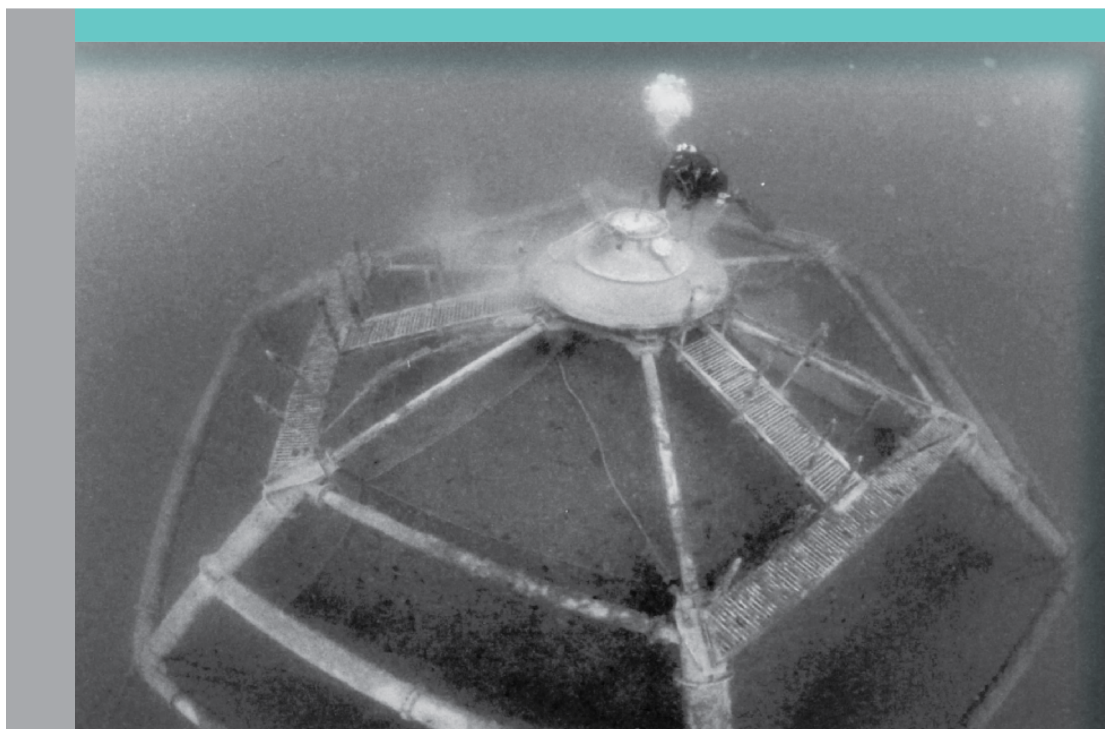


Expanding mariculture farther offshore

Technical, environmental, spatial and governance challenges

FAO Technical Workshop
22–25 March 2010
Orbetello, Italy



Cover photograph: Fully submerged Sadco-Shelf E-Series sea cage with self-contained underwater feeding system (Courtesy of Sadco Shelf Ltd).

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Preparation of this document

This publication is the proceedings of the Food and Agriculture Organization of the United Nations (FAO) expert technical workshop on “Expanding mariculture farther offshore: technical, environmental, spatial and governance challenges”, held in Orbetello, Italy, from 22 to 25 March 2010 and organized by the Aquaculture Branch of the Fisheries and Aquaculture Department.

The workshop was attended by 13 internationally renowned experts from eight countries (Canada, Chile, Denmark, Israel, Italy, New Zealand, Norway, the United States of America), representing the private sector, industry, academia, government, research organizations, and eight staff members from FAO.

The focus of this workshop was to discuss the growing need to transfer land-based and nearshore aquaculture production systems farther from the coast as a result of the expected increases in human population, competition and access to land and sea along the coastal belt.

This initiative attempts to collect information on the potential for global mariculture development (off the coast and offshore) by considering technical, biological, spatial, environmental, socio-economic, legal and policy issues and to identify major opportunities and challenges to act upon at all levels for the industry to expand sustainably. Furthermore, it intends to respond to the needs of the FAO Members to ensure access to adequate information on the potential for off-the-coast and offshore aquaculture, as well as, the requirements to fulfil this potential in terms of governance, research, information, investment, capacity building, relevant policies and required strategies at national, regional and global level.

These proceedings are written for national authorities (e.g. governments, ministries, research institutions and the private sector) that are interested in promoting and supporting the development for off the coast and offshore aquaculture, and it attempts to provide a comprehensive review on the main issues specific to this subsector. Furthermore, the recommendations to FAO can also be very useful for consideration by the Committee on Fisheries (COFI) and its Sub-Committee on Aquaculture (SCA) in their deliberations on the increase in global aquaculture output to deliver nutritious food in a sustainable manner.

As an additional output derived from the workshop, the FAO Fisheries and Aquaculture Technical Paper No. 549 entitled “A global assessment of offshore mariculture potential from a spatial perspective” was prepared to provide estimates of quantitative spatial measures of the status and potential for offshore mariculture development. Applications of satellite data for enhanced operational aquaculture management are also described.

The workshop report has been edited by FAO. All the other reviews and case studies have been reproduced as submitted (on the accompanying CD-ROM).

Abstract

This document contains the proceedings of the technical workshop entitled “Expanding mariculture: technical, environmental, spatial and governance challenges”, held from 22 to 25 March 2010, in Orbetello, Italy, and organized by the Aquaculture Branch of the Fisheries and Aquaculture Department of the Food and Agriculture Organization of the United Nations (FAO).

The objective of this workshop was to discuss the growing need to increasingly transfer land-based and coastal aquaculture production systems farther off the coast and provide recommendations for action to FAO, governments and the private sector. The workshop experts proposed general “operational criteria” for defining mariculture activities in three broad categories: (i) coastal mariculture, (ii) off the coast mariculture and (iii) offshore mariculture.

Offshore mariculture is likely to offer significant opportunities for food production and development to many coastal countries, especially in regions where the availability of land, nearshore space and freshwater are limited resources. Mariculture is also recognized as a relevant producer of the protein that the global population will need in the coming decades.

It is likely that species with the highest production today, such as salmon, will initially drive the development of offshore mariculture. Nevertheless, the workshop agreed that additional efforts are necessary to define optimal species and improve efforts in the development and transfer of technologies that can facilitate offshore mariculture development. The workshop discussions and reviews indicate large potential for the development of offshore mariculture although more detailed assessments are needed to determine the regions and countries that are most promising for development. It is also recommended that efforts be increased to farm lower trophic levels species and optimize feeds and feeding in order to minimize ecosystems impacts and ensure long-term sustainability. Similarly, risk assessments and/or environmental impact assessment and monitoring must always be in place before establishing offshore farms, and permanent environmental monitoring must be ensured.

All coastal nations should be prepared to engage actively in developing the technological, legal and financial frameworks needed to support the future development of offshore mariculture to meet global food needs. The workshop report highlights the major opportunities and challenges for a sustainable mariculture industry to grow and further expand off the coast. In particular, the workshop recommended that FAO should provide a forum through which the potential importance of the sea in future food production can be communicated to the public and specific groups of stakeholders and to support its Members and industry in the development needed to expand mariculture to offshore locations.

The proceedings include the workshop report and an the accompanying CD-ROM containing six reviews covering technical, environmental, economic and marketing, policy and governance issues, and two case studies on highfin amberjack (*Seriola rivoliana*) offshore farming in Hawaii (the United States of America) and one on salmon farming in Chile.

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Abbreviations and acronyms

AAA	adequate areas for aquaculture
ABNJ	areas beyond national jurisdiction
ACOE	Army Corps of Engineers
ADP	Aquaculture Development Program
AMBI	AZTI's Marine Biotic Index
CCRF	Code of Conduct for Responsible Fisheries
CDUA	conservation district use application
CDUP	conservation district use permit
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMBB	Center for Marine Biotechnology and Biomedicine
COFI	Committee on Fisheries
CRAB	collective research on aquaculture biofouling
CWB	Clean Water Branch
CZM	coastal zone management
DA	Department of the Army
DAR	Division of Aquatic Resources
DBOR	Division of Boating and Ocean Recreation
DLNR	Department of Land and Natural Resources
DOA	Department of Agriculture
DOH	Department of Health
EA	environmental assessment
EAA	ecosystem approach to aquaculture
EATIP	European Aquaculture Technology and Innovation Platform
ECASA	Ecosystem Approach to Sustainable Aquaculture
ED	environmental declaration
EEZ	exclusive economic zone
EIA	environmental impact assessment
EPA	Environmental Protection Authority
EU	European Union
FAA	Federal Aviation Authority
FAD	fish aggregating device
FAO	Food and Agriculture Organization of the United Nations
FCR	feed conversion ratio
FDA	Food and Drug Administration (United States of America)
FIFO	fish-in fish-out ratio
FIRA	Aquaculture Branch (FAO)
FOB	freight on board
FONSI	finding of no significant impact
FOSI	finding of significant impact
FWW	Food and Water Watch
GHGs	greenhouse gases
GIS	geographic information system
GMO	genetically modified organism
GPS	Global Positioning System
HAB	harmful algae bloom
HDPE	high density polyethylene
HIHWNMS	Hawaiian Islands Humpback Whale National Marine Sanctuary
HIMB	Hawaii Institute of Marine Biology
HOARP	Hawaii Offshore Aquaculture Research Project

HRS	Hawaii Revised Statutes
ICCAT	International Commission for the Conservation of Atlantic Tunas
ICOAD	International Council for Offshore Aquaculture Development
IIFET	International Institute of Fisheries Economics and Trade
IMTA	integrated multitrophic mariculture
IPN	infectious pancreatic necrosis
ISA	infectious salmon anemia
ITI	infaunal trophic index
IUCN	International Union for Conservation of Nature
KIA	Kona International Airport
LCA	life cycle assessment
MAFAC	Marine Fisheries Advisory Committee
MAFF	Ministry of Agriculture Fisheries and Food
MHC	Marine Harvest Chile
MHI	main Hawaiian islands
MII	Marine Industries and Investments
MMMP	Marine Mammal Monitoring Plan
MOM	modelling–ongrowing fish–monitoring system
NAAFE	North American Association of Fisheries Economists
NACA	Network of Aquaculture Centres in Asia-Pacific
NASCO	North Atlantic Salmon Conservation Organization
NELHA	Natural Energy Laboratory of Hawaii Authority
NGO	non-governmental organization
NIMBY	not in my back yard
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NWHI	Northwest Hawaiian islands
OCCL	Office of Conservation and Coastal Lands
OECD	Organisation for Economic Co-operation and Development
OFC	off the coast
OFS	offshore
OSHA	Occupational Safety and Health Administration
OTEC	ocean thermal energy conversion
PIRO	Pacific Islands Area Office
PRD	Public Relations Department
R&D	research and development
RAMA	Reglamento Ambiental Para la Acuicultura (Chile)
RFMO	regional fisheries management organization
ROV	remotely operated vehicle
SCA-COFI	Sub-Committee on Aquaculture of the Committee on Fisheries
SCUBA	self-contained underwater breathing apparatus
SEAFDEC	Southeast Asian Fisheries Development Center
TBT	tributyltin
UH	University of Hawaii
UHSG	University of Hawaii Sea Grant Program
UNCLOS	United Nations Convention on the Law of the Sea
UNIDO	United Nations Industrial Development Organization
USDA	United States Department of Agriculture
USFWS	US Fish and Wildlife Service
WET	whole effluent toxicity
WFC	WorldFish Center
WFM	Whole Foods Markets
WG	working group
WHAP	West Hawaii Aquarium Project
ZOM	zone of mixing