

## Small Scale Freshwater Fish Farming

Small-Scale Aquaponic Food Production  
Measuring the Contribution of Small-scale Aquaculture  
Sustainable Land Use and Rural Development in Southeast Asia: Innovations and Policies for Mountainous Areas  
Tilapias: Biology and Exploitation  
Biodiversity  
Integrated Livestock-fish Farming Systems  
Small-scale aquaculture for rural livelihoods: Proceedings of the Symposium on Small-scale aquaculture for increasing resilience of Rural Livelihoods in Nepal. 5-6 Feb 2009. Kathmandu, Nepal  
Handbook on Small Scale Freshwater Fish Farming  
Fishing with Traps and Pots  
Handbook on Fisheries and Aquaculture Technology  
Ornamental Fish Farming  
Farm Ponds for Water, Fish and Livelihoods  
Freshwater Aquaculture  
Cage Aquaculture  
The History of Aquaculture  
Aquaculture Engineering  
Success Stories in Asian Aquaculture  
The Context of Small-scale Integrated Agriculture-aquaculture Systems in Africa  
An Evaluation of Small-scale Freshwater Rural Aquaculture Development for Poverty Reduction  
Management for Freshwater Fish Culture, Fish Stocks, and Farm Management  
Growing Fish in Pen Systems  
Rural Aquaculture  
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Handbook of Polymer Applications in Medicine and Medical Devices  
Small-scale Rainbow Trout Farming  
AD15E Small-scale freshwater fish farming  
FAO Aquaculture Newsletter Home Aquaculture  
AD15E 2008 Small-scale freshwater fish farming  
Nutrient Requirements of Fish and Shrimp  
A Strategic Assessment of the Potential for Freshwater Fish Farming in Latin America  
Aquaculture Sourcebook  
Small-scale Aquaculture  
Aquaculture in Zambia  
Aquaculture Technology  
Farming Freshwater Prawns  
A Strategic Assessment of Warm-water Fish Farming Potential in Africa  
Sustainable Aquaculture Techniques  
Tilapia Fish Farming ~ Practical Manual  
Aquaculture and the Environment

### Small-Scale Aquaponic Food Production

Ponds add value to farming activities: water form pounds can serve domestic and livestock water supplies as well as irrigation for crops. Raising fish is an obvious use for a farm pound; it adds value to the water, and provides improved nutrition for farm families. This booklet provides basic and practical information on multiple-use smallholder farm pounds.

### Measuring the Contribution of Small-scale Aquaculture

This manual provides information on the farming of *Macrobrachium rosenbergii*. Many of the techniques described are also applicable to other species of freshwater prawns that are being cultured. The manual is not a scientific text but is intended to be a practical guide to in-hatchery and on-farm management. The target audience is therefore principally farmers and extension workers. However, it is also hoped that, like the previous manual on this topic, it will be useful for lecturers and students alike in universities and other institutes that provide training in aquaculture.

## **Sustainable Land Use and Rural Development in Southeast Asia: Innovations and Policies for Mountainous Areas**

Key features: Takes a quantitative approach to the science of aquaculture Covers the complete landscape of the scientific basis of fish culture Promotes problem solving and critical thinking Includes sample problems at the end of most chapters Guides the reader through the technical considerations of intensive aquaculture, including fish growth rates, hydraulic characteristics of fish rearing units, oxygen consumption rates in relation to oxygen solubility and fish tolerance of hypoxia, and water reconditioning by reaeration and ammonia filtration. Discusses the environmental effects of aquaculture Includes a chapter on hatchery effluent control to meet receiving water discharge criteria Aquaculture Technology: Flowing Water and Static Water Fish Culture is the first book to provide the skills to raise fish in both a flowing water and a static water aquaculture system with a pragmatic and quantitative approach. Following in the tradition of the author's highly praised book, *Flowing Water Fish Culture*, this work will stand out as one that makes the reader understand the theory of each type of aquaculture system; it will teach the user "how to think" rather than "what to think" about these systems. The book presents the scientific basis for the controlled husbandry of fish, whether it be in a stream of water or a standing water pool. Part 1, *Flowing Water Fish Culture*, is a major revision of the author's initial book and includes greatly expanded coverage of rearing unit design criteria, fish growth and the use of liquid oxygen, hatchery effluent control, and recirculating systems. Part 2, *Static Water Fish Culture*, presents the scientific basis of fish culture in standing water systems including nutrient and dissolved gas dynamics, pond ecology, effects of fertilization and supplemental feeding, water quality management and representative static water aquacultures. *Aquaculture Technology* conveys the science in a manner appropriate for use by university students and teachers and others involved in fish production and aquaculture research and development worldwide. It will enable the reader to adapt to changing technologies, markets, and environmental regulations as they occur.

## **Tilapias: Biology and Exploitation**

### **Biodiversity**

*Aquaculture and the Environment* Second Edition T. V. R. Pillay The continuing rapid increases in aquaculture production world-wide raise fears of further environmental degradation of the aquatic environment. The second edition of this well-received book brings together and discusses the available information on all major environmental aspects of various aquaculture systems, providing a valuable aid to the preparation of environmental impact assessments of aquaculture projects and showing how potential environmental problems can be reduced or mitigated by sound management. Much new

information is presented in this new edition, including details of the impact of genetically modified food products and a new chapter on the sustainability of aquaculture, which covers the definitions of sustainability and responsible aquaculture, environmental, economic, social and ethical aspects of sustainability and the concept of ecotechnology in fish farming. Aquaculture and the Environment, Second Edition is essential reading for all personnel working on fish farms and for those moving into the aquatic farm business. Environmental scientists, ecologists, conservationists, fish and shellfish biologist and all those involved in the preservation of aquatic environments will find much of great use and interest within the covers of this book. Libraries in all universities and research establishments where these subjects are studied and taught should have copies of this excellent and useful book on their shelves. Dr T. V. R. Pillay was formerly Programme Director, Aquaculture Development and Coordination Programme, Food and Agriculture Organization of the United Nations.

### **Integrated Livestock-fish Farming Systems**

### **Small-scale aquaculture for rural livelihoods: Proceedings of the Symposium on Small-scale aquaculture for increasing resilience of Rural Livelihoods in Nepal. 5-6 Feb 2009. Kathmandu, Nepal**

This manual deals in two volumes with the practical aspects of management related to freshwater fish culture in earthen ponds. The first volume (FAO Training Series No. 21/1, 1996, ISBN 92-5-102873-7, US\$51.00) explains how to manage the pond itself. This second volume deals with how to manage fish stocks and, as a whole, a fish farm. Fish handling, propagation, feeding, harvesting, grading and storage are explained in simple terms, as well as the prevention and treatment of simple fish diseases and the monitoring of fish farm activities.

### **Handbook on Small Scale Freshwater Fish Farming**

This manual describes the basic elements of fishing with traps and pots for small-scale fishermen. It presents the various types of traps and pots and their construction, and gives guidance on the choice and use of equipment, how to select places to fish, soaking time and care of the catch.

### **Fishing with Traps and Pots**

Referred to in the Bible, pictured on the wall-friezes of ancient Egyptian tombs, and a subject of fascination for generations of scientists, the tilapias (Cichlidae: Tilapiini) have featured in the diet and culture of humankind for thousands of years. The

present century has seen their spread from Africa throughout the tropics and sub-tropics, largely for food and fisheries purposes. This book attempts to pull together our knowledge of this important group - their biology and fisheries and aquaculture - in a single volume, something that has not been done comprehensively for nearly two decades. A succession of chapters by acknowledged authorities covers evolution, phylogenetic relationships and biogeography, reproductive biology, mating systems and parental care, diet, feeding and digestive physiology, environmental physiology and energetics, the role of tilapias in ecosystems, population dynamics and management, genetics, seed production, nutrition, farming, economics and marketing. The book is aimed at biologists, fisheries scientists, aquaculturists, and all interested in aquatic ecology.

### **Handbook on Fisheries and Aquaculture Technology**

### **Ornamental Fish Farming**

As aquaculture continues to grow at a rapid pace, understanding the engineering behind aquatic production facilities is of increasing importance for all those working in the industry. Aquaculture engineering requires knowledge of the many general aspects of engineering such as material technology, building design and construction, mechanical engineering, and environmental engineering. In this comprehensive book now in its second edition, author Odd-Ivar Lekang introduces these principles and demonstrates how such technical knowledge can be applied to aquaculture systems. Review of the first edition: 'Fish farmers and other personnel involved in the aquaculture industry, suppliers to the fish farming business and designers and manufacturers will find this book an invaluable resource. The book will be an important addition to the shelves of all libraries in universities and research institutions where aquaculture, agriculture and environmental sciences are studied and taught.' Aquaculture Europe 'A useful book that, hopefully, will inspire successors that focus more on warm water aquaculture and on large-scale mariculture such as tuna farming.' Cision

### **Farm Ponds for Water, Fish and Livelihoods**

"Definitive guide to freshwater aquaculture"--back cover.

### **Freshwater Aquaculture**

### **Cage Aquaculture**

Aquaculture now supplies half of the seafood and fisheries products consumed worldwide and is gaining international significance as a source of food and income. Future demands for seafood and fisheries products can only be met by expanded aquaculture production. Such production will likely become more intensive and will depend increasingly on nutritious and efficient aquaculture feeds containing ingredients from sustainable sources. To meet this challenge, *Nutrient Requirements of Fish and Shrimp* provides a comprehensive summary of current knowledge about nutrient requirements of fish and shrimp and supporting nutritional science. This edition incorporates new material and significant updates to information in the 1993 edition. It also examines the practical aspects of feeding of fish and shrimp. *Nutrient Requirements of Fish and Shrimp* will be a key resource for everyone involved in aquaculture and for others responsible for the feeding and care of fish and shrimp. It will also aid scientists in developing new and improved approaches to satisfy the demands of the growing aquaculture industry.

### **The History of Aquaculture**

The current world biodiversity consists of an inestimable amount of living forms, that at all levels, from genes to biomes, from individuals to populations, from species to communities, are in constant pursuit of the best strategies to react to the natural and anthropic environmental changes. The arrangement of new and dynamic ecosystems balanced by the formation and the vanishing of species, is the direct consequence of these changes. This book contains comprehensive overviews and original studies focused on ecological and ecosystem functioning studies, hazards and conservation management, assessment of environmental variables affecting species diversity, also considering species richness and distribution, in order to identify the best management strategies to face and solve the conservation problems.

### **Aquaculture Engineering**

"This is a manual on the commercial production of ornamental fish. It is based predominantly on the author's 30 years of experience, mostly on his own farms. Contents include: the fundamentals of production; operating styles; strategies and facilities; commercial breeding and rearing methods for over 130 species/varieties from 14 major families/groups of fish; diets; miscellaneous fish farming techniques; health management; water chemistry; marketing; site selection and a glossary of terms."--Back cover.

### **Success Stories in Asian Aquaculture**

### **The Context of Small-scale Integrated Agriculture-aquaculture Systems in Africa**

The fishery sector is important from Indian economy view point as it contributes a source of income to a number of fishermen and has huge export potential. The systems and technology used in aquaculture has developed rapidly in the last fifty years. They vary from very simple facilities like family ponds for domestic consumption in tropical countries to high technology systems like intensive closed systems for export production. Much of the technology used in aquaculture is relatively simple, often based on small modifications that improve the growth and survival rates of the target species. Nowadays, the fish and fisheries industry is one of the fastest growing international commodity markets globally. Guaranteeing an adequate supply to this international market requires hundreds of thousands of fishing vessels and fish farms, as well as tens of thousands of fish processing workers, wholesalers and retailers in countries spread all over the world. The fishery sector thus generates employment and income for millions of people and in one of the major fields to venture. A wide range of aspects of fresh water aquaculture such as selection of species of fish and shellfish, construction and preparation of various types of fish ponds, control of aquatic weeds and predators, production of seed fish and their transportation, fish nutrition and fish diseases and their control pertaining to composite fish culture, air breathing fish culture etc. have been dealt with a length for easy adoption. The major contents of the book are classification of fishes, general characters of fishes, techniques in fish identification, cold water fisheries of India, physical and chemical properties of fishery water, chemical constituents of fish, economic importance of fishes, fish in relation to human health, construction of fish farms, etc. In this book you can find all the basic information required on the fundamental aspects of the fisheries and aquaculture technology with detailed information of their applications a wide variety of industrial processes etc. The book is very useful for research scholars, technocrats, institutional libraries and entrepreneurs who want to enter into the field of aquaculture technology.

### **An Evaluation of Small-scale Freshwater Rural Aquaculture Development for Poverty Reduction**

The orthopedic and biomaterials literature of the 1990s reflects an early academic curiosity in implant applications of polyaryletherketone (PAEK) biomaterials [1,2]. However, widespread commercial applications for PAEK biomaterials in the human body were first realized with cage implants intended to promote intervertebral body (interbody) fusion of the lumbar spine. Success of PAEK with interbody implants would later inspire applications in a broad variety of spinal implant applications, including posterior fusion, dynamic stabilization, and disc arthroplasty.

### **Management for Freshwater Fish Culture, Fish Stocks, and Farm Management**

Aquaculture has become of the fastest growing segments of agriculture around the world, but until recently many people have been unaware of its existence. The practice of raising fish is centuries old with a rich history of techniques and

scientific advances. The History of Aquaculture traces the development of fish farming from its ancient roots to the technologically advanced methods of today. The History of Aquaculture is a comprehensive history of captive fish production from its small scale prehistoric roots through to the large-scale industrialized practices of today. Thirteen chapters take readers chronologically through the evolution of this important discipline. Chapters cover key periods of advancement and trace changes in the field from subsistence fish farming in the Middle Ages through the efforts to build global capacity for fish production to meet the needs of the world's ever growing population. Informative and engaging, The History of Aquaculture will broadly appeal to aquaculture scientists, researchers, professionals, and students. Special Features: Comprehensive history of advances in aquaculture production from prehistoric origins to industrialized practices Written by a revered scientists with decades of experience working in the aquaculture field Engaging and informative it will broadly appeal to individuals involved in all facets of aquaculture

### **Growing Fish in Pen Systems**

Since the first edition of this book, 17 years ago, aquaculture has consolidated its position as an important means of producing food and as a contributor to global food security. Cage aquaculture too has continued to expand apace. The third edition of this important, useful and well-received book maintains the original aim of providing a thorough synthesis of information on cages and cage aquaculture practices with data and examples encompassing all major world regions. Fully updated, the book's comprehensive contents include details of the origin and principles of cage aquaculture and an overview of its current position. Contents of the chapters following include key information on cage design and construction, site selection, environmental impacts and environmental capacity, management, and potential problems in cage aquaculture systems. A comprehensive reference list and index are included to help readers. The volume is essential reading for all personnel involved in fish and shellfish farms that use cages, and for all those embarking on a career in aquaculture. Cage manufacturers and others supplying the aquaculture trade will find much of commercial use within the book. All those involved in aquaculture research and equipment design should have a copy of this most useful book. All libraries in universities and research establishments where aquaculture, environmental science, aquatic science, fish biology and fisheries are studied and taught should have several copies on their shelves.

### **Rural Aquaculture**

Aquaculture for both finfish and shellfish is expanding rapidly throughout the world. It is regarded as having the potential to provide a valuable source of protein in less developed countries and to be integrated into the farming systems and livelihoods of the rural poor. This book addresses key issues in aquaculture and rural development, with case studies drawn from several countries in South and South-East Asia. Papers included cover topics ranging from production and technical

issues (such as pond culture and rice field fisheries) to social aspects and research and development methodology. The book has been developed from a meeting of the Asian Fisheries Society. It is aimed at all concerned with aquaculture and rural development.

### **Increasing productivity and improving livelihoods in aquatic agricultural systems: A review of interventions**

The Handbook on small-scale freshwater fish farming provides a wealth of simply presented and illustrated information on freshwater fish farming in ponds, pens and cages, compiled from five booklets published on the subject in FAO's Better Farming Series between 1979 and 1990. Here is an improved format, particulars of pond, pen and cage location, construction and management are covered in outlines that can be modified to suit local conditions. The handbook is primarily intended to help workers, technicians and teachers present their knowledge of freshwater fish farming to small-scale farmers. For example, it can be used as a trainer's aid in conjunction with the five original booklets, which can be distributed among trainees. The handbook ends with a set of questions that could be used to test the trainees' comprehension. Contents Chapter 1: Introduction; What is fish farming?, Why do we raise fish?, What do you need to raise fish?, How do we begin?; Chapter 2: Locating your Fish Farm; Where to put your fish pond, Water supply, Soil quality, Testing soil; Chapter 3: Constructing Fish Ponds; How large should your pond be?, How to build a 20 by 20 metre pond; Chapter 4: Inlets to Let Water into the Pond; Simple inlets, A better inlet; Chapter 5: Outlets to Let Water Out of the Pond; Simple outlets, A better outlet, Another kind of outlet: the monk, Improving your pipe outlet, Using a siphon to drain your pond; Chapter 6: Bringing Water to your Ponds; Raising the level of your water supply, Digging a supply ditch, Digging a return ditch, Building a sluice to control the water flow; Chapter 7: Controlling the Water in the Pond; Overflow, Controlling trash and fish: screens; Chapter 8: Preparing your Pond; Before filling the pond, Fertilizing the water, How to make plant compost, How to make animal compost, Building a crib, Putting fertilizer into the crib, When is your pond ready?; Chapter 9: Stocking your Pond with Baby Fish; Growing your own baby fish, Feeding the fish in your nursery pond, Using your baby fish, Transporting your baby fish, Putting baby fish into your pond; Chapter 10: Taking Care of your Pond; Chapter 11: Taking Care of your Fish; Feeding your growing fish, Providing good water for your fish; Chapter 12: Harvesting your Pond; Harvesting without draining the water, Harvesting by draining part of the water, Harvesting by draining all of the water, Harvesting fish when you have a monk, Harvesting inside the pond, Harvesting outside the pond, Harvesting many fish, What to do with your baby fish; Chapter 13: Beginning Again; Chapter 14: Improving Farm Management; Growing fish all year round, Growing only male fish; Chapter 15: Producing Fish in Pens; Locating fish pens, How large should your pen be?, Building a pen, Putting baby fish into your pen, Feeding fish in pens, Taking care of your fish in a pen, Taking care of your fish pen, Harvesting fish in pens, Starting again; Chapter 16: Producing Fish in Cages; Locating fish cages, Building a cage, Building a simple post cage, Building a simple floating cage, Building a better floating cage, Putting baby fish in the cage,

Feeding fish in cages, Taking care of your fish in a cage, Taking care of the cage, Harvesting fish in cages, Starting again; Chapter 17: Your Farm and your Fish Ponds; Chapter 18: Keeping you and your Family Healthy.

### **Handbook of Polymer Applications in Medicine and Medical Devices**

As traditional commercial fishing becomes increasingly expensive and restrictive, aquacultural fish production emerges as a practical viable alternative. The Aquaculture Sourcebook is an introductory text and ready reference for information on the fresh-, brackish-, and salt-water farming of both fish and shellfish, as well as of several important algae. Until now, such material has been available only in scattered publications; but the Aquaculture Sourcebook incorporates all the feasibility data pertinent to farming aquacultural species in North America into one easy-to-use text. It will be welcomed not only by current and future aquaculturists, but also by fisheries, seafood company managers, biologists, teachers, and students. The Aquaculture Sourcebook has been designed to satisfy the needs of fisheries, scientists, and commercial aquaculturists by providing, in a handy and well-organized format, information vital for successful North American aquacultural ventures. Concise details are given for over a hundred individual speices, including not only those raised for human consumption, but also organisms reared for feed, bait, or other purposes. Each entry in this valuable volume covers such relevant material as: \*the scientific and common names of the organism \*its visual appearance and distinctive characteristics \*habitat range specifications \*species reproduction and development \*age- and growth-related factors \*specific parasites an diseases \*potential predators and/or competitive species \*its prospects for future aquacultural success Key groups of closely related species are discussed in a geographical context, highlighting areas which each will find the habitat best for its survival. Great care has been taken to specify ranges of tolerable salinity and optimum temperature for candidate species, and emphasis has been placed on creating aquacultural environments that replicate those normally habitated in nature. Comprehensive, informative, and accessible to layperson and scientist alike, the Aqualculture Sourcebook is both the perfect desktop reference for anyone establishing an aquacultural facility, and a ready reference to help maintain one.

### **Small-scale Rainbow Trout Farming**

This book presents some innovative developments in sustainable aquaculture practices in the context of environmental protection and seafood production techniques. The chapters are written by experts in their respective areas, so that their contribution represents the progress of their research, which is intended to mark the current frontier in aquaculture practices. Every chapter presents techniques that contribute to good aquaculture practices, where direct and vital nutrition and food, as a source of energy and biomass generation, is fundamentally based. We hope this book supports producers and researchers in their activities and helps to maintain a spirit of environmental protection in the context of production of high quality, nutritional food.

## **AD15E Small-scale freshwater fish farming**

This book is based on the findings of a long-term (2000-2014) interdisciplinary research project of the University of Hohenheim in collaboration with several universities in Thailand and Vietnam. Titled Sustainable Land Use and Rural Development in Mountainous Areas in Southeast Asia, or the Uplands Program, the project aims to contribute through agricultural research to the conservation of natural resources and the improvement of living conditions of the rural population in the mountainous regions of Southeast Asia. Having three objectives the book first aims to give an interdisciplinary account of the drivers, consequences and challenges of ongoing changes in mountainous areas of Southeast Asia. Second, the book describes how innovation processes can contribute to addressing these challenges and third, how knowledge creation to support change in policies and institutions can assist in sustainably develop mountain areas and people's livelihoods.

## **FAO Aquaculture Newsletter**

### **Home Aquaculture**

This report looks at small-scale aquaculture from the viewpoint of poverty reduction. What are the main factors that enable fish farming to generate livelihoods and reduce poverty? Based on case studies, the first part of the report highlights the importance of access to capital assets--human, social, natural, physical, and financial--and to a range of transforming processes, such as markets, institutions, facilities, infrastructure, and services.

## **AD15E 2008 Small-scale freshwater fish farming**

A basic guide to starting and successfully practicing small-scale rainbow trout farming, summarizing all essential technical information important for small-scale trout production. It includes general information on efficient treatment of trout farm effluents, taking into consideration the need to protect mountainous regions where water resources could support profitable trout farming. The aim is to guide the reader through the necessary technical information, related practical solutions and the steps of preparation of both investment in and day-to-day operation of a small-scale rainbow trout farm. It includes a glossary and illustrations for easy understanding.

## **Nutrient Requirements of Fish and Shrimp**

Aquatic agricultural systems (AAS) are food production systems in which the productivity of freshwater or coastal ecosystems contributes significantly to total household nutrition, food security, and income in developing countries. The Consultative Group of International Agricultural Research (CGIAR) engages in research in development to address this challenge. The goal of the CGIAR research program on Aquatic Agricultural Systems (referred to in this paper as “the AAS program”) is to harness the development potential of aquatic agricultural systems to improve the livelihood security and well-being of an estimated 10 million by 2016 poor people who are dependent on these systems This working paper draws lessons from the target countries through a review of productivity interventions such as modifying habitats, harnessing underutilized productive resources, improving the integration of production commodities, supporting community-based natural resource management, and genetically improving strains. In total, this paper reviewed 20 productivity interventions.

### **A Strategic Assessment of the Potential for Freshwater Fish Farming in Latin America**

#### **Aquaculture Sourcebook**

#### **Small-scale Aquaculture**

Given the recent expansion and commercialization of aquaculture in Zambia, an important question that needs to be explored is how have the recent changes in the Zambian aquaculture sector contributed to the needs of the poor? The aim of this report is to (a) outline the current trajectory of aquaculture development in Zambia and (b) evaluate whether these development efforts are inclusive of and responsive to the needs of the poor.

#### **Aquaculture in Zambia**

This book examines how the adaptability and innovation of small-scale aquaculture farmers have been crucial to success in the region. It describes the relationship between aquaculture development in Asia to natural systems, social conditions and economics.

#### **Aquaculture Technology**

#### **Farming Freshwater Prawns**

Aquaponics is the integration of aquaculture and soilless culture in a closed production system. This manual details aquaponics for small-scale production--predominantly for home use. It is divided into nine chapters and seven annexes, with each chapter dedicated to an individual module of aquaponics. The target audience for this manual is agriculture extension agents, regional fisheries officers, non-governmental organizations, community organizers, government ministers, companies and singles worldwide. The intention is to bring a general understanding of aquaponics to people who previously may have only known about one aspect.

### **A Strategic Assessment of Warm-water Fish Farming Potential in Africa**

#### **Sustainable Aquaculture Techniques**

The FAO Expert Workshop on Methods and Indicators for Evaluating the Contribution of Small-scale Aquaculture to Sustainable Rural Development held in Nha Trang, Viet Nam, from 24 to 28 November 2009, attempted to develop an indicator system to measure the contribution of SSA. The workshop used a number of processes and steps in the developing the indicator system, including: (i) understanding the subject of measurements; (ii) identifying an analytical framework and rating criteria (iii) developing a list of SSA contributions; (iv) categorising the contributions; (v) devising and organising the indicators of contribution; and (vi) measuring the indicators. The major outcome was the development, through an iterative process, of an indicator system which can provide a good measure of the contribution of SSA based on agreed criteria (accuracy, measurability and efficiency) and the sustainable livelihood approach analytical framework which consists of five capital assets (human, financial, physical, social and natural) and can be used for various livelihoods options.

#### **Tilapia Fish Farming ~ Practical Manual**

Integrated farming in Asia is either considered an eco-friendly good that should be preserved for environmental reasons or a poor practice that will soon be superseded by industrial aquaculture. This report finds that most livestock-fish integration is sound business conducted by entrepreneurs accessing urban markets where the price of fish is relatively low. It can be used as part of a strategy to reduce environmental impacts of intensive livestock production and to produce low-cost food. Farmers have proved adept at both developing their systems to meet their own needs and diversifying the role of ponds, fish and livestock within their complex livelihoods.

#### **Aquaculture and the Environment**



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