

Technische Hochschule Darmstadt  
Institut für Wasserversorgung,  
Abwasserbeseitigung und Raumplanung  
- Bibliothek -  
6100 Darmstadt, Petersenstraße 13

---

WORLD BANK TECHNICAL PAPER NUMBER 36

---

W. A. R. — Bibliothek  
Inv. - Nr. D 10818

~~44 EDW~~

09.4 EDW

# Aquaculture

## A Component of Low Cost Sanitation Technology

Peter Edwards

The World Bank  
Washington, D.C., U.S.A.

## CONTENTS

<b>FOREWORD</b> .....	xi
<b>CHAPTER I. INTRODUCTION</b> .....	1
<b>CHAPTER II. COMMERCIALY VIABLE AQUACULTURE EXCRETA REUSE SYSTEMS</b> .....	3
<b><u>DRY SYSTEMS</u></b> .....	3
<u>China</u> .....	3
<u>Malaysia and Thailand</u> .....	5
<u>Viet Nam</u> .....	5
<u>Bangladesh</u> .....	5
<u>Indonesia</u> .....	5
<u>Aquatic Macrophytes</u> .....	7
<b><u>WET SYSTEMS</u></b> .....	7
<u>India</u> .....	7
<u>China</u> .....	9
<u>Federal Republic of Germany</u> .....	11
<u>Hungary</u> .....	13
<u>Israel</u> .....	14
<b>CHAPTER III. AQUACULTURE IN RELATION TO SANITATION OPTIONS</b> .....	15
<u>COMPOSTING TOILET</u> .....	15
<u>BUCKET LATRINE</u> .....	18
<u>PIT LATRINE</u> .....	18
<u>VAULT</u> .....	18
<u>AQUAPRIVY AND SEPTIC TANK</u> .....	19
<u>CONVENTIONAL SEWERAGE</u> .....	19
<u>SUMMARY</u> .....	20
<b>CHAPTER IV. BIOLOGICAL CONSIDERATIONS IN AQUACULTURE EXCRETA REUSE SYSTEMS</b> .....	22
<u>SANITARY ENGINEERING CONCEPTS AND AQUACULTURE</u> .....	22
<u>DISSOLVED OXYGEN IN WASTE LOADED PONDS</u> .....	22
<u>NUTRIENTS IN WASTE LOADED PONDS</u> .....	24
<u>BIOTA OF WASTE LOADED SYSTEMS</u> .....	24

<u>Phytoplankton</u> .....	24
<u>Macrophytes</u> .....	25
<u>Zooplankton</u> .....	28
<u>Benthic Invertebrates</u> .....	28
<u>Fin Fish</u> .....	28
<u>Shrimp and Prawns</u> .....	29
<u>Molluscs</u> .....	30
<b>CHAPTER V. PUBLIC HEALTH ASPECTS</b> .....	31
<u>HEALTH HAZARDS</u> .....	31
<u>Occupational Hazards</u> .....	31
<u>Consumption of Contaminated Organisms</u> .....	31
<u>Environment for Disease Vectors</u> .....	33
<u>SAFEGUARDING HEALTH</u> .....	33
<b>CHAPTER VI. ECONOMIC AND FINANCIAL ASPECTS</b> .....	37
<u>ECONOMIC DATA OF DIFFERENT EXCRETA REUSE OPTIONS</u> .....	37
<u>ECONOMIC AND FINANCIAL COSTING OF SANITATION TECHNOLOGY</u> .....	38
<b>CHAPTER VII. SOCIOLOGICAL ASPECTS</b> .....	41
<u>SOCIAL ACCEPTANCE OF EXCRETA REUSE</u> .....	41
<u>IMPLEMENTATION OF EXCRETA REUSE</u> .....	42
<b>REFERENCES</b> .....	45