AN ABC OF MODELLING

A is for Assume.

If your mathematical experience has taught you never to assume what you are not given, then this book will startle you. What you are given is rarely enough, so you will have to make assumptions—about what is important and what is not, about what is assured beyond reasonable doubt and what is still open to question. Indeed, in a very real sense, a model is simply the assumptions you make. Mathematics enables you to deduce, from those assumptions, conclusions which (a) might otherwise not be so readily apparent and (b) can be compared with observations of the real phenomenon that your abstract model attempts to explain. The degree of correspondence determines the value of the model. Poor agreement does not (or should not!) suggest that the mathematics is wrong, however, but rather that one (or more) of the assumptions you made is of doubtful validity. Then you modify your model (i.e., modify your assumptions), and the merry-go-round begins again.

B is for Borrow.

Why borrow? A mathematical model is an attempt to capture, in abstract form, the essential characteristics of an observed phenomenon. The success of the attempt depends as much (if not more) on the modeller's empirical

knowledge of that phenomenon as on her or his mathematical ability. What do you do if you have neither the knowledge nor the time to acquire it? The answer is that you borrow your assumptions, from the scientific literature or from more experienced colleagues (being sure, of course, to acknowledge your sources). With due respect to geniuses, it is much more practical to build upon existing models than it is to start from scratch. So you must be prepared to borrow freely. Yet therein lies a danger, the danger that you will accept too readily the authority of the printed word. Hence ...

C is for Criticize.

You must be prepared to criticize, too; prepared to criticize not only your own assumptions but also those you have borrowed from other people. Who is to say if they are right or wrong? The answer is you! Modelling is an iterative process. You begin by assuming or borrowing; with the help of mathematics, you reach conclusions; you criticize them; if you are not satisfied then you assume or borrow again, conclude and criticize again, and so on, until eventually you are satisfied (that the model explains the observations). Don't forget the ABC. Assume. Borrow. Criticize.

D is for, among other things, Decay.

Which brings us nicely to Chapter 1.