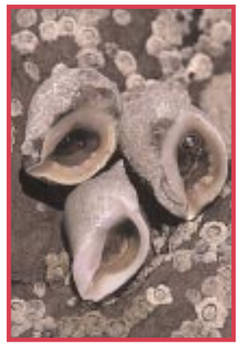
One of the most dramatic effects is the now infamous induction of masculisation, or " imposex", in female dog whelks *(Nucella lapillus)*. Female dog whelks develop male genital characteristics, a penis-like appendage developing and blocking access to the oviduct, at concentrations as low as 1ng/l. Masculisation attributed to organotin use in antifouling paints, has been reported in up to 140 species of female neogastropods.

Alternative antifouling systems

WWF-Germany is working with three environmental Ministries, nine ships, nine paint manufacturers, seven dockyards and two research institutions investigating biocide-free alternative technologies for antifouling. Each ship is cleaned and an alternative paint applied (several per hull). The ships then operate on a normal basis. The vessels are inspected by scientists every two months. The aim is to assess which alternatives can be recommended as effective substitutes to organotin antifouling paints.

A number of existing ecological alternatives are being tested – self-polishing, antifouling paints without biocides; non-toxic, non-stick coatings to prevent settling, and hard coatings in combination with special cleaning procedures. Other methods include electro-chemical methods and self-polishing antifouling paints with biogenic biocides.



WWF recommendations

- IMO should draft an Assembly Resolution for adoption in 1999, recommending a global ban on the use of organotins in antifouling paints by 2001 and should work to introduce the necessary mechanism to achieve such a global ban within this timeframe.
- A world-wide ban on the production, trade and application of organotin compounds in antifouling paints for ships' hulls by 2001 should be sought.
- The development of environmentally sound, biocide-free alternatives to organotin-containing paints should be supported.

Further reading:

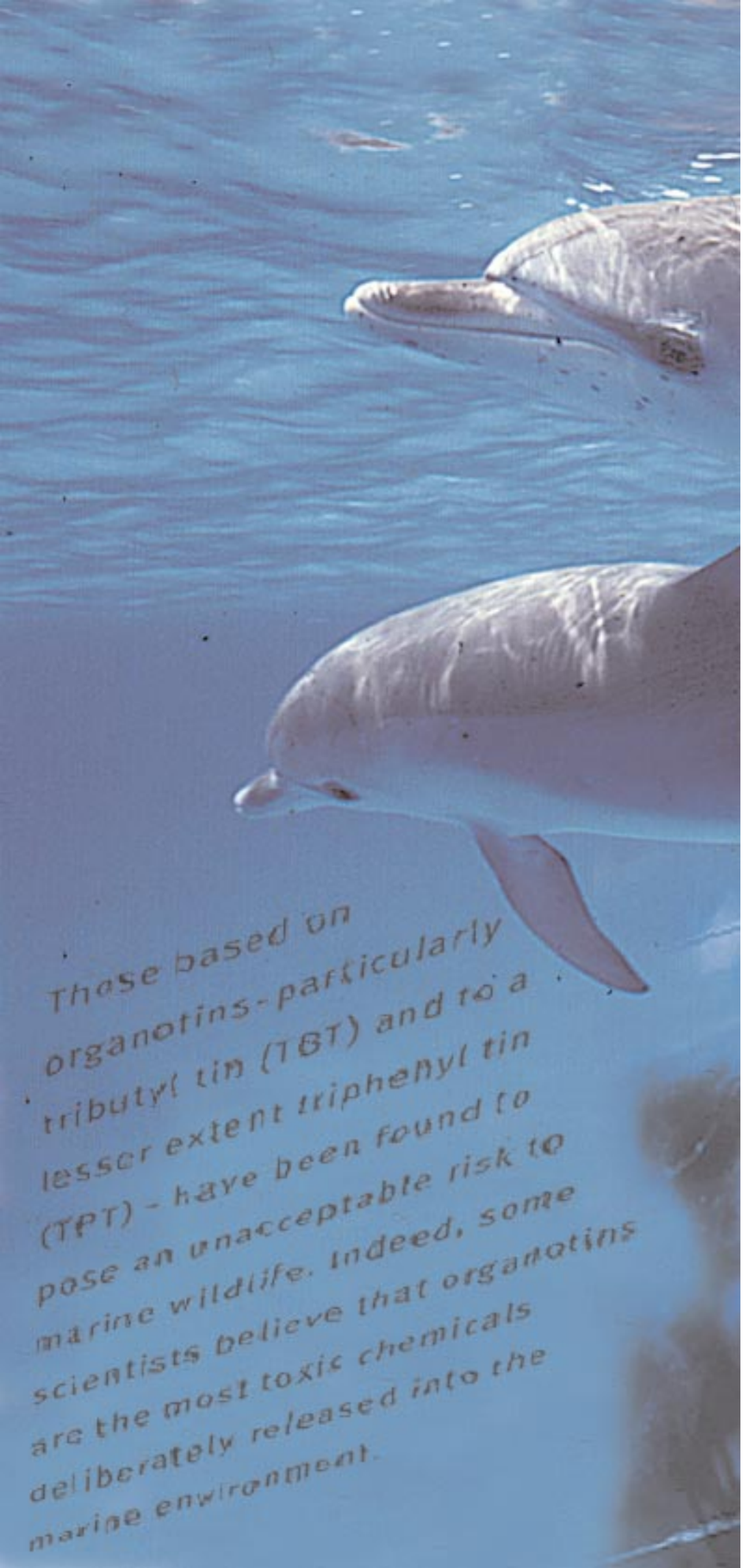
WWF Factsheet: *Organotin compounds* October 1993
Marine Update 21: *Marine Pollution by Triorganotins* May 1995

Registered charity number 201707
Printed on recycled paper
October 1998/1031

WWF works to reconcile the needs of people with the conservation of the natural environment upon which they depend

Most of the paints commercially used on the hulls of ships to prevent fouling by marine plants and animals are toxic.

living seas



This is not new: the effects of organotins used in antifouling paints have been recognised for three decades. The effects of the leachate of these paints on non-target organisms – non-fouling marine wildlife and plants – became apparent in the late 1970s when it was suspected to be the cause of declining oyster *(Crassostrea gigas)* production along the Atlantic coast of France and in the UK. Since then, effects have been catalogued in a large cross-section of aquatic organisms. Marine snails appear to be among the most sensitive.

In the 1980s many countries recognised the impact that TBT paints were having on some marine invertebrates – largely oysters and dog whelks – and its use was banned on sea-going vessels under 25m in length. This meant that the widespread use of organotin paints on recreational craft, in particular yachts, had to be curtailed. It was anticipated that this ban would be enough to reduce inputs of organotins to the marine environment sufficiently to eliminate the problems.

To an extent the ban has worked: inputs of organotins have reduced in coastal waters of some parts of the world where the 25m ban was imposed. It seems dog whelk and oyster populations appear to be recovering in some areas. But the continued use of organotins on ocean-going vessels is still resulting in large emissions of this toxic biocide to the marine environment. In areas close to ports and dockyards in particular dog whelks are still impacted and frequently in decline. And there are now reports of organotins in marine wildlife further afield – distant from ports and dockyards. In the North Sea, along busy shipping lanes, edible whelks (Buccinum undatum) have been reported as exhibiting mild imposex, while there are increasing reports of organotins or the breakdown products – dibutyl tin (DBT) and monobutyl tin (MBT)- being detected in marine mammals, sea birds and fish.

In the Mediterranean, research has shown that TBT and its breakdown products MBT and DBT are present in liver and blubber of **bottlenose dolphins** *(Tursiops truncatus),* in the muscle and liver of **bluefin tuna** *(Thunnus thynnus thynnus)* and in the kidneys of **blue shark** *(Prionace glauca)*.

In the North Sea, organotins were detected in **sperm whales** which were stranded late in 1997. An examination of the stomach contents indicated that the whales had not fed since entering the North Sea – so it is assumed that the levels of organotins detected in their bodies had accumulated while they were feeding in the deep ocean.

Off the coast of Japan, butyl tins have been detected in **Risso's dolphins, finless porpoises** and **Steller sea lions** and even, albeit to a lesser extent, in Steller sea lions off Alaska. Further Japanese work investigating concentrations of butyl tin compounds in the kidney and liver of **seabirds** from Japan, Korea, the North Pacific and the southern Indian Ocean found that butyl tins could be detected in most samples, including in animals from remote areas. The **Laysan albatross** from the North Pacific was found to have accumulated the highest liver butyl tin residues of the open-ocean birds.

Concentrations of butyl tin residues have also been detected in most samples of muscle tissue of fish collected from local markets and sea food shops in **India, Bangladesh, Thailand, Indonesia, Vietnam, Australia, Papua New Guinea** and the **Solomon Islands,** indicating widespread contamination of the food chain by organotins.

It is now four decades since organotins were first used in the marine environment as an antifouling agent and three decades since the impact on marine wildlife was first recognised. The **International Maritime Organization** (IMO) – the UN body which regulates shipping – has spent two years deliberating the need for further action on organotins and in late 1998 work will begin to decide upon the mechanism by which a global ban may be introduced. Following the Earth Summit in 1992, IMO adopted guidelines on how the precautionary approach should be applied to its work. **WWF believes that continuing to pollute the marine environment with one of the most toxic biocides known can simply not be considered a precautionary approach.**

It is imperative that IMO adopts an Assembly Resolution in 1999, recommending a global ban on the use of organotins in antifouling paints by 2001 and works to introduce the necessary mechanism to achieve such a global ban within this timeframe.