

Pesticides - The Case of Tributyltin (TBT)

In the 2003 shipping season, there were over 3 800 vessel transits through the Great Lakes-St. Lawrence Seaway System.

Tributyltin (TBT) is a pesticidal compound applied to the hulls of ships and small boats to protect against an accumulation of barnacles and other fouling organisms on underwater surfaces. TBT is one of a class of compounds called organotins and was introduced in the 1960s. Compared to earlier copper-containing antifouling coatings, TBT was more toxic to fouling organisms and lasted longer. Ships painted with TBT needed repainting every 4 to 5 years, as opposed to every 2 years for copper-painted ships.

Problems with TBT began to emerge in the 1970s and 1980s. It was shown to be extremely toxic to aquatic organisms other than those it was intended to target. Scientists concluded it was responsible for declines in oyster populations in France, and for adverse effects in certain marine snails. A notable effect was *imposex*, the imposition of male sexual characteristics on females of the species. This occurred at concentrations as low as, or lower than, 1 part per trillion.



NWRI and Tributyltin

NWRI research was the first in the world to demonstrate the occurrence and extent of TBT in the environment. Researchers mapped TBT contamination in water, sediment and aquatic biota across Canada; they determined its persistence, fate and environmental dynamics; and they assessed its risk to aquatic organisms.

Researchers concluded that TBT was present in the Canadian environment at concentrations that posed hazards to freshwater and marine life. The problem was especially acute in or adjacent to harbours, marinas and shipping channels.



Impacts of NWRI Research on Decision Making

NWRI research results were communicated to the Pest Management Regulatory Agency, the US Environmental Protection Agency (US EPA) and, internationally, to the Organotin Environmental Programme Association (ORTEPA).

NWRI research on TBT led to the first regulation of its use in antifouling paints in Canada in 1989. It was also influential in the US EPA regulation around that time.

When subsequent NWRI research indicated that the 1989 regulation was only partially effective in reducing TBT levels, a further regulation banning all antifouling uses of TBT was introduced in 2003 by the Pest Management Regulatory Agency.

NWRI research also led to the development of the International Maritime Organization (IMO) proposal to ban the application of organotin antifouling paints in 2003, and to ban their presence on ships by 2008.

Benefits to Canadians

The research that built the case for regulatory measures to phase out tributyltin as an antifouling agent has economic, environmental and human health benefits:

- **Food chain accumulation and bioconcentration have been demonstrated in crabs, oysters and salmon exposed to tributyltin oxide. TBT antifouling agents can be extremely toxic to aquatic organisms. Their phase-out will make a considerable contribution to protecting domestic and global water resources from their harmful effects and to safeguarding national and international fisheries - encouraging more environmentally acceptable and sustainable alternatives.**
- **The International Maritime Organization estimates that the international shipping industry is responsible for the carriage of 90% of world trade, with some 50,000 merchant ships trading internationally, registered in over 150 nations. Policies encouraging a total ban on TBT spur researchers to develop innovative anti-fouling agents less destructive to aquatic environments, and therefore more favourable to an environmentally sustainable shipping industry.**