

## Cruise Report - LOIS Airborne Remote Sensing Programme

### Vessel and Period

'Sea Vigil', 28th Jun - 2nd July - (SV1)

### Location

Humber Estuary and plume

### Personnel

### Responsibility

from PML	A. Bale G. Siley	Co-ordination/ground truth samples UOR deployment
from UoP/PML	S. Hudson M. Moore	UOR, underway data and spectral work Spectral reflectance and filtration
from UoP	K. Hammond	Profiling radiometer

### Objectives

1. To develop sampling and ground-truthing protocols for use on subsequent surveys in support of CASI airborne remote sensing of estuarine and coastal waters within LOIS.

1. To obtain measurements of the optical characteristics of estuarine waters that would be relevant to the interpretation of remotely sensed (aircraft) images.

2. To measure and characterise water quality parameters which influence the absorption and reflection of light.

### Introduction

This survey of the Humber Estuary was the first of a series of three, one-week survey periods available during 1993 for the elucidation and interpretation of spectral information obtained from airborne instruments. This series of cruises were envisaged as a preliminary to the main remote sensing effort within the LOIS programme. Aircraft observations were not programmed during this first week so effort was concentrated on development of protocols for 'ground truth' observations required during subsequent surveys, and measurements of in-water optical data. Since this was PML's first experience with 'Sea Vigil', there was also a need to familiarise ourselves with the vessel's facilities and capability during this week. Because of the constraints imposed by crew numbers and accommodation on-board, scientific operations were limited to day work and the scientific party stayed in hotel accommodation overnight.

## Outline Report

**Mon 28th:** The scientific party travelled to Hull arriving late pm and located the Sea Vigil.

**Tuesday 29th:** Loading and setting up of scientific equipment commenced at 08:30hrs and continued during the morning with the vessel along side in Hull marina. The vessel then locked out of the marina at 12:00hr to test sampling protocols, measuring equipment and for trials of the undulating oceanographic recorder (UOR); work was completed by 16:00hr.

**Wednesday 30th:** Sailed at 05:30hr (visibility very poor); started an axial survey from Hull seaward following the main navigation channel. The undulator was deployed (Tow 1) at a fixed depth of 3-4m and underway measurements were made on board the vessel of:-

salinity	
temperature	
chlorophyll fluorescence	logged by the on-board, 'QUBIT' system
suspended solids (unreliable)	along with time and position data
dissolved oxygen (not calibrated)	

At half hourly intervals along this track water samples were taken from a pumped supply collecting water from 1m below surface for the determination of:

- suspended solids (by gravimetry)
- chlorophyll a (by subsequent acetone extraction)
- particle size distribution (Malvern)
- phytoplankton (Lugols Iodine -preserved)
- salinity (by precision salinometer)
- particle reflectance (SPECTRON SE590 Spectrometer)

The UOR carried the following sensors:

- salinity
- temperature
- depth
- fluorescence
- light transmission
- up and down welling light.

The first tow was completed at the 'Humber Buoy' (Figure 1a) approximately 10 miles offshore where vertical profiles were also carried out: (NB details of UOR tows are given in Table 1). The parameters measured during the vertical profiles were:-

salinity/temperature/spm	AML logged to QUBIT
light spectra	PRR 600
light penetration	Secchi disc

At the Humber Buoy the UOR was down-loaded and serviced and the first of three shorter tows (tows 2,3 &4) commenced on the return journey (Figure 1b). Water sampling was

continued at half hourly intervals and vertical profiles repeated between UOR tows. Work was completed off Hull Marina and the vessel docked at 16:00hrs.

**Thurs 1 July.** Sailed at 06:15hr and proceeded to occupy five vertical profile stations (A-E) between Hull and the Humber Bridge (Figure 2a). NB positions of the vertical profile stations are given in Table 2). Experiments were also performed on samples collected at these stations to measure spectral reflectance of estuary samples in large (20 litre) open top reservoirs and also over the side of the vessel when stopped.

At 08:00hr<sup>GMT</sup>, an axial profile with UOR (tow 5) and half hourly discrete sampling (as previous day but displaced in time by 2 hours relative to the previous days tide) was commenced off Hull and completed at the Spurn Light Float.

The vessel then returned to the mouth of the estuary and five more vertical profile stations (F- J) were occupied in the vicinity of the Bull Sand anchorage. Scientific work was completed by 14:30hrs and the scientific apparatus was cleaned and packed for unloading as the vessel returned to Hull Marina where we docked at about 17:00hrs. The scientific equipment and samples were then off loaded.

**Friday 2nd July.** Scientific party (except G.Siley who drove to Loch Ness with the UOR) returned to Plymouth.

### **Preliminary scientific observations**

Weather conditions during this survey were very calm and, presumably due to minimal wave action, suspended solids concentrations within the estuary were much lower than had been anticipated from previous work. The combination of low suspended solids in the mouth of the estuary and sunny (mid summer) weather had given rise to a marked phytoplankton bloom in the vicinity of Bull Sand and Spurn Head. The effect of this can be seen in the UOR fluorometer output (calibrated against samples) plotted against salinity in Figure 5b. The chlorophyll fluorescence measured by the NRA is shown for comparison. The optics of this instrument (Turner Associates) are apparently sensitive to the relatively higher suspended solids in the salinity range 15-20ppt and insensitive to chlorophyll in the peak of the bloom at about 29ppt.

### **Conclusions**

All the primary objectives of this survey were achieved. Analysis of discrete samples is in hand and the results will be used to calibrate underway data. All data will be forwarded to BODC as computer files in due course. The data from this survey will be identified with the prefix: SV1.

Prepared by Tony Bale, 2 October 93

Table 1. Details of the UOR tows: 'Sea Vigil' H1; times = GMT

Tow	start time	date	start position	end time	end position
1	05:11:23	30/6	N 53° 43.6 W 0° 20.8	09:00:33	N 53° 36.4 E 0° 21.7
2	10:10:13	30/6	N 53° 35.8 E 0° 19.2	11:16:25	N 53° 33.9 E 0° 05.8
3	11:41:26	30/6	N 53° 34.0 E 0° 05.4	12:26:01	N 53° 36.7 E 0° 04.7
4	12:43:32	30/6	N 53° 36.7 E 0° 04.9	14:10:00	N 53° 44.1 W 0° 19.9
5	08:01:56	1/7	N 53° 43.6 W 0° 21.9	11:03:28	N 53° 33.0 E 0° 14.1

Table 2. Location and time of vertical profile stations

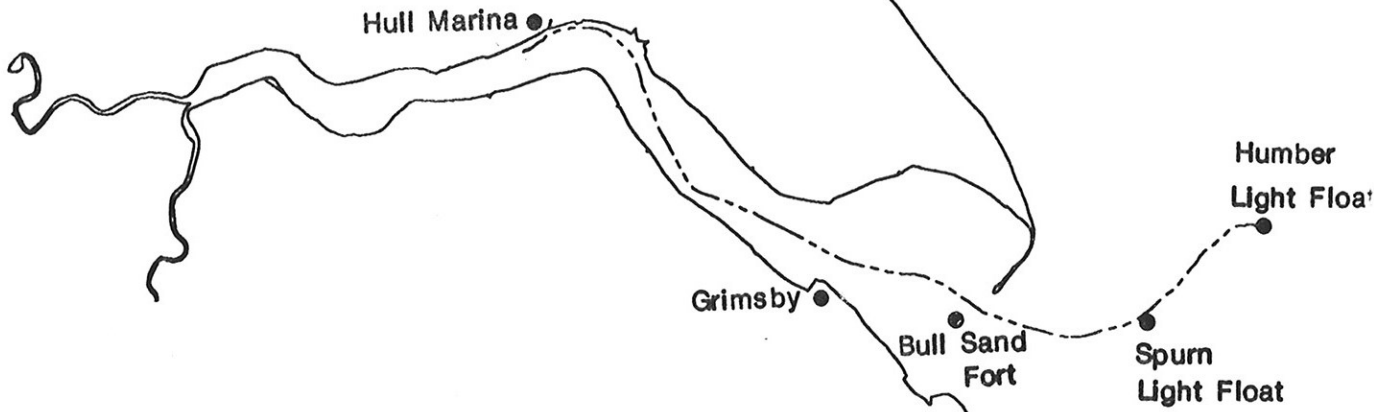
file	Lat	Lon	date	comments
HUM9	N 53° 43.99	W 0° 20.34	29/6	
P930630A	38.89	11.92	30/6	
P930630C	36.43	E 0° 21.84	30/6	
P930630F	33.89	05.53	30/6	
P930630J	36.70	W 0° 04.90	30/6	
P930630K	36.70	04.90	30/6	repeat
P930630L	44.09	19.96	30/6	(1515) repeat
P930630M	44.09	19.96	30/6	15:20hr repeat
P930701B	43.93	19.59	01/7	07:10hr A
P930701B	43.93	19.59	01/7	07:20hr repeat
P930701D	43.57	21.23	01/7	07:50hr B
P930701E	43.20	22.60	01/7	08:10hr C
P930701F	42.64	24.02	01/7	08:25hr D
P930701G	42.47	24.65	01/7	08:45hr Bridge E
P930701H	42.09	E 0° 14.12	01/7	12:05hr N.Sea
P930701H	33.09	14.12	01/7	ditto
P930701K	33.60	05.77	01/7	13:00hr Spurn Hd F
P930701M	33.54	05.59	01/7	13:35 sea mist G
P930701N	33.60	05.05	01/7	13:59hr H
P930701O	33.55	05.58	01/7	14:05hr I
P930701P	33.50	05.54	01/7	14:25hr J

BST

Data file : h693301

Fig 2 a

( Tow 1 )



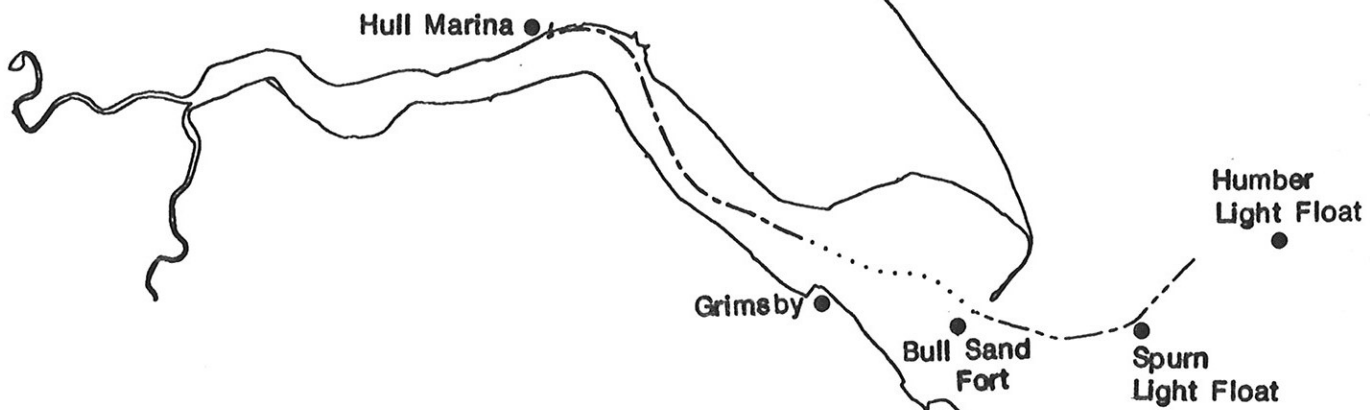
30 June 93

Humber Estuary




Data file : h693302 h693303 h693304

b

( Tows 2 3 4 )



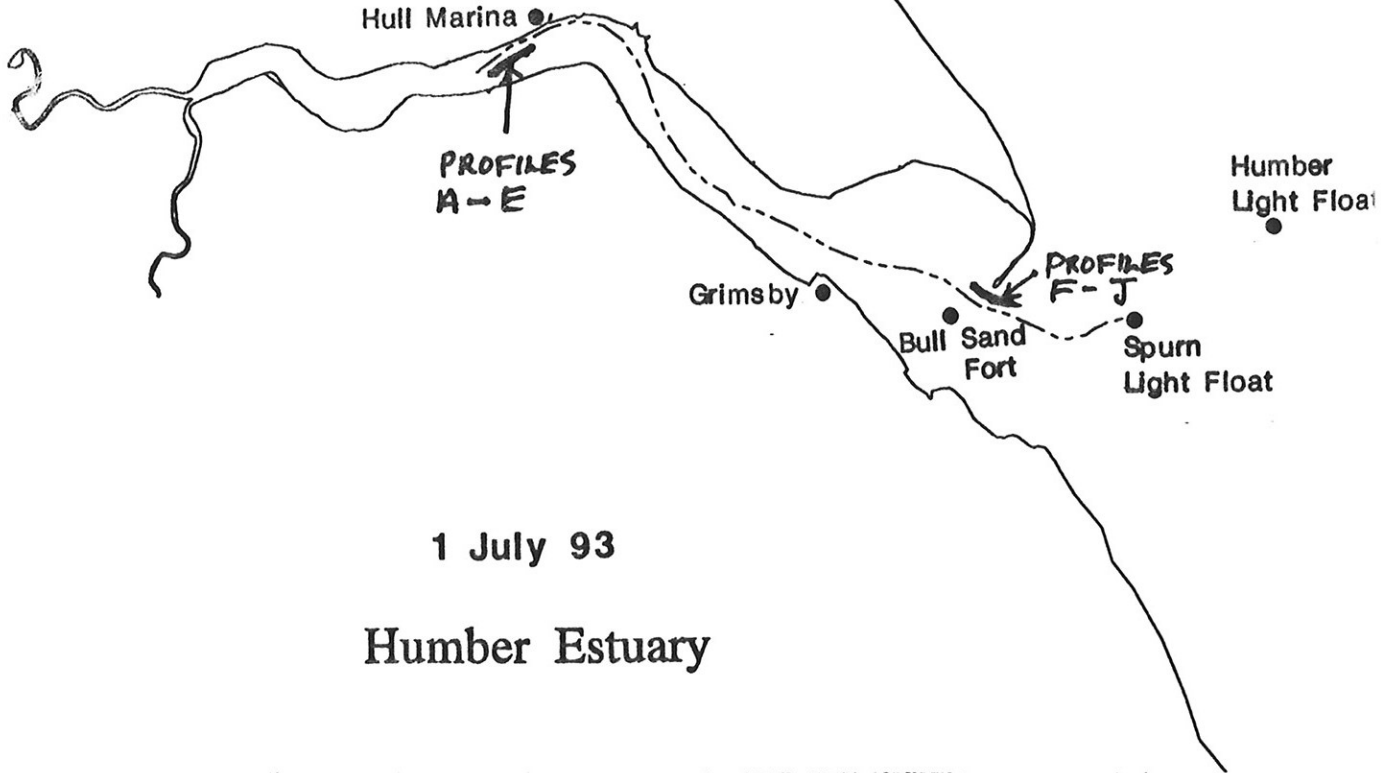
Tow number

	2
	3
	4

'H1' 30 June 93

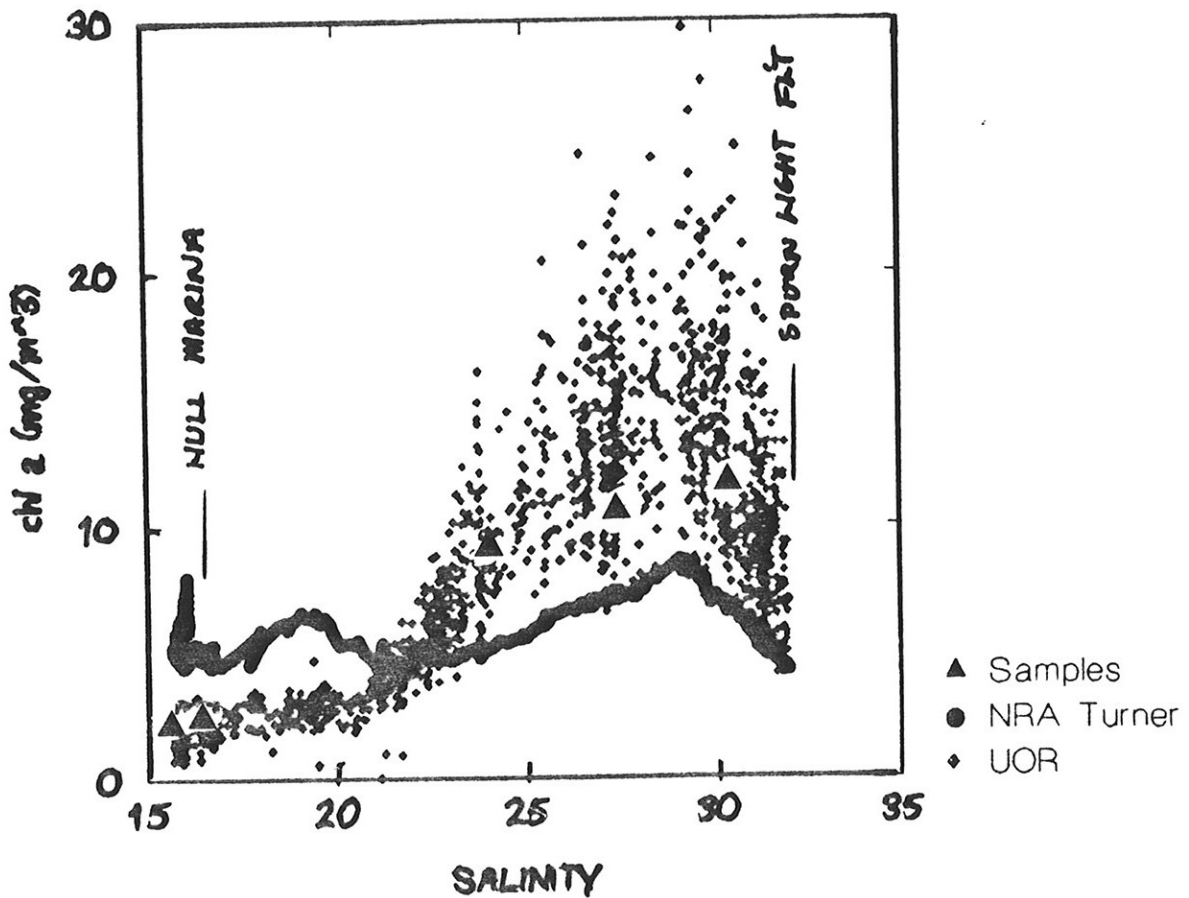
Humber Estuary

( Tow 5 )



1 July 93

Humber Estuary



Chlorophyll Plot For Tow 5

b