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On the one hand it has been described as "a potential DDT of the waterways." On the other it has been welcomed as the most efficient anti-fouling paint yet introduced. It is Tributyl tin (TBT) paint, and worldwide it has health and environment authorities in a quandary over how much its use should be restricted.

TBT paints were first introduced commercially in the mid-1960s, and found ready acceptance with merchant fleets, commercial fishers, navies and recreational boaties. They provided large cost savings over copper-based paints, were more effective in warding off troublesome barnacles and – especially attractive to small boat owners – they enable boats to be painted in bright gaudy colours because of their chemical makeup.

In the United States TBT paints are used on recreational boats and the remainder on docks, buoys, lobster pots and fishing nets – in short, anywhere algae and barnacles might prove a nuisance. On large boats, for example, such organisms attach themselves to vessel bottoms, increasing drag and hence decreasing the ship's speed. The US Navy estimates that if its entire fleet was treated with TBT paint (not all is yet), it would make savings of $150 million a year in fuel consumption alone. Savings are even greater for the larger US merchant fleet – a huge $318 million a year.

Furthermore, boats treated with TBT paints have to come into dry dock for a repaint only every seven years, by comparison with once every two years if they had been treated with copper-based paints.

Environmental hazards

Set against these economies are the environmental hazards. French scientists were the first to alert the world that all might not be well with TBT paints. In 1977 they started to notice a strange thickening in the shells of the Pacific oyster *Crassostrea gigas* in the Baie d'Archachon, a popular boating area and the site of a flourishing oyster farming industry. Tests showed that poor tidal flushing was allowing TBT to accumulate in the bay. Healthy oysters transplanted into the bay showed 50 percent mortality within 130 days, whereas deformed oysters taken from the bay to areas without recreational boats resumed normal growth patterns. In addition no juvenile oysters were developing.

Within five years the French had introduced a ban on TBT paints on all pleasure craft over 25 metres in length, except on those with aluminium hulls.

In the years just preceding the ban, 95 to 100 percent of the oysters had deformed shells. In the first year of the ban, the number dropped to about 75 percent; in 1983 to 45-50 percent. Spatfall – in other words, offspring – showed a similar recovery. There was no spatfall in 1980 and 1981, but it resumed in 1982 and thereafter.

Following the French experience, the British decided to investigate their own faltering oyster industry. Over 90 percent of the country's small yachts used TBT paints. Extensive tests were carried out with oysters in waters both free of and containing TBT, and the results pointed as conclusively as possible to TBT being the culprit for oyster deaths.

In response to these tests, in 1986 the British banned the production of TBT copolymer paints with more than 7.5 percent TBT.

Meanwhile in New Zealand Dr Peter Smith of the Fisheries Research Division in Wellington had been conducting his own experiments. He collected samples of water from Westhaven (Auckland), Port Nicholson and Evans Bay (Wellington) and Picton and Havelock marinas. Although the levels of TBT were found to be low, they were still greater than those known to be lethal to larvae of shellfish.

MAF then discovered abnormally thickened rock oysters in Westhaven marina and similar Pacific oysters in Half Moon Bay, Auckland.

In 1986 Peter Smith travelled to Britain where he saw experiments being carried out on sea snails. The condition of "imposex" was noted, whereby all the females had changed to males, sporting penises instead of female genitalia.

Back in New Zealand he did not have to go further than Evans Bay in Wellington to collect a different but similar species of sea snail, and the result from experiments on these replicated those in Britain – no females could be found. There are a number of small craft moored in the bay. Samples for comparison were taken from open water in Northland, and the proportion of males to females there was 1:1.

Salmon also affected

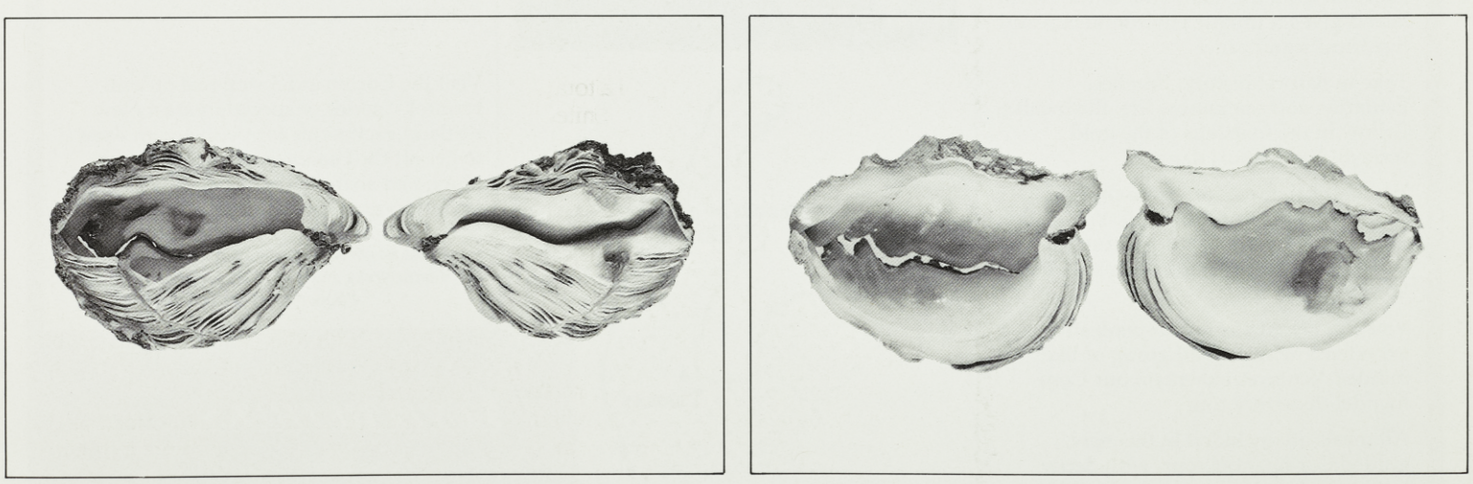
Shellfish are not the only animals that have been affected by TBT. Recently researchers from the US National Marine Fisheries Service in Alaska found that farmed chinook salmon can absorb the compounds from antifouling paint used on the pens where the fish are reared.

Pens at an Alaskan research station run by the service were coated in 1983 to prevent them becoming clogged with crustaceans. TBT was thought to be barely soluble in sea water, so the researchers saw no risk to the fish in the pen. Yet they soon saw fish dying for no apparent reason. Further investigations confirmed that TBT dissolving in the water was responsible.

Because it is common practice for US salmon farmers to coat their pens with TBT paints, the researchers decided to sample salmon bought at markets for TBT content. Only four of the 15 they bought did not contain TBT.

In New Zealand it is now a condition of salmon farmers' licences that they do not use TBT paints on pens.

Fears have been raised that TBT has a similar effect to DDT: it accumulates as it goes up the food chain. Possible proof of this accumulation effect has been recently found with the discovery of TBT in tissues



TBT paints have a dramatic effect on shellfish, as this photo (left) of shell thickening on a Pacific oyster shows. A less affected example is shown at right. The extremely toxic TBT has also been shown to accumulate as it moves up the food chain. Photo: MAF