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FAO Aquaculture Newsletter

Conference on Aquaculture in the Third Millennium

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EDITORIAL

Dear Reader

The Millennium Aquaculture Conference has expressed itself. The daunting task of collaboration and cooperation among stake-holders in reaching consensus towards developing a strategy for sustainable aquaculture development over the next 20 years has been achieved, a congratulatory thanks to all the contributions and all those who have been a part of this endeavour. The Bangkok Declaration and Strategy on Aquaculture Development in the Third Millennium has been published and is being discussed and appraised at various fora. As a tribute to this mammoth task, which we together achieved successfully, we decided to dedicate this issue of FAN to the Millennium Conference. You will find a comprehensive report of the Conference and the full text of Bangkok Declaration and Strategy in this issue.

From left: Mr H. Kongkeo, NACA Coordinator, Thailand,
Mr M. Rajapaksa, Minister of Fisheries, Sri Lanka and his wife,
Mr P. Adireksan, Minister of Agriculture and Cooperatives, Thailand,
Mr N. Thang, Vice Minister of Fisheries, Viet Nam,
Mr D. Prakobboon, Director-General of the Department of Fisheries, Thailand.

The greatest challenge we now face is how to translate the recommendations of the Conference and the provisions of the Bangkok Declaration into action. This will require prudent and tactical planning, multidisciplinary and collaborative approaches, strong commitment towards effective implementation, and working together for a common cause. The bottom-line is how to create an enabling environment for farmers to produce quality products acceptable to consumers, in an environmentally friendly manner while maintaining social equity. The implementation of the Bangkok Declaration and Strategy must improve farmers' livelihoods, while enhancing the social and economic development of the producing countries.

FAN will attempt to address the opportunities and challenges for implementing specific issues and achieving provisions of the Bangkok Declaration and Strategy in its future issues.

Rohana Subasinghe
Chief Editor

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Conference on Aquaculture Bangkok, Thailand

Background

Two milestone events in the recent history of aquaculture are the FAO Technical Conference on Aquaculture, held in Kyoto, Japan in 1976, and the Conference on Aquaculture in the Third Millennium, held in Bangkok, Thailand in February 2000. Both aimed to envision the future opportunities and roles of aquaculture in society and to recommend strategies to meet expectations and demands for sustainable aquaculture development in the next two - three decades. The Kyoto Conference looked into the opportunities provided by technology and science, and the possibilities for networking, personnel development and institutional strengthening for aquaculture development. In addition to these aspects, the Bangkok Conference also examined the role that aquaculture will play within the overall context of development, from the local to the global level. The Kyoto Conference adopted two broad strategies: to bring science into aquaculture, which was until then largely traditional, and to expand aquaculture development through regional cooperation. These strategies were translated into policy and action by governments, with the initial assistance of various multilateral and bilateral agencies.

The rationale for the Bangkok Conference was that, 24 years having passed since Kyoto, it was time to reassess the direction that aquaculture development was taking and to develop strategies to facilitate its sustainable growth.

Objectives

The Bangkok Conference was designed to continue the work started in Kyoto, with the objective of developing a strategy to facilitate the sustainable growth of the sector and harness its potential contribution to greater social development. As with Kyoto, the results are intended to assist government policy makers and other stakeholders concerned with aquaculture development to meet the social, technical and regulatory needs of aquaculture over the next 20 years. Furthermore, the conference was designed to provide the opportunity for more stakeholders to participate in this process, and to discuss the opportunities and functions of modern-day technologies in the development of sustainable aquaculture. To achieve these purposes, the conference:

- envisioned the likely state of aquaculture in the first 20-30 years of the new millennium,
- identified possible constraints to the future development of the sector, and
- recommended strategies to solve these constraints, with emphasis on regional and global cooperation.

Organization

Preparatory Activities

The major inputs to the conference were developed via a number of focused and intensive preparatory activities designed to achieve global coverage and comprehensive review of all the relevant issues. These included:

- the regional workshop to formulate the Asian aquaculture development strategy for 2000-2020, conducted by NACA in Kanchanaburi, Thailand in August 1999;
- a review of South Pacific aquaculture conducted by the Secretariat of the Pacific Community (SPC) with the assistance of ICLARM;

in the Third Millennium 20-25 February 2000

- the reviews on the state of, and trends in, aquaculture development in five other regions, namely, sub-Saharan Africa, Latin America and the Caribbean, Europe, the former Soviet Republics, the Near East and North America, that were facilitated and supervised by FAO;
- the expert-led 14 thematic reviews of the entire range of policy, legal and technological issues related to sustainable aquaculture development;
- a global synthesis workshop, held at the FAO Regional Office in Asia-Pacific in October 1999, that discussed the regional reviews of aquaculture development trends and synthesized these, along with other information, into a global review on the state of, and prospects for, aquaculture development;
- the preparation of two keynote papers, one to review the development of aquaculture since the Kyoto Conference on Aquaculture in 1976, the other to assess the global prospects for aquaculture development in the next 20-30 years; and
- the development of five plenary lectures by experts aimed to broadly place the themes and issues in context.

Additionally, technical and experience papers were submitted voluntarily, most of which were presented as posters.

Programme

Dr. Rohana Subasinghe of FAO provided an introduction to the background, objectives, strategies adopted, activities and expectations of the conference. As it was an agenda-setting strategic exercise, the Conference Programme was structured so that there were, at most, only two days of parallel sessions, each session following logically from the previous one. The parallel sessions were the six thematic sessions covering policy and the six sessions addressing technical issues. This was designed to promote greater interaction and wider participation in the discussion of issues associated with the biological, technical, social, economic, environmental, policy and legal aspects of the development of aquaculture.

The Conference Programme indicates a deliberate, participatory and iterative procedure that allowed every participant an ample opportunity to contribute constructively to the discussions and the framing of the Declaration and Strategy. The various sessions developed conclusions and recommendations pertaining to the themes discussed, which were synthesized by the Technical Drafting Committee (TDC) into a draft Declaration and Strategy. This draft document was discussed and adopted, in principle, during the final plenary session. The TDC, with assistance from the Conference Secretariat,

From right to left: Mr P. Adireksan, Minister of Agriculture and Cooperatives, Thailand, Mr M. Rajapaksa, Minister of Fisheries, Sri Lanka and his wife.

additionally incorporated relevant comments and suggestions made during this final plenary discussion and those submitted over the one-month period after the conference.

The conference offered broad-based participation and wide-ranging involvement of stakeholders in its planning, preparation, development and conduct, marked by transparency of the entire process, to achieve a high credibility for its results.

Inaugural Ceremony

The inaugural ceremonies of the conference, as well as the Aquaculture and Seafood Fair 2000, were held on the afternoon of 20 February. Welcoming words, acknowledgements and expressions of gratitude to participants and their organizations, governments, sponsors of the conference, and individuals and institutions that rendered assistance to the conference and the activities leading up to it, as well as assurances of commitment to the recommendations of the conference, were spoken by the representatives of NACA and FAO and the host government organization. The welcoming speeches of NACA Coordinator, Mr Hassanai Kongkeo, FAO/RAP Officer-in-Charge, Mr Dong Qingsong, NACA Governing Council Chairman, Mr A.M. Jayasekara, and Thailand's Director General for Fisheries, Mr Dhammarong Prakobboon appear in the Conference Report.

The Inaugural Speaker was the Minister of Agriculture and Cooperatives of Thailand, Mr Pongpol Adireksan. Using the aquaculture development status and prospects of Thailand to underpin his message, he outlined the policy and technological requirements that the country would need to sustain its ability to continue to provide food and good livelihoods to the rural people and to improve the economy of the nation. He urged the conference participants to come up with a practicable and comprehensible set of recommendations. The Minister's inaugural address also appears in the Conference Report.

Aquaculture and Seafood Fair 2000

The Bangkok Conference was organized together with the Aquaculture and Seafood Fair 2000 to focus on the participation of the private sector in the development of aquaculture and its allied industries. It also provided an opportunity for members of the aquaculture business and industry sector to interact with policy-makers and members of the scientific community, enabling them to learn of international, regional and national policies related to aquaculture and the possibilities that science and technology offer to assist them in developing appropriate strategies. The fair was inaugurated jointly by the Minister of Agriculture and Cooperatives of Thailand, Mr. Pongpol Adireksan, the Minister of Fisheries and Aquatic Resources Development of Sri Lanka, Mr. Mahinda Rajapakse, and the Vice Minister of Fisheries of Viet Nam, Dr Nguyen Viet Thang.

Outputs

Bangkok Declaration and Implementation Strategy

The first major output of the Conference is Aquaculture Development Beyond 2000: the Bangkok Declaration and Strategy. The Declaration encapsulates the vision of the conference and the principles and practical considerations upon which the vision is based, and the Strategy describes 17 key elements that countries can incorporate when developing strategies for aquaculture development for the next 20 years.

The draft Declaration and Strategy was presented for discussion and adoption on the afternoon of the final day of the conference. It had been circulated two days earlier to the participants for their comments and suggestions, with the request that these be given in writing or made during the plenary discussion. Twenty-eight lengthy, detailed and unanimously constructive comments from individuals and groups comprising a coalition of international, regional and national non-governmental organizations (NGOs) were received between the time the draft was circulated and its presentation in plenary.

Mr Glenn Hurry, Co-Chairman with Mr. Chen Foo Yan, of the Technical Drafting Committee (TDC), presented the Declaration and Strategy. He said the committee abided by the guideline suggested by the Inaugural Speaker, the Minister of Agriculture of Thailand, which was that the outcomes should be practicable, workable and understandable to the people who have to implement them. He admitted that developing a broadly acceptable text required a degree of compromise and conciliation from all the participants. He emphasized that the key issues and broad strategic directions have been incorporated to provide the framework within which individual countries can tailor their own plans for the development and integration of aquaculture. He stressed that the Declaration must be strong enough to address the key issues confronting the future of aquaculture, because a mediocre document with a weak approach that avoids issues would not give aquaculture a sustainable future.

The TDC Co-Chairman also paid tribute to the architects of the Kyoto Declaration on Aquaculture, which he considered to be one of the most important documents in the development of aquaculture. He credited this to the vision and commitment of those involved, in particular, Dr T. V. R. Pillay who, he said, was instrumental in Kyoto and, again, provided the spark and encouragement for the Bangkok Conference.

He reiterated the conference concern that the next 20 years will see many challenges in food-producing systems and in balancing the use of natural resources, but also the optimism that it will also benefit from improvements in communication, science and technology. He closed with an appeal for all who are involved in, and benefit from, aquaculture to embrace the Declaration and take it forward with the commitment and courage to do and say what is right and necessary to ensure that aquaculture fulfils its potential. "It will be your courage, your flexibility, your commitment and your integrity and not self-interest or self-promotion that will make the vision of the Bangkok Declaration on Aquaculture a reality," he said. The full text of the TDC Co-Chairman's introduction to the Declaration and Strategy appears in the Conference Report.

The presentation was followed by a discussion on the substantive issues. The conference agreed to the draft document, with the proviso that additional comments arising from the day's discussion, lodged in writing with the Secretariat by the end of the conference, or submitted to the drafting committee during the one-month period after the conference, would be included in the final document, where appropriate. This procedure was implemented by the TDC, with the assistance of the Conference Secretariat.

The TDC was comprised of 20 persons representing a broad range of expertise and every legitimate stakeholder group in aquaculture: government, non-government, civil society, community-based organizations, farming, business and industry, policy, academe, research and development, and national, regional and international development assistance. The members were from developing and developed countries in the Asia-Pacific, Africa, Latin America, Europe, and North America. Please see the full text of the Bangkok Declaration on pages 10-18.

Report of the Conference and the Technical Proceedings

In addition to Aquaculture Development Beyond 2000: the Bangkok Declaration and Strategy, the two other conference publications are the Report of the Bangkok Conference on Aquaculture and the Technical Proceedings of the Bangkok Conference on Aquaculture. The detailed recommendations of the thematic sessions are included therein. These were developed by the members of the session panels and other associated experts during the conference, presented in a plenary session, redrafted, and then refined through consultations by correspondence among the panel members and other associates after the conference.

The Technical Proceedings of the Bangkok Conference on Aquaculture will include the full texts of the global, regional and thematic reviews, the keynote and plenary lectures, and the contributed technical papers. The latter will be subject to the peer-review process.

Inputs

Three sets of major inputs to the conference were presented: the global synthesis and regional reviews of aquaculture development status and trends; thematic reviews; and keynote papers and plenary lectures. In addition, some 60 abstracts and/or full manuscripts of technical and experience papers were contributed, 40 of which were presented as posters at the Aquaculture and Seafood Exhibition Hall.

Keynote Papers

Two keynote papers were presented at the start of the conference. The first, From Kyoto 1976 to Bangkok 2000, by Dr T. V. R. Pillay, reviewed the progress of aquaculture since the Kyoto Conference, highlighted the recommendations of the conference that were successfully put into practice, and focused on crucial development challenges. Dr Pillay was lead person in the Kyoto Conference, former coordinator of the UNDP/FAO Global Aquaculture Development Coordinating Programme based in FAO, and NACA Adviser.

The second keynote paper, Aquaculture development beyond 2000: global prospects, by Mr Jia Jiansan, outlined the prospects and potential for aquaculture development into the new millennium. The constraints and opportunities on a global, as well as regional perspective were described, and a number of strategies were highlighted that could make aquaculture respond more effectively, in a sustained manner, to social development needs, particularly those of providing nutritious food to increasing populations and improving livelihoods. Jia Jiansan is FAO's Chief of the Inland Fisheries and Aquaculture Services (FIRI). The keynote paper was developed in collaboration with Messrs Ulf Wijkström, Rohana Subasinghe and Uwe Barg. The keynote papers will appear in the Technical Proceedings of the Bangkok Conference on Aquaculture.

Global and Regional Reviews of Trends in Aquaculture Development

The synthesis of global aquaculture development status, trends and issues; and the regional reviews of the development status, trends and issues (which largely, but not solely, formed the basis of the global synthesis) from eight regions (Asia, the Pacific Island Nations and Oceania, sub-Saharan Africa, Latin America and the Caribbean, Europe, the former USSR countries (with a supplementary presentation on Ukraine's aquaculture history, development and status), North America, and the Near East), as well as from China, were presented in plenary in Session 1, also on the first day of the conference, following the keynote papers. The titles of the reviews and the names of the reviewers are listed below (if more than one reviewer, the person whose name is underscored gave the presentation):

- Asian aquaculture: trends, issues and prospects, *Hassanai Kongkeo*
- Current status of aquaculture in the Pacific Islands, *Tim Adams, <u>Johann Bell</u> and Pierre Labrosse*
- Aquaculture in China, *Wang Yianliang*
- Sub-Saharan African aquaculture, *Cecil Machena, John F. Moehl, Jr., A.G. Coche and V.O. Sagua (abstracted and presented by <u>Matthias Halwart</u>)*
- Aquaculture status and development trends in Latin America and the Caribbean, *Cesar Alceste-Oliviero and <u>Manuel Martinez-Espinosa</u>*
- Aquaculture status and development trends in Near East countries, *Abdel El Gamal (abstracted and presented by <u>Krishen Rana</u>)*
- North American review on trends in aquaculture development, *Paul G. Olin*
- Aquaculture development trends in the former USSR countries, *Laszlo Varadi, Sergey Blokhin, <u>Ferenc Pekar</u>, Istvan Szucs and Imre Csavas*
- Aquaculture development trends in Europe, *<u>Laszlo Varadi</u>, Istvan Szucs, Ferenc Pekar, Sergey Blokhin and Imre Csavas*
- A global perspective of aquaculture in the new millennium, *Sena S. de Silva.*

Plenary Lectures

The six plenary lectures, presented on succeeding days, broadly provided the setting for the thematic sessions. These were on the following areas:

- Policy-making and planning for aquaculture, *Ulf Wijkström*
- Technologies for sustainable aquaculture development, *Patrick Sorgeloos*
- Regional and interregional cooperation for sustainable aquaculture development, *Lennox Hinds*

- Human resource development for sustainable aquaculture development, *Sena S. de Silva, Michael J. Phillips, Sih Yang Sim and Zhou Xiaowei*
- Aquaculture and trade, *Helga Josupeit and Audun Lem*
- Livestock production: a model for aquaculture? *Robert A. Swick and Michael C. Cremer.*

Thematic Reviews

There were 14 thematic reviews on policy, planning and technological aspects of sustainable aquaculture development. Each thematic review was conducted by a panel of experts headed by a chairperson. The names of the persons presenting the reviews are listed below. The full list of contributors to the review process will appear in the Technical Proceedings of the Bangkok Conference on Aquaculture.

- Increasing the contribution of aquaculture for food security and poverty alleviation, *Albert G. J. Tacon*
- Integrating aquaculture into rural development in coastal and inland areas, *Simon Bland*
- Involving stakeholders in policy-making, planning and management, *Sevaly Sen*
- Promoting sustainable aquaculture through economic incentives, *Rolf Willmann*
- Establishing legal institutional and regulatory frameworks for aquaculture development and management, *Annick Van Houtte*
- Building the information base for aquaculture policy-making, planning and management, *Yong-ja Cho*
- Aquaculture systems and species, *Harald Rosenthal*
- Genetics in aquaculture development, *K. Mujimdar and R. Dunham*
- Aquaculture health management, *Rohana Subasinghe*
- Nutrition and feeding, *Sadasivam Kaushik and M. R. Hasan*
- Culture-based fisheries and enhancement, *K. Lorenzen*
- Systems approach to aquaculture management, *C. E. Boyd and M. J. Phillips*
- Aquaculture products: quality, safety, marketing and trade, *Helga Josupeit and Audun Lem*
- Aquaculture development: financing and institutional support, *Ronald Zweig.*

The extended summaries of the above inputs, except the global synthesis, which appeared in full, were published in the Book of Synopses that was distributed to the participants before the conference. As mentioned above, the full text of all papers will be published in the Technical Proceedings of the Bangkok Conference on Aquaculture.

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The Bangkok Declaration and Strategy

The Bangkok Declaration and Strategy was drafted by a Technical Drafting Committee (TDC), taking into account the recommendations of all conference sessions, and the views and suggestions expressed by the participants during and after the Conference. The composition of the TDC is: Glenn Hurry and Chen Foo Yan (Co-Chairs), Uwe Barg, Pedro Bueno, Jorge Calderon, Jason Clay, Sena De Silva, Maitree Duangsawasdi, Dilip Kumar, Le Thanh Luu, Modadugu V. Gupta, Joaquin Orrantia, Michael Phillips, Rolando Platon, Vincent Sagua, Sevaly Sen, Patrick Sorgeloos, Rohana Subasinghe, Rolf Willmann, and Wu Chao Lin.

Preface

The first major international Conference on Aquaculture organized by FAO was held in Kyoto, Japan in 1976. The Conference adopted the "Kyoto Declaration on Aquaculture". In February 2000, some 540 participants from 66 countries and more than 200 governmental and non-governmental organizations participated in the "Conference on Aquaculture in the Third Millennium" in Bangkok, Thailand. This conference was organized by the Network of Aquaculture Centres in Asia-Pacific (NACA) and FAO and hosted by the Government of Thailand. Additional support was provided by the European Union (EU), the Australian Agency for International Development (AusAID), the Canadian International Development Agency (CIDA), the Danish Centre for Environment and Development (DANCED), the Department of Agriculture, Forestry and Fisheries of Australia (AFFA), the Rockefeller Brothers Fund, and the World Bank-Netherlands Partnership Program.

Throughout 1999, NACA and the FAO facilitated the preparation of reviews on aquaculture developments in Africa, Asia, Europe, Latin America, North America, the countries of the former USSR, the Near East, and the Pacific Island nations and held expert meetings to consider major trends in aquaculture development. Fourteen Thematic Reviews on selected aspects of aquaculture were promoted and eight overviews on key issues were prepared for presentation and discussion at the Conference. All participants to the Conference received extended summaries of all material prepared. Twenty plenary presentations and discussions, and 12 workshop sessions facilitated by expert panels enabled participants to discuss and prioritize major issues and strategic actions for follow-up.

Major themes discussed included policy-making and planning for sustainable aquaculture development (covering food security and poverty alleviation, rural development, stakeholder involvement, incentives, and legal and institutional frameworks); technological and R&D priorities (including systems/species, genetics, health management, nutrition/feeding, and culture-based fisheries); human resource development; international trade; product quality, safety and marketing; regional/interregional cooperation; financing; and institutional support.

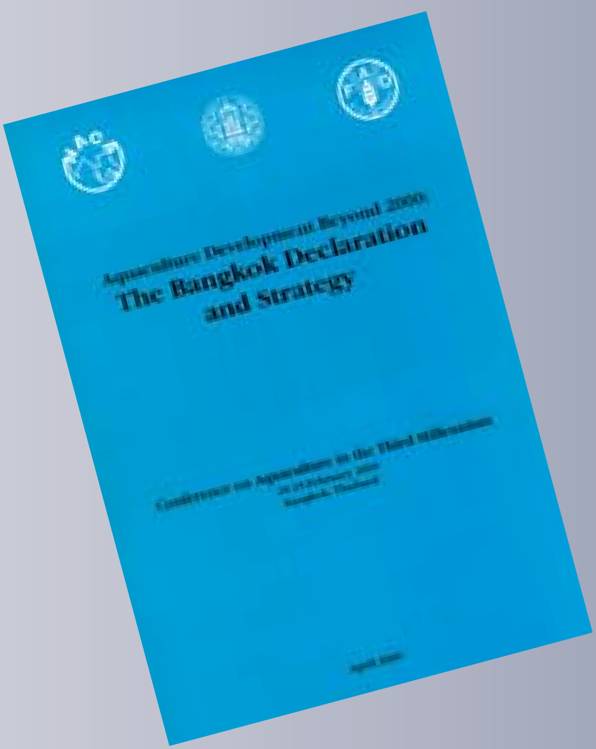
Against this background, the Conference participants discussed priorities and strategies for the development of aquaculture for the next two decades, in the light of the future economic, social and environmental issues and advances in aquaculture technologies. Based on these deliberations, the participants adopted the **Bangkok Declaration and Strategy for Aquaculture Development Beyond 2000.** The Conference encouraged States, the private sector and other concerned stakeholders to incorporate in their strategies for aquaculture development the key strategy elements identified during this Conference.

The proceedings of the Conference, including global and regional reviews on trends in aquaculture development, thematic reviews, keynote addresses and other invited presentations will be published by NACA and FAO.

NACA and FAO acknowledge all individuals and agencies who assisted in the conference process.

Aquaculture Development Beyond 2000: The Bangkok Declaration and Strategy[1]

Conference on Aquaculture Development in the Third Millennium 20-25 February, Bangkok, Thailand



1 PREAMBLE

1.1 The first international Conference on Aquaculture organized by the Food and Agriculture Organization of the United Nations (FAO) was held in Kyoto, Japan in 1976. The Conference adopted the "Kyoto Declaration on Aquaculture".

1.2 In February 2000, some 540 participants from 66 countries participated in the "Conference on Aquaculture in the Third Millennium" in Bangkok, Thailand. This Conference was organized by the Network of Aquaculture Centres in Asia-Pacific (NACA) and FAO and hosted by the Government of Thailand.

1.3 Throughout 1999, NACA and the FAO facilitated the preparation of reviews on aquaculture developments in Africa, Asia, Europe, Latin America, North America, the countries of the former USSR, the Near East, and the Pacific Island nations and held expert meetings to consider trends in aquaculture development. Thematic Reviews on various aspects of aquaculture were also conducted. Participants to the Bangkok Conference were informed of the findings and conclusions of these activities.

1.4 Against this background, the Conference participants discussed strategies for the development of aquaculture for the next two decades, in the light of the future economic, social and environmental issues and advances in aquaculture technologies.

1.5 Based on these deliberations, the participants to the Conference adopted the following Declaration.

[1]NACA/FAO, 2000. Aquaculture Development Beyond 2000: the Bangkok Declaration and Strategy. Conference on Aquaculture in the Third Millennium, 20-25 February 2000, Bangkok, Thailand. NACA, Bangkok and FAO, Rome. 27pp.

2 THE DECLARATION

We, the participants to the Conference on Aquaculture in the Third Millennium, Bangkok 2000, recognize that:

2.1 during the past three decades aquaculture has become the fastest growing food-producing sector and is an increasingly important contributor to national economic development, the global food supply and food security;

2.2 aquaculture consists of a broad spectrum of users, systems, practices and species, operating through a continuum ranging from backyard household ponds to large-scale industrial systems;

2.3 the per caput supply of food fish from capture fisheries is likely to decline with population increase;

2.4 a great proportion of aquaculture production comes from developing countries, where aquaculture will continue to contribute to peoples' livelihoods, food security, poverty alleviation, income generation, employment and trade;

2.5 there has been a significant increase in commercial and industrial aquaculture, both in developed and developing countries, that has contributed to food supply, export income and trade;

2.6 globally, aquaculture is at varying stages of development and will require different strategies for growth;

2.7 the potential of aquaculture to contribute to food production has not yet been realised across all continents;

2.8 aquaculture complements other food production systems, and integrated aquaculture can add value to the current use of on-farm resources;

2.9 aquaculture can be an entry point for improving livelihoods, planning natural resource use and contributing to environmental enhancement;

2.10 responsible aquaculture practitioners are legitimate users of resources;

2.11 education and research will continue to make a significant contribution to the growth of aquaculture;

2.12 some poorly planned and managed aquaculture operations have resulted in negative impacts on ecosystems and communities;

2.13 aquaculture has also been negatively impacted by other unplanned activities;

2.14 the continued growth of aquaculture will occur through investment by the private and public sectors;

2.15 effective national institutional arrangements and capacity, policy, planning and regulatory frameworks in aquaculture and other relevant sectors are essential to support aquaculture development;

2.16 improving cooperation among stakeholders at national, regional and interregional levels is pivotal for further development of aquaculture;

2.17 the potential of aquaculture to contribute to human development and social empowerment cannot be fully realized without consistent, responsible policies and goals that encourage sustainable development;

and declare that:

2.18 the aquaculture sector should continue to be developed towards its full potential, making a net contribution to global food availability, household food security, economic growth, trade and improved living standards;

2.19 the practice of aquaculture should be pursued as an integral component of development, contributing towards sustainable livelihoods for poor sectors of the community, promoting human development and enhancing social well-being;

2.20 aquaculture policies and regulations should promote practical and economically viable farming and management practices that are environmentally responsible and socially acceptable;

2.21 national aquaculture development processes should be transparent and should take place within the framework of relevant national policies, regional and international agreements, treaties and conventions;

2.22 in pursuing development, States, the private sector, and other legitimate stakeholders

should cooperate to promote the responsible growth of aquaculture;

2.23 strengthened regional and interregional cooperation should increase the efficiency and effectiveness of aquaculture development efforts; and

2.24 all parties formulating improved policies and implementing practices for aquaculture development should consider and where appropriate, build on the FAO Code of Conduct for Responsible Fisheries.

The following contains the major strategy elements based on the Conference session recommendations. The detailed recommendations from the sessions are given in the Conference Report.

3 STRATEGY FOR AQUACULTURE DEVELOPMENT BEYOND 2000

States are encouraged to incorporate in their strategies for aquaculture development the key elements identified during this Conference.

The key elements are:

3.1 INVESTING IN PEOPLE THROUGH EDUCATION AND TRAINING

Further investments in education and training are essential to build the knowledge, skills and attitude of all people involved in the sector. Human capacity development can be made more cost-effective and responsive to needs through:

- using participatory approaches to curriculum development;
- improving cooperation and networking between agencies and institutions;
- multidisciplinary and problem-based approaches to learning;
- use of modern training, education and communication tools, such as the Internet and distance learning, to promote regional and interregional cooperation and networking in the development of curricula, exchange of experiences and development of supporting knowledge bases and resource materials; and
- providing a balance of practical and theoretical approaches to train farmers and provide more skilful and innovative staff to industry.

3.2 INVESTING IN RESEARCH AND DEVELOPMENT

There is a need to increase investment in aquaculture research, while making efficient use of research resources and building the capacity of research institutions to be more responsive to development requirements through such mechanisms as:

- collaborative multidisciplinary research;
- stakeholder participation in research identification and implementation;
- improving linkages between research, extension and producers;
- collaborative funding arrangements between institutions and public and private sector organizations;
- efficient communication networks;
- regional and interregional cooperation; and
- a continued effort to build the skills of researchers involved in aquaculture development.

3.3 IMPROVING INFORMATION FLOW AND COMMUNICATION

Efficient management of the sector requires improved information flows at the national, regional and interregional levels which will avoid duplication of effort and save costs, while encouraging consistency in areas such as education and training, policy-making, planning and the application of rules and procedures.

Improved information flows will increase institutional capacities for dealing with emerging issues and can be achieved by:

- establishing arrangements for sharing data and information;
- strengthening national capacity to determine data requirements and data selection and management;
- providing effective mechanisms for access to relevant and reliable information to all stakeholders; and
- making effective use of new technologies to improve information flows and management policies and practices within aquaculture.

The collection and dissemination of accurate and verifiable information on aquaculture may help to improve its public image and should be given attention.

3.4 IMPROVING FOOD SECURITY AND ALLEVIATING POVERTY

Enhancing food security and alleviating poverty are major and complementary global priorities. Aquaculture has a special role in achieving these objectives because, first, fish is a highly nutritious food that forms an essential, if not indispensable, part of the diet of a large proportion of the people in developing countries. Second, while aquaculture contributes to the livelihoods of poor farming households, particularly in areas of Asia where it is a traditional farming practice, there is a huge, unfulfilled potential in most countries, as aquaculture is a relatively recent and underdeveloped sector as compared to agriculture and animal husbandry. Aquaculture could improve food security, provide entry points and contribute to sustainable livelihoods for the poor through:

- promoting poor-people-centred development focus in aquaculture sector policies, wherever appropriate;
- promoting systems to farm low-value fish affordable to the poor, particularly small-scale household production in rural areas where it may be the only source of fish due to poor infrastructure;
- disseminating information about the nutritional advantages of fish to vulnerable groups of people such as pregnant and lactating women, and families with infants and pre-school children;
- greater use of holistic, participatory approaches to identify the poor and assess their needs; and to develop and extend aquaculture technologies appropriate to the resources and capabilities of poor households;
- recognising that the development of small-scale aquaculture requires initial public sector support, with more support needed and for longer periods for poorer target groups; and
- empowering poor stakeholders to actively participate in policy decision-making.

3.5 IMPROVING ENVIRONMENTAL SUSTAINABILITY

There is a need to develop and adopt policies and practices that ensure environmental sustainability, including environmentally sound technologies and resource efficient farming systems, and integration of aquafarms into coastal area and inland watershed management plans. Improvements in environmental sustainability can be achieved through:

- development, adoption and application of environmental, economic and social sustainability assessment criteria and indicators of aquaculture development;
- development of and support to implementation of improved management practices and codes of good practice for aquaculture sectors that are supported by enforceable regulations and policy;
- research and development of resource-efficient farming systems which make efficient use of water, land, seed and feed inputs; exploring the potential for commercial use of species feeding low in the food chain; and utilizing enhancement techniques;
- development of strategies to integrate aquaculture into the coastal areas and inland watershed management plans and ensuring aquaculture developments are within local and regional carrying capacities;
- promotion of good practices for environmental management of aquaculture; and
- promotion of aquaculture, where appropriate, as a means of improving environmental quality and resource use.

3.6 INTEGRATING AQUACULTURE INTO RURAL DEVELOPMENT

With the goal of increasing the impact of aquaculture on rural development and poverty alleviation, strategies are required to put people as the focal point for planning and development for such programmes and to integrate aquaculture into overall rural development programmes. In essence, this can be achieved through:

- integrating aquaculture planning within overall rural development planning, taking into account multisectoral developments and views, and multisectoral coordination which brings agencies together;
- integrating aquaculture with other rural development efforts to improve resource utilisation, such as integrated coastal area management and inland watershed management;
- awareness-raising in other rural development sectors of the potential of aquaculture to improve livelihoods;
- using participatory approaches to involve stakeholders in policy-making, planning, implementation and monitoring; and
- the documentation and wide dissemination of information on experiences and utilization of good practices and benefits thereof.

3.7 INVESTING IN AQUACULTURE DEVELOPMENT

Future investment in aquaculture should be made with long-term strategies in mind to ensure sustainability. Private sector investments make the biggest contribution to aquaculture development, but adequate public sector finance for capacity building, institutional development and infrastructure, is indispensable for society to reap the full benefits of a well-managed and efficient aquaculture sector.

Sound investment strategies should include:

- providing initial financial encouragement and facilitating investments in aquaculture development;
- encouraging continued public investment in rural and small-scale aquaculture in developing countries, and in applied research and farmer access to knowledge and capital;
- encouraging private sector funding and investment in aquaculture development and infrastructure which will provide the benefits of aquaculture to rural communities;
- developing mechanisms (e.g. investment screens, credit linked to performance or adoption of best management practices, performance bonds) which encourage the growth of environmentally and socially responsible aquaculture, including economic, educational and other incentives for responsible aquaculture;
- support to sponsorship of industry-driven codes of practice to promote responsible aquaculture;
- fostering a greater understanding within financial institutions and bilateral and multilateral assistance agencies regarding aquaculture development and its financial needs; and
- establishing credit schemes that support sustainable aquaculture, e.g. microcredit programmes, particularly for small-scale development.

International development assistance is becoming increasingly directed towards poverty alleviation and needs to adhere to basic principles of social equity, including gender equity, environmental sustainability, technical feasibility, economic viability and good governance. The level of risk is important when supporting initiatives to address poverty alleviation.

To make efficient use of international donor resources, a programme approach to multisectoral development should be applied under which donors can more effectively cooperate and collaborate with each other. Ultimately, this should occur within comprehensive planning and development frameworks. There is thus a need for donors to adopt more cohesive approaches and procedures.

3.8 STRENGTHENING INSTITUTIONAL SUPPORT

One of the key issues for the growth of aquaculture will be the ability of countries and organizations to strengthen their institutional capacity to establish and implement policy and regulatory frameworks that are both transparent and enforceable. Incentives, especially economic incentives, deserve to be given more attention in the planning and management of aquaculture development.

Institutional capacity should be made more effective and strengthened through:

- developing a clear aquaculture policy, and identification of a lead agency with adequate organizational stature to play a strong coordinating role;
- developing, through a participatory approach, comprehensive and enforceable laws, regulations and administrative procedures that encourage sustainable aquaculture and promote trade in aquaculture products;
- providing education and training, research and extension services to support the development of enforceable legislation, policy and regulatory frameworks, encompassing economic and other incentives to improve aquaculture management;
- targeting not only government ministries and public sector agencies dealing with administration, education, research and development, but also organizations and institutions representing the private sector, NGOs, consumers and other stakeholders;
- developing mechanisms and protocols for the timely collection and reporting of statistics;
- sharing information on policies and legislation, rules and procedures that encompass best practices in aquaculture;
- clarifying legal frameworks and policy objectives regarding access and user rights for farmers; and
- improving the capacity of institutions to develop and implement strategies targeting poor people.

3.9 APPLYING INNOVATIONS IN AQUACULTURE

The technologies for sustainable aquaculture development should provide a varied and adaptable "tool box" from which people can select and design the system which most effectively meets their needs and best fits the opportunities and constraints of the local environment. The delivery of such techniques requires efficient communication networks, reliable data on the merits and drawbacks of the various approaches, and help with the decision-making process through which people choose their production systems and species.

As we move into the next two decades, water and land for aquaculture will become critical issues. New opportunities for aquaculture development will also emerge through improvements in science and technology for aquaculture systems.

The potential areas for further consideration include:

- technologies for sustainable stock enhancement and ranching programmes, and open ocean aquaculture;
- increased use of aquatic plants and animals as nutrient stripping;
- increased emphasis on integrated systems to improve environmental performance; and
- emerging technologies (e.g. recirculating systems, offshore cage culture, integrated water use, artificial upwelling and ecosystem food web management).

3.10 IMPROVING CULTURE-BASED FISHERIES AND ENHANCEMENTS

Fisheries enhancements in inland and coastal waters include culture-based fisheries and habitat modifications in common pool aquatic resources, which require minimal food and energy inputs. These practices therefore provide important opportunities for resource-poor sections of the population to benefit from relevant aquaculture technologies and permit efficient use of underutilized, new or degraded resources. Culture-based fisheries in particular have considerable potential for increasing fish supplies from both freshwater and marine fisheries and generating income in rural inland and coastal areas.

The full potential of enhancements and culture-based fisheries could be achieved by:

- creating conducive institutional arrangements to enable and sustain investment in common pool resources;
- providing appropriate research and development inputs;
- managing environmental and other external impacts; and
- promoting effective regional cooperation and information exchange.

3.11 MANAGING AQUATIC ANIMAL HEALTH

Disease is currently an important constraint to aquaculture growth which has impacted both socio-economic development and rural livelihoods in some countries. Addressing aquatic animal health issues has, therefore, become an urgent requirement for sustaining growth of aquaculture, especially through proactive programmes. Harmonizing health protection approaches and measures and effective cooperation at national, regional and interregional levels are needed to maximize the effectiveness of limited resources.

This can be achieved through:

- developing, harmonizing and enforcing appropriate and effective national, regional and interregional policies and regulatory frameworks on introduction and movement of live aquatic animals and products to reduce the risks of introduction, establishment and spread of aquatic animal pathogens and resulting impacts on aquatic biodiversity;
- capacity building at both the institutional and farmer levels through education and extension;
- developing and implementing effective national disease reporting systems, databases, and other mechanisms for collecting and analysing aquatic animal disease information;
- improving technology through research to develop, standardize and validate accurate and sensitive diagnostic methods, safe therapeutants, and effective disease control methodologies, and through studies into emerging diseases and pathogens;
- promoting a holistic systems approach to aquatic animal health management, emphasizing preventative measures and maintaining a healthy culture environment; and
- developing alternate health management strategies such as the use of disease resistant, domesticated strains of aquatic animals to reduce impact of diseases.

Establishment of an effective international mechanism, such as an international task force which is outcome-oriented with focused strategies and milestones that are independent of vested interests, would be beneficial in reducing the losses due to diseases in aquaculture.

3.12 IMPROVING NUTRITION IN AQUACULTURE

Nutrition and feeding strategies play a central and essential role in the sustainable development of the aquaculture sector. Feed development will need to give increased emphasis on efficient use of resources and reduction of feed waste and nutrient discharge. Fishmeal reduction in diets will be important to reduce feed costs and avoid competition with other users.

These can be achieved through:

- increasing the understanding of dietary nutrient requirements of cultured species, including their application to practical culture conditions;
- developing species-specific broodstock diets that allow complete domestication and maximal reproductivity and larval quality;
- better understanding of larval nutritional requirements in order to develop suitable compound diets, which will further reduce the need for live food;
- improving the understanding of the aquaculture farming systems and the potential nutrient loads and losses to the environment, to maximize nutrient retention efficiency;
- improving the use of agricultural and fishery by-products and non-food grade feed materials, and basing feeding strategies,

wherever possible, on the use of renewable feed ingredient sources;

- better understanding of nutrient bioavailability and interactions of commonly used feed ingredients;
- better understanding of the mechanisms of nutrient modulation of disease resistance as well as improved strategies to minimize toxicity of nutrients and other compounds of feed origin;
- promotion of "good aquaculture feed manufacturing practice" and "good on-farm feed management;" and
- ensuring that limitations in the selection and trade of raw materials for aquaculture feeds are based on sound, documented scientific facts.

3.13 APPLYING GENETICS TO AQUACULTURE

Genetics has an important role to play in increasing productivity and sustainability in aquaculture through higher survival, increased turnover rate, better use of resources, reduced production costs and environmental protection. This will require resources, but the benefits in both the short and long term should justify these efforts.

There are many elements and practices of genetics that may be considered for aquaculture. Recognizing that aquaculture has not benefited as much as terrestrial animal husbandry from the adoption of best practices such as selective breeding and stock improvement programmes, high priority should be given to the application of genetics in aquaculture. The interventions include:

- developing and utilizing improved domestication and broodstock management practices and efficient breeding plans to improve production in aquatic animals;
- designing and promoting strategies for equitable dissemination of genetic techniques and genetically improved organisms;
- encouraging public awareness and providing information to consumers on the application of genetics;
- greater application of genetic technologies to the conservation of aquatic biodiversity; and
- addressing the potential implications for aquaculture, including environmental and human health implications, in a precautionary, safe and practical way.

3.14 APPLYING BIOTECHNOLOGY

Biotechnology as a science has the potential to impact on all food production sectors. In the future the aquaculture sector will confront the issue of biotechnology through:

- developing and applying biotechnological innovations for advances in nutrition, genetics, health, and environmental management;
- addressing the potential implications for aquaculture of biotechnology, including GMOs and other products, in a precautionary, safe and practical way; and
- encouraging public awareness and providing information to consumers on the potential applications of biotechnology.

3.15 IMPROVING FOOD QUALITY AND SAFETY

As consumer awareness increases, aquaculture producers, suppliers and processors will need to improve the quality of products and enhance product safety and nutritional value. The incentives for this will be potentially higher prices, lower insurance rates and increased consumer demand.

This can be achieved through:

- improvements in diets, feeding regimes and harvesting strategies to enhance product quality and nutritional value of aquaculture products;
- promoting the application and adoption of international food safety standards, protocols and quality systems in line with international requirements such as the Codex Alimentarius;
- adopting international protocols for residue monitoring in aquaculture and fisheries products;
- appropriate and informative labelling of aquaculture feeds, including information on additives, growth promoters and other ingredients;
- collection, analysis and dissemination of relevant and scientifically sound information to allow producers and industry operators to make informed decisions and ensure consumer confidence in the food safety of aquaculture products;
- application of appropriate safety assessments based on risk analysis and the precautionary approach prior to market approval, including products from modern biotechnology; and
- increasing consumer confidence in aquaculture products by ensuring that industry takes responsibility for the production and distribution of safe products, utilizing systems that allow traceability of product ingredients, including information on packaging, processing and production conditions.

3.16 PROMOTING MARKET DEVELOPMENT AND TRADE

A focus on market development and trade will increase demand, add value and increase returns for aquaculture products. This will require developing marketing and promotional strategies for aquaculture products and understanding consumer requirements and changing market demands.

These goals can be achieved through:

- reducing trade barriers for aquatic products;
- assisting producers, processors and manufacturers in identifying markets for aquaculture inputs, products and technology;
- providing data for, and investing in, information-technology based market-information systems that are easily accessed by producers and processors;
- researching changing consumption patterns, market segmentation trends and the emergence of new markets and products; and
- ensuring transparency in the chain of custody ("chain traceability") of aquatic products and encouraging the provision of relevant information to consumers through product labelling (e.g. nutritional values, environmental friendliness).

3.17 SUPPORTING STRONG REGIONAL AND INTERREGIONAL COOPERATION

Over the years, regional and interregional cooperation has brought considerable benefits to aquaculture development through dissemination of knowledge and expertise. In an era of globalization, further strengthening of this cooperation at all levels will ensure increased benefits for sectoral development and sustainability.

This could be achieved through:

- supporting and strengthening existing regional organizations;
- improving interregional collaboration and networking between existing regional organizations to ensure synergy;
- encouraging the formation and development of regional organizations for aquaculture development in regions where they are lacking; and
- facilitating in-country support for the establishment and operation of these organizations.

The Conference noted there are issues relevant to aquaculture development that require a strong global focus to be addressed and that this need might best be achieved by establishing a global intergovernmental forum within an appropriate existing international organization, having sustainable aquaculture development as its primary focus, and with a mandate for discussion, decision and agreement on technical and policy matters.

4. IMPLEMENTATION

4.1 The Conference encourages States, the private sector and other concerned organizations to implement Strategies for Development of Aquaculture Beyond 2000.

4.2 The aquaculture sector has become considerably more diverse since the Kyoto Conference and has developed a broad range of stakeholders. This diversity provides considerable opportunity for productive cooperation.

4.3 The Conference recognizes that the primary responsibilities for development and implementation of these strategies rest with States and their private sectors. The Conference recommends that States develop strategies through encouraging private sector development incorporating the key elements identified above.

4.4 The Conference further affirms that cooperative mechanisms among countries provide an excellent opportunity to coordinate and support the development of aquaculture, through sharing of experiences, technical support, and allocation of responsibilities for the varied research, education and information exchange. The fostering of cooperation among developing countries deserves special attention and support.

4.5 Furthermore, the Conference recommends that effective use of existing regional and interregional mechanisms be made, and that decision-makers seek to promote synergy and cooperation between existing organizations. Where effective regional intergovernmental organizations to promote cooperation in aquaculture development do not exist, such as in Africa and Latin America, building of such mechanisms, and sharing experiences with the existing regional networks, is recommended.

4.6 The Conference notes that there are considerable opportunities for enhanced regional and interregional cooperation among different partners including governments, non-governmental organisations, farmers, organizations, regional and international organizations, development agencies, donors and lending agencies with a common interest in development through aquaculture.

4.7 In this regard, the Conference strongly recommends the development of an effective programme of regional and interregional cooperation to assist in implementation of the Strategies for Aquaculture Development Beyond 2000.

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From left to right: Mr P. Adireksan, Minister of Agriculture and Cooperatives, Thailand, Mr D. Prakobboon, Director-General of Fisheries, Thailand and Mr Jia Jiansan, Chief of the Inland Water Resources and Aquaculture Service, FAO.

This is the speech given at the inaugural session of the Conference on Aquaculture in the third Millennium, by Mr Jia Jiansan, Chief of the Inland Water Resources and Aquaculture Service, FAO.

Conference on Aquaculture in the Third Millennium, Bangkok, Thailand 20-25 February 2000

Keynote Address II
Aquaculture Beyond 2000: Global Prospects

Jia Jiansan[1], Ulf Wijkström[2]
Rohana Subasinghe[1] and Uwe Barg[1]
Fishery Resources Division[1]
Fishery Policy and Planning Division[2]

Professor De Silva and Dr Laszlo Varadi – Joint Chairpersons, Members of the Panel, Fellow Participants,

It is my pleasure to be here today, at this Conference on aquaculture in the Third Millennium, to deliver this Second Keynote Address entitled "Aquaculture Beyond 2000: Global Prospects".

During the last Keynote Address, Dr Pillay elaborated the journey from Kyoto to Bangkok. Dr Subasinghe's Introduction covered the scope and purpose of the Conference. In my Keynote, I do not intend to provide you with a detailed analysis of specific trends in aquaculture sector. They will be covered by the regional and global trends reviews and the thematic reviews which will be presented over the next few days.

In this Keynote, I will attempt to look at some broad global trends, key issues and constraints, and important challenges and development prospects for the future, in realizing the full potential of aquaculture for humankind. I would like you to debate, discuss, and consider these "Food for Thought" ideas over the next few days for achieving our objectives of the Conference.

In my presentation, I attempt to cover, briefly, within the given 25 minutes or so, the following:

- Short introduction and an overview of the aquaculture sector today
- Major trends and issues – where do we stand?
- Future aquaculture development – prospects and outlook, and
- Conclusions

Introduction and Overview

Over the past three decades, aquaculture has developed to become the fastest growing food producing sector in the world. Aquaculture ha expanded, diversified, intensified, and technologically advanced, and its contribution to aquatic food production has increased significantly.

Aquaculture is highly diverse and consists of a broad spectrum of systems, practices, operations ranging from simple backyard small, household pond systems to large-scale, highly intensive commercially oriented practices.

A large proportion of aquaculture production comes from small-scale producers in developing countries and Low Income Food Deficit Countries (LIFDCs) and the sector contributes to food security, poverty alleviation, and social wellbeing in many countries.

Contributions of aquaculture to trade, both local and international, have increased over the past decades, and its share in the generation of income and employment and for national economic development has increased in many countries.

The world population is in the increase as is the demand for aquatic food products.

The production from capture fisheries at global level is leveling off and most of the main fishing areas in the Atlantic ocean and some in the Pacific have reached their maximum potential. Some additional contribution from capture fisheries may derive from increased landings in some fishing areas both marine and inland.

Professor Sena De Silva, Australia.

Global fish supply could be increased through reduction of discards and by-catch and utilization for human consumption of, at least part of, the catch going for reduction to fishmeal and fish oils. Better management of fishery resources, and enhanced efforts to protect fishery resources from accelerating environmental degradation, particularly in inland waters and estuaries, may well contribute to sustained, if not enhanced fish supplies in the medium to long term.

However, aquaculture appears to have the significant potential to meet the increasing demand for aquatic products in most regions of the world. Potential contributions of aquaculture to local food security and livelihoods however can be very significant, especially in many remote and resource-poor rural areas.

However, it appears that the full potential of the aquaculture sector to contribute to human development and social empowerment is yet to be realized, and therefore the sector may require new approaches to realize its goals beyond 2000.

These approaches could be different in different countries, and depend on country specific circumstances and the national development plans, goals, and aspirations. The challenge is to develop such approaches, which are realistic and achievable, within the context of current social, economic, environmental, and political circumstances. Such approaches should not focus only on increasing production; they should focus on producing a product which is affordable, acceptable, and accessible to all sectors of the society.

Major Trends and Issues Where do we stand?

Aquaculture can be an activity which produces nutritious, high value species using sophisticated systems, a mechanism for local food security, rural livelihoods, and poverty alleviation, and a sector which provides income (local and foreign exchange), employment and food security. Aquaculture is an income-generating activity.

However, rapid sector growth has, in some instances, outstripped planning and regulatory activities. The regulatory requirements have grown over-proportionately as resource use conflicts have occurred, resource scarcities have become more constraining, and demand for product quality and safety increased significantly. Increasingly, some developed country markets will consider additional product attributes to environmental and social impacts of production.

It may be necessary to redefine and/or reasses the respective roles of government and private sector, including producers' association and organizations, in managing aquaculture development.

In some regions, aquaculture faces a considerable problem with public perception. Yes, in some cases, aquaculture development has failed to keep up with, or meet, some environmental and socio-economic issues and expectations. Future aquaculture development should certainly continue producing a product, which is acceptable to public and consumers, in terms of price, quality, safety and environmental costs. In some regions, aquaculture has a very long tradition, and is well recognized and accepted as an important food supplying practice.

Development Prospects and Outlook

The constraints in farming can be highly complex and often of technical/technological nature. However, overall success of farming may depend largely on economics and social issues. The challenge will be to focus on meeting social needs – i.e. food security, poverty, livelihoods, community development, etc. rather than solely trying to produce fish. While doing so, the sector should be well integrated into the overall development programme so that the conflicts can be minimized.

It is also important that necessary technical/ technological means/solutions and capacity building needs are met for the future success of the sector. Aquaculture will continue to grow but will have to address the costs of production, quality and safety of products, international trade obligations and requirements, environmental concerns, etc. More

Left to right: Mr D. Prakobboon, Director-General of the Department of Fisheries, Thailand, and Mr L. Hinds, CIDA, Canada.

emphasis on investment, research, information, and public perception would be needed. Challenges for increasing aquaculture's contribution to food security, poverty alleviation and rural livelihoods will have to be addressed.

The essential challenge for future aquaculture development would be to ensure that the full potential of aquaculture is realized and a nutritious, safe and quality product, which is affordable, acceptable, and accessible to all sectors of the society, is produced. In doing so we need to address the following needs and opportunities.

We have to assist in feeding people in this millennium. This means investing in food security! Aquaculture can play a significant role in this respect!

We have to assist in social development, poverty alleviation, and improving livelihoods of people. In doing so, there is a need to increase emphasis on aquaculture and aqua-farmers in national social and economic development plans and endeavours with the view to enhancing institutional and financial support for the sector.

This can only be achieved though investing in human resources including existing and future aquaculture practitioners as well as government and non-government agencies and institutions. Investing in training, education, extension, information and communication are important in this respect. Use of modern information and communication tools and methods such as the Internet, and other state of the art communication methodologies will have to be given due consideration, as will the essential requirement to ensure broad-based public access, especially the farmers, to these sources of information.

We must create and provide an enabling environment, with an appropriate policy, legal and institutional framework to facilitate access to key development resources, such as financial resources and knowledge. There is a strong need for greater emphasis on institutional support, that is support not only to government ministries and public sector agencies dealing with administration, extension, and research and development, but also to organizations and institutions representing private sector, consumers and other stakeholders.

Aquaculture development, especially if it is to be sustainable and for food security, may need to be stimulated, at least in the beginning, so there should be a key point on increasing access to credit for farmers, producers, and local marketing.

It is important to understand the investment opportunities in the sector. In an era of globalization, it is imperative to emphasize national and international trends of trade.

Trade of aquaculture produce, input supplies, capital, and of information is important to mention. Aquaculture dependence on key natural resources such as water, land, seed, nutrients. There is strong pressure or drive for more production and marketing systems, which are more efficient and more effective in terms of the resource utilization. In this respect, we should invest in research on developing production and marketing systems with better resources utilization and more efficient performance.

During production, there should be emphasis on targeting the consumers. We must emphasize the difference between mass production and production for the masses. For example, trends of formerly expensive produce such as salmon and shrimp are increasingly becoming affordable by larger segments of the population. We should compete and complement other food producing sectors and providers.

The aquaculture produce should be acceptable to all sectors of the society. Tremendous gains will be possible through improved biotechnology, genetic modification, improved nutrition, probiotics, disease diagnosis and treatment.

However, the problems are consumer resistance to perceived risks stemming from "unnatural" products, ethical problems and fear of unknown technologies will affect potential gain. Environmental and human health issues will slow development or reduce market access. Strategic solutions are required.

We should emphasize biosafety issues, development and promotion of biotechnology that conserves environment; we should promote policies that support ethical issues of welfare and autonomy, and emphasize labelling and transparency for production process and beneficiaries. There is a need to increase the impact of research to understand technical and other constraints and to enhance the applicability and use of research results in the development of strategies to overcome these challenges.

Stakeholder participation and consultation in aquaculture development decision-making, and policy planning should be duly considered. Aquaculture's potential for social empowerment should be harnessed, and the involvement of more women in aquaculture development should be given due respect. The trust between producers and consumers needs to be improved and avenues must be found to achieve this. Public relations, campaigns, and labelling issues will have to be addressed.

The role of regional and interregional cooperation in achieving the future development goals for aquaculture should be reviewed and strengthened, based on the benefits to aquaculture development from regional and interregional cooperation seen over the past 25 years. There are considerable opportunities to increase the impact on aquaculture development through regional and interregional cooperation and therefore further strengthening of such cooperation is recommended.

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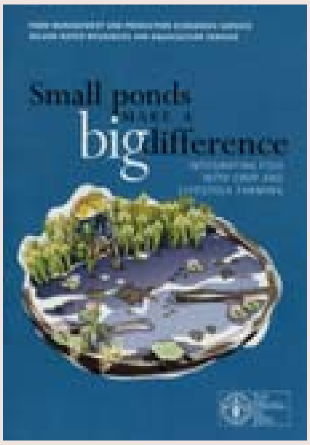
Halwart, M., M. Martinez and A. Schückler. 2000. Small ponds make a big difference: integrating fish with crop and livestock farming. Rome, FAO. 30 pp.



This book aims to raise awareness about the many potential contributions of aquaculture to household food security and income generation. Although aquaculture encompasses a wide range of aquatic organims and intensities of production, the main focus of this document is on extensive to semi-intensive pond aquaculture. The various challenges and multiple advantages of integrating aquaculture into smallholder farming systems are pointed out, and key considerations which are crucial for aquaculture and farming systems development in different parts of the world are highlighted.

This book is the outcome of a long-standing working relation between Messrs Matthias Halwart and Manuel Martinez of the Inland Water Resources and Aquaculture Service (FIRI) and Ms Angelika Schückler of the Farm Management and Production Economics Service (AGSP). The officers developed the concept and orientation of the document, contracted its preparation to Mr Uli Schmidt of COFAD, and provided the final inputs and revisions including editorial services.

The hard copy of this publication is available in English, French and Spanish and the electronic version is in Arabic, Chinese, English, French and Spanish.

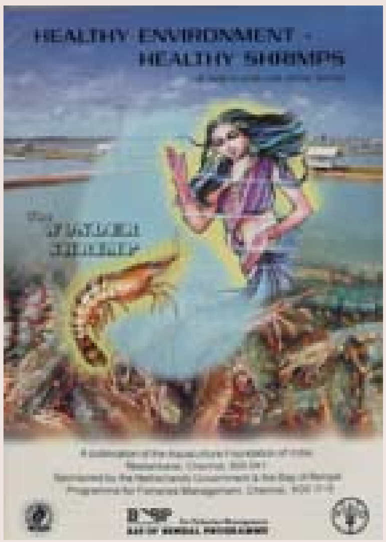
Healthy environment, healthy shrimps: The wonder shrimp.

This comic book produced by the Aquaculture Foundation of India (AFI) with collaboration from the BOBP. It is well-researched, presented imaginatively, in story form, and is attractively illustrated. There are even technical data for those who are interested, but I believe that the essence of shrimp culture can be grasped and followed even without such data. What makes the comic book particularly valuable is that it is being published in Telugu and Bengali.

The BOBP mobilized funding from the Netherlands Government for an experimental project on shrimp culture by the AFI, and supported the printing of this comic book. Sincere thanks are due to Mr Rene Verduffin, who served as Resource Economist (APO) of the BOBP for two years. He contacted the Netherlands Embassy in New Delhi and obtained its support for the AFI project. We are especially grateful in this connection to Mr LW Van Beek of the Netherlands Embassy in New Delhi, for his strong support to the endeavour.

Sustainable shrimp culture cannot be achieved overnight. It is a process, and we are very happy to have encouraged it and participated in it. We are also pleased to be associated with the production of this comic book.

Kee-Chai CHONG
Programme Coordinator
Bay of Bengal
Programme

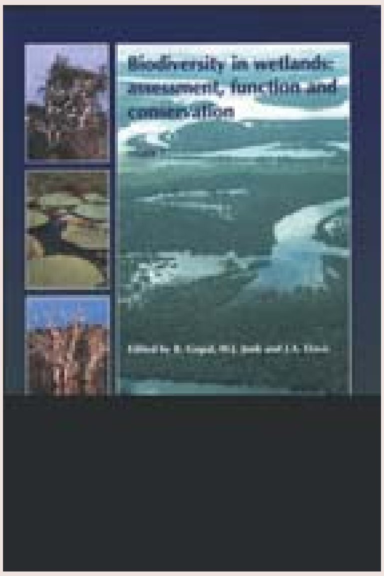


New Species for Mediterranean Aquaculture. 1999. Edited by G. Enne and G.F. Greppi.

This book represents the proceedings of the 33rd International Symposium on Animal Production on "new species for Mediterranean aquaculture" organized by the Department of Animal Science of Sassari University in collaboration with the Società Italiana per il Progresso della Zootecnica and the Istituto Sperimentale Italiano "L. Spallanzani". The last few decades have been witness to dramatic growth in Mediterranean aquaculture. However, some problems are arising in the area from the complicated effects of climate change and from basic economics. The culture of new species or new ways to culture existing species are discussed in this volume so that the aquaculture sector can continue to grow and be a viable industry in the region. This book is not an FAO publication, but contains contributions by Dr Devin Bartley (FIRI) on "A precautionary approach for the introduction of new species in aquaculture", by Dr Krishen Rana with Dr F. Barbato *et al*. on "First results in obtaining hybrids employing *Sparus aurata* fresh oocytes and *Diplodus puntazzo or Pagrus major* cryopreserved sperm", and by former FAO staff, Dr James Muir (Stirling University) on "Strategic issues in new species development for aquaculture". The book is published by Elsevier, 23 rue Linois, 75724 Paris cedex 15.
ISBN: 2-84299-156-7

Biodiversity in wetlands: assessment, function and conservation. 2000. Vol 1. Edited by B. Gopal, W.J. Junk and J.A. Davis.

The contributions to this publication deal with many of the diverse types of wetlands, for example, riverine floodplains, mangroves, bogs and fens, and the seasonal wetlands of arid regions. The editors point out that although biodiversity is an important topic today, most studies and discussions are focused on terrestrial systems such as rainforests; discussions on aquatic biodiversity usually address coral reefs. The biodiversity of inland water ecosystems is now starting to receive attention and we are realizing that they are
i) fragile and threatened, ii) highly productive, iii) contain a wealth of biodiversity, and iv) we know very little about them. Although this publication is not an FAO publication, current and former FIRI staff contributed articles. Dr Robin Welcomme, retired service chief of FIRI, contributed an article on "Fish biodiversity in floodplains and their associated rivers", and Dr Devin Bartley (FIRI) contributed a chapter on "International mechanisms for the conservation and sustainable use of wetlands". The book is published by Backhuys Publishers, Leiden, 2000, the Netherlands. Additional ordering information may be obtained by telephone: +31 71 517 0208 or e-mail: backhuys@backhuys.com.
ISBN: 90-5782-059-5



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FAN

FAO Aquaculture Newsletter

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The FAO Aquaculture Newsletter (FAN) is issued three times a year by the Inland Water Resources and Aquaculture Service, Fishery Resources Division, of FAO's Fisheries Department, Rome, Italy. It presents articles and views from the FAO aquaculture programme and discusses various aspects of aquaculture as seen from the perspective of both headquarters and the field programme. Articles are contributed by FAO staff from within and outside the Fisheries Department, from FAO regional offices and field projects, by FAO consultants and, occasionally, by invitation from other sources. FAN is distributed free of charge to various institutions, scientists, planners and managers in member countries and has a current circulation of about 3 000 copies.
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http://www.fao.org/waicent/faoinfo/fishery/newslet/newslet.htm