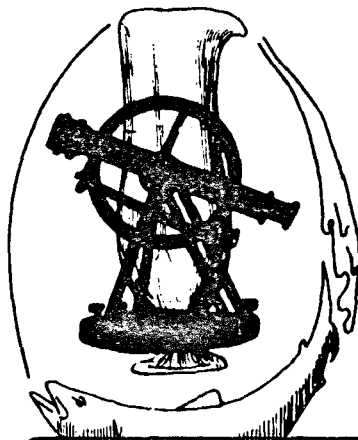


Proceedings of the Bio-Engineering Symposium for Fish Culture



UNIVERSITÄTSBIBLIOTHEK
HANNOVER

TECHNISCHE
INFORMATIONSBIBLIOTHEK

Edited by
Lochie Jo Allen
and
Edward C. Kinney

FCS Publ. 1

FISH CULTURE SECTION
of the American Fisheries Society

5410 Grosvenor Lane
Bethesda, Maryland 20014
and the

NORTHEAST SOCIETY OF CONSERVATION ENGINEERS

CONTENTS

Letter of Welcome.....	ix
<i>The Honorable William G. Milliken, Governor of Michigan</i>	

Preface.....	x
<i>Harry Westers, Chairman</i>	

SESSION I *Symposium Perspective*

Bio-Engineering: An Overview.....	1
<i>Roger E. Burrows</i>	

A Commercial Fish Farmer's View.....	2
<i>Leo Ray</i>	

SESSION II *Requirements of the Fish*

Introduction.....	5
<i>Roger Lee Herman</i>	

The Hatchery Environment Required to Optimize Smoltification in the Artificial Propagation of Anadromous Salmonids.....	6
<i>Gary A. Wedemeyer, Richard L. Saunders, and W. Craig Clarke</i>	

Requirements of Warmwater Fish.....	21
<i>Nick C. Parker and Kenneth B. Davis</i>	

Relationships of Trout Behavior and Management: Hatchery Production and Construction.....	29
<i>Robert L. Butler</i>	

Nitrogen Toxicity to Crustaceans, Fish, and Molluscs.....	34
<i>John E. Colt and David A. Armstrong</i>	

Possible Effects of Phototactic Behavior on Initial Feeding of Walleye Larvae.....	48
<i>Luciano Corazza and John G. Nickum</i>	

SESSION III *Water Conditioning for Fish Rearing*

Management of Dissolved Oxygen and Nitrogen in Fish Hatchery Waters.	53
<i>Richard E. Speece</i>	
Performance Ratings for Submerged Nitrification Biofilters — Development of a Design Calculation Procedure.	63
<i>W. John Hess</i>	
Nitrogen Gas Removal Using Packed Columns.	71
<i>David E. Owsley</i>	
An Overview of the Various Techniques to Control Infectious Diseases in Water Supplies and in Water Reuse Aquacultural Systems	83
<i>Harry K. Dupree</i>	
Recent Advances in Evaluating Biofilter Performance.	90
<i>George W. Klontz</i>	
Preliminary Results and Design Criteria from an On-Line Zeolite Ammonia Removal Filter in a Semi-Closed Recirculating System.	92
<i>William Bruin, John W. Nightingale, Laura Mumaw, and Dennis Leonard</i>	
Determination of Operating Parameter Values for Water Reuse Aquaculture	97
<i>William E. Mancini and John T. Quigley</i>	
A Closed Vertical Raceway Fish Cultural System Containing Clinoptilolite as an Ammonia Stripper.	104
<i>William J. Slone, Douglas B. Jester, and Paul R. Turner</i>	
Management and Cost Implications in Recirculating Water Systems.	116
<i>James F. Muir</i>	

SESSION IV *Instrumentation and Automation in Fish Culture*

Measurement and Control of Hatchery Functions.	128
<i>K. B. Jefferts</i>	
An Air-Operated Fish Culture System with Water-Reuse and Subsurface Silos. . .	131
<i>Nick C. Parker</i>	

Design of Aeration Systems for Aquaculture.....	138
<i>John E. Colt and George Tchobanoglous</i>	
Keeping Hatchery Design Simple.....	149
<i>Ivan C. Quinata</i>	

SESSION V *Hatchery Effluent Treatment*

Introduction.....	156
<i>William A. Godby</i>	
Federal Regulation of Fish Hatchery Effluent Quality.....	157
<i>James Harris</i>	
Hatchery Effluent Water Quality in British Columbia.....	162
<i>R. A. H. Sparrow</i>	
Hatchery Effluent Treatment, U.S. Fish and Wildlife Service.....	167
<i>Terry W. McLaughlin</i>	
Guidelines for Economical Commercial Fish Hatchery Wastewater Treatment Systems.....	174
<i>Vincent A. Mudrak</i>	
Aquaculture as a Method for Meeting Hatchery Discharge Standards.....	183
<i>C. M. Brown and C. E. Nash</i>	

SESSION VI *Fish Production Facilities*

Bio-Engineering and Facility Design.....	190
<i>David W. McDaniel</i>	
Channel Catfish Production in Geothermal Water.....	192
<i>Leo Ray</i>	
How to Develop Criteria for Design and Operation of Fish Facilities.....	196
<i>Phil Jeppson and LeRoy R. Taylor</i>	
Experiences with a Fouling-Resistant Modular Marine Fish Cage System.....	201
<i>John Edward Huguenin, Spencer C. Fuller, Frank J. Ansuini, and Wayne T. Dodge</i>	

Solar Aquaculture: An Ecological Approach to Human Food Production	210
<i>Ronald D. Zweig, John R. Wolfe, John H. Todd, David G. Engstrom, and Albert M. Doolittle</i>	
An Approach to Functional, Economical, and Practical Fish Culture Through Better Bio-Engineering	227
<i>Keen W. Buss</i>	
Intensive Eel Farming in a Nuclear Power Plant Effluent	235
<i>Philippe Lemerrier</i>	
Considerations for Selecting Fish Production Facilities	238
<i>Nick C. Parker</i>	
The Transition and Scale-Up of Research Results to Commercial Marine Aquaculture Systems	240
<i>John E. Huguenin and Harold H. Webber</i>	
An Ecological Approach to a Water Recirculating System for Salmonids: Preliminary Experience	249
<i>Kenneth T. MacKay and Wayne Van Toever</i>	
Evolution of the Design and Operation of a Freshwater Waste Heat Aquaculture Facility at an Electric Generating Plant	259
<i>Bruce L. Godfriaux and Nils Stolpe</i>	
Integration of Hatchery, Cage and Pond Culture of Common Carp (<i>Cyprinus carpio</i> L.) and Grass Carp (<i>Ctenopharyngodon idella</i> Val.) in The Netherlands	266
<i>E. A. Huisman</i>	
A Perspective on the Salmonid Enhancement Program in British Columbia	274
<i>Alan F. Lill, P. Eng.</i>	
Design Features of a Carp Hatchery in Bangladesh	282
<i>John R. Snell, A. Q. Chowdhury, William M. Bailey, and Kermit E. Sneed</i>	
Evaluation of a Closed Recirculating System for the Culture of Tilapia and Aquatic Macrophytes	296
<i>James E. Rakocy and Ray Allison</i>	