

CENTRE FOR ENVIRONMENT, FISHERIES AND AQUACULTURE SCIENCE,  
LOWESTOFT, SUFFOLK, UK

DRAFT 2004 Cruise Report

PROGRAMME: RV CEFAS Endeavour: CRUISE 14

STAFF:

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DURATION: Friday 22<sup>nd</sup> October – Monday 1<sup>st</sup> Nov  
Approx Sailing Time 1845 BST (HW 1704 GMT)  
Approx Docking Time 1030 GMT on 1<sup>st</sup> (HW 1139 GMT)  
LOCALITY: Central North Sea, Dogger Bank region

Full Cruise Report CEFAS Endeavour 1404 22<sup>nd</sup> October- 1<sup>st</sup> November

#### Cruise Aims

This cruise is part of the A1225 project aimed to better understand the dynamics of circulation processes of the seas around the UK and to characterise the extent and nature of density driven and seasonal jet-like circulation which acts as a direct and rapid pathway for transport of material.

This cruise and the previous cruises *Corystes* 13/04 and *C. Endeavour* 12/04 were targeted to describe the gradual (September – November) alteration of pathways as frontal regions move and revert to the fully mixed and largely wind driven winter regime. The chosen area of interest is the northern flank of the Dogger Bank with moorings along a line that was previously visited in June and August 1999, 2000 and 2001.

The main aims of the cruise were:

1. Recover ADCP moorings used to study the mixing processes in the transitional region.
2. To characterise the hydrographic and biogeochemical structure associated with the frontal regions by use of towed undulating CTDs and rosette casts (water bottle + CTD).
3. Recover ARGOS drifting buoys used to quantify Lagrangian circulation.

#### Cruise Summary

*C. Endeavour* sailed on Friday 22<sup>nd</sup> October with the promise of difficult weather conditions to come and headed towards the Dogger Bank. Surprisingly good conditions enabled the recovery of the first mooring on the first day of the cruise; the second mooring was recovered the next day. Due to

acoustic release failures both of the mooring recoveries (m7, m23) involved dragging with grapples. By this date all of the drifters deployed on earlier cruises had stopped communication or were out of range and thus the third aim of the cruise was not required. The task of completing a thorough hydrographic survey was accomplished by the combination of CTD and the Scanfish. After a series of intermittent failures the Scanfish failed early on Thursday 28<sup>th</sup> Oct having completed 760 km of tow. This enabled the cruise to concentrate on CTD + water bottle casts which have the advantage over Scanfish of taking samples at specific depths, to compensate for the loss of horizontal resolution. Only about 6 hours work was lost to weather over the cruise. This enabled us to repeat the necessary previous sections and add new sections into waters east of Scotland (113-124-135-144) and in novel directions (sf64 and sf89) to better characterise the boundaries between different hydrographic areas. Having completed the main survey we were able to take some NIOZ cores in the Farne Deep that will enable us to better understand the effects of the hydrodynamic retention mechanisms believed to act in this area. Finally we were able to return to the location of the first stations on the cruise and make casts to examine the change in conditions over the 9 days.

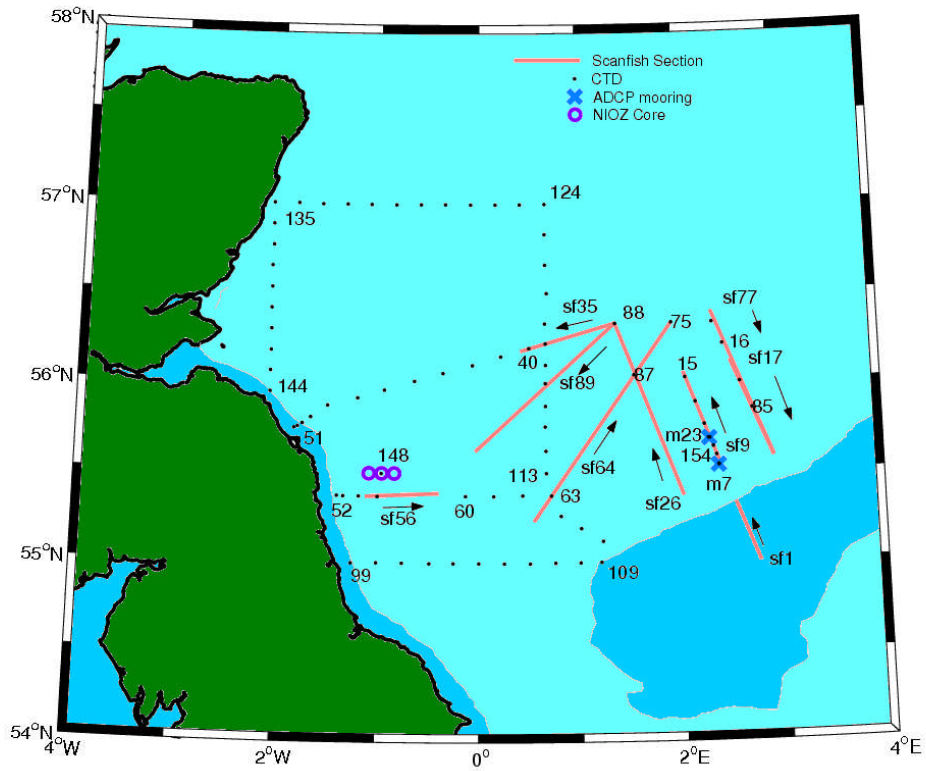
154 Stations, 84 CTDs, 45 Underway Samples, 760km Scanfish, 12 Cores.

We would like to thank the Officers and crew of the CEFAS Endeavour for their hard work, experience and professionalism. The cruise objectives were exceeded despite numerous setbacks and this would have been impossible without an excellent ships staff. In particular the recovery of the two ADCP moorings in spite of the failure of the acoustic release mechanisms was only achieved through the excellent team-work of the bridge and deck crew.

#### Preliminary Results

Despite the likelihood of difficult weather conditions at this time of year, the loss of Scanfish capability and malfunctions of mooring equipment the cruise was able to exceed its desired aims. A thorough hydrographic, nutrients, chlorophyll and oxygen survey north of the Dogger Bank was completed and the data collected will be able to characterise the receding extent of the coldpool region. Oxygen samples were taken at more stations than previous cruises in order to provide detailed spatial information of a fundamental parameter to ecosystem models. The area of observation was extended to the north and west in order to better understand the fluxes of nutrients, freshwater and oceanic water from the north west boundary. The time-series of ADCP current profiles will increase understanding of the change in circulation as breakdown proceeds.

Figure 1: Cruise track and station summary. Darker blue represents depths shallower than 40m.



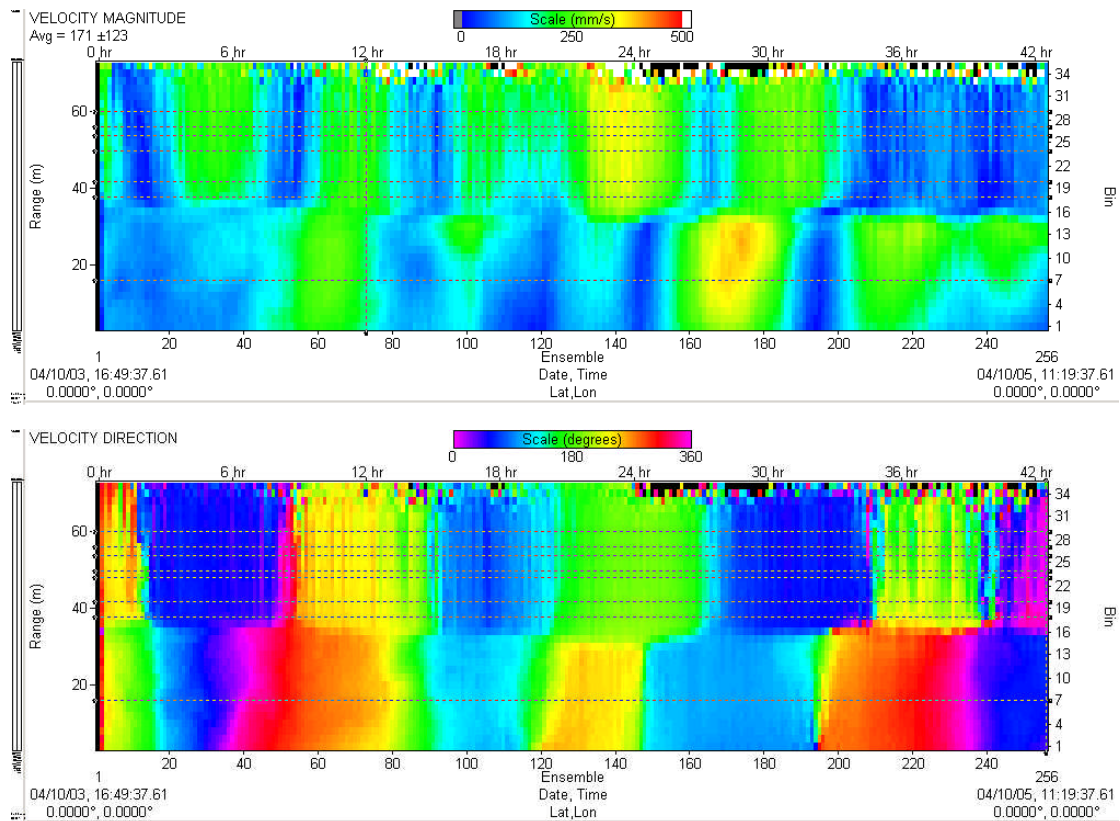
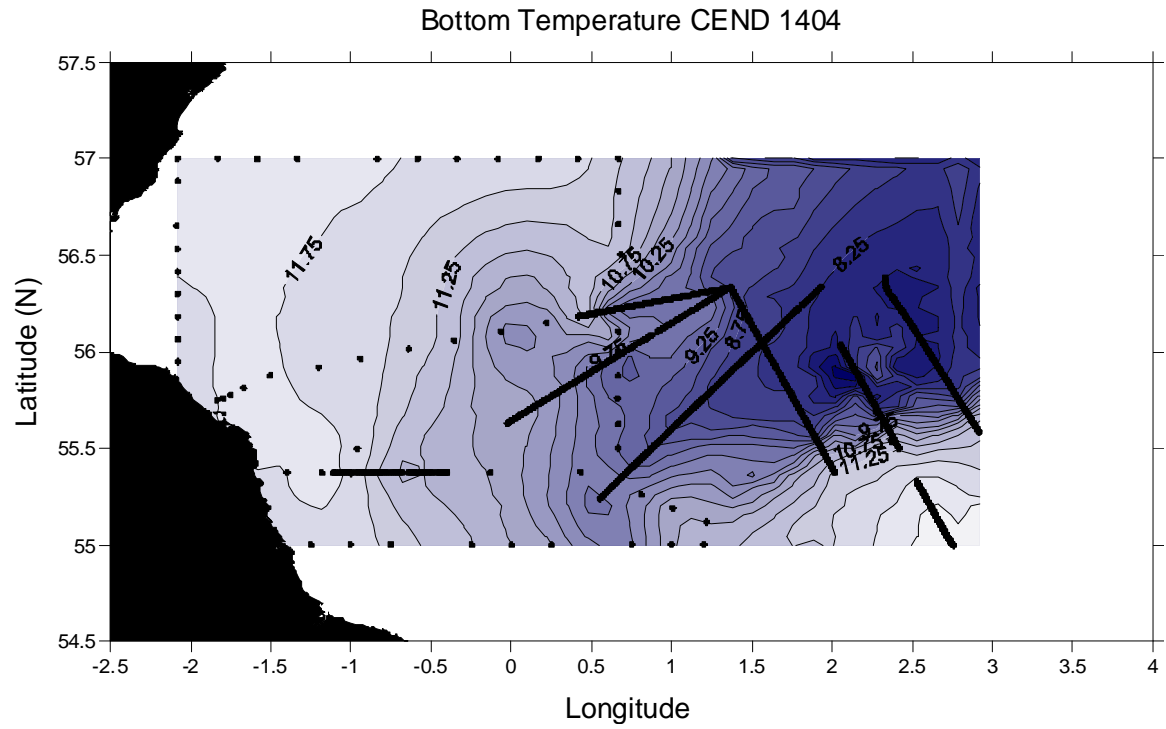


Figure 2: ADCP data from 42 hours of 50 day record of 600 kHz ADCP-B (m23) clearly showing the effect of stratification on the tidal phase, with strong shear at the thermocline evident at certain times of the tidal cycle is likely to be an important source of turbulence where the water column structure is thermally stable.

Figure 3: Bottom temperature (°C) contours from the CTD and Scanfish data shows the strong horizontal gradients associated with bottom fronts north of the Dogger Bank persisted until late October in 2004.



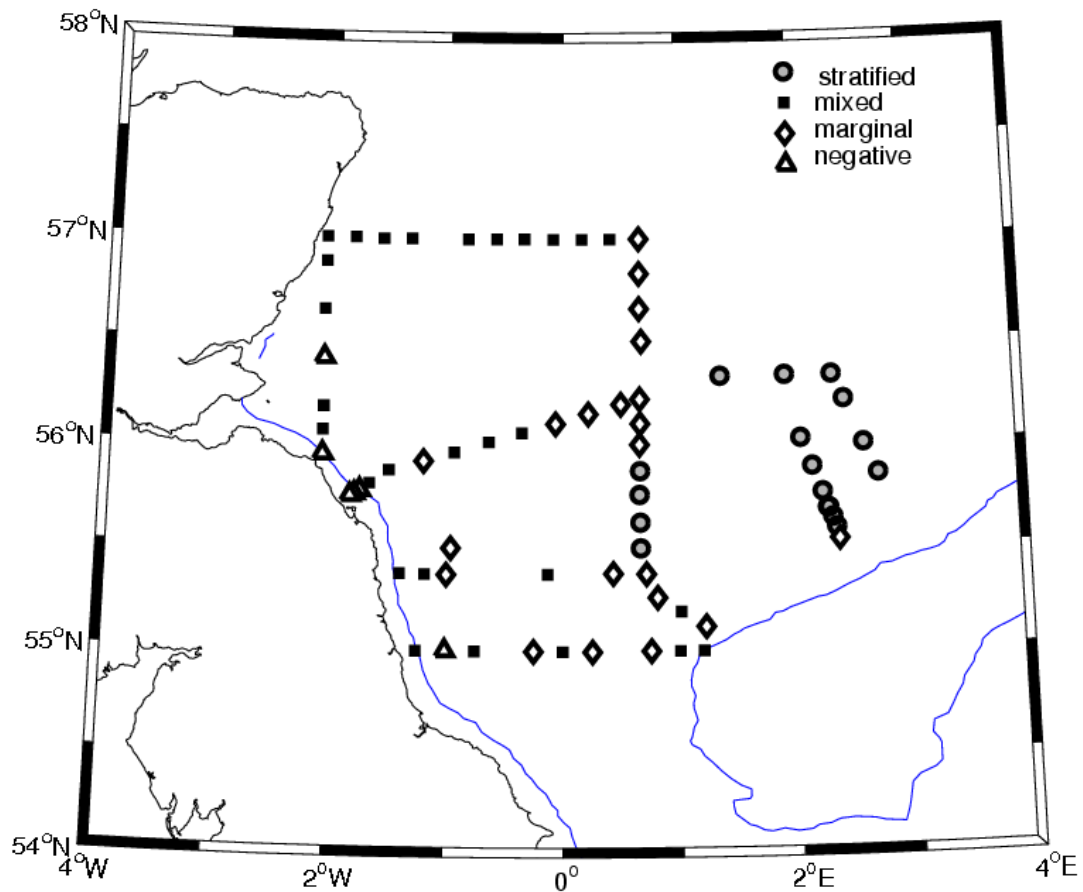


Figure 4: Top to Bottom temperature ( $^{\circ}\text{C}$ ) difference from the reversing thermometers on all the CTD casts. Stratified conditions where the temperature difference was found to be  $> 1^{\circ}\text{C}$ , marginal where this difference is  $>0.1^{\circ}\text{C}$  and negative where the difference is  $<-0.2^{\circ}\text{C}$ . Negative thermal stratification is seen towards the east coast and is indicative of an increase in importance of freshwater in maintaining the density contrast between top and bottom of the water column. Strongly stratified conditions were observed in a more limited region than the previous cruises as the seasonal structure breaks down over the autumn months. Interestingly the 'cold pool' region is limited to the region immediately north of the Dogger Bank, further west and north the observed stratification was marginal.

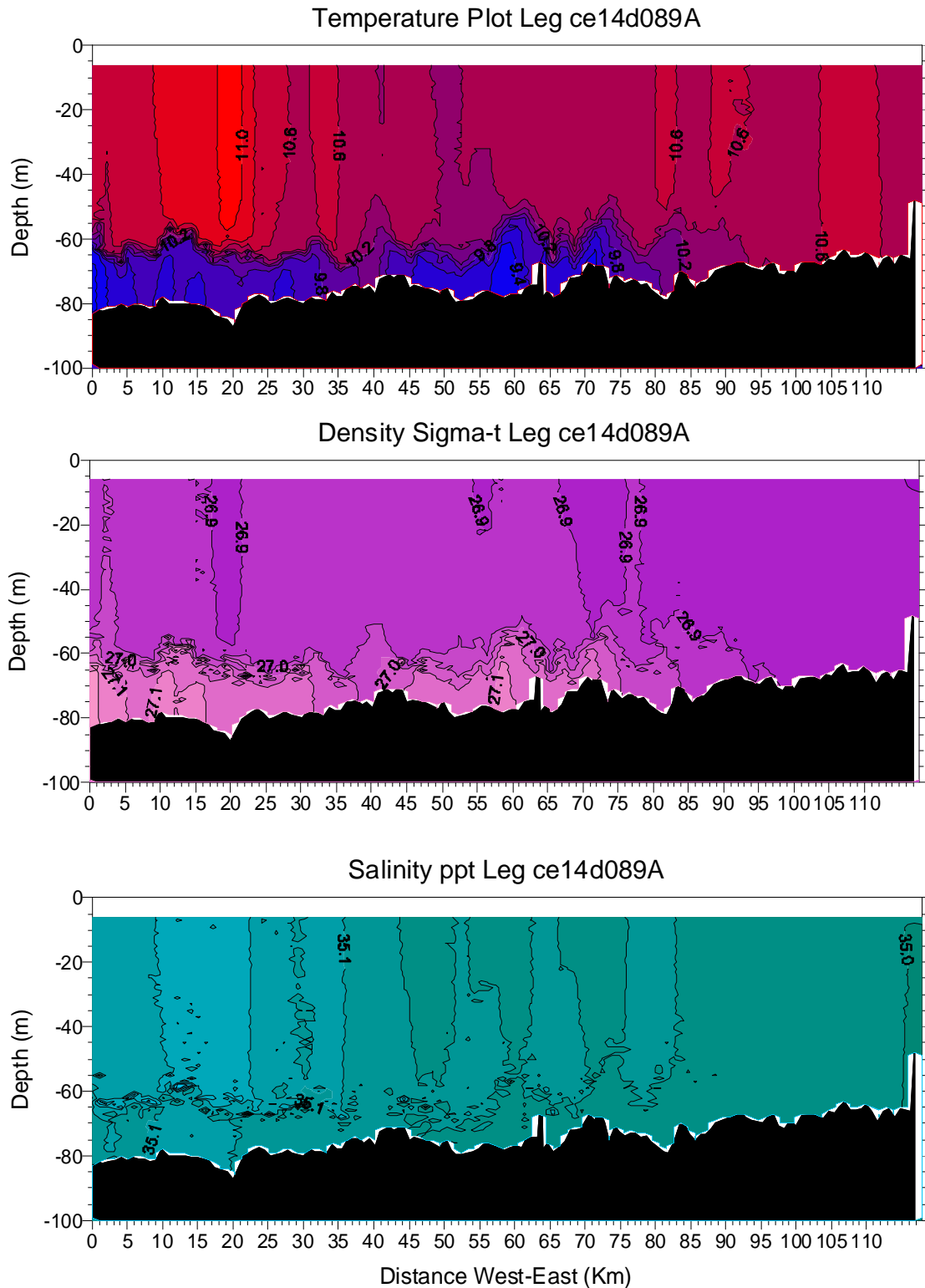


Figure 5: Temperature, density and salinity sections from the final Scanfish line (sf89) on CEnd1404 starting in the stratified region and heading south-west. The thermocline at the start of the section exhibits 1-1.5 °C of stratification over about 5m with a well mixed surface layer of some 60m in depth that has been gradually deepened over the 2 months of this experiment by cooling and wind mixing from the surface.