993 STATIONS

SHOWING :
CRUISE TRACK
STATION POSITION
COASTLINE

