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SCIENCE DIRECT
Marine Environmental Research 62 (2006) S342–S346
MARINE ENVIRONMENTAL RESEARCH
www.elsevier.com/locate/marenvrev

Short communication

A biological effects monitoring survey of Cardigan Bay using flatfish histopathology, cellular biomarkers and sediment bioassays: Findings of the Prince Madog Prize 2003

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Abstract

Cardigan Bay on the western coast of the UK is considered a pristine location with much of its coastal and marine habitats protected under various national and EC Directives. Despite this, populations of the flatfish dab (*Limanda limanda*) captured from Cardigan Bay display elevated levels of liver tumours relative to the background prevalence of the disease. This study describes the findings of a research cruise that took place during November 2003 to assess the prevalence of tumours in dab from selected sites in and around Cardigan Bay. In addition, potential causative mechanisms were investigated via measurement of a range of end points (including composition and abundance of benthic and phytoplankton communities, sediment toxicity and cellular biomarkers of genotoxicity) from sediment, water and biota samples. Fish captured from South Cardigan Bay displayed a relatively higher prevalence of liver tumours compared to those captured from Red Wharf Bay. Hepatocellular adenoma (8% and 2%, respectively) and hepatocellular foci of cell alteration (18% and 6%, respectively) were most prevalent in South Cardigan Bay. Analysis of the sediment failed to

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doi:10.1016/j.marenvres.2006.04.064

distinguish any differences in toxicity between the two sampling sites. However, DNA strand breaks in red blood cells of dab were significantly higher ($p < 0.05$) in fish collected from Red Warf Bay compared with those sampled at Cardigan Bay. The alignment of biological effects measures via such integrated cruise programs are discussed. This work was partly funded under the auspices of the 2003 Prince Madog Prize.

Keywords: Dab *Limanda limanda*; Cardigan Bay; Liver tumours; Comet assay; Histopathology; DNA adducts

Cardigan Bay on the western side of the British Isles is considered a pristine location and as such, much of the marine and coastal environment is designated as a 'Special Protection Area' under the EC 'Birds' Directive and large areas have been proposed as 'Special Areas of Conservation' under the new EC Habitats Directive (Fig. 1). In addition the southern section of Cardigan Bay contains the Skomer Marine Nature Reserve, which is one of only three statutory Marine Nature Reserves in the UK (OSPAR Commission, 2000). Eutrophication risk assessment currently being carried out under the Water Framework Directive indicated no or low risk for Cardigan Bay from nutrient enrichment

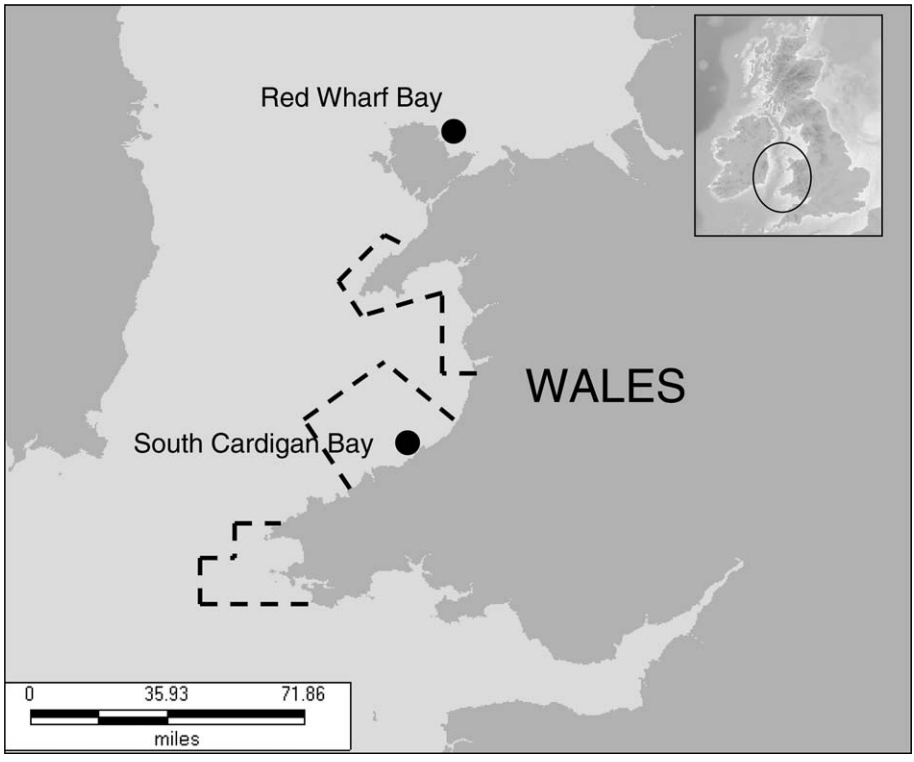

Fig. 1. South Cardigan Bay and Red Wharf Bay sample locations visited during the 19th–24th November 2003 RV *Prince Madog* research cruise. EC Habitats Directive Marine 'Special Areas for Conservation' designated by dashed lines (- - -).