MINISTRY OF AGRICULTURE, FISHERIES AND FOOD
FISHERIES LABORATORY, LOWESTOFT, SUFFOLK NR33 0HT, ENGLAND

1996 RESEARCH VESSEL PROGRAMME

REPORT: RV CIROLANA : 9/96

STAFF

J M Rees (SIC)	
D S Kirkwood	
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A Reeve	
J Taylor	
R Sanders	UEA
M Trimmer	UE (27th to 11th)
B Fogg	(6-14 October)

DURATION: 27 September - 14 October 1996

LOCALITY: North Sea, Thames Estuary and Irish Sea

AIMS:

1. To undertake process measurements at sites in the Thames estuary and southern North Sea to determine the impact of land derived nutrients on the marine ecosystem (AE0529AO and C926J168).

2. To undertake spatial surveys to determine the distribution of nutrients, phytoplankton indicators and other relevant parameters using CTD and underway sampling in the outer Thames estuary (AE0529AO and C926J168)

3. To undertake process measurements at sites in Dundalk Bay, the Western 'Gyre' region and in the Liverpool Bay in the Irish Sea (AE0529AO and C926J168).

4. To undertake spatial surveys to determine the distribution of nutrients, phytoplankton indicators and other relevant parameters using CTD and underway sampling in the Irish Sea (AE0529AO and C926J168).

NARRATIVE: (all times are GMT):

R.V. CIROLANA sailed from Lowestoft on the 2145 tide on the 27th September and proceeded to the Warp anchorage in the mouth of the Thames Estuary (TH1). Early the following morning, sediment cores were taken for analysis (see results 1 and 2). A thirteen hour anchor station collecting water samples from near the seabed and the surface followed. Before light on the 29th a process station, consisting of a CTD with large water samples from three depths and Bongo net hauls for zooplankton, was

undertaken. Water samples were used to estimate primary production (see results 3). The remainder of the day was occupied with a grid of CTD's and surface water stations in the outer Thames estuary

This cycle of sediment cores, anchor station, process CTD and grid was repeated at sites at Long Head Spit (TH2) (30th and 1st) and the Outer Gabbard (TH3) (2nd and 3rd). On the evening of the 3rd CIROLANA sailed for Liverpool Bay arriving on the morning of the 6th.

The suite of experiments was repeated at three sites in the Irish Sea, Liverpool Bay (6th and 7th), Site 45 in the centre of the "gyre" circulation (8th and 9th) and Dundalk Bay (10th). Scientific staff were changed at Llandudno on the 7th and Fishguard on the 11th.

As weather conditions to the north of Ireland precluded stretching/bedding down the trawl warps on the return passage to Lowestoft, CIROLANA sailed 18 hours early to reach a deep enough position SW of Ushant.

R.V. CIROLANA docked on the 1000 tide on the 14th October in Lowestoft.

RESULTS

1. Sediments were collected with the NIOZ corer at six sites. On each occasion sub-sample cores were removed and subsequently processed for sediment-water nutrient fluxes, porosity, adsorbed ammonium, organic carbon and nitrogen and sediment chlorophyll. Interstitial water profiles were also collected at each site, an example from Long Sand Head (TH2) is shown below (Figure 1). The marked decrease in ammonium and subsequent increase in nitrate between 5 cm and 2 cm is probably evidence of nitrification.

Nutrient fluxes measured at the three Thames sites all showed a gradient from nearshore to offshore. e.g. the release of ammonium decreased from 12.9 to 2.8 μmol m^{-2} hr^{-1}, while the release of nitrate (23.6 μmol m^{-2} hr^{-1}) to the overlying water nearshore, switched to a minor removal (-0.6 μmol m^{-2} hr^{-1}) at the Outer Gabbard (TH3). The nutrient fluxes in the Irish Sea were of the same magnitude as those in the Thames/Southern North Sea.

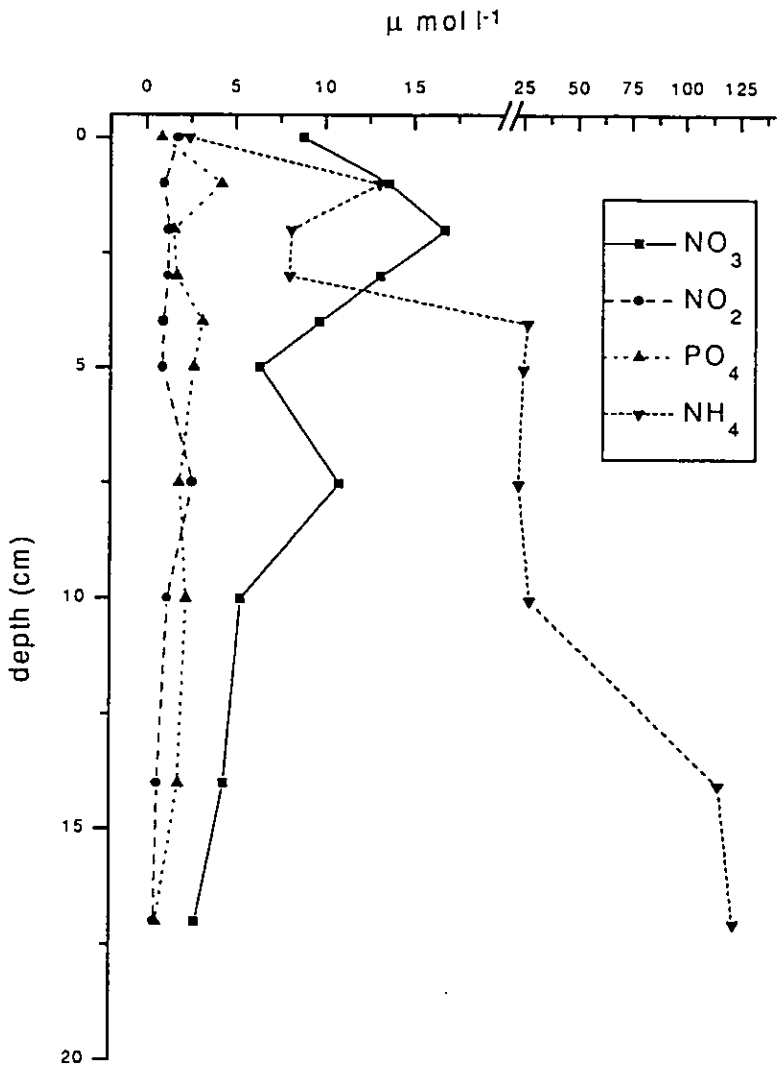

Figure 1

2. At each of the six sites visited sub sample cores were collected from the main box corer and stored in incubators in aerated site water at *in situ* temperature. Sedimentary denitrification rates were measured using isotope pairing techniques. Nitrification rates were measured by determining either the accumulation of ammonium or a decrease in the sedimentary demand for oxygen in the presence of nitrification inhibitors. Sedimentary oxygen uptake rates were measured using dissolved oxygen electrodes and data logging equipment. Measurements were also made of dissolved oxygen using Winkler techniques.

The oxygen uptake rates measured at the three off-shore Thames sites were similar to those measured in July, 1996, and ranged from 500-1100 µmol O_2. m^{-2}. h^{-1}. Nitrification rates were very low but as yet inconclusive.

The data collected from the CTD during both anchor and grid surveys was plotted up (Figure 2). An example from TH 1 is included and the strong tidal signal from freshwater nutrients can be seen clearly. The strength of the signal decreased moving off-shore.

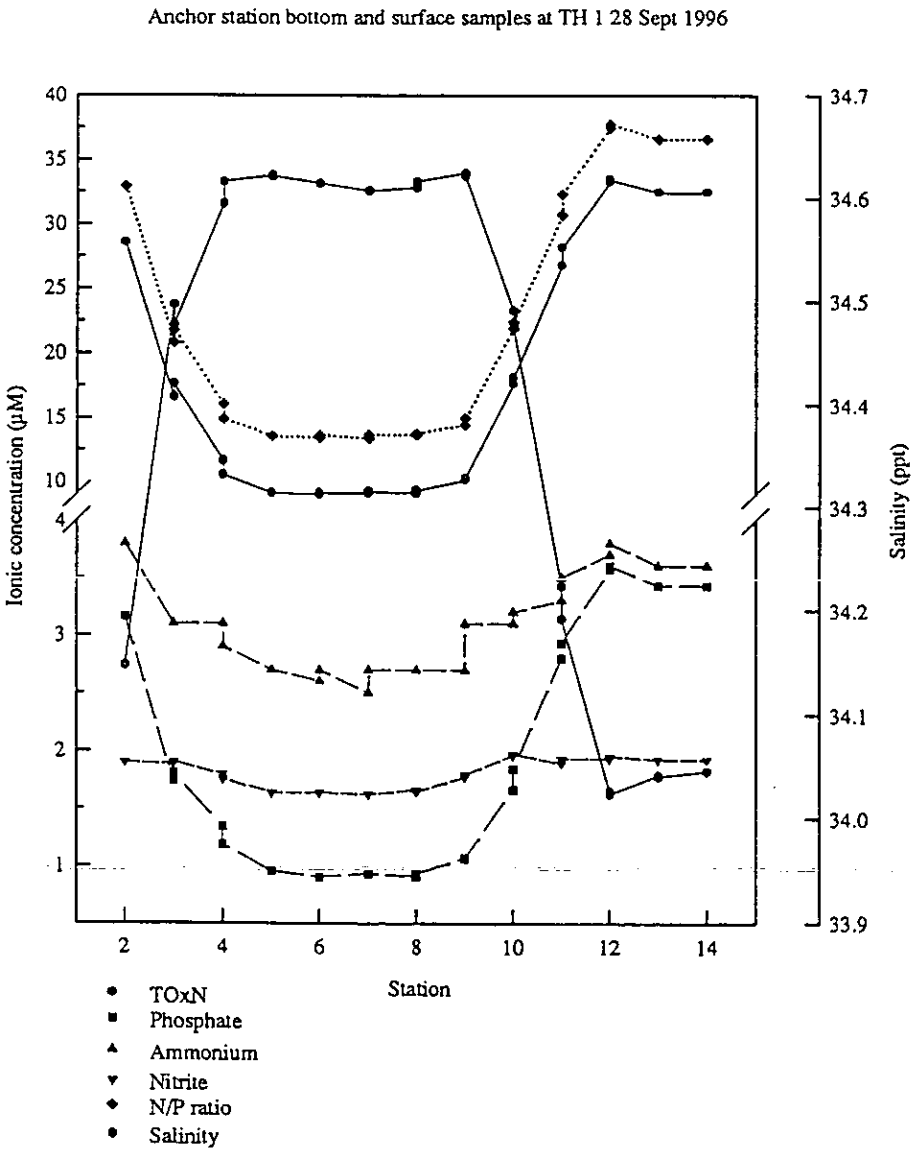

Figure 2

3. Measurements of size fractionated primary production were made at three sites in the Thames and three sites in the Irish sea. Results from the inner Thames plume are somewhat disappointing due to the high levels of suspended load which precluded the filtration of sufficient water to conduct the experiments. In contrast, in the Irish sea, good results were obtained at all three stations. In addition the incubator temperatures, run from the continuous clean water supply, fluctuated more than on previous cruises. The table below gives approximate values of P_{max} in units of µmoles $O_2\ l^{-1}\ h^{-1}$ with the approximate percentage in each size fraction.

Site	Whole	<20µm	<5µm
TH1	1 (100%)		
TH2	1 (100%)	0.5 (50%)	
TH3	0.8 (100%)	0.6 (75%)	0.2 (25%)
LB	1.4 (100%)	0.5 (35%)	0.5(35%)
GYRE	0.4 (100%)	0.3 (75%)	0.2 (50%
DB	1.4 (100%)	0.6 (40%)	0.5 (35%)

In contrast to results obtained in July on CIROLANA, the results of this study are not clear cut. However the same decline in P_{max} going offshore in the Thames region was observed. A large proportion of the offshore production (75%) at TH3 was <20µm, in contrast to the more inshore site TH2 where only 50% was below 20µm. It is surprising to find such photosynthetically active populations so far offshore so late in the year. In the Irish Sea, Liverpool Bay and Dundalk Bay appear very similar from their photosynthetic behaviour, in contrast to the gyre which had very low levels of photosynthetic activity, biased towards small size fractions.

In addition measurements of grazing and nutrient limitation of phytoplankton were made at the same six sites in an attempt to quantify the relative contributions of three different nutrient pools (internal, external and remineralisation) to phytoplankton growth. Good results were obtained from TH1, TH3, and Dundalk Bay with growth rates at the other sites being too low to be accurately resolved by the precision of the chlorophyll measurements. In both Liverpool Bay and the Gyre the phytoplankton community appears to have been declining rapidly with negative growth rates measured at several dilutions. Sites TH1 and TH3 provide an interesting contrast with strong grazing apparent at TH1 resulting in low growth rates in undiluted water and phytoplankton apparently dependent on remineralised nutrients at TH3 resulting in higher growth rates in undiluted seawater.

SEEN IN DRAFT: Captain D McDarren (Master)
M Reynolds (Senior Fishing Mate)

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