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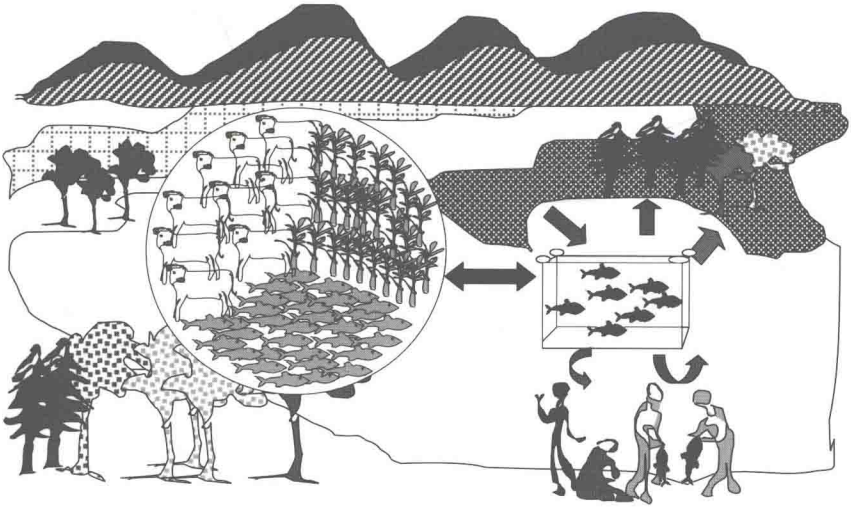
5

Suppl. 4

AQUACULTURE DEVELOPMENT

4. Ecosystem approach to aquaculture



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AQUACULTURE DEVELOPMENT

4. Ecosystem approach to aquaculture

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PREPARATION OF THIS DOCUMENT

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The initial discussions leading to the preparation of these guidelines took place in the FAO/Universitat de les Illes Balears *Expert Workshop on Building an Ecosystem Approach to Aquaculture* convened in Palma de Mallorca, Spain, from 7–11 May 2007. Another expert group discussed the initial draft content of the guidelines in the FAO *Expert Workshop on Guidelines for the Implementation of an Ecosystem Approach to Aquaculture (EAA)* that took place in Rome, Italy, from 24–26 November 2008. The experts participating in these workshops and contributing to the development of the guidelines were: José Aguilar-Manjarrez, Dror Angel, Conner Bailey, Uwe Barg, Kenny Black, Malcolm Beveridge, Alex Brown, Thierry Chopin, Barry Costa Pierce, Sena de Silva, Salud Deudero, Peter Edwards, Shirra Freeman, Nguyen Song Ha, John Hambrey, Nathanael Hishamunda, Nelly Isyagy, Yannis Karakassis, Duncan Knowler, Alessandro Lovatelli, Nuria Marba, Javier Martinez-Cordero, Syndhia Mathe, Miao Weimin, Reinaldo Morales, Ricardo Norambuena, Bill Silver, Francois Simard, Rohana Subasinghe, Phutchapol Suvanachai, Paul Tett, Max Troell and Alexandre Wainberg.

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ABSTRACT

Social and biophysical dimensions of ecosystems are inextricably related such that a change in one dimension is highly likely to generate a change in the other. Although change is a natural consequence of complex interactions, it must be monitored and even managed if the rate and direction of change threatens to undermine system resilience.

> ***"An ecosystem approach to aquaculture (EAA) is a strategy for the integration of the activity within the wider ecosystem such that it promotes sustainable development, equity, and resilience of interlinked social-ecological systems."***

Being a strategy, the ecosystem approach to aquaculture (EAA) is not **what** is done but rather **how** it is done. The participation of stakeholders is at the base of the strategy.

The EAA requires an appropriate policy framework under which the strategy develops through several steps: (i) the scoping and definition of ecosystem boundaries and stakeholder identification; (ii) identification of the main issues; (iii) prioritization of the issues; (iv) definition of operational objectives; (v) elaboration of an implementation plan; (vi) the corresponding implementation process, which includes reinforcing, monitoring and evaluation; and (vii) a long-term policy review. All these are steps informed by the best available knowledge.

Implementing the EAA will require strengthening institutions and associated management systems so that an integrated approach to aquaculture development can be implemented and account fully for the needs and impacts of other sectors. The key will be to develop institutions capable of integration, especially in terms of agreed upon objectives and standards.

The widespread adoption of an EAA will require a much tighter coupling of science, policy and management. It will also require that governments include the EAA in their aquaculture development policies, strategies and development plans.

Abbreviations and acronyms

APFIC	Asia-Pacific Fishery Commission
ASA	American Soybean Association
ASA-IM	American Soybean Association International Marketing (Program)
BMP	better management practice
CBA	capture-based aquaculture
CCRF	Code of Conduct for Responsible Fisheries (of the FAO)
COFI	Committee on Fisheries (of the FAO)
COP	codes of practice
EA	ecosystem approach
EAA	ecosystem approach to aquaculture
EAF	ecosystem approach to fisheries
EIA	environmental impact assessment
FAO	Food and Agriculture Organization of the United Nations
FCR	Feed conversion rate
GDP	gross domestic product
GIS	Geographic Information System
ICZM	integrated coastal zone management
ILO	International Labour Organization
IMTA	integrated multitrophic aquaculture
IWSM	integrated watershed management
LME	large marine ecosystem
MPA	marine protected area
NGO	non-governmental organization
OIE	World Organisation for Animal Health
PAS	partitioned aquaculture system
PCBs	polychlorinated biphenyls
SEA	strategic environmental assessment
SPS	sanitary and phytosanitary
TBT	technical barriers to trade
UNCBD	United Nations Convention on Biological Diversity
UNCED	United Nations Conference on Environment and Development
WHO	World Health Organization
WTO	World Trade Organization

BACKGROUND

1. From ancient times, fishing from oceans, lakes and rivers has been a major source of food, a provider of employment and other economic benefits for humanity. Ocean productivity seemed particularly unlimited. However, with increased knowledge and the dynamic development of fisheries and aquaculture, it was realized that living aquatic resources, although renewable, are not infinite and need to be properly managed, if their contribution to the nutritional, economic and social well-being of the growing world's population was to be sustained.

2. However, for nearly three decades, because of the dramatic increase of pollution, abusive fishing techniques worldwide, and illegal, unreported and unregulated fishing, catches and landings have been shrinking and fish stocks declining, often at alarming rates.

3. Stock depletion has negative implications for food security and economic development and reduces social welfare in countries around the world, especially those relying on fish as their main source of animal protein and income such as subsistence fishers in developing countries. Living aquatic resources need to be properly managed, if their benefits to society are to be sustainable.

4. Sustainability of societal benefits requires a recovery of depleted stocks and maintenance of the still-healthy ones, through sound management. In this regard, the adoption of the United Nations Convention on the Law of the Sea, in 1982 was instrumental. The law provides a new framework for the better management of marine resources. The new legal regime of the oceans gave coastal States rights and responsibilities for the management and use of fishery resources within the areas of their national jurisdiction, which embrace some 90 percent of the world's marine fisheries.

5. In recent years, world fisheries have become dynamically developing sectors of the food industry, and many States have striven to take advantage of their new opportunities by investing in modern fishing fleets and processing factories in response to growing international demand for fish and fishery products. It became clear, however, that many fisheries resources could not sustain an often uncontrolled increase of exploitation. Overexploitation of important fish stocks, modifications of ecosystems, significant economic losses, and international conflicts on management and fish trade still threaten the long-term sustainability of fisheries and the contribution of fisheries to food supply.

6. In light of this situation, while recognizing that the recovery of depleted stocks is still urgent and avoiding depleting still-healthy stocks as important, FAO Member States have expressed the need to further develop aquaculture as the only immediate way to bridge the gap between the dipping capture fisheries output and the increasing world demand for seafood.

7. Indeed, in the last three decades, aquaculture has recorded a significant and most rapid growth among the food-producing sectors and has developed into a globally robust and vital industry. However, aquaculture also has been shown at times to carry the potential to cause significant environmentally and socially adverse impacts.

8. Thus, the Nineteenth Session of the FAO Committee on Fisheries (COFI), held in March 1991, recommended that new approaches to fisheries and aquaculture management embracing conservation and environmental, as well as social and economic, considerations were urgently needed. FAO was asked to develop the concept of responsible fisheries and elaborate a Code of Conduct to foster its application.

9. Subsequently, the Government of Mexico, in collaboration with FAO, organized an International Conference on Responsible Fishing in Cancún in May 1992. The Declaration of Cancún, endorsed at that Conference, was brought to the attention of the United Nations Conference on Environment and Development Summit in Rio de Janeiro, Brazil, in June 1992, which supported the preparation of a Code of Conduct for Responsible Fisheries. The FAO Technical Consultation on High Seas Fishing, held in September 1992, further recommended the elaboration of a code to address the issues regarding high seas fisheries.

10. The One Hundred and Second Session of the FAO Council, held in November 1992, discussed the elaboration of the Code, recommending that priority be given to high seas issues and requested that proposals for the Code be presented to the 1993 session of the Committee on Fisheries.

11. The Twentieth Session of COFI, held in March 1993, examined in general the proposed framework and content for such a Code, including the elaboration of guidelines, and endorsed a time frame for the further elaboration of the Code. It also requested FAO to prepare, on a "fast track" basis, as part of the Code, proposals to prevent reflagging of fishing vessels which affect conservation and management measures on the high seas. This resulted in the FAO Conference, at its Twenty-seventh Session in November 1993, adopting the Agreement to Promote Compliance with International Conservation and Management

Measures by Fishing Vessels on the High Seas, which, according to FAO Conference Resolution 15/93, forms an integral part of the Code. It was also recognized and confirmed that issues of responsible aquaculture development and aquaculture sustainability should be addressed in the formulation process so that these be appropriately covered in the envisaged Code.

12. This implicit recognition of the importance of governance in aquaculture is underlined in Article 9.1.1 of the Code, which requires states to "establish, maintain and develop an appropriate legal and administrative framework to facilitate the development of responsible aquaculture". In addition, at the beginning of the new millennium, there is growing recognition of the significant potential for the use of ocean and coastal waters for mariculture expansion. The outstanding issue in this area is that, unlike in capture fisheries, the existing applicable principles of public international law and treaty provisions provide little guidance on the conduct of aquaculture operations in these waters. Yet, experts agree that most of the future aquaculture expansion will occur in the seas and oceans, certainly further offshore, perhaps even as far as the high seas. The regulatory vacuum for aquaculture in the high seas would have to be addressed should aquaculture operations expand there.

13. The Code was formulated so as to be interpreted and applied in conformity with the relevant rules of international law, as reflected in the 10 December 1982 United Nations Convention on the Law of the Sea. The Code is also in line with the Agreement for the Implementation of the Provisions of this Law, namely the 1995 Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks. It is equally in line with, *inter alia*, the 1992 Declaration of Cancún and the 1992 Rio Declaration on Environment and Development, in particular Chapter 17 of Agenda 21.

14. The development of the Code was carried out by FAO in consultation and collaboration with relevant United Nations agencies and other international organizations, including non-governmental organizations.

15. The Code of Conduct consists of five introductory articles: Nature and scope; Objectives; Relationship with other international instruments; Implementation, monitoring and updating; and Special requirements of developing countries. These introductory articles are followed by an article on General principles, which precedes the six thematic articles on Fisheries management, Fishing operations, Aquaculture development, Integration of fisheries into coastal area management, Post-harvest practices and trade, and Fisheries research. As already mentioned, the Agreement to Promote

Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas forms an integral part of the Code.

16. The Code is voluntary. However, certain parts of it are based on relevant rules of international law, as reflected in the United Nations Convention on the Law of the Sea of 10 December 1982. In capture fisheries, the Code also contains provisions that may be or have already been given binding effect by means of other obligatory legal instruments among the Parties, such as the Agreement to Promote Compliance with Conservation and Management Measures by Fishing Vessels on the High Seas, 1993. In aquaculture, the provisions of the Code implicitly encourage participatory governance of the sector, which extends from industry self-regulation, to co-management of the sector by industry representatives and government regulators and to community partnerships. Compliance is self or enforced by peer pressure, with industry organizations having the ability to exclude those who do not comply and governments only checking periodically.

17. The Twenty-eighth Session of the Conference in Resolution 4/95 adopted the Code of Conduct for Responsible Fisheries on 31 October 1995. The same Resolution requested FAO, *inter alia,* to elaborate appropriate technical guidelines in support of the implementation of the Code in collaboration with members and interested relevant organizations.

18. The expanding role and increasing contribution of aquaculture to economic growth, social welfare as well as global food security was recognized and reiterated at international levels such as the 1995 FAO/ Japan Conference on the Contribution of Fisheries and Aquaculture to Food Security, the 1996 World Food Summit, the 1999 Ministerial Meeting on Fisheries, the 2000 FAO/NACA (Network of Aquaculture Centres in Asia and the Pacific) Conference on Aquaculture in the Third Millennium and its Bangkok Declaration and Strategy, and most recently, the 2009 World Summit on Food Security.

19. The application of the ecosystem approach to fisheries and aquaculture as strategies for the development of the sector contributes to the implementation of the provisions of the Code, thereby enforcing the technical, ecological, economic and social sustainability of the industry.

CONTENTS

1. INTRODUCTION

These technical guidelines on the ecosystem approach to aquaculture (EEA) are developed to support mainly Articles 9 and 10 of the FAO Code of Conduct for Responsible Fisheries (CCRF).

The main objective of the guidelines is to assist countries, institutions and policy-makers in the development and implementation of a strategy to ensure the sustainability of the aquaculture sector, integration of aquaculture with other sectors and its contribution to social and economic development.

1.1 The ecosystem approach to aquaculture

Aquaculture growth worldwide invariably involves (with differences among regions and economies) the expansion of cultivated areas, larger aquaculture farms, higher density of farmed individuals and the use of feed resources often produced outside of the immediate area. Worldwide, aquaculture has increasing social and economic impact through the production of food, contribution to livelihoods and generation of income. Other positive effects on the ecosystem include, for example, the provision of seeds for restocking of endangered or overexploited aquatic populations. However, when badly managed, aquaculture can affect ecosystems functions and services, with negative environmental, social and economic consequences. Aquaculture usually also faces risks from other human activities such as contamination of waterways by agriculture and industrial activities.

There have been important advances regarding the formulation of instruments and codes to facilitate sustainable development of the aquaculture sector. These include the provisions in Articles 9 and 10 in the CCRF, the development of technical guidelines expanding on the scope and meaning of these articles (e.g. FAO, 1997) and other numerous guiding documents. Countries worldwide are also attempting to implement a diverse array of aquaculture regulations to control inadequate development of the sector.

Yet some relevant constraints persist, often including:

- lack of awareness and understanding of ecosystem processes;
- lack of appropriate connection between ecological and social processes;
- lack of local institutions to agree upon appropriate standards and mechanisms to uphold them for aquatic systems or farm groups;
- lack of institutions capable of implementing more strategic approaches;
- the priority afforded to short-term interests by many business enterprises and by the poor;
- lack of consideration of relevant boundaries and a multiple-scales approach, when appropriate; and
- lack of integrated multisectoral planning and management.

To address these issues, the FAO workshop *Building an Ecosystem Approach to Aquaculture* (Soto, Aguilar-Manjarrez and Hishamunda, 2008)[1] laid the foundations for the development of the present guidelines and proposed the following definition:

> ***"An ecosystem approach to aquaculture (EAA) is a strategy for the integration of the activity within the wider ecosystem such that it promotes sustainable development, equity and resilience of interlinked social-ecological systems."***

Being a *strategy*, the EAA is not *what* we do but *how* we do it; and the participation of relevant stakeholders is at the base of the formulation and implementation of the "strategy". Figure 1 and Box 1 depict the changing approach from the conventional to an ecosystem approach to aquaculture emphasizing "the way we do things".

The premise of the ecosystem approach (EA) is in the Convention on Biological Diversity (UNCBD, 1993), which defines EA as a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way.

Indeed, most of the principles and practical steps of EAA are not new. The EAA builds on the conceptual work carried out to develop the ecosystem approach to fisheries (EAF) (FAO, 2003, 2005), including the guidelines on human dimensions of the ecosystem approach to fisheries (FAO, 2008a), as well as initiatives related to integrated natural resource management such as integrated coastal zone management (ICZM) and integrated watershed management (IWSM) and the planning and management for sustainable coastal aquaculture development (e.g. GESAMP, 2001).

The requirements and criteria presented below on the implementation of an EAA are to be based on, and interpreted in accordance with, the current suite of agreed international instruments that pertain to aquaculture (Box 2).

The EAA also echoes the development principles stated in the formulation of the EAF. Both the EAA and EAF have three main objectives within a hierarchical tree framework:

1. ensuring human well-being;
2. ensuring ecological well-being; and
3. facilitating the achievement of both, i.e. effective governance of the sector/areas where aquaculture occurs and has potential for development.

The EAA is based on the principles of sustainable development, where "sustainable" is not restricted to ecological considerations, but includes economic and social considerations and their interaction with ecological

[1] This publication contains extensive background material and case studies related to EAA (available at www.fao.org/docrep/011/i0339e/i0339e00.htm).

Box 1
The core ideas underlying the ecosystem approach

The ecosystem approaeh (EA) recognizes that

- humans are an integral part of important ecosystems, and people should be at the center of biodiversity management. This implies the need for integrated, participatory approaches in the identification of issues and further in to "ecosystem" management.
- ecosystems provide services that underpin most human activity, and that we need to ensure that we do not threaten the sustained delivery of these services through damage to ecosystem functions.
- given our ignorance of the functioning of these highly complex systems, there is a need for a precautionary and adaptive approach.
- some activities threaten or reduce the quality of ecosystem services available to society at large and therefore represent a cost that should be accounted or internalized.
- waste products from one activity or sector may serve as inputs to another, thus enhancing productivity and reducing pressure on ecosystem functions and services.
- ecosystems function at a range of scales from highly local to global, and we therefore need a "nested" approach with different approaches to management according to scale.
- there is a need for analysis and understanding of the broader social, economic and environmental implications of meeting targets and for transparency of decision-making in relation to trade-offs between social, economic and environmental objectives.

Modified from Hambrey, Edwards and Belton (2008).

ones. Both the social and biophysical or ecological dimensions of ecosystems are tightly linked, so that disruption in one is likely to cause a disruption or change in the other.

The present EAA guidelines provide a common, coherent and practical framework for policy-making and promote a process of enhanced sectoral management at different scales, taking full account of environmental limits and the interests of other resource users and stakeholders. Although the guidelines have a sectoral perspective, which is needed for practical purposes related to the implementation of the approach, they are congruent with more general guidelines for integrated natural resources management,

Box 2

Principles, instruments, global and national agreements, regulations and codes of practice related to the sustainable development of the aquaculture sector

Aquaculture should:

- Recognize the sovereign rights of States and comply with all relevant local, national and international laws and regulations.
- Be consistent with relevant international agreements and conventions, in particular:
  - The United Nations Convention on the Law of the Sea (UNCLOS, 1982)[2]
  - The Convention on Biological Diversity (UNCBD, 1993)
  - The FAO Code of Conduct for Responsible Fisheries (CCRF), especially Articles 9 and 10 (FAO, 1995)
  - The rules of the World Trade Organization (WTO), notably the Agreement on the Application of Sanitary and Phytosanitary (SPS)[3] Measures and the Agreement on Technical Barriers to Trade (TBT)
  - The FAO/World Health Organization (WHO) *Codex Alimentarius* (FAO/WHO)[4]
  - World Organisation for Animal Health (OIE) Aquatic Animal Health Code 12th edition (OIE, 2009)
  - The labour standards of the International Labour Organization (ILO)
  - The Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention)
  - Agenda 21 (Rio Earth Summit, 1992)
- Be consistent with the following documents
  - Aquaculture development; FAO Technical Guidelines for Responsible Fisheries. No. 5 (FAO, 1997)
  - Aquaculture Development Beyond 2000: The Bangkok Declaration and Strategy (NACA/FAO, 2000)
  - The International Principles for Responsible Shrimp Farming (FAO/NACA/UNEP/WB/WWF, 2006)
  - Expert consultation on improving planning and policy development in aquaculture (FAO, 2008b)

[2] See www.un.org/Depts/los/convention_agreements/texts/unclos/closindx.htm

[3] See www.wto.org/english/tratop_e/sps_e/spsagr_e.htm

[4] Available at ftp://ftp.fao.org/codex/Publications/understanding/Understanding_EN.pdf

integrated watershed and river basin management, and integrated coastal zone management. Practitioners are encouraged to select, modify and continuously adapt their own approaches and tools to specific circumstances.

1.2 Aim

The prime goal of EAA is to overcome the sectoral and intergovernmental fragmentation of resources management efforts and to develop institutional mechanisms for effective coordination among various sectors active in the ecosystems in which aquaculture operates and between the various levels of government.

The two outcomes of this should be:

(i) a "truly" sustainable aquaculture sector (environmentally, economically, socially); and

(ii) change in the public's (understood as broadly as possible) attitude and perception of aquaculture.

1.3 Key principles

As "the" strategy to ensure aquaculture contributes positively to sustainable development, the EAA should be guided by three main interlinked principles:

Principle 1

Aquaculture development and management should take account of the full range of ecosystem functions and services, and should not threaten the sustained delivery of these to society.

Developing aquaculture in the context of ecosystem functions and services is a challenge that involves defining ecosystem boundaries (at least operationally), estimating some assimilative and production carrying capacities, and adapting farming practices accordingly. The mix of ecosystem services will depend on wider management practices and the trade-off among different services must be acknowledged. This is especially important in the case of ecosystem functions that are unique, essential or threatened to ensure their preservation.

Principle 2

Aquaculture should improve human well-being and equity for all relevant stakeholders.

This principle seeks to ensure that aquaculture provides equitable opportunities for development and equitable sharing of its benefits. This includes ensuring that it does not result in any undue detriment for any groups within society, especially the most vulnerable. Both food security and safety are to be promoted as key components of well-being.