As many salmon poachers nowadays use cyanide it is of interest to note that the threshold toxicity is as low as about 0.1 p.p.m. and that the gills of the fish dying in cyanide solutions become bright red. I agree that this is an important symptom of the cause of death, but unfortunately in a few hours the gill colour returns to normal.

Other chapters deal with organic gases, acids, alkalis, pH tolerance limits, synthetic detergents and soaps, complex effluents, and thermal pollution.

A discussion on the growth rates of fish in acid and alkaline waters ends with a quotation from Brown that evidence of better growth in alkaline water is circumstantial and that "no one has demonstrated unequivocally that growth rates are directly affected by the ionic composition of the water". To this I would add that most acid waters I have investigated have been overcrowded and the population thereby underfed. Given enough food, salmonids will grow well in acid waters.

The 'newer' pollutants in the form of synthetic detergents, herbicides and insecticides are dealt with adequately. The high toxicity and long life of some of the components of these substances make sad reading for anyone interested in the preservation of our fishes. It is equally distressing to learn that fish are not capable of avoiding phenol in solution at any concentration.

To the full discussion on the effect of pollution on fish eggs I would like to add that the absence or very reduced flow of water at the spot where the salmon or trout eggs are about to be laid is temporary. Once the female fish has covered her eggs with gravel the water will once again flow through the gravel. Also, the bed-making activities of the female salmon and trout are such that a great deal of the silt and detritus in the gravel is carried downstream. Consequently the gravel around the eggs is reasonably clean and will itself form an adequate filter to prevent the eggs being silted.

Dr. Jones is to be complimented on his achievement, but I wonder if the book could be made more acceptable to the less scientifically minded by the addition of simple abstracts at the beginning of each chapter. I would also like to see the generic and specific names of the fish given in the text, not as an appendix, especially as the American common names can be confusing.

J. W. JONES

TIDAL COMPUTATIONS

Tidal Computations in Rivers and Coastal Waters

By J. J. Dronkers. Pp. xii+518. (Amsterdam: North-Holland Publishing Company, 1964.) 110s.

"... the effect of either luminary doth likewise depend upon its declination or distance from the equator: for if the luminary were placed at the pole, it would constantly attract all parts of the waters without any intensification or remission of its action, and could cause no reciprocation of motion. And, therefore, as the luminaries decline from the equator towards either pole, they will, by degrees, lose their force; and on this account will excite lesser tides in the solstitial than in the equinoctial syzygies ...".

DR. J. J. DRONKERS, of the Netherlands Rijkswaterstaat, begins *Tidal Computations in Rivers and Coastal Waters* with a historical outline which may well tempt the reader to turn to the *Principia* and savour such arguments as this before following with Dr. Dronkers the development of tidal theory through the work of D. Bernoulli, Laplace, Airy and Kelvin to the present time. In his introductory outline, Dr. Dronkers states that "this book is devoted to those tidal computations in rivers and coastal waters which are of great use in the planning and construction of engineering works in tidal waters". Thus, the book is primarily addressed to engineers, and so is largely confined to shallow water phenomena: for constructional work in the oceans is not yet envisaged.

Under the term 'tidal computations' Dr. Dronkers includes the harmonic analysis of tides, and the broad range of calculations concerned with tidal propagation. Such a statement, however, gives little indication of the actual scope of the work; and a brief résumé will therefore be attempted.

Chapter 1, in addition to the historical sketch, contains reference to problems arising when civil engineering works are contemplated in tidal régimes: for example, new navigation channels, land reclamation works and tidal barrages for power or water-supply purposes. The vital 'closure' problems arising in tidal barrage works are treated more fully later in the book. In solving such problems, the engineer will nowadays make use of the hydraulic scale-model, the electrical analogue, or the mathematical model with computer. Chapter 1 contains a general comparison of these devices.

The remaining chapters of the book are distributed between four main divisions. Part 1, "The Generation and Harmonic Analysis of the Tides", occupies about one-fifth of the text. It contains sections on the necessary basic astronomy, develops the tidal potential by vector methods, and considers the inertia-less 'equilibrium tide', the constituents of which are always in advance of the real ones. There is a list of 29 tidal constituents, and a chapter devoted to practical harmonic analysis, which leads to phase and amplitude determinations for the real constituents. The work of Doodson occupies a conspicuous position.

Part 2, "Basic Hydrodynamics and Hydraulics", leads from continuity, through the Euler equations, and thence by tensor methods to the Navier-Stokes equations. There follow an introduction to concepts of turbulent motion, and the velocity-distribution arising from the mixing-length theory of Prandtl. Chapter 6 discusses both long and short waves, with the approximations appropriate to each class, and also gives some consideration to the propagation of a semi-diurnal tide on a flowing river. Chapter 7 deals with the equations for long waves in shallow water; and, in particular, with the propagation across important discontinuities in the profile, as, for example, through a gap.

In Part 3, which deals with tidal computations in rivers and coastal waters, complete chapters are devoted to each basic method of solution; that is, to the harmonic, characteristic and finite-difference methods. It occupies nearly two-fifths of the book, and presupposes in the reader a considerable mathematical background. However, in the excellent bibliography, reference is made to some basic text-books. Chapter 9, on the method of characteristics, contains some sixteen pages devoted to the fascinating question of the propagation of a tidal bore. Here, as elsewhere, the combination of physical and mathematical reasoning is impressive.

Part 4, "Practical Applications", contains condensed descriptions of the solution by the harmonic method of the problem of tides in the River Lek; and of an application of the method of characteristics to a sluice problem. The first part of the final chapter deals in outline with 'closure' problems. In the second paragraph of p. 460 the words 'ebb' and 'flood' should apparently be interchanged. The work closes with a discussion of very high tides, followed by a further short contribution on hydraulic and analogue models. Reference is made to the impressive *Delta* model at Delft, with its battery of Magnus-Coriolis cylinders.

One would expect to find this book in the libraries of all civil engineering schools and hydraulic research institutes because of its wide scope and coverage of modern analytical and computational techniques. Many readers would doubtless welcome a second (perhaps shorter) volume devoted to the detailed solution of specific problems.

R. B. WHITTINGTON

* Isaac Newton, *Principia*, Book 3, prop. XXIV (1686): Translated by A. Motte, edit. by W. Davis (1803).