Water Quality Criteria for Freshwater Fish

Second Edition

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Published by arrangement with the
Food and Agriculture Organization of the United Nations
by
Butterworths
London Boston Durban Singapore Sydney Toronto Wellington

This book is based on material originally published by the Food and Agriculture Organization of the United Nations, in the form of EIFAC Reports.

First published by Butterworths 1980
Second edition 1982
Reprinted 1984

British Library Cataloguing in Publication Data

Water quality criteria for freshwater fish.–2nd ed.
1. Fishes, Effect of water pollution on–Europe
–Addresses, essays, lectures
2. Fishes, Fresh-water–Europe–Addresses,
essays, lectures 3. Water quality–Europe
–Addresses, essays, lectures
I. Alabaster, J. S. II. Lloyd, R.
597'.052632 SH174

ISBN 0-408-10849-5

Typeset in 10/11pt IBM Press Roman by
RDL, 26 Mulgrave Road, Sutton, Surrey
Printed in Great Britain at the University Press, Cambridge

engineering works during which large volumes of earth are disturbed, from forestry operations, and from the discharge of sewage, sewage effluents, mining wastes, pulp and paper mill wastes, and other industrial effluents. Solids of many different kinds are therefore to be found in surface waters. Some of them–basic salts of zinc for example–have toxic properties (Lloyd, 1960; Herbert and Wakeford, 1964), while organic solids are oxidized by micro-organisms which can reduce the concentration of dissolved oxygen to levels at which fish are asphyxiated. Effects of these kinds are not considered in this chapter, nor has particular attention been given to the effects which solids may have by altering physical characteristics of the water such as temperature. Furthermore, some waste waters contain both solids in suspension and potentially harmful substances in solution.

The possibility that suspended solids will modify the resistance of fish to poisons, or to low dissolved oxygen, high temperature and extremes of pH value has not been examined, nor are there included in the chapter the results of laboratory studies or of observation in the field unless it was reasonably certain that any adverse effects were due only to the solids. For example, Rolley and Owens (1967) have shown that dissolved oxygen may be reduced as a result of deposits of organic matter being brought into suspension, consequently we have not used some reports of fish kills during floods when the suspended-solids concentration was high and the dissolved-oxygen concentration was not measured.

Some other research reports have been excluded because we considered that the conclusions reached by their authors were not fully supported by the evidence. In many research papers–especially some of those reporting studies of lakes and rivers–much of the evidence which we have used is less securely established than is desirable because the suspended-solids concentrations were not measured very often.

Although most authors have reported their observations as weight of solids per unit volume of water, others have expressed them as light transmittancies of Secchi disc readings. One of these systems of measurement cannot be converted into another unless the relation between them has been determined for the particular solid under consideration. Because the appropriate relation has seldom been reported, we have not attempted to use one system of measurement throughout the literature survey, but have quoted results in the units employed by the authors.

From our study of the literature it is apparent that there are at least five ways in which an excessive concentration of finely divided solid matter might be harmful to a fishery in a river or a lake. These are:

(a) By acting directly on the fish swimming in water in which solids are suspended, and either killing them or reducing their growth rate and resistance to disease.
(b) By preventing the successful development of fish eggs and larvae.
(c) By modifying natural movements and migrations of fish.
(d) By reducing the abundance of food available to the fish.
(e) By affecting the efficiency of methods for catching fish.

In addition, some or all of these factors could operate together to harm a fishery.

These subjects (except (e)) are considered in the next section of this chapter.