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FRV *Scotia*

Cruise 1102S

## REPORT

20 July - 3 August 2002

**Start port:** Aberdeen

**End port:** Aberdeen

### Personnel

Alistair McIntosh (In charge)  
Craig Robinson  
Anne Craig  
Eric Dalgarno  
Gill Packer  
Andy Smith (CEFAS) Visitor

### Fishing Gear

Granton 48' Trawl (BT101) (modified) - with tickler chains; 3 m beam trawl

### Objectives

1. To conduct a survey of the offshore oil development and production effects on hydrocarbon loadings in fish, shellfish and sediments in the East Shetland Basin.
2. To conduct a random stratified sampling survey in the East Shetland Basin to determine temporal changes in hydrocarbon loading in surface and depth profile sediment samples.
3. To conduct a survey of the offshore oil development and production effects on hydrocarbon loadings in fish, shellfish and sediments in the Forties field.

**Estimated Days per Project:** 15 days AE08o

### Narrative

After all scientific gear and equipment had been loaded and secured, *Scotia* sailed from Aberdeen at 1100 hours on 20 July and made passage for the north of the East Shetland Basin area. Twenty six carboys of (low nutrient) sea water were filled at a location in the outer Moray Firth. *Scotia* arrived at the first sediment sampling station at 1400 hours on 21 July. Over the next seven days, and working 24 hours per day, a sediment survey was conducted at the locations shown on the attached figure. Trawling was undertaken at eight locations within this sampling grid. This part of the survey was completed by 0100 hours on 28 July, and *Scotia* made passage south to the Forties oilfield. Sediments were sampled at randomly selected stations on a transect between the East Shetland Basin sampling area and trawls were taken at four locations on this transect covering potentially impacted and non impacted areas.

Sampling in the Forties field commenced at 0900 hours on 30 July. Trawls were taken in the vicinity of the Forties field, covering the north, east, south and west areas of the oilfield. Sediments were sampled at the start, mid and end points of the trawl track. Trawling was then conducted on a gradient of five stations in a south-south-westerly direction from the Forties field. On completion of the survey, *Scotia* made passage for Aberdeen where docking was completed by 1800 hours on 2 August. All fishing and scientific equipment was unloaded on 3 August.

## Results

The purpose of the main survey was to investigate any temporal change in the hydrocarbon loading in the sediments of the East Shetland Basin area and whether there was any detectable impact on fish.

As a consequence of the proliferation of exploration and production activity in the East Shetland Basin and to inform the debate on the need to gain a better description of wider area contamination patterns to advise future wider area monitoring surveys, a random stratified sampling regime was adopted. The criteria for selection of the sampling sites were those areas within defined blocks that were greater than 5 km from multi-well drilling sites and greater than 2 km from other known drilling activity.

This survey comprised 250 sediment sampling sites. Sediment was sampled by Day grab. The multicorer was deployed on five occasions and provided material for depth profile analysis.

All sediment samples will be analysed initially for the presence of hydrocarbons by ultraviolet fluorescence (UVF) oil equivalent determination and based on this screening, further analysis will be conducted on selected samples to determine and quantify the polycyclic aromatic hydrocarbon (PAH) and *n*-alkane composition and concentration.

An aliquot of sediment from every sample was taken for subsequent particle size analysis (PSA) and carbon, hydrogen and nitrogen (CHN) analysis. The above analyses will be carried out by FRS ML.

At each of the sediment sampling locations, duplicate samples were taken for yeast oestrogen (YES) and androgen (YAS) screening. Sediment for macrobenthos analysis was sampled in triplicate from a potentially impacted location, 500 m from a multi-well production site, a potentially moderately impacted site, greater than 2 km from known drilling activity and from one non impacted sites remote from any known drilling activity. These analyses will be carried out at CEFAS Burnham laboratory.

Haddock, mackerel, herring, and *Nephrops* were sampled by trawl at eight locations within the sampling grid in the East Shetland Basin and provided pools of (five) fish muscle tissue for sensory assessment and similar pools of (five) muscle and liver tissue for PAH analysis. Lemon sole were sampled for hepatic EROD activity, sensory assessment and muscle and liver tissue for PAH analysis.

Cod, plaice and saithe were sampled for plasma vitellogenin (VTG) analysis and samples of gonad and liver taken for histological examination in support of VTG analysis. Liver and muscle tissue were sampled from the three species for exploratory alkyl phenol (AP) analysis.

Twenty sediment samples and four trawls were taken on a transect between the East Shetland Basin and the Forties field and provided a similar range of samples as outlined above.

At the Forties field, nine trawls were taken on the north, east, south and west of the field, which provided pools of fish muscle tissue for sensory assessment and pools of muscle and liver tissue for PAH analysis from haddock, mackerel, herring and *Nephrops*. Lemon sole were sampled for hepatic EROD activity, sensory assessment and PAH analysis of muscle and liver tissue. Cod and plaice were sampled for plasma VTG analysis and samples of gonad and liver taken for histological examination in support of VTG analysis.

All samples were treated according to standard protocols. All sensory assessment of fish muscle tissue, hepatic EROD activity, PAH determination in fish liver and muscle tissue will be carried out at FRS ML. All VTG, AP and histological analyses will be carried out by CEFAS at their Burnham-on-Crouch and Weymouth laboratories.

Summary of fish samples collected during survey.

Fish	Haddock	Mackerel	Herring	<i>Nephrops norvegicus</i>	Lemon sole	<i>Limanda limanda</i>
Sensory assessment	44 Pools of 5 fish	15 Pools of 5 fish	12 Pools of 5 fish	5 Pools of 20	50 Pools of 5 fish	
PAH chemistry	44 Pools of 5 fish (FL and LV)	15 Pools of 5 fish (FL and LV)	12 Pools of 5 fish (FL and LV)	(1)	50 Pools of 5 fish (FL and LV)	8 Pools of 5 fish (FL and LV)
Biological effects (hepatic EROD activity; PAH bile metabolites <sup>2</sup> )					260; 65	40;8
Sampled by CEFAS		Cod	Plaice	Saithe		
Plasma VTG analysis		187	62	20		
Liver and gonad histology		187	53	n/a		
Alkyl phenol analysis		62	42	20		

(1) Tail flesh will be split for sensory and chemical analysis

(2) Bile sampled as pools from 5 fish

Summary of sediments collected during survey.

Area sampled	Determinands			
	PAH chemistry	PSA/CHN	YES/YAS	macro benthos analysis
East Shetland Basin	250	250	250 in duplicate	2 x 3 grabs + 5 cm core
Transect to Forties field	32	32	32 in duplicate	1 x 3 grabs + 5 cm core
Forties field	18	18	18 in duplicate	
Transect west of Forties	15	15	15 in duplicate	

All objectives were successfully completed due to agreeable weather conditions, the excellent co-operation of the officers and crew of *Scotia* and the effort and co-operation given by the scientific staff.

A McIntosh  
9 August 2002

Seen in draft: Captain P Ramsay, OIC *Scotia*

Figure 1 Cruise track and sampling locations - 1102S - 20 July - 2 August 2002

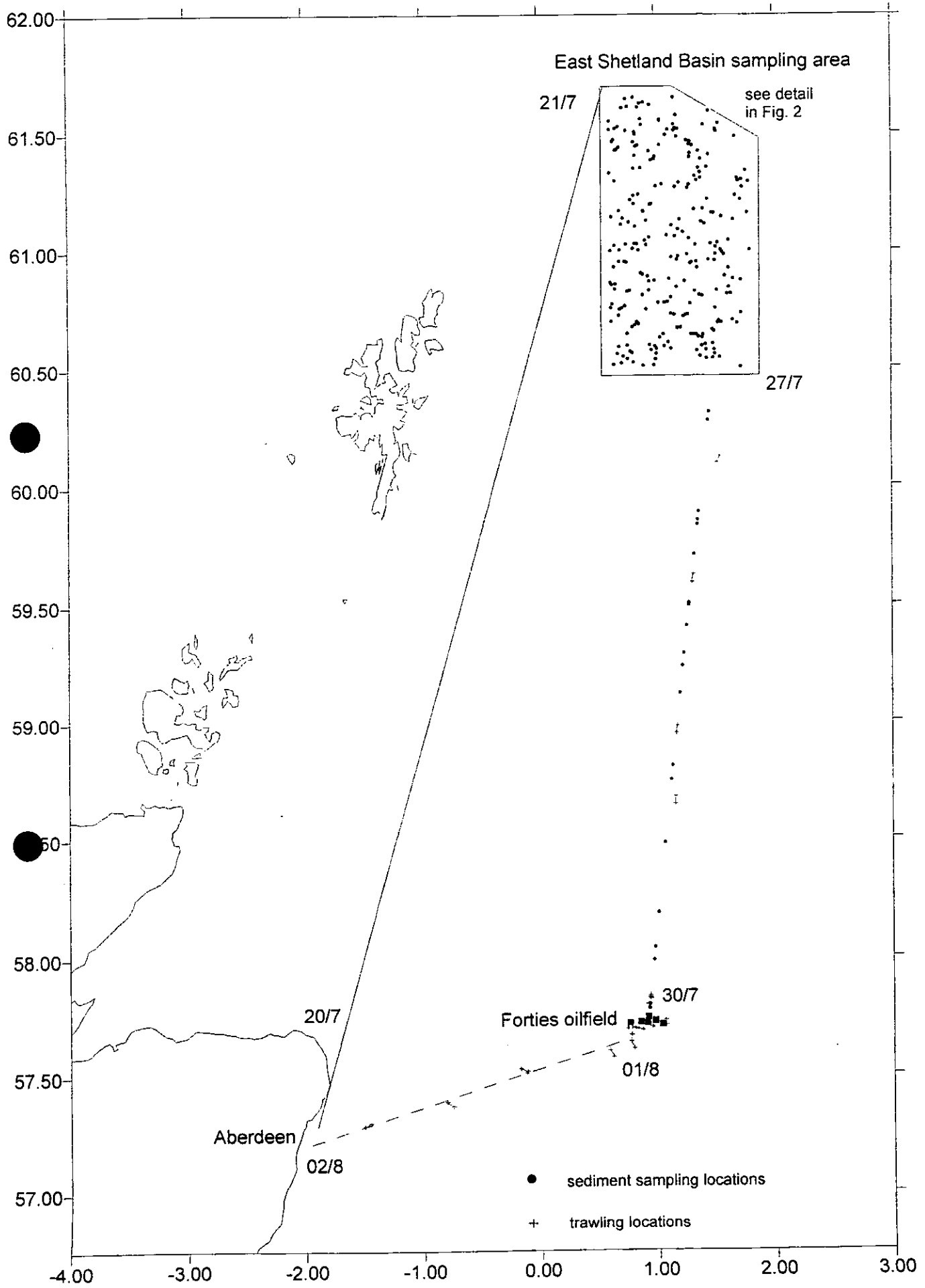


Figure 2

# Sediment sampling and trawl locations - East Shetland Basin - 1102S

