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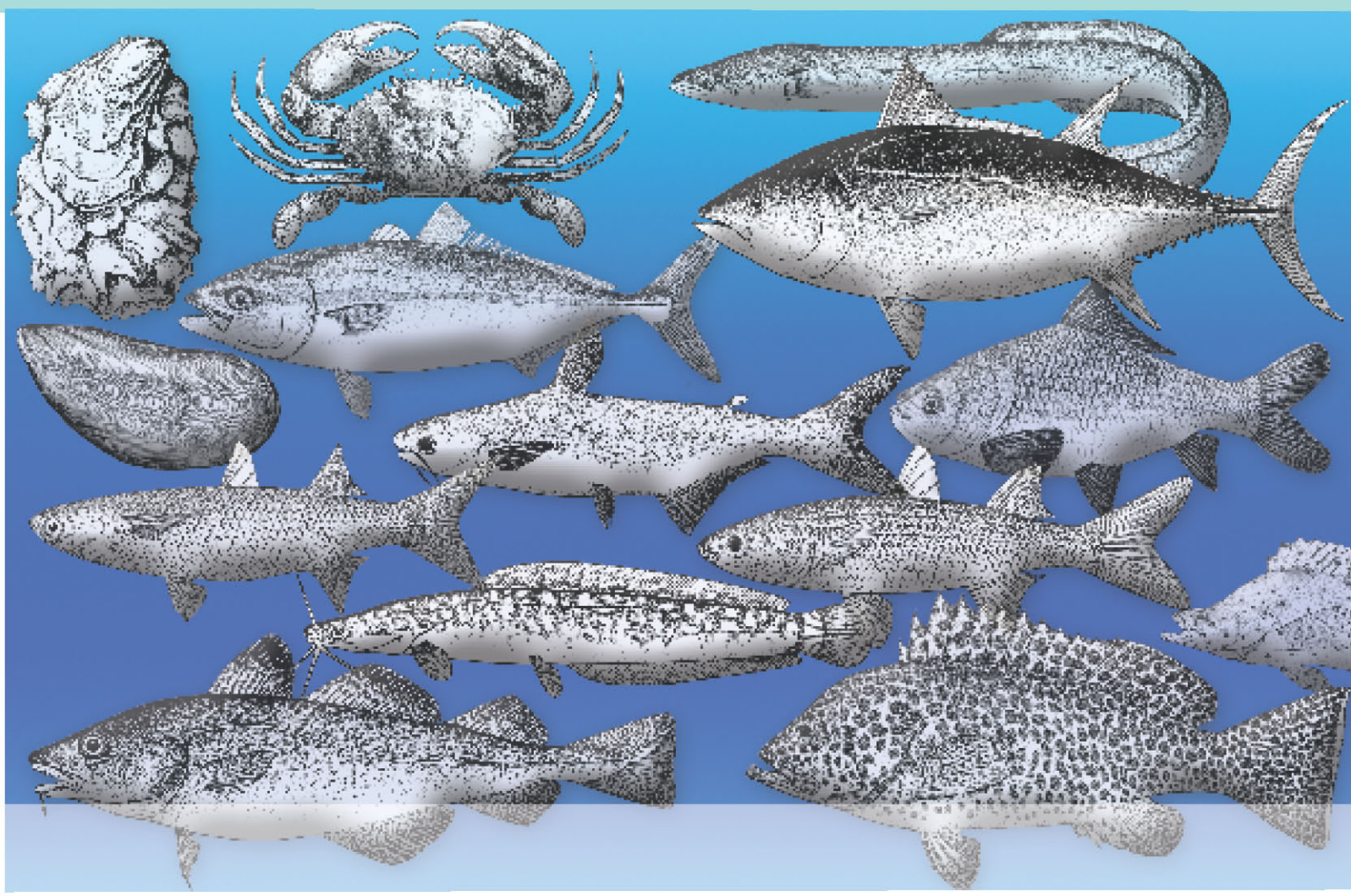
Capture-based aquaculture

Global overview



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Cover:
Line drawings of commercial aquatic species produced through capture-based aquaculture. Drawings from the FAO Species Identification and Data Programme (SIDP). Montage created by Alessandro Lovatelli and José Luis Castilla Civit.

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Preparation of this document

The two thematic reviews on the (a) environmental and biodiversity and (b) socio-economic issues related to capture-based aquaculture and the eleven species-specific papers covering both marine and freshwater examples contained in this document have been prepared as support material for the "FAO international workshop on technical guidelines for the responsible use of wild fish and fishery resources for capture-based aquaculture production". The workshop organized by the Food and Agriculture Organization of the United Nations (FAO) was held in Hanoi, Viet Nam, from 8 to 12 October 2007, with the collaboration of the Ministry of Agriculture and Rural Development (MARD).

The commissioning of the papers and presentation at the Hanoi workshop were organized by the Aquaculture Management and Conservation Service (FIMA) of the FAO Fisheries and Aquaculture Department and financially supported by the regular programme and extrabudgetary funds from the Government of Japan in support of the project "Towards sustainable aquaculture: selected issues and guidelines".

Part 1 of the publication consists of two thematic reviews: "Environmental and biodiversity impacts of capture-based aquaculture" by Yvonne Sadovy and Min Liu of the University of Hong Kong and "Social and economic impacts of capture-based aquaculture" by Robert Pomeroy of the University of Connecticut-Avery Point. Part 2 reproduces the eleven species-specific papers prepared, in alphabetical order, by Choi Kwang Sik (oyster) of the Cheju National University (Republic of Korea); Makoto Nakada (yellowtail) of the Tokyo University of Marine Science and Technology (Japan); Thomas Nielsen (consultant) and Patrick Prouzet (European eel) of the Institut français de recherche pour l'exploitation de la mer (France); Bjørg H. Nøstvold, Kjell Ø. Midling, Bent M. Dreyer and Øystein Hermansen (cod) of the Norwegian Institute of Fisheries and Aquaculture Research (Norway); Francesca Ottolenghi (bluefin tuna) of Halieus (Italy); Anders Poulsen, Don Griffiths, So Nam and Nguyen Thanh Tung (Pangasiid catfish and snakehead) respectively of the Ministry of Agriculture and Rural Development (Viet Nam) (first two authors), Inland Fisheries Research and Development Institute (Cambodia) and Southern Sub-Institute of Fisheries Planning (Viet Nam); Victor Pouomogne (*Clarias* catfish) of the Institute of Agricultural Research for Development (Cameroon); Mhd Mokhlesur Rahman (Indian major carps) of the Center for Natural Resource Studies (Bangladesh); Magdy Saleh (mullets) of the General Authority for Fish Resources Development (Egypt); Colin Shelley (mud crab) of YH & CC Shelley Pty Ltd (Australia); and Mark Tupper and Natasja Sheriff (grouper) of the WoldFish Center (Malaysia).

The photographs presented in the species papers where taken by the authors unless otherwise indicated.

The final revisions and inputs for the papers were provided by the technical editors, A. Lovatelli and P.F. Holthus.

Abstract

Aquaculture is a diverse and multibillion dollar economic sector that uses various strategies for fish production. The harvesting of wild individuals from very early stages in the life cycle to large mature adults for on-growing under confined and controlled conditions is one of these strategies. This system, referred to as capture-based aquaculture, is practised throughout the world using a variety of marine and freshwater species with important environmental, social and economic implications. The need to evaluate the sustainability of this farming practice in light of its economic viability, the wise use of natural resources and socio-environmental impacts as a whole has been extensively discussed at national, regional and international levels.

In 2004, the Food and Agriculture Organization of the United Nations (FAO) launched a project entitled "Towards sustainable aquaculture – selected issues and guidelines" funded by the Government of Japan which included a thematic component on the use of wild fish and fishery resources for aquaculture production. The objective is to produce a set of technical guidelines that would assist policy-makers in developing informed and appropriate capture-based aquaculture regulations that would take into account the use and conservation of the aquatic resources exploited.

This publication contains technical information prepared in support of and background material for the "FAO international workshop on technical guidelines for the responsible use of wild fish and fishery resources for capture-based aquaculture production" held in Viet Nam in October 2007. The first draft of the technical guidelines on capture-based aquaculture was produced during this meeting. This publication contains two parts. Part 1 consists of two reviews on (a) environmental and biodiversity and (b) social and economic impacts of capture-based aquaculture and Part 2 consists of eleven species review papers. Both marine and freshwater examples have been reviewed and include finfish (mullet, bluefin tuna, European eel, cod, grouper, yellowtail, *Clarias* catfish, Indian major carps, and snakehead and Pangasiid catfish), crustaceans (mud crab) and molluscs (oyster).

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Contents

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A special thanks also goes to the Government of Viet Nam and in particular to Mr Vu Van Trieu and Ms Nguyen Trang Thi Nhung, International Cooperation Department, Ministry of Agriculture and Rural Development, for their support in the organization of the "FAO international workshop on technical guidelines for the responsible use of wild fish and fishery resources for capture-based aquaculture" at which the papers included in this document where presented and discussed in preparation of the technical guidelines on capture-based aquaculture.

The editors also wish to thank Mr Jia Jiansan, Mr Rohana Subasinghe, Mr Devin Bartley, Mr Matthias Halwart and Mr Mohammad Hasan of the Aquaculture Management and Conservation Service, FAO Fisheries and Aquaculture Department, for their technical advice and review of selected papers. Ms Tina Farmer, Ms Françoise Schatto and Ms Helen Nakouzi, FAO Fisheries and Aquaculture Department, also contributed towards the final production of this document. The graphic layout of this technical paper was prepared by Mr José Luis Castilla Civit.

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Abbreviations and acronyms

ACIAR	Australian Centre for International Agricultural Research
ADB	Asia Development Bank
AIT	Asian Institute of Technology
APEC	Asia-Pacific Economic Cooperation
APGN	Asia-Pacific Grouper Network
APO	Associate Professional Officer
BFAR	Bureau of Fisheries and Aquatic Resources (Philippines)
BFRSS	Bangladesh Fisheries Resources Survey Systems
BFT	Bluefin tuna
BNP	Bacillary Necrosis of *Pangasius*
BOBP	Bay of Bengal Programme
BOD	Biological Oxygen Demand
BWDB	Bangladesh Water Development Board
CBA	Capture-based aquaculture
CCRF	Code of Conduct for Responsible Fisheries
CIRAD	Centre de coopération en recherche agronomique pour le développement (Cameroon)
CITES	Convention on International Trade in Endangered Species
CNRS	Center for Natural Resource Studies (Bangladesh)
COD	Chemical oxygen demand
COFI	Committee on Fisheries
COPIFOPEM	Collectif des pisciculteurs intensifs de Fokoué et Penka Michel (Cameroon)
CPUE	Catch per unit effort
CSIRO	Commonwealth Scientific and Industrial Research Organization
DANIDA	Danish International Development Agency
DARD	Department of Agriculture and Rural Development
DFID	Department for International Development (United Kingdom of Great Britain and Northern Ireland)
DO	Dissolved oxygen
DOCA	Deoxycorticosterone acetate
DOF	Department of Fisheries
EC	European Commission
EELREP	Estimation of the reproduction capacity of European eel
EIA	Environmental impact assessment
EIFAC	European Inland Fisheries Advisory Commission
ELISA	Enzyme linked immunosorbent assay
ELP	Early Life-history phase
EU	European Union
FAL	Fisheries Act Law
FAO	Food and Agriculture Organization of the United Nations
FCA	Fishermen's cooperative association (Japan)
FCDI	Flood control drainage and irrigation
FCR	Food Conversion Ratio
FFRC	Freshwater Fisheries Research Center (Bangladesh)
FOB	Free on Board
FRSS	Fisheries Resource Survey System (Bangladesh)

FSMFs	Fish seed multiplication farms (Bangladesh)
FSPS	Fisheries Sector Programme Support
GEF	Global environment facility
GFCM	General Fisheries Commission for the Mediterranean
GIS	Geographical Information System
GSI	Gonad Somatic Index
HACCP	Hazard Analysis and Critical Control Points
HBA	Hatchery-based aquaculture
HCG	Human Chorionic Gonadotropin
HUFA	Highly Unsaturated Fatty Acids
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICES	International Council for the Exploration of High Seas
ICLARM	International Center for Living Aquatic Resources Management
IFAD	International Fund for Agricultural Development
IFREMER	Institut français de recherche pour l'exploitation de la mer
INDICANG	INDICateurs d'abondance et de colonisation sur l'ANGuille européenne *Anguilla anguilla*
IRAD	Institut de recherche agricole pour le développement (Cameroon)
ITCZM	Integrated Tropical Coastal Zone Management
IUCN	World Conservation Union
IUU	Illegal, unregulated and unreported fishing
JFA	Japanese Fisheries Agency
LHRH-A	Luteinizing Hormone Releasing Hormone Analogue
LRFF	Live Reef Food Fish
LRFT	Live Reef Fish Trade
MAC	Marine Aquarium Council
MARD	Ministry of Agriculture and Rural Development (Viet Nam)
MEDRAP	Mediterranean Regional Aquaculture Project
MINEPIA	Ministère de l'élevage, des pêches et des industries animales (Cameroon)
MINRESI	Ministère de la recherche scientifique et de l'innovation (Cameroon)
MPAs	Marine Protected Areas
MRC	Mekong River Commission
NACA	Network of Aquaculture Centres in Asia-Pacific
NGOs	Non-governmental Organizations
ODA	Overseas Development Agency (United Kingdom of Great Britain and Northern Ireland)
PBT	Pacific bluefin tuna
PCB	Polychlorinated biphenyls
PCSD	Palawan Council for Sustainable Development
PECOSUDE	Pêches côtières et estuariennes du sud de l'Europe
PEPISA	Pêcheurs et pisciculteurs de Santchou (Cameroon)
R&D	Research and Development
RAP	Regional Office for Asia and the Pacific (FAO)
RIA2	Research Institute for Aquaculture No.2 (Viet Nam)
ROI	Return on investment
SAPB	Shrimp Action Plan for Bangladesh
SAR	Special Administrative Region
SARS	Severe Acute Respiratory Syndrome
SBT	Southern bluefin tuna
SCRS	Standing Committee on Research and Statistics (ICCAT)
SEAFDEC	South East Asian Fisheries Development Center

SL	Standard Length
SPC	Secretariat of the Pacific Community
SPREP	South Pacific Regional Environment Programme
SSB	Spawning Stock Biomass
STECF	Scientific, Technical and Economic Committee for Fisheries
SUDA	Sustainable Development of Aquaculture
TAC	Total allowable catch
TAFA	Tasmanian Fisheries and Aquaculture
TBT	Tributyltin
TL	Tail Length
TNC	The Nature Conservancy
UN	United Nations
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
VHS	Viral Haemorrhagic Septicaemia
WFC	WorldFish Center (ex-ICLARM)