This volume provides a case study of a marine pollutant of exceptional potency: tributyltin (TBT). TBT compounds are extremely poisonous, and have been widely utilised as active ingredients in marine anti-fouling paint formulations to obtain increased fuel efficiencies during ship operations, and long lifetimes between repainting for maritime vessels and structures. However, its extreme toxicity has resulted in numerous adverse biological effects on non-target organisms. The environmental persistence of TBT ensures that such problems are likely to continue for some time to come.

This authoritative synthesis reviews the environmental chemistry and toxicological effects of TBT and its degradation products, and outlines the international response to control TBT. A wide variety of disciplines are brought together to illustrate the general principles, pathways and problems involved in identifying and quantifying an environmental toxin, elucidating deleterious biological consequences, and the legal framework that can invoke mitigation via regulation.

This text serves a dual purpose. Firstly, from a research perspective, it provides a benchmark for assessing environmental recovery and therefore has wide appeal for undergraduate courses in environmental science, chemistry, ecology and marine biology. Secondly, by depicting the evolution of environmental legislation, it forms a valuable sourcebook for environmental planners and serves as a 'successful' case study for undergraduate courses in environmental law, planning and science.

TRIBUTYLTIN: CASE STUDY OF AN ENVIRONMENTAL CONTAMINANT

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Tributyltin: case study of an environmental contaminant

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This book is dedicated to my dad.

Both his silent encouragement and gentle cajoling inspired me to set goals which seemingly daunting were nevertheless attained.

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Preface

Tributyltin (TBT) compounds are extremely poisonous, an attribute that has seen them utilized as the active ingredient in marine anti-fouling paint formulations. The potency of TBT ensures good fuel efficiencies during ship operation and long lifetimes between repainting for both boats and structures used in mariculture. However, its extreme toxicity has resulted in numerous adverse biological effects on non-target organisms, of particular importance being the shell deformations observed in oysters and the masculinization of female marine snails. The environmental persistence of TBT ensures that such problems are likely to continue for some time to come. In the first instance, this book describes the manufacture and industrial applications of TBT compounds, reviews their distribution and behaviour in the environment, and summarises their deleterious effects on organisms and aquatic ecosystems.

The widespread use of these anti-fouling paints has meant that TBT has become a contaminant of global concern. Many countries have taken diverse steps to regulate the use of TBT-based products in order to protect coastal and fresh water ecosystems, together with their resources. The political response to this pollutant has been notably faster and more widespread globally than that shown towards other pollutants in the environment, such as lead, for example, despite the fact that public health was never threatened. The steps taken have not been without controversy, considering the economic advantages to shipping on the one hand and the ecological damage on the other hand. The diversity of opinion is reflected in the range of authors presenting material here. Hopefully this book portrays a balanced point of view reflecting the responsible actions that have been taken worldwide. The history of the international legislative response to this toxic contaminant is documented. Also included is a consideration of the efficacy, to date, of the recently imposed TBT

controls. TBT usage is now restricted and as the flux of TBT into the environment has diminished lately, environmental concentrations are set to decrease, albeit slowly in some circumstances. Thus, the maximum extent of the distribution is likely to have been already achieved. This is probably also the case for biological damage, but population dynamics for some species may be such that recovery to 'pre-TBT' levels may be prolonged.

Thus, this book reviews the environmental chemistry and toxicological effects of TBT and its degradation products. Hand in hand with this, it outlines the international response to control TBT. These two facets serve a dual purpose. Firstly, from a research perspective, the text provides a benchmark for assessing environmental recovery and should have wide appeal for teaching in tertiary courses for environmental science and chemistry, as well as ecology and marine biology. Secondly, depicting an evolution of environmental legislation, the book is aimed at environmental planners in general but should be useful as a 'successful' case study for tertiary courses in environmental law, planning and science. The material is presented in such a way that this text will act as a general guide illustrating the principles, pathways and problems involved in identifying and quantifying an environmental toxin, elucidating deleterious biological consequences, and the process of mitigation and legislation to protect the environment.

Stephen de Mora
Rimouski