Lecture Notes on Coastal and Estuarine Studies

3

Synthesis and Modelling of Intermittent Estuaries

A Case Study from Planning to Evaluation

Edited by W.R. Cuff and M. Tomczak jr.

Springer-Verlag Berlin Heidelberg GmbH

Editors

Dr. Wilf Cuff
Research Scientist
Maritimes Forest Research Centre, Environment Canada
Canadian Forestry Service
P.O. Box 4000, Fredericton NB, E3B 5P7, Canada

Dr. Matthias Tomczak jr.
CSIRO Marine Laboratories, Division of Oceanography
P.O. Box 21, Cronulla N.S.W. 2230, Australia

ISBN 978-3-540-12681-2 ISBN 978-3-642-49991-3 (eBook)
DOI 10.1007/978-3-642-49991-3

Originally published by Springer-Verlag Berlin Heidelberg New York Tokyo in 1983

2131/3140-543210

PREFACE

This book reports on the findings of, and summarizes the conclusions from, the Port Hacking Estuary Project, a model–guided, multidisciplinary study of an estuarine ecosystem. The Project began in 1973, at a time when it was thought that environmental problems could be solved readily by assembling a multidisciplinary team of research scientists and having them co–ordinate their research around the construction of an ecosystem model. But a decade has passed and time has not been easy on this approach. The anticipated predictive dynamic models have not been produced and bitter argument has often marred the course of such studies.

Yet the need to anticipate the flow of various chemical species (carbon, oxygen, nitrogen, phosphorus, toxicants) through the environment remains: the evidence is everywhere, from fertilization of urban lakes to acid rain. The magnitude of the problem ensures that funds will continue to be made available – although with short–term variations as perceptions swing. It is thus clear that although the difficulties are great, so is the need. It is from this background that we present this book.

The Port Hacking Estuary Project involved some 15 – 20 research scientists over a period of 5 years. The goal was to research the flow of carbon into, within, and out of a small unpolluted estuary chosen for convenience rather than for its social significance. The idea was to use the information obtained from these studies to build a predictive dynamic model.

Emphasis was placed on the South West Arm of Port Hacking: this Arm is broadly characterized by exhibiting two states. In one state the salinities are typical of an arm of the sea. In the other, which occurs for short periods following rainstorms, a stratified water column is set up when fresh water sits on the surface and saline tidal water enters over a sill and falls down into the basin of South West Arm to reach water of a similar density. In fluid dynamics terms, South West Arm can be described as a fjord; but the intermittency of freshwater inflow has such a marked effect on the biota that a different classification is warranted on ecological considerations. Our choice is reflected in the title of this book. "Intermittent estuaries" do exist in various places around the world but as yet do not seem to have been recognized as a class.

Another feature of this book, as reflected in the subtitle, is that both scientific and organizational aspects are discussed. In model–guided multidisciplinary studies they are not independent, and in this case study we use a description of both to draw lessons about this genre of scientific endeavour.

The Port Hacking Estuary Project was an umbrella for such a diverse range of investigations that it is not possible to ascribe overall success or failure to the Project. Suffice it to say that the Project did not reach its goal of making a predictive dynamic ecosystem model of South West Arm. The (by now expected) personal animosities associated with this genre of scientific endeavour were present. The unique aspect of the project is that participants agreed to continue to work together in this analysis of their efforts. Their willingness to submit their activities to close scrutiny speaks highly of them, and the resulting book is a fitting close to the Port Hacking Estuary Project. Our hope is that it can also help to clarify some of the problems that plague other multidisciplinary studies, and thereby contribute to a solution.

The book begins with a chapter by Radway Allen, former Chief of the Division of Fisheries and Oceanography, and under whose initiative this Project was begun. He describes the motivation and hopes for the Project, as seen in 1973 and 1981. Then Parker and Tranter, who were largely responsible for the organizational aspects, combine with Rochford, Chief of the Division during the latter part of the Project, to give a history of research in Port Hacking before 1973, and to describe the initial organization and direction. The body of the text includes papers covering a wide variety of observational, experimental, and modelling aspects relating to South West Arm. These papers are of interest in their own right but have been selected to provide the reader with an understanding of South West Arm. (They do not, of course, represent the total published output of the Project: a list of other publications is appended to the paper by Parker *et al.*) We also include a paper by Vaudrey *et al.* on the data set obtained by the Project and on the data base management system used to store and retrieve the data. An attempt to interconnect the facts presented so far is made in the chapter where many of the Project participants (Cuff *et al.*) join together to synthesize the static information for South West Arm. Then one of us (W.R.C.) synthesizes the dynamic information that has been obtained by the Project (not resorting to the general literature for missing information). These two papers represent the culmination of our synthesis efforts but a number of other models were constructed throughout the Project and a gradual evolution of ideas about ecosystem modelling occurred; these experiences are described by Sinclair *et al.* Their chapter builds up to the last part of the book where we evaluate the Project (as a representative of the genre), in two separate contributions, each of us along his own line of thought. While the two papers may not be totally complementary, we feel that the full story emerges only when both contributions are taken together.

In 1981 the CSIRO Division of Fisheries and Oceanography was reorganized into the Division of Fisheries Research and the Division of Oceanography, both Divisions now being known as the CSIRO Marine Laboratories. This change is reflected in the affiliation of authors given in their contributions.

Over the past decade of work so many people have played their role and we begin by thanking all for their part. But specifically we thank the Chiefs of the Division of Fisheries and Oceanography (David J. Rochford) and of Computing Research (Peter J. Claringbold) for supporting this evaluation of the Project and Bob Kelly and Stephen Kessell for reviewing the book. We also thank the following individuals for contributions of various sorts: Peter Sands, Peter Benyon, Rob Hurle, Gay Watt and Joan Brown.

This book was typeset on the COM (Computer Output on Microfilm) of the CSIRO's CSIRONET computer network, using COMTEXT, a computer typesetting program developed by the CSIRO Division of Computing Research. We thank Bob McKay for advice with COMTEXT when we had difficulties, and the following members of the CSIRO Division of Computing Research and of the CSIRO Marine Laboratories for assistance:
computer file production: Sue Aynsley, Narelle Hall, Maryanne Nicholas,
drafting: Neridah Charlesworth, Ian Hamilton, Bea Lindsay,
photography: Charles Purday,
technical editing: Phil Hindley, Jan Somers.

Wilfred R. Cuff, Canberra
Matthias Tomczak, Cronulla

CONTENTS