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# HYDROCARBON CONCENTRATIONS IN WATER AND SEDIMENTS FROM THE IRISH SEA, LIVERPOOL BAY AND THE ENGLISH CHANNEL

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## ABSTRACT

During 1978 and 1979 samples of water and sediment were collected from various sites around the UK, in order to gather data on the concentrations of hydrocarbons generally present in UK marine waters. A summary of results for samples obtained during 1978 has already been presented to ICES, results for those collected during 1979 are reported here.

Total hydrocarbon concentrations (THCs) of one metre depth water samples, as measured by fluorescence spectroscopy (UVF), were very low in samples collected away from estuaries. In the English Channel THCs were 0.2 to 4.7 µg $l^{-1}$ Ekofisk crude oil equivalents, and in the Irish Sea 2.4 to 3.5 µg $l^{-1}$. The highest concentration was found in the Mersey entrance (74 µg $l^{-1}$).

The range of THCs in surface sediments was 0.46 to 540 µg $g^{-1}$ dry weight Ekofisk crude oil equivalents, the highest THC being found in the Mersey entrance. High THCs were also found in Falmouth Bay, Carmarthen Bay and Liverpool Bay.

## INTRODUCTION

A paper presented at last year's ICES Statutory Meeting (Law, 1979) identified a lack of data on the concentrations of hydrocarbons in UK marine waters. That paper reported results of UVF analyses of water and sediments from the North Sea and English Channel collected during four cruises in 1978. This paper presents the results of UVF analyses of samples collected during a further cruise in 1979; samples being taken from the English Channel, Irish Sea and Liverpool Bay.

The aim of these surveys was to gather background information on petroleum hydrocarbon concentrations. Samples were collected from both offshore and coastal sites and included industrial areas with high expected inputs and samples from areas expected to be clean.

## SAMPLING AND EXTRACTION

Samples were collected during a cruise aboard RV CLIONE, 9-14 September 1979: the locations of the sampling sites are shown in Figure 1. The samples of seawater were collected from 1 m depth by means of a 2.7 l glass bottle sealed with a teflon stopper and mounted in a weighted frame. The sampling bottles were opened at the required depth, and then resealed prior to recovery.

The sampling of surface sediments and the extraction methods used for both types of samples have been previously described (Law, 1978).

## ANALYSIS

UVF analyses were carried out using a Baird-Atomic SFR-100 ratio-recording spectrofluorimeter. The procedure used was based on that adopted for the IGOSS project (IOC/WMO, 1976). Both emission (excitation 310 nm) and synchronous ($\Delta\lambda$ = 25 nm) spectra were recorded for each sample. All results are quoted as equivalents of Ekofisk crude oil, used as an arbitrary standard in both this and the earlier survey.

Blanks were equivalent to approximately 0.4 $\mu g\ l^{-1}$ (water samples) and 0.09 $\mu g\ g^{-1}$ (sediment samples). These amounts have not been subtracted from the results quoted.

## RESULTS AND DISCUSSION

The results of water analyses are presented in Table 1, and those of sediment analyses in Table 2.

### Water

The water samples collected away from estuarine areas contained very low THC concentrations. In the English Channel the THC concentrations ranged from 1.2 to 1.7 $\mu g\ l^{-1}$ Ekofisk crude oil equivalents and were similar to those found previously in the western Channel (1.1 to 1.7 $\mu g\ l^{-1}$), but lower than those found previously in the eastern Channel (2.1 to 2.8 $\mu g\ l^{-1}$) (Law, 1979). In contrast, samples taken in areas receiving the discharges from large urban areas or from refinery complexes, were higher. Thus, in the outer Thames Estuary

concentrations in water were 5.7 and 7.1 $\mu g\ l^{-1}$ and in the area adjacent to Southampton Water concentrations increased from 1.5 $\mu g\ l^{-1}$ south of the Isle of Wight to 2.9 and 4.9 $\mu g\ l^{-1}$ to the west and east of the Solent and 7.7 $\mu g\ l^{-1}$ in the area adjoining the southern part of Southampton Water.

Samples of offshore water from the Irish Sea contained slightly higher concentrations than were found in the Western Channel (2.1 to 3.5 $\mu g\ l^{-1}$). Higher THCs were found in water samples from estuarine areas and in Liverpool and Morecambe Bays. The highest concentration (74 $\mu g\ l^{-1}$ Ekofisk crude oil equivalents) was found in a sample (Station 4) taken at low tide in the mouth of the Queen's Channel, the main entrance to the River Mersey. The Mersey and the surrounding area are heavily industrialised and large quantities of shipping move through this area to the docks at Liverpool. All other inshore samples had THCs ranging from 2.9 to 12 $\mu g\ l^{-1}$. Station 5 was close to the single point mooring buoy (SBM) at the Amlwch oil terminal on Anglesey. At the time of sampling the 475 000 tonne supertanker BATILUS had just finished discharging oil via the SBM and was preparing to leave. The THC of this water sample was fairly low, 5.2 $\mu g\ l^{-1}$.

Sediment

Surface sediment samples showed a wide range of THCs, 0.46 to 340 $\mu g\ g^{-1}$ dry weight Ekofisk crude oil equivalents. The highest THC was again found in the Queens's Channel (340 $\mu g\ g^{-1}$) where the sediment was very muddy. High THCs were also found in areas of probable high input, e.g. 48 $\mu g\ g^{-1}$ in Falmouth Bay, 54 $\mu g\ g^{-1}$ in Carmarthen Bay and 29 $\mu g\ g^{-1}$ in Liverpool Bay.

CONCLUSION

This cruise concluded the planned sampling programme for this survey of hydrocarbon levels around the UK. Only the UVF analyses have been reported to date, but further analysis by gas-liquid chromatography and combined gas chromatography - mass spectrometry is underway, and the results will be reported at a later date.

REFERENCES

INTERNATIONAL OCEANOGRAPHIC COMMISSION/WORLD METEOROLOGICAL OFFICE, 1976. Guide to the operational procedures for the IGOSS project on marine pollution (petroleum) monitoring. UNESCO Manuals and Guides, No 7, 50 pp.

LAW, R. J., 1978. Determination of petroleum hydrocarbons in water, fish and sediments following the Ekofisk blow-out. Mar. Pollut. Bull., 9: 321-324.

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Table 1 Total hydrocarbon concentrations ($\mu g\ l^{-1}$ Ekofisk crude oil equivalents as measured by UVF) in 1 m water samples

| Station | Concentration |
|---|---|
| 1 | 12 |
| 2 | 3.5 |
| 3 | 6.4 |
| 4 | 74 |
| 5 | 5.2 |
| 6 | 2.7 |
| 7 | 4.5 |
| 8 | 2.1 |
| 9 | 2.1 |
| 10 | 4.9 |
| 11 | 5.1 |
| 12 | 10 |
| 13 | 1.7 |
| 14 | 1.2 |
| 15 | 1.5 |
| 16 | 1.5 |
| 17 | 1.5 |
| 18 | 4.9 |
| 19 | 7.7 |
| 20 | 2.9 |
| 21 | 1.7 |
| 22 | 1.7 |
| 23 | 7.1, 5.7 |

Table 2 Total hydrocarbon concentrations ($\mu g\ g^{-1}$ dry weight Ekofisk crude oil equivalents as measured by UVF) in samples of surface sediment

| Station | Depth (m) | Sediment type | Dry weight (%) | Concentration |
|---|---|---|---|---|
| 1 | 32 | Medium sand | 75 | 12 |
| 2 | 44 | Sand and large shell | 83 | 4.9 |
| 3 | 30 | Sand, shell and mud | 81 | 29 |
| 4 | 12 | Mud and sand | 50 | 340 |
| 6 | 100 | Gravel and sand | 88 | 5.8 |
| 7 | 26 | Mud, sand and shell | 74 | 16 |
| 9 | 68 | Medium sand and shell | 74 | 9.9 |
| 11 | 20 | Fine sand and mud | 76 | 34 |
| 13 | 52 | Shell, sand and gravel | 79 | 3.9 |
| 15 | 49 | Fine sandy silt and shell | 56 | 48 |
| 16 | 90 | Shell and sand | 74 | 3.3 |
| 17 | 28 | Stones and gravel | 90 | 0.46 |
| 18 | 22 | Stones, gravel and sand | 25 | 1.4 |
| 20 | 19 | Medium/coarse sand and shell | 72 | 4.7 |
| 21 | 53 | Stones, shell and gravel | 84 | 3.3 |
| 23 | 26 | Fine sand and shell | 77 | 5.2 |

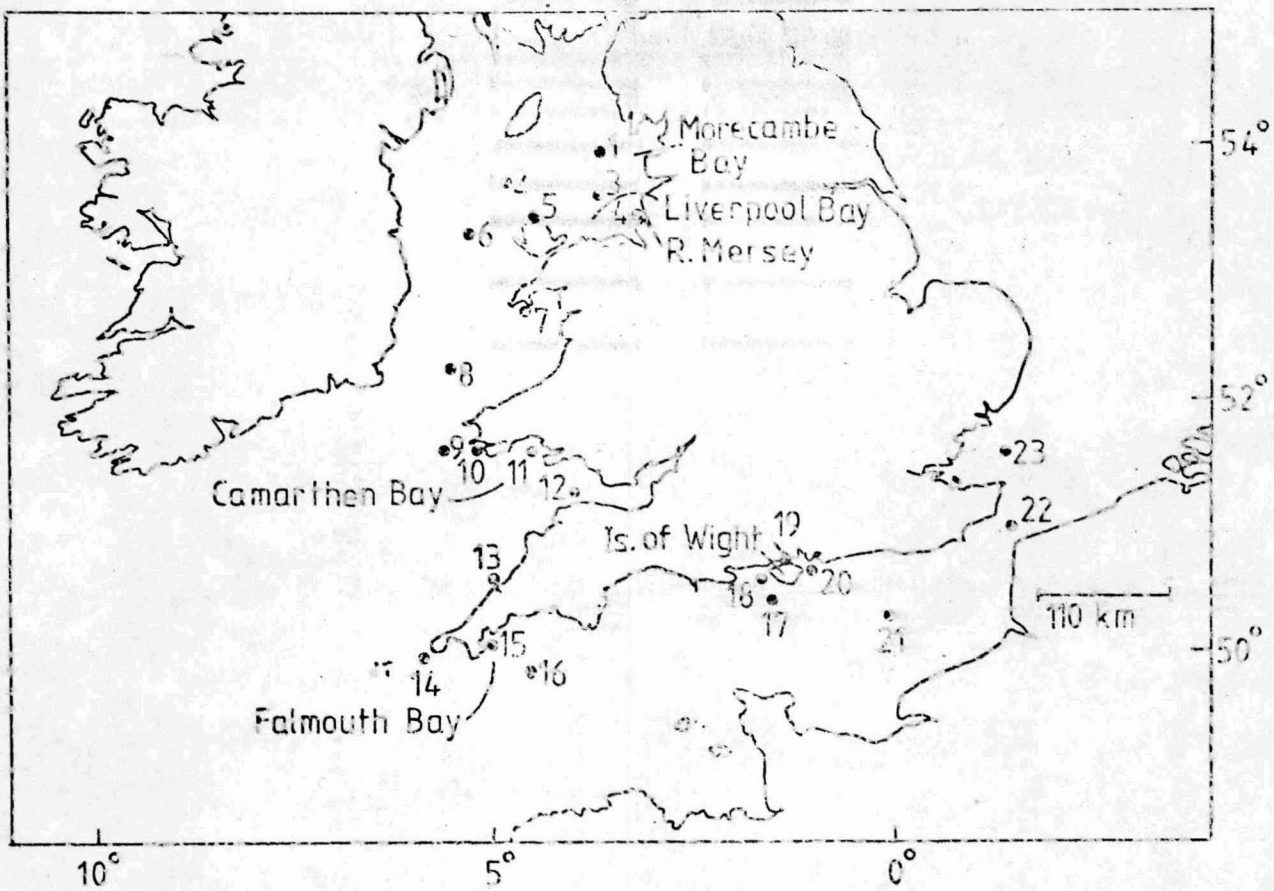


Figure 1 Location of sampling sites for water and sediment samples.