The Ecology of Poole Harbour
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18. Water Quality and Pollution Monitoring in Poole Harbour

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The waters of Poole Harbour currently achieve the statutory water quality standards laid down by the European Union. Water pollution from human and industrial activity in the last century has caused lasting damage to the ecological balance in Poole Harbour. Toxic pollutants have been concentrated in sediments, particularly in Holes Bay where circulation and flushing is restricted, and will take many years to recover. While many of the historically polluting point source discharges to the harbour have been eliminated or improved in quality, diffuse metal, bacteriological and nutrient sources remain a threat to wildlife.

Introduction

Poole Harbour is an estuary of nearly 4000 ha with an unusual double-high tide and micro-tidal regime. The narrow opening at the eastern end ensures that only 22% of the harbour water at neap tides, and 45% on spring tides, is returned to Poole Bay. This poor flushing ensures that, particularly in inner zones such as Holes Bay which also has a narrow entrance, pollutants are easily trapped. Fine intertidal muds offer poor dispersion in the bay for pollutants, especially metals and organic chemicals.

The wide diversity of habitats and limited human access allows many species to thrive, giving rise to high conservation status as an SSSI (Site of Special Scientific Interest), RAMSAR Wetland Site and Special Protection Area (SPA).

Legislation

The first attempts to introduce legal controls over aqueous discharges were made in England in 1936, mainly to combat increasing public health issues from sewage. More specific anti-pollution legislation was enacted in 1951 for rivers and 1960 for tidal waters, with controls over trade effluent discharges to foul sewers tightened in 1937 and 1974. The current powers of the Water Resources Act 1991 give strong control over consented discharges and illegal pollution.

Effective regulation is a combination of statutory powers and commitment, which was perhaps lacking until the late twentieth century. EU Directives currently govern the

majority of harbour monitoring, providing statutory European standards for Bathing Waters, Dangerous Substances, Urban Wastewater, Shellfish Hygiene, Shellfish Waters, Nitrates and water basin management.

Future development must be mindful of the Habitats Directive, the Birds Directive, the Water Framework Directive and the internationally important conservation status of Poole Harbour for birds and wildlife.

Human pressures on Poole Harbour

Socio-economic conditions have dominated harbour uses, as can be seen today in the general split between development and commerce in Poole town and natural protected areas in the southern harbour. It was not always this way: early development focused on exploiting clay and mineral deposits to the south of the harbour and on Brownsea Island. Mineral extraction remains, but is largely hidden from view: oil production from the southern side of the harbour in the biggest onshore oilfield in western Europe is a shining example of how industrial development need not damage the environment if the will exists.

Industry in the twentieth century has left a deep scar on the northern shores of the harbour. With the benefit of hindsight, the choice of location for chemical manufacture, metal plating and sewage treatment could probably not have been much worse. Holes Bay in particular has suffered: the discharge of treated sewage effluent was first consented in the 1950s, no doubt preceded by untreated local discharges. This domestic sewage discharge was combined with significant chemical pollutant loads from illegal trade effluent (especially heavy metals) with poor application of the legislation, until as recently as the late 1970s. Although now treated to extremely high standards (both chemically and disinfected), nutrients in the discharge remain a threat to wildlife, currently encouraging spectacular growths of algae. Many threats remain despite removal of some industry: land has been reclaimed with landfill, and housing and light industry generate their own pollution pressures in the form of poor management, illegal drainage connections and contaminant runoff.

Significant pollutants

Heavy metals

Metal contamination within the harbour is largely restricted to Holes Bay, affecting bioaccumulation in molluscs and crustaceans, species composition, larval fish and birds. Decades of toxic metal discharges have occurred, passing through the foul and surface water sewers, to a low-energy intertidal zone with restricted dispersion, causing concentration of contaminated particles throughout the bay. The sediments have accumulated these toxic elements, including cadmium and mercury, and locally silver, copper, zinc and selenium.

The fate of these is unknown and natural breakdown is slow, but it has been suggested that these metals may be labile, and could re-mobilize when disturbed. The use of sacrificial zinc anodes on sheet piling and commercial and recreational craft has caused local effects throughout the harbour and is currently being studied.

TBT and organic pollutants

Used widely for anti-fouling, tributyltin (TBT) was found, in the 1980s, to have severely damaging effects upon marine organisms, causing changes such as deformities, shell thickening and death. High concentrations were found in most of the northern shoreline in the water and in sediments. TBT was banned in 1987 for craft smaller than 25 m, but continues to affect harbour mollusc populations on northern shores. There has been little recorded pollution by organic chemicals, but local pollution by wood preservative at Holton Heath in the late 1980s introduced toxic pentachlorophenol, dieldrin and lindane to the local environment.

Nutrients

High nutrient levels in harbour waters have led to Poole Harbour being designated in 2002 as a Sensitive Area (Eutrophic) and Polluted Waters (Eutrophic) under the Urban Wastewater and Nitrate Directives respectively, and the river catchment area being designated a Nitrate Vulnerable Zone (NVZ) (Langston *et al.* (2003)). The main sources of elevated nitrate and phosphate in the harbour are Poole Sewage Treatment Works and the riverine inputs from the Rivers Frome and Piddle containing diffuse pollutants. High nutrient inputs have caused macro-algal and diatom blooms, and may be responsible for shellfish mortalities between 1995 and 1997 (including partial closure of the shellfishery).

Some 50,000 m^3 of treated sewage effluent discharge daily from Poole Sewage Treatment Works, contributing approximately 1500 kg of nitrogen per day. It also contributes some 80% of the input of phosphate to the harbour. Treatment improvements before 2010 should address this nutrient load, but it may be many years before these reductions are observed in positive changes to flora and fauna. Contributing rivers derive most nitrate from agricultural sources, and the Rivers Frome, Piddle, Corfe and Sherford are designated as NVZs. New mandatory restrictions in slurry storage during winter and fertilizer applications will reduce nitrogen input.

Monitoring

Routine harbour water quality monitoring is dominated by the statutory requirements of EU Directives. In 2002, no monitoring site failed to meet the EU standards, reflecting the improving waters of the harbour. This monitoring includes water, shellfish and some limited sediment analysis. Elevated bacteriological results have caused local downgrading of the shellfishery, and are currently under investigation.

Major harbour inputs (Rivers Frome, Piddle, Corfe and Sherford) are routinely sampled as well as consented discharges. Combined storm overflows (CSOs) exist and discharge sporadically, but none are known to cause environmental damage.

The legacy of previous pollution remains in the sediments, primarily in Holes Bay. These are not routinely examined (except for limited sites under the Dangerous Substances Directive), other than when development is proposed, but some exceptional surveys have been undertaken, indicating slow improvement.

It is clear that monitoring could be improved to provide a more comprehensive picture of the current and future states of the harbour, but unless significant funding is forthcoming, this is unlikely to happen.

Future challenges

The legacy of historic pollution will remain in the harbour for many years, particularly in Holes Bay, but significant measures have been taken to prevent current discharges from causing further damage. While direct and diffuse discharges remain, nutrient reduction remains the major challenge. Some effort is also required to examine the threat of zinc, and to determine whether all elevated levels of bacteria have been addressed. Future development must be mindful of previous damage, and of the need to prevent pollution in this very sensitive environment.

References

Langston, W. J., Chesman, B. S., Burt, G. R., Hawkins, S. J., Readman, J. and Worsfold, P. (2003) *Site Characterisation of the South West European Marine Sites – Poole Harbour SPA*. A study carried out by Plymouth Marine Science Partnership on behalf of the Environment Agency and English Nature.