

**DEPARTMENT FOR ENVIRONMENT, FOOD AND RURAL AFFAIRS.  
CEFAS LOWESTOFT LABORATORY, LOWESTOFT, SUFFOLK, ENGLAND.**

**2004 RESEARCH VESSEL, PROGRAMME.**

**REPORT: RV ENDEAVOUR; CRUISE 7/04.**

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All staff from Burnham Laboratory unless indicated otherwise.

**DURATION:**

21<sup>st</sup> June to 12<sup>th</sup> July, 2004.

**LOCATION:**

North Sea, Irish Sea, Celtic Sea and English Channel.

**AIMS:**

1. To collect samples of demersal fish for chemical analysis from the North Sea, Eastern English Channel and Irish Sea in support of UK National Marine Monitoring Programme (NMMP).
2. To collect water samples for NMMP biological effects studies and to deploy fractionation / bioassay techniques on water samples from offshore and near shore/estuarine locations.
3. To collect fish samples at NMMP sites, for fish disease and genetic toxicological analysis (e.g. DNA adducts).
4. To further investigate the use of appropriate biochemical, cytochemical and other biological techniques in support of NMMP.

5. To sample representative offshore NMMP locations using grab, core, and trawl for trace metal contaminants, PAHs and other organic contaminants (including nonylphenols, flame retardants and HCs) and the benthic fauna.

6. To collect biota for determination of imposex and TBT analysis, and sediment for TBT analysis from shipping lanes, anchorages and reference sites in support of OSPAR requirements.

**Additional aim:**

7. To collect NMMP summer water samples for nutrients, salinity and chlorophyll.

**NARRATIVE: (all times GMT)**

*ENDEAVOUR* sailed from Swansea at 1900 hrs on the 21<sup>st</sup> June and steamed to south Cardigan Bay, arriving there in the early morning of 22<sup>nd</sup> June. The presence of static gear prevented the trawl from being deployed at the south Cardigan Bay station and *ENDEAVOUR* steamed north to the mid Cardigan Bay station (NMMP 656). The trawl was deployed here to collect fish for aims 1, 3 and 4. In addition, sediment samples from a series of 10 Day grabs and benthos from a 2m-beam trawl were obtained at the NMMP station 665, 2 miles north of NMMP station 656 for aim 5. Throughout the day the wind had freshened but the easterly wind and cliffs of mid Cardigan Bay had not hampered the sampling. However, a westerly gale warning had been given for sea areas Lundy and Irish Sea for late evening of the 22<sup>nd</sup> June and consequently after completion of this station *ENDEAVOUR* sailed overnight to Dundrum Bay (NMMP 815). By late morning on the 23<sup>rd</sup> June sufficient fish had been collected for aim 1. As the weather was deteriorating *ENDEAVOUR* steamed north to Belfast Lough. By mid afternoon the wind had reached 50 knots gusting 60 knots from the North West, no work was possible under these conditions and upon reaching Belfast Lough in the late afternoon *ENDEAVOUR* anchored by the North Shore.

The wind had eased by the morning of the 24<sup>th</sup> June and the ship's Jet Boat was used to collect water and sediment samples from stations in Belfast Lough for aims 2 and 6. Further sediment and water samples were taken at NMMP stations in Belfast Lough as *ENDEAVOUR* sailed to St Bees, east of the Isle of Man. At 1600 hrs the Granton trawl was deployed and after two tows sufficient fish were obtained for aims 1, 3 and 4. Overnight *ENDEAVOUR* moved to the SE Isle of Man NMMP 806 fishing station and collected fish for aim 1, 3 and 4. This was completed by late morning when *ENDEAVOUR* moved to the SE Isle of Man (NMMP 805) benthos station. A series of 10 Day grabs was successfully completed as well as six multicore deployments and a 2m wooden beam for macrobenthos for aim 5. After completing this station the ship sailed to the Morecambe Bay (NMMP 795) station where fish were collected after 3 tows of the Granton trawl. This station was completed by 2130 hr.

On the morning of the 26<sup>th</sup> June *ENDEAVOUR* was in position at the Burbo Bight (NMMP 706) station where the Granton trawl was deployed to collect fish samples for aims 1, 3 and 4. This was followed by a further deployment of the Granton trawl to the west of Burbo Bight at the Trend station where commercial fish species in length stratified size ranges were collected for trend analysis (aim 1). At 1515 hrs the ship had moved to the Liverpool Bay NMMP station (715). After successfully collecting fish a series of 10 Day grabs and the 2m beam were used to collect sediments and macrobenthos for aim 5. This work was completed at 2100hrs.

On the morning of the 27<sup>th</sup> June further fishing was carried out with the Granton trawl at the Trend station and the Red Wharf (NMMP 776) station for aims 1, 3 and 4. Overnight *ENDEAVOUR* steamed to North Cardigan Bay (NMMP 649) and in the afternoon to Off Cardigan Bay (NMMP 665). At these two stations fish were successfully collected with the Granton trawl for aims 1, 3 and 4. *ENDEAVOUR* then sailed to Carmarthen Bay (NMMP 616) arriving there on the morning of the 29<sup>th</sup> June. Fishing was successfully completed here by 1100 hrs after which the ship steamed to Weymouth.

*ENDEAVOUR* arrived at Weymouth in the early evening of 30<sup>th</sup> June. On the morning of 1<sup>st</sup> July approximately 30 staff from the Weymouth Laboratory visited the ship and were given guided tours by scientific staff and the ship's officers. Whilst in port, liquid nitrogen was brought on board to replenish the storage Dewars. In addition, replacement equipment was brought on board and the changeover of four staff took place. During the cruise an intermittent fault had developed in the ships electrical system in the engine room and during the time in Weymouth this was successfully repaired. *ENDEAVOUR* sailed from Weymouth on the afternoon of the 1<sup>st</sup> July.

Overnight the ship sailed to Rye Bay (NMMP 486) and successfully collected fish from the outer and inner trawling stations for aims 1, 3 and 4. During the morning the wind had freshened and by 1330 hrs was strong to gale from the south-west. *ENDEAVOUR* then proceeded along the Dover Straits inside the separation zone and using the 3m steel beam collected whelks and macrobenthos from Hythe Flats (south of Dover) and The Downs (north of Dover) for aim 6.

By morning on the 3<sup>rd</sup> July the wind remained strong from the south-west and *ENDEAVOUR* continued sampling for macrobenthos on the Thames Warp anchorage for aim 6. The 3m steel beam was shot on three occasions and accompanying Day grabs across the tows were successfully completed. This was completed by 1030 hrs and *ENDEAVOUR* sailed to the Outer Gabbard (NMMP 475), *en route* sampling for macrobenthos with the 3m steel beam at the Outer Sunk anchorage. On arrival at the Outer Gabbard it was discovered that a pipeline had been placed through the middle of the NMMP tow. The pipeline also passed through a nearby alternative tow used for the groundfish surveys. It was impossible to use the Granton trawl and as an alternative means of fishing the 3m beam was deployed on part of the tow. The trawl was shot on three occasions but was unsuccessful in obtaining fish in sufficient numbers. At 2000 hrs fishing was terminated. The wind remained strong from the south-west but with a promising improvement in the weather *ENDEAVOUR* sailed overnight to the Indefatigable Bank (NMMP 378) and Off Humber (NMMP 346). *En route* the Granton

trawl was deployed at the Smiths Knoll Trend site where commercial fish were collected for trend analysis. Fish were successfully collected for aims 1, 3 and 4 at the Indefatigable Bank and Off Humber stations. The work was completed by 2015 hrs.

Overnight on the 4<sup>th</sup> July the weather improved dramatically and *ENDEAVOUR* headed for the Dogger Bank. Over the next three days the Granton trawl was deployed successfully to collect fish for aims 1, 3 and 4 at Central Dogger (NMMP 287), NE Dogger (NMMP 283), North Dogger (NMMP 284), West Dogger (NMMP 286) and Off Flamborough (NMMP 344). After completion of the Off Flamborough station *ENDEAVOUR* sailed for Bridlington and dropped off a scientist using the ship's Jet Boat. By evening on the 7<sup>th</sup> July the weather had deteriorated and the forecast was for NE gales and the possibility of severe weather locally. On the evening of the 7<sup>th</sup> July forty mollusc/crustacean pots were deployed on the Humber anchorage for collection 24hrs later.

On the morning of the 8<sup>th</sup> July the Granton trawl was deployed at the Inner Wash (NMMP 387) and later at the Humber (NMMP 377) stations and fish were successfully collected for aims 1 and 3. At 1900 hrs *ENDEAVOUR* returned to collect the pots from the Humber anchorage. Despite strong to gale force NE winds the pots were successfully recovered and samples obtained for aim 6.

Overnight and the following day the wind remained poor with strong NE winds. However, fishing was successfully completed at the Tees Bay (NMMP 344) and Amble (NMMP 244) stations using the Granton trawl for aims 1, 3 and 4. On the evening of the 9<sup>th</sup> July the mollusc/crustacean pots were deployed at the Tyne anchorage. At 0830 hrs on the 10<sup>th</sup> July the Jet Boat was launched to collect water and sediment samples for aim 2, 4 and 6. Whilst the small boat was sampling *ENDEAVOUR* collected a series of six Day grabs for sediment across the anchorage and successfully retrieved the pots. This was completed by mid day. In the afternoon *ENDEAVOUR* deployed the Granton trawl to sample fish for aim 1 at the Farne (NMMP 243). This was completed by 1700 hrs and the ship headed for Tees Bay, arriving there at 2145 hrs and subsequently deployed the mollusc/crustacean pots on the Tees Anchorage

On the morning of the 10<sup>th</sup> July the Jet boat was launched and sediment and water samples collected at five stations on the Tees (aims 2 and 4). At the same time *ENDEAVOUR* successfully retrieved the pots obtaining samples of whelks, hermit crabs and velvet crabs. All work was completed by 1100 hrs and *ENDEAVOUR* sailed for Lowestoft, berthing on the morning tide of the 12<sup>th</sup> July.

## RESULTS

**Aim 1.** Samples of dab for chemical analysis were collected when caught in sufficient numbers (i.e. 50) and appropriate size at all NMMP sites. This amounted to 24 stations (see appendix 1) and coincided with sites where fish were caught for biological effects and fish disease studies. All samples were frozen and stored at -20 C. for chemical analysis at the Burnham Laboratory.

Samples of plaice, dab and whiting in five consecutive length stratified groups were collected for trend purposes from Liverpool Bay. Dab only were collected from the Smith's Knoll trend site. All samples were frozen and stored at -20 C. for chemical analysis at the Burnham Laboratory.

**Aim 2.** Twenty eight 60l bulk water samples were taken from NMMP sites and additional sites and extracted on-board using SPE cartridges for concentrating contaminants and subsequent bioassay back at the Burnham laboratory. Seventeen water samples were taken at inshore sites for extraction and subsequent analysis of pharmaceutical contaminants. Sediment samples were collected from 38 NMMP and additional stations using the Day grab. These sediments were frozen and will be analysed for chemical contaminants to support the chemical contaminants in fish NMMP programme and to support biological effects studies. In addition these sediments will be analysed for ArH dioxin-like screening using the CALUX assay.

**Aim 3.** External and internal diseases of dab (*Limanda limanda*) were assessed at the following stations. Figures in parenthesis refer to numbers of dab sampled for histopathology and for external diseases respectively:

Indefatigable Bank (50, 264), Rye Bay (50, 242), Carmarthen Bay (50, 137), Inner Cardigan Bay (50, 106), Roker Park (50, 0), SE Isle of Man (50, 201), Morecambe Bay (50, 250), Red Wharf Bay (50, 230), Liverpool Bay (50, 197), Liverpool Trend Site (0, 83) Burbo Bight (50, 205), St. Bee's (50, 125), West Dogger (50, 219), North Dogger (50, 253), North East Dogger (50, 300), Hospital Ground (50, 295), Off Humber (50, 208), Off Flamborough (50, 211), Off Tees (50, 211), Amble (50, 200).

In total, 4887 dab were screened for disease. Liver nodules were removed and will be further processed for histological diagnosis of lesion type. Additionally, large tumours were excised and frozen for proteomic and genomic assessment of tumour-specific protein and genes. Those dab routinely sampled for histopathological changes in liver were further sampled for blood plasma and liver, which were subsequently frozen for proteomic and metabolomic assessment respectively. These specimens will be retained in a tissue bank at the CEFAS Weymouth laboratory for cross-referencing to samples taken for histology and biomarker assessment.

### **Other fish species examined**

A number of additional fish species were collected from each haul for assessment of pathology and for parasites. These included whiting, haddock, flounder, lesser spotted dogfish, John Dory, ling and cod. In total, 32 cod were sampled for plasma, bile, CALUX and histopathology from five sites, namely Smith's Knoll (2), Off Humber (15), Off Tees (2), Amble (8) and Farne Deep (5). Material from these species will be further analysed at the Burnham and Weymouth laboratories.

### **Shellfish species examined**

In addition to the fish species listed above, a number of species of crustaceans and molluscs were collected for pathology and parasitology. Molluscs included king scallops, queen scallops and horse mussels. Crustaceans included Norway lobster (*Nephrops norvegicus*), pink shrimp (*Pandalus montagui*), sand swimming crab (*Liocarcinus depurator*), velvet swimming crab (*Necora puber*) and shore crab (*Carcinus maenas*). Preliminary examinations revealed the presence of the dinoflagellate parasite *Hematodinium* in the haemolymph of *L. depurator*, *N. norvegicus* and *C. maenas*. For confirmation, further samples were collected for electron microscopy and molecular biology and will be examined at the Weymouth laboratory.

### **Electron microscopy**

Selected samples were collected and preserved for ultrastructural analysis under the scanning and transmission electron microscope. This included samples of Norway lobster and velvet swimming crab for diagnosis of *Hematodinium*, samples of flounder liver for presence of fibrillar inclusions, samples of horse mussel digestive gland for analysis of intercellular parasites, samples of dab epidermis for analysis of epidermal papilloma/hyperplasia lesions and samples of liver tumours excised from dab for ultrastructural analysis and application of immuno-gold labelling of tumour-specific proteins.

### **Virology and Molecular Genetics**

Samples of John Dory, hake, sprat, cuckoo ray, thornback ray, starry smoothhound, black sea bream, sea bass, common eel, twaite shad, ling, anglerfish, greater sandeel and herring were sampled for food authenticity testing carried out by the Virology and Molecular Genetics (VMG) team at the Weymouth laboratory. Herring were further sampled for liver, kidney, spleen and heart for the detection of the VHS virus.

**Aim 4.** Fish tissue was collected from dab at 18 locations (including NMMP) for biological effects investigations using biomarkers. Sections of dab liver were stored in liquid nitrogen for measurement of EROD activity, analysis of DNA adducts and bile was frozen for PAH analysis. The analysis will be carried out at the Burnham and Lowestoft Laboratories.

**Aim 5.** Ten sediment samples were collected for the determination of metal and organic contaminants and benthic fauna, from each of 3 NMMP sites (655, 715 and 805). Chemical analysis and identification of the benthos will be carried out back at the Burnham Laboratory. In addition, 2-m beam benthos samples were collected at these three sites.

**Aim 6.** Sediment samples were collected from 38 NMMP and additional stations and frozen at -20 C for subsequent TBT analysis at the Burnham Laboratory. *Buccinum undatum*, *Neptunea antiqua*, *Eupagurus bernhardus* and *Portunus puber* were collected at 12 NMMP fishing stations for the analysis of imposex in whelks and also for the analysis of TBT in tissues. In addition, targeted sampling of these species was

successfully carried using baited pots at large ship anchorages at the Tyne, Tees and Humber anchorages. Previous sampling at these sites with trawls and dredges had resulted in loss of gear.

**Aim 7.** Twenty-four water samples were collected from NMMP and other appropriate sites for nutrient, salinity and chlorophyll studies. Water samples were taken through the ships Wet Laboratory continuous sea water pumping system. Analysis of these samples will be carried out at the Lowestoft Laboratory.

**Cetacean sightings:**

During the ship's passage the following cetaceans were sighted.

21<sup>st</sup> June 2004, 2020 hrs at 51 30.70N 04 19.73W

Six small common dolphins following the ship for twenty minutes as then ship sailed west (off Gower).

29<sup>th</sup> June 2004, 0835 hrs at 50 50.06N 05 18.03W

Four Common Dolphins following the ship for around 30 minutes as the ship headed south-west.

**Acknowledgements:** I would like to acknowledge the active and excellent support and help of the Captain, officers and crew in completing the above programme of work

John Thain (**Scientist In Charge**) - signed  
12<sup>th</sup> July 2004.

**SEEN IN DRAFT:**

Captain R McCurry (**Master**) - signed

A Lincoln (**Fishing Skipper**) - signed

**INITIALLED:**

Jacqueline Jones (**Contract Leader for CEFAS NMMP**) - signed

David Morris (**Science Area Head**) - signed

**DISTRIBUTION:**

Basic list: +

J Thain (SIC)

J Jones

W Reynolds

B Lyons

G Stentiford

E Garnacho

S Feist

K Bateman

J Bignall

S Lincoln

S Lucas

F Goodsir

L Clarke

P Martin

A Kenny

J Harries

S Brooks

Paul Roberts

A Franklin

D Morris