THE SEA EMPRESS OIL SPILL : FISHERIES CLOSURE AND REMOVAL OF RESTRICTIONS

by Robin Law and Carole Kelly

The tanker Sea Empress grounded at the entrance to Milford Haven in Wales in February 1996, spilling 72,000 tonnes of Forties blend crude oil.

The waters off south and west Wales support diverse fisheries for both fish and shellfish, including important stocks of cockles and mussels in some intertidal areas.

A voluntary ban was imposed by local fishermen as soon as the spill began, but as the scale of the incident became clear the government implemented controls under the 1985 Food and Environment Protection Act in order to safeguard consumers. The closure area included 810 square miles of coastal waters and the rivers entering that zone (Figure 1).

A monitoring programme was instituted in which PAH concentrations were determined in fish and shellfish taken both within and outside the closure area. Few pre-spill background data for PAH were available. Some of the locations were sampled regularly in order to follow time trends. In all 880 bulked samples were analysed (Figure 1).

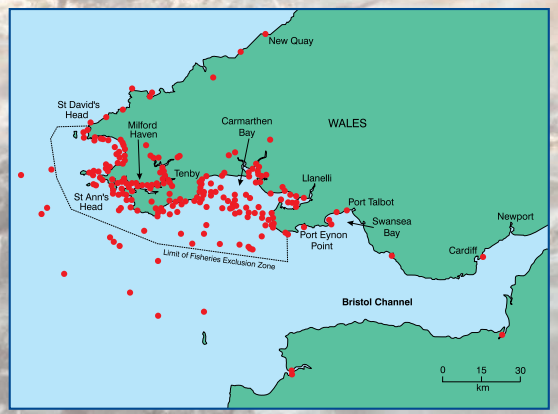

Figure 1. Locations from which fish and shellfish were sampled.

Once PAH concentrations had declined to background, samples were tested for taint, and advice sought from the Department of Health prior to lifting of restrictions. Finfish accumulated low concentrations of 2- and 3-ring PAH only, and fisheries were opened ca. 3 months after the spill. Molluscs accumulated higher levels of PAH with 2- to 6-rings, and controls remained for up to 19 months in some species and areas. In all cases, ΣPAH concentrations had declined to < 100 μg kg^{-1} wet weight and concentrations of benzo[*a*]pyrene were generally below 1 μg kg^{-1} when fisheries were re-opened, although these were not defined as necessary criteria for the removal of restrictions.

A haul of fish.

Mussels are often found close to sewage and effluent discharges.

Investigation of the data generated within the monitoring programme revealed both spatial and temporal influences on PAH contamination of shellfish unconnected with the oil spill. To the east of the closure area, PAH concentrations in mussels rose steadily with the highest concentrations occurring near Cardiff. This is related to urban and industrial activity on the South Wales coast. Principal component analysis (PCA) of PAH in molluscs demonstrated a difference in behaviour between oil-derived and combustion-derived PAH (Figure 2).

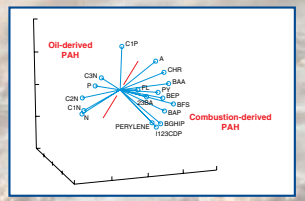

Figure 2. PCA of PAH data for cockles, mussels and oysters.

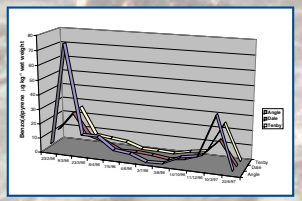

Figure 3. Seasonal cycling of benzo[a]pyrene concentrations in mussels at three sites in south-west Wales.

Concentrations of oil-derived PAH declined once the release of oil had ceased and the bulk oil had moved away, whilst combustion-derived PAH exhibited seasonal cycles. Concentration maxima for benzo[*a*]pyrene, for example, were observed in February/March, and minima in July/August (Figure 3), and seem to be linked with lipid storage related to spawning cycles.

A similar trend seems to be evident in data derived from the US National Status and Trends programme, with a narrower concentration range being observed in samples collected in summer (Figure 4).

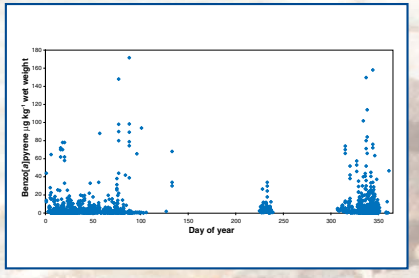

Figure 4. Benzo[a]pyrene concentrations in molluscs from US Mussel Watch surveys, 1986-1996.

Many commercial shellfish beds in England and Wales are within estuaries close to urban and industrial sources of PAH, and shellfish are likely to be contaminated by combustion-derived PAH to varying degrees.

British Steel at Redcar, a major PAH source to the lower Tees estuary.

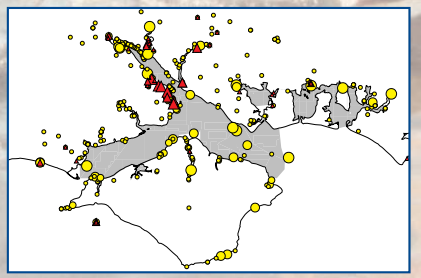

Figure 5. Classified shellfish beds around the Solent, in relation to known discharges. Triangles indicate industrial trade effluent discharges, and circles sewage inputs, with the symbols scaled to the magnitude of the discharge.

Licensed harvesting areas can be subject to inputs from multiple sources (Figure 5). Background PAH concentrations may therefore differ markedly between areas, and, in the absence of standards or guideline values for PAH, different criteria could be devised to justify the removal of fishery restrictions. The development of standards or guidelines would yield a uniform approach to the protection of public health whether related to oil spills or chronic pollution sources.

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