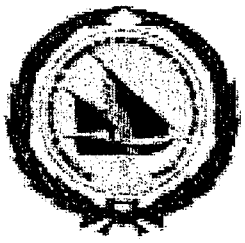

ENVIRONMENTALLY FRIENDLY AQUACULTURE AND FISHERIES PRACTICES

Proceedings of a workshop held on 15-17 September 2002 in Hurghada, Egypt

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For bibliographic purposes this document should be cited as follows:
El Gamal, A.A., Abdullah, S., and Barrania, A. (editors). 2002. Environmentally Friendly Aquaculture and fisheries practices, workshop proceedings, 15-17 September 2002, Hurghada, Egypt. 173pp.

Foreword

On behalf of the workshop sponsors; Regional Organization for the Protection of Environment of the Red Sea and Gulf of Eden (PERSGA)[1], Regional Organization for the Protection of Marine Environment (ROPME), The World Fish Center for Africa and West Asia (ICLARM)[2], Agriculture Policy Reform Project USAID/Egypt (RDI)[3] and (FAO Regional Office for the Near East (Cairo), I welcome you today in the "Environmentally Friendly Aquaculture and Fisheries Practices".

As observed and document, natural fishery resources worldwide have reached its utmost production and/or declining due to various reasons. Fishing practices and other environmental factors are claimed to be the cause of fishery stagnation and/or declining.

Aquaculture should be credited for filling the gap between the demand and supply for fish products being able to make up for the deficit and fulfill the requirements from fishery products for the growing populations worldwide. Moreover, because of health concerns, the per capita consumption of fishery products has steadily increased reaching an average of about 15 kg per capita per year.

Fish production in the Near East as well as the Red Sea region is below the world average. However, there are considerable variation within the region in regard to fish production as well as the per capita consumption that could reach as high as 30 kg per year in some countries while may reach as low as 2 kg/capita/year in other countries.

Aquaculture in the region is developing at varying degrees. Whereas aquaculture is developing, the trend of intensification is almost the case in the current practices. The scarcity of water and land as well as the rising of production costs favor the trend of intensification.

The intensification has its impact on surrounding environments causing more of public awareness and triggering the debate between food security and environmental interests. It is obvious, that in order for such systems

[1] Sustainable Use of LMR Component – SAP - PERSGA
[2] Current name: WorldFish Center
[3] Reform Design and Implementation Unit (RDI)

(aquaculture and fisheries) to remain sustainable, it should stay friendly with the environment, which has been planned as the focus for this workshop.

The present workshop is trying to address the environmentally friendly practices in fisheries and aquaculture. In order to accomplish that, we have invited keynote speakers to address lectures on various topics of the workshop. Afterwards, country reports will be presented. In that regard, guidelines for the country reports were circulated ahead of time targeting that reports would include some important elements. We will try in the workshop to place more emphasis on generating management plans for environmentally management of fisheries and aquaculture especially in coastal zones.

Working groups will be formed with a task to develop plan of actions for environmentally friendly aquaculture and fishery practices.

Finally, on behalf of the organizations sponsoring this event, I would like to acknowledge the efforts of Dr. Ahmed Barrania and Dr. Abdel Rahman El Gamal the members of the organizing committee who worked very hard to make this event happening.

Let us hope to achieve the goals of this workshop. Doing that we wish you a nice stay and productive workshop.

Dr. Mohammad Saif Abdullah

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ENVIRONMENTAL IMPACT ASSESSMENT (EIA) AND THE QUALITY OF LIFE: *SOME REFLECTIONS ON THE CANADIAN EXPERIENCE IN THIS AREA*

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I. INTRODUCTION

It is generally recognized that the ongoing availability of good quality natural resources and skilled work force are the two central pillars of a modern economy. This fact is recognized by senior decision makers every where and especially those managing the economies of the industrialized nations. But because of historically much stronger ties to the vast Canadian land mass and traditionally a resource-based economy, people and the governments in Canada, have been more aware of the direct linkages between a healthy biophysical environment and the good quality of life.

A vast majority of Canadians irrespective of their social, economic and ethnic backgrounds understand that there is a direct relationship between the good quality of life they enjoy and the health of the surrounding environment. Consequently, Canadians have a much deeper sense that individually and collectively, they must remain faithful stewards of this vast land mass and its precious resources.

It is, however, a well-established fact that Canada like most other industrialized nations of today faces a wide range of very complex and difficult environmental issues. In this age of Internet economy, globalization of trade and commerce, rapidly shifting economic, political and military alliances and rapid movements of humans and funds across international boundaries, the natural heritage of every nation is under constant stress and Canada is no exception.

At the same time, it is recognized that Canada needs to retain its traditional role as the leading voice for furthering the cause of global environment as it has been doing for the past many years. For instance, Canada played a key role in organizing the first global environment summit held in Stockholm in 1972. Canada's contribution to the Brundtland report, OUR COMMON FUTURE, is yet another indication of its resolve to protect its own natural heritage and assist the global community to do the same.

It is important to realize that the sustainable use, prudent management and adequate protection of fast dwindling natural resources need to be planned and done within the national and international context. Whether it is the construction and operation of a coal-fired power plant or proper management of fisheries resource, most if not all activities having direct or indirect impacts on the natural environment, can have trans-boundary and inter-jurisdictional implications.

In other words, dealing with national environment ultimately requires the same approach as the one adopted for wrestling with other important issues such as the national economy and international trade and commerce.

As is the case in most other industrialized countries, traditional environmental problems ranging from the growing public concern about waste disposal, omni presence of toxic chemicals, depletion of fisheries stocks, threat to the quality of drinking water etc. remain high on the public agenda in Canada and are likely to remain so in the future. Canadian politicians and senior decision makers are fully cognizant of this fact.

On the other hand, extreme variations in global climate, rapid growth in world population and ongoing changes in the Canadian and global demographic patterns etc. create formidable challenges to those responsible for improving the national economy and for protecting the ecosystem integrity. The real challenge is to create an acceptable balance between the economic necessities and environmental considerations.

In order to do a reasonably effective job for protecting the shrinking global natural resources, there is need for strong national and international commitment and meaningful cooperation. Obviously, it also requires allocation of considerable financial resources, highly skilled professionals and expensive technology. In addition, it needs ongoing cooperation and collaboration among various governments, public and private sector institutions and the general public.

Recognizing the constitutional division of power and shared control over Canada's enormous natural resources, federal and provincial governments in Canada have tried to develop workable cooperative mechanisms such as Council of Canadian Environment Ministers with a permanent secretariat based in Winnipeg, Manitoba. The Council and its Secretariat plays an important role to facilitate cooperation for natural resource protection in all parts of Canada.

However, given the perennial need to address other priorities and meet pressing social and economic needs, the level of resource allocation for environmental protection measures including EIA, often fall short of the desired amount needed to get the job done properly. This has often been the case at all levels of government in Canada. Consequently, the real effectiveness of the federal EIA Process in Canada remains in question (Gibson, 1993).

II. CANADIAN TRADITION OF CONSENSUS BUILDING AND COOPERATION

Recognizing its historical evolution as a modern state and the diversity of its population, Canada is, in large measure, a consensus state. Ever since the days of the earliest settlers, people have developed a considerable measure of trust and reliance, although not always fully justified, on governments to become directly involved in protecting their natural heritage.

Generally speaking, governments in Canada have done reasonably well in protecting the environment given the tight jurisdictional and financial restraints. To their credit, governments try hard to build partnerships with other stakeholders for resolving environmental issues. Governments and people in Canada recognize the need and importance of public and private sector cooperation for protecting Canada's natural heritage.

III. EIA AND ENVIRONMENTAL QUALITY

EIA has been defined and described in various ways in the published literature. It is, however, generally agreed that:
"EIA REFERES TO A SYSTEMATIC PROCESS FOR EXAMINING/ANALYZING THE ENVIRONMENTAL AND SOCIAL CONSEQUENCES, BOTH POSITIVE AND NEGATIVE, ASSOCIATED WITH A PROPOSED ACTIVITY AND RECOMMENDING APPROPRIATE MEASURES TO ELIMINATE OR MINIMIZE THE ADVERSE IMPACTS AND THUS MAXIMIZE THE POSITIVE GAINS". (Sadar, 1996).

In other words, the main objectives of conducting an EIA exercise are:

1- To improve the economic development planning process by examining carefully and systematically all intended benefits and potential adverse impacts on social and biophysical environments *before* starting the implementation phase of the proposal.

2- To assist the decision makers make a well informed decision so that the proposed activity enhances the quality of life of the people without unnecessary damage to the environmental quality.

IT SIMPLY MEANS THAT EIA IS ESSENTIALLY A "BALANCING ACT" FOR ACHIEVING GOALS OF SUSTAINABLE DEVELOPMENT.
THE CONCEPT OF EIA as a useful tool for preventing damage to environmental quality was first introduced in the National Environmental Policy Act (NEPA) of the United States of America in 1969. Today, a vast majority of nations around the globe have made EIA as a legal

requirement for approving the proposed economic development activities (Sadler, 1996).

In spite of differences in their political and administrative structures, all governments face the same basic challenge in developing a workable and effective EIA process. The principal challenge is to strike a credible and publicly defendable balance between the economic necessity and environmental quality considerations.

Put in simple words, the basic objective for conducting an EIA exercise is to ensure that the proposed activity adds to the QUALITY OF LIFE OF THE COMMUNITY.

Obviously, any EIA exercise whether under a legal framework or a policy directive, must be conducted in a way that it has public credibility and professional comprehensiveness. Moreover, it must result in sound conclusions and realistic recommendations, which can be accepted and implemented by the decision makers and the proponent(s).

IV. EIA IN CANADA

Prior to the promulgation of the Canadian Environmental Assessment Act in January of 1995, EIA in Canada was conducted under a federal Cabinet policy directive known as the Guidelines Order. The resultant procedure, which was put in place in 1973, was known as the Environmental Assessment and Review Process (EARP) (Sadar and Stolte 1996).

In 1990, The Parliament of Canada passed the Canadian Environmental Assessment Act (CEAA), which provided a legal base to EIA in Canada. CEAA was promulgated in January 1995. Since then, EIA is being conducted in Canada under a new regulatory mechanism as required by the new Act. Obviously, it is too early to judge the relative effectiveness and benefits of the new Canadian EIA process developed recently under CEAA as compared to that of EARP which was based on a policy directive only (Sadar and Stolte, 1996).

Considering the level of investment by the regulatory bodies and the developers in Canada and in other countries for meeting EIA requirements, it seems necessary to find out if the current EIA procedures are leading towards the goals of sustainable development. Such an evaluation may be useful in improving the practice of EIA so that assessment exercises can produce the desired results.

V. KEY ISSUES SURROUNDING EIA AND ENVIRONMENTAL QUALITY CONSIDERATIONS

A comprehensive review and analysis of all issues associated with the current processes, procedures and practices of EIA in Canada and in countries around the globe, is beyond the scope of this paper. However, it seems appropriate to identify at least some of the key areas, which in the opinion of the author need further review and analysis.

1- HEAVY FOCUS ON THE ASSESSMENT PHASE OF THE EIA PROCESS

As we all know, EIA consists of two distinct phases, namely the *assessment or impacts prediction phase and the follow-up phase.* Whereas the conceptual frame of the assessment phase keeps on expanding and perhaps justifiably so, to include cumulative effects assessment, assessment of impacts associated with climate change, strategic or policy assessment etc; the need and importance of the *follow-up phase* has rarely received as much attention as it deserves. (Sadar, 1999).

The assessment part of an EIA exercise basically is a *prediction making* exercise based largely on the description of the proposed activity and the state of surrounding biophysical and social environments, which are likely to be impacted. Based on the nature and significance of the *predicted impacts,* the proponent is required to propose relevant mitigation and monitoring measures. Since this phase in completed *before* the start of any physical work, it is basically a paper exercise.

Once the EIA report is reviewed and approved by the responsible authority and the actual work begins, the situation changes dramatically as the activities conducted are subject to existing environmental protection laws, regulations and standards. In other words, once the project work actually starts, the proponent has to comply with the provisions of various laws and regulations already in place for protecting human health and the environment.

It is fair to say that the follow-up phase remains the weakest link in the entire spectrum of the EIA process. This weakness must be removed in order to make EIA an effective tool for improving the environmental quality and the quality of life of people.

Obviously, a systematic implementation and evaluation of follow-up phase is the key element in ensuring that EIA does make a positive

contribution to environmental quality. Without putting in place appropriate compliance and effects monitoring measures and evaluating the data so produced, one can never learn the accuracy of predicted impacts and the methodologies used during the assessment phase. Similarly, ongoing effects monitoring is absolutely essential to determine the relevance and effectiveness of the mitigation measures proposed or implemented by the proponents.

THE QUESTION IS HOW CAN ONE DETERMINE IF EIA IS CONTRIBUTING ANY THING FOR IMPROVING THE ENVIRONMENTAL QUALITY AND THUS QUALITY OF LIFE OF THE PEOPLE IF THERE ARE NO SYSTEMATIC FOLLOW-UPS TO VERIFY THE ACCURACY AND RELEVANCE OF WHAT WAS PREDICTED/CLAIMED DURING THE ASSESSMENT PHASE? (Sadar, 1998).

2- SOCIAL ISSUES (HUMAN HEALTH CONCERNS) AS THE PRINCIPLE DRIVING FORCES BEHIND EIA

EIA is primarily a process for facilitating a public dialogue among various stakeholders in order to reach agreement(s) for acceptable trade-offs. For instance, proposing a new industrial facility in a rural area will bring much needed jobs. On the other hand, the construction and operation of the factory may require cutting part of the natural forest to prepare the construction site. A good EIA exercise provides a platform to have an informed discussion for finding acceptable trade offs.

As such, EIA in *NOT* purely a scientific exercise. However, credible scientific information and its proper interpretation are crucial for maintaining proper focus, objectivity and usefulness of any EIA exercise. Obviously, the conclusions and recommendations contained in any assessment report must be based on the best available and verifiable information.

Generally speaking, developments in various disciplines especially social, medical and engineering sciences have not yet been fully integrated into the EIA procedures. As a result, information and data presented and used in the assessment reports may not always be totally relevant and useful for predicting various impacts accurately. Lack of adequate baseline information is one of the most difficult impediments in conducting good EIA's.

Recognizing that a good economy and availability of good jobs are fundamental requirements for improving community health and their

quality of life, an EIA exercise needs to identify all positive elements which can be helpful for improving health and the way of life of the people. Obviously, any real or perceived potential risks to human health and safety as well as to the ecosystem need to be identified and evaluated properly. The purpose is to weigh carefully the anticipated benefits and possible harmful effects associated with the proposed activity.

As it stands now, health professionals do not play an effective role in the assessment and follow-up phases of the EIA process. This situation should be reviewed and changed so that the vast expertise of the health professionals can be fully utilized for achieving the most desirable goal of EIA which is to improve the quality of life of the people.

3- OTHER KEY ISSUES REQUIRING ATTENTION

3.a Human Resource Development

There is need for developing national strategies for human resource development in this area. Ongoing training and education are essential for improving the professional skills of EIA practitioners so that they are able to conduct assessments properly in face of rapid changes and new developments in national and global economies.

At present, EIA related education and research at colleges and universities generally lack focus, uniformity and national standards. There should be more emphasis on public education and awareness about EIA and its intended benefits.

The level of participation in EIA related professional meetings and other activities within the country, the region and especially at the international level should be increased significantly. Obviously, ongoing support for professional net working and interactions both at the national and international levels, is essential for developing the needed skills of professionals and for expanding the EIA knowledge base.

3.b Human Health Impact Assessment (EHIA)

A quick glance at the past EIA experience should reveal that during all public meetings, the central issues are human health and safety, economic gains or losses and community structure and its value system. *It does not require a genius to conclude that these are all QUALITY OF LIFE issues.*

In a properly conducted EIA exercise, the main focus must be on direct and indirect impacts, both positive and adverse, on human health. Creating jobs is good for the local economy and it contributes positively to the quality of life in the community. Obviously, such gains have to be

balanced against potential loss to environmental quality and other potential adverse consequences so that a more realistic and balanced picture can be presented to the public and the decision makers.

As it stands now, not enough attention is paid to identify and quantify the positive effects of well planned development on human health and the quality of life.

Consequently, there is need to revise and update human health impacts assessment (EHIA) methodologies for making EIA more focused on the quality of life issues.

3.c. The Role of EIA In Biodiversity Protection

Considering global commitment for implementing provision of *BIODIVERSITY CONVENTION* at RIO-92 and now at Johannesburg-2002, it seems highly desirable to explore further the positive contributions EIA can and should make in this important area.

3.d. EIA And Climate Change

There seems to be growing need for assessing impacts of climate change and this subject deserves special attention.

3.e. Development of Sector-Specific EIA Data Bases

Comprehensive analyses of sector-specific EIA experiences should provide useful information for making future such exercises more efficient, cost-effective and focused. For example, after having conducted say ten EIA's in mining sector, the eleventh one should become a bit easier based on the lessons learnt from the previous experience.

VI. EIA AS APPLIED TO WATERSHED PROJECTS. *(FISHERIES AND FISH HABITAT PROTECTON)*

Understandably, maintaining the health and integrity of the aquatic ecosystem is a fundamental requirement for ensuring the growth and even survival of the fisheries and aquaculture industries. A good fish habitat must have sufficient quantity/volume of good quality water, supply of nutrients and food for fish to feed and availability of good spawning grounds for reproduction of species. Consequently, a comprehensive approach for protecting water resources is a pre-requisite for ensuring a healthy, productive and sustainable fisheries.

Canada has a long history in applying EIA to watershed modification projects. It must be noted in most if not all such projects, the provisions

of the Canada Fisheries Act that trigger EIA as a legal requirement for seeking federal approval of such projects. In most such assessments, the major issues identified were potential impacts on water quality, disruption of water flow regimes and fluctuations in the water levels in lakes, rivers and man-made water reservoirs.

Other concerns related to non-point sources of pollution, stream bank erosion, impacts on down stream water users and wild life and potential damage to fish habitat (Sadar, Dirschl and Novakowski, 1993; *and* Sadar and Stolte, 1998).

VII. CHALLENGES AND OPPORTUNITIES FOR THE EIA PRACTITIOERS

Obviously, in order to achieve the desired goals and objectives, each phase and every step of the EIA process must be completed using the best available scientific information and most reliable impact prediction methodologies followed by a systematic and effective implementation of the follow-up phase as described earlier.

THIS IS THE ONLY WAY TO PREVENT POTENTIAL DAMAGE TO THE ENVIRONMENTAL QUALITY IN THE FACE OF FAST CHANGING NATIONAL AND GLOBAL ECONOMIES AND SOCIO-POLITICAL CIRCUMSTANCES.

Recognizing that:

1- The policy initiatives and relevant measures for protecting the "environment" started only about forty years ago, but the natural ecosystem has been in evolution for millions of years. Consequently, our current knowledge and ability too deal with the complexities of the natural ecosystems is very limited and decidedly inadequate.

2- EIA is a key component of the "*prevention approach'* and its results need to be integrated into plans and programs under the "*protection"* and '*conservation' strategies* for protecting the natural environment.

3. The main purpose of EIA is to ensure that human beings plan and their conduct their activities in a way, which either eliminates or minimizes irreversible damage to the natural resource base.

IT MUST BE REMEMBERED THAT EIA IS NOT MEANT TO STOP OR IMPEDE THE ECONOMIC DEVELOPMENT PROCESS BUT TO MAKE IT MORE BALANCED AND BENEFICIAL TO BOTH THE SOCIETY AND THE NATURAL ENVIRONMENT.

4. EIA is basically a prediction making exercise and like other such practices, weather prediction, it is not expected to always produce one hundred percent accurate results.

5. In most situations, there is insufficient base-line information, which may lessen the accuracy and relevance of predicted impacts considerably.

6. Conclusions and recommendations in the assessment reports are meant to assist the decision makers make better informed and balanced decisions. Consequently, the recommendations made at the end of an assessment exercise must take into account the cost of implementing such recommendations.

In other words, EIA practitioners must be mindful of the existing social, economic and political conditions and realities and try to use common sense in formulating occlusions and recommendations based on assessment findings.

ACKNOWLEDGEMENT

The author wishes to thank the following for their helpful comments on the manuscript:
1- Mr. D. G. Tilden,
Environmental Assessment Branch,
Environment Canada. *And*

2- Mr. Kamuran Sadar,
Healthy Environments and Consumer Safety Branch,
Health Canada.

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EIA, HACCP AND ISO 14000 AS THREE PILLARS FOR SUSTAINABLE AND ENVIRONMENTALLY FRIENDLY AQUACULTURE PROJECTS: ADVANTAGES AND CONCERNS

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Paper presented as a keynote address at the "ENVIRONMENTALLY FRIENDLY AQUACULTURE AND FISHERIES PRACTICES" Workshop held at Hurghada, Egypt on September 15-17, 2002

1. KEY WORDS AND TERMINOLOGIES USED IN THE TEXT:

-EIA: Is an environmental management tool. It is used to identify, predict and assess significant impacts of development activities/projects before being implemented. EIA is compulsory, by law, in many countries both in developed and developing countries.

-HACCP: Is an international standard that was established to ensure food safety and quality through being compliance with the clauses of the standard. It is mainly directed towards all types of food industries. A company that holds a HACCP certificate need to be fully compliant with the clauses of the standard, carry internal and external auditing, renew its certificate each three years and to be compliant with local food hygiene laws and regulations.

-ISO 14000: Is a set of a family of standards related to improving environmental performance of companies? A company that holds a ISO 14001 certificate need to be fully compliant with the clauses of the standard, carry internal and external auditing, renew its certificate each three years and to be compliant with local environmental laws and regulations.

-Sustainable Development: Is a development that meets the needs of the present without comprising the ability of future generations to meet their own needs.

2. INTRODUCTION

This paper sheds the light on three important and significant tools that can enhance environmental performance and protection and, also, ensuring food safety and quality. These three methods are:

1- Environmental Impact Assessment (EIA).

2- Hazard Analysis Critical Control Point (HACCP Standard).

3- Environmental Management System (ISO 14001 Standard).

In this paper, these tools are referred to as the three pillars of sustainable fisheries projects. EIA is a method used to assess different types of significant projects and activities before being implemented. HACCP is an international standard that was established to ensure food safety and quality all the way from obtaining raw materials till the final product reaches the consumer. ISO 14001 is, also, an international standard that was established to ensure enhancing environmental performance of companies and to make them fully compliant with related environmental laws and regulations.

The paper also stress on the fact that, in theory, the use of such tools is of a paramount importance to enhance environmental protection and food safety and quality in fisheries and non fisheries projects in order to achieve some of the objectives of sustainable developments. However, in real life this might not be case. For example, problems associated with EIA laws and regulations, the quality and experience of consultants and auditors of HACCP and ISO 14001 and other significant factors, stem as factors that can lead to environmental deterioration, increase cost and might endangering food safety and quality. Refer to Figures 1 and 2 and Tables 1 and 2.

3. EIA:

3.1 Introduction:

In the past three decades most projects were only assessed on the basis of technical feasibility studies and Cost Benefit Analysis (CBA). The objective of these studies were to assess the impacts of project in terms of resource costs valued in monetary terms whereas the potential environmental, health and social impacts are often neglected and not considered (Clark, 1986). The main consideration in EIA is that, the environment must be " thought as an economic resource and not as a dispensable luxury" (Clark, 1984).

The use of CBA as an economic assessment tool led to a severe disturbance in the physical and socio-economic components of the environment where major projects are being constructed. Well known examples of such disturbances are the increase of earth quakes frequencies and fish kill around the world. However, during the past 30 years basic yet significant questions are raised by the public, planners and organizations concerned with environmental protection and human health safety, whenever development project are being proposed. Examples of such questions:
Is such proposed development activities needed? If so what are the alternatives, which could provide the same benefits with less risk to the environment, human health and public safety?

Are the impacts of proposed activities well studied and mitigation measures proposed to minimize their effects?

Do monitoring programs exist to monitor pollutants emitted or released to the environment after projects implementation?

Are development projects planned near areas with significant features i.e. ecological, economic, historic and landscape sites? If so, what considerations are needed to be taken?

The appropriate answers to these questions can be emerged through the sound application of Environmental Protection and Pollution Control Management (EPPCM). There are two systems of controlling pollution and their impacts within EPPCM. The first system is Input Pollution Control (IPC). Pollutants are managed and controlled in terms of identifying them, their effects and how they can be mitigated during projects design and implementation. In such system, pollutants are managed and controlled before being emitted or released to the environment. This might involve site selection, considering alternative construction designs that take into consideration environmental, health and safety factors. Also, it can involve using environmental friendly technology to operate facilities and machinery used for industrial and non industrial projects such aquaculture projects. To implement sound IPC it needs strict litigation and environmental awareness.

The second system is Output Pollution Control (OPC). Pollutants are managed and controlled after being emitted or released to the environment. Pollutants are managed and controlled through proper disposal of waste into land, discharges of industrial waste water and controlled emission of air pollutants. OPC involves issues like reuse, recycling, material recovery, energy recovery and composting. For such system to fully succeed, it requires proper legislation's, monitoring and strict compliance with environmental standards. Both systems should not be seen as separate but must be thought of as complementary. However, in terms of order and importance in minimizing the adverse impacts of pollution, IPC stems more significant than the OPC.

3.2 Environmental Impact Assessment (EIA) as an effective IPC method:

Environmental Impacts Assessment (EIA) can be defined as a legal and an administrative procedure used by environmental and planning agencies to indicate which, how and when development actions need to be assessed. Also, it is a scientific analysis process. This is because the impacts of an action can have an adverse effect on the different components of the environment. Therefore, the main objective of EIA is to link the different types of data and information about the site and the project into a systematic structure to identify, assess and mitigate significant impacts. To carry-out such a task the Environmental Impact Assessment Analyst (EIAA) must co-ordinate the work of the EIA team involved in projects assessment.

Such team usually comprises from planners, engineers, geologists, ecologists and other specialists depending on the project it self. This multidisciplinary team requires large and specific data and information on the technical framework of the proposed action and the different

constituents of the environment likely to be affected. These experts, assesses the likely significant impacts, through identification and prediction of such impacts. This requires, for example, the use mathematical models, water and soil sampling and the use of laboratory analysis. Impacts identification, prediction and assessment are to be considered for the whole project life cycle, that is, at site preparation, during construction, after commissioning and finally after decommissioning.

Based on the fact that actions produce impacts, these according to Bisset, (1986) can be classified into two major categories. These are:

1-Impacts on the bio-physical environment e.g. alteration of aquatic, terrestrial, air, and landscape quality.

2- Impacts on the socio-economic structure e.g. displacement of ethnic and minority communities, changing aesthetical and historic sites, disturbing local economy, adverse impacts on human health and safety.

The first step undertaken in EIA is to decide whether the project at the first place requires an assessment or not. It will be time consuming and costly to assess all types of projects. Therefore, a system was devised to concentrate the assessment task on projects that are likely to produce adverse impacts. This is can be achieved through the Screening Process, which is an elimination process. There are several methods used to conduct screening. For example, negative and positive lists. The former, are lists that indicate projects that require an EIA, whilst, the latter, indicate projects which does not require assessment. If the project requires an assessment, then scoping is carried out. Scoping is a process of deciding on significant issue that needs to be addressed at the assessment task. As with screening, it will be impossible to assess all possible impacts that might be generated.

Therefore, many scoping methods are used to identify the significant issues such questionnaires and the utilization of the EIA team experience. After screening, Base Line Study (BLS) is carried-out. This is a data and information collection task, in relation to the issues already decided to be significant and require assessment. Once this is achieved, impacts identification, prediction and assessment are undertaken through detailed scientific study, which might involve, for example, using air or water pollution models. A statement is then produced for the decision makers stating the adverse impacts associated with the implementation of the project and possible mitigation measures. The last step is monitoring impacts to observe if they are correctly predicted and comply with standards. Finally, the accuracy of the assessment methods, used during impacts identification and prediction, are investigated through the

Auditing Process (AP) to refine the procedures and methods used for further future applications and studies.

4. HACCP:

HACCP is a food safety international standard. The Codex Alimentarius of the Food and Agriculture Organization of the United Nations and the World Health Organization Food Hygiene Committee have mandated in 1991 a working group to develop the HACCP guidelines. HACCP is short for Hazard Analysis Critical Control Point. The standard takes into consideration the control of food production processes i.e. from raw material all the way to providing the final product to customers. This is can be achieved by making the concerned food processing factories or plants being compliant with the clauses of the HACCP standard.

The standard is considered as one of the safest food control methods. HACCP can be applied to small, medium and large size food production establishments and factories i.e. bakeries, catering companies and fish caning factories. The standard is being implemented worldwide and is recognized as a systematic and preventative method that considers biological, chemical and physical hazards during food processing. This hazard analysis acts as an active prediction and prevention method for biological, chemical and physical sources of risk.

Without HACCP, the finished food products are usually inspected for compliance with related food regulations. However, HACCP is a pro-active process and control system to ensure food safety and quality against the risk of biological, chemical and physical factors. Many companies around the world are either already implementing the standard or in the process of achieving certification from an accredited body. The companies, who adopt this international standard, see several benefits from applying it. These include:

Ease of export.
Preventing legal liabilities from contaminated food.
Easily to compete with companies that are not HACCP certified.
Ensuring food safety and quality.

HACCP is an optional standard and is not obligatory in many countries. Qualified consultants i.e. experienced, certified and registered consultants are able to assist companies that are interested to obtain the HACCP certificate by carrying-out gap analysis, designing the system, training staff and implementing the HACCP system. To achieve and have the HACCP certificate, several steps need to be carried-out. These are:

1- Hazard Analysis (HA).
2- Identifying Critical Control Points (CCP).
3- Establishing Critical Limits for each CCP identified.
4- Monitoring CCP requirements and using the data gathered to effectively control food production processes.
5- Corrective Action (CA) i.e. correcting all non conformities in regard to the HACCP standard/system clauses.
6- Record Keeping (RC) i.e. all records concerned with HACCP should be well maintained and controlled.
7- Verification i.e. external audit.

5. ISO 14000:

5.1 Introduction:

After the Rio de Janeiro Summit, an increasing concern has developed to the importance of introducing environmental management systems in organizations of all kinds. To assist organizations to achieve and demonstrate sound environmental performances, by controlling the impact of their activities, the international standards ISO 14000 was introduced. Public and private sectors are constantly seeking ways to improve environmental conditions and reducing pollution. The ISO 14000 family of standards enables businesses to adopt specific procedures and technical specifications to be used consistently in order to ensure achieving environmental protection. It also ensures that materials used, processes adopted, products produced and services provided are all environmentally sustainable. The ISO 14000 management system of standards provides a framework for environmental management for public and private sectors in order to reduce the adverse impacts associated with their activities. Refer to Fig. 3.

The International Organization of Standardization predetermined certain standards for businesses to achieve a sustainable environmental performance. These standards are known as the ISO 14000 Environmental Management Systems. The importance of such systems stems from the fact that they are very essential in controlling and managing the adverse impacts associated with services, products and activities of public and private sectors e.g. fisheries projects. Such systems are needed to be implemented as a result of strict environmental legislation worldwide and to reduce waste and pollution. These standards are applicable to all types of organizations worldwide regardless of their type and size.

To achieve the task of controlling the adverse impacts associated with public and private sectors activities and to enhance environmental performance, companies are required to adopt, implement and maintain certain environmental standards. This should be carried-out within a very structured environmental management system and to be part of the overall management activity to achieve sustainable environmental and economic objectives. The over all aim of the ISO 14000 environmental management systems are to support environmental protection and pollution prevention in balance with the socio-economic needs of societies.

5.2 The benefits of adopting the ISO 14001:

A company certified as compliant with the ISO 14001 environmental management systems standard, will demonstrate that it had done substantial efforts to prevent pollution and minimize the adverse impacts of its activities. The benefits of adopting the 14000 standards are the following:

1- To provide the organization with the elements of affective environmental management systems to achieve their set of economic objectives without obstacles and harming the environment and human health. The latter is not required, however, it is recommended to be taken into consideration.

2- To assess the effectiveness of the organization environmental objectives, policies and procedures to achieve conformance with such goals and to demonstrate such compliance to other organizations and the public.

3- To integrate the standards with other management systems that already exist within an organization in order to ensure that the organization overall performance is within acceptable international standards.

4- To reduce the cost associated with dealing with adverse environmental impacts and waste management.

5- To reduce and eliminate conflicts with environmental legislations and authorities where the organization is operating.

6- To have a good market opportunity in a very competitive world and to enhance the social and environmental image of the organization.

Refer to Table 2 and Fig. 3.

5.3 Factors that can lead to the success of the ISO 14001:

It is very important that certain factors exist in order to achieve compliance with the ISO 14001 environmental management systems. These include:

1- Commitment from the top management and other down stream management in adopting the ISO 14001.

2- Top and down stream management are required to ensure that procedures are set to maintain and improve operational conditions and unsustainable actions are amended.

3- Obtaining an accreditation by an approved external organization.

Continuous compliance with the stringent standards of the ISO 14001.

4- Implementing the best available green technology and environmental protection methods that are most suitable and economically feasible.

6. CONCERNS:

6.1 The limitation of EIA:

Environmental Impact Assessment is widely used in both developed and developing countries to assess projects. The question, which arises as whether, the implementation of EIA at the project level can be considered as an effective tool to achieve sustainable development. The answer conclusively can be no for two reasons. The first is that the application of EIA at the project level has limited utility in sustaining development. This is because policies and plans can generate adverse impacts as much or more than projects. Therefore, limiting the scope of assessment only to projects is not sufficient to protect the environment and human health. The second is that there are many significant issues that cannot be addressed at the project level. Two examples are given:

1- If a government authority decides on designating lands or marine areas for fisheries projects, then a project level EIA can have a limited application because the bases in which the government authority decided to select these particular areas are usually and not based on project EIA. It should be based on a higher level EIA i.e. applying EIA at the land use planning/policy level.

2- On which bases issues related to abating air, water and soil pollution are set, formulated and executed? Are these are set within a stringent environmental policy framework? Is any kind of assessment was conducted before executing the policy?

Most countries which adopted EIA, they implement it solely as a project assessment tool, with less emphasis is given to its role in land use planning, technology assessment, policy assessment (Khuraibet, 1989). This confined way of using EIA is often referred to in the EIA literature since the beginning. For example, Clark, (1981) indicated that the appraisal and assessment of development projects alone is of limited use in helping to protect the environment. In the other hand, Jones, (1983) argues that the application of EIA is too often restricted to projects although it can be used at the planning and policy levels. Bisset, (1983), also, suggest that although EIA applied to major projects it can be incorporated into the evaluation of policies, plans, and projects.

Other significant issues that weaken EIA effectiveness are the followings:

1- Poor EIA legislations.

2- Absence of EIA guidelines.

3- Shortage of staff and training at EIA departments in environment protection agencies.

4- Unqualified EIA consultants.

5- The absence of follow ups and monitoring once the project is implemented.

Refer to Fig. 4

6.2 Concerns related to HACCP and ISO 14001:

The concerns for these two standards include the following issues:

1- The lack of controlling laws and regulations.

2- The absence of awareness in ISO 14001 and HACCP for decision makers.

3- Consultant companies over exploiting clients.

4- Unregistered and unqualified consultants.

5- The clients are not aware of hidden costs.

6- Clients are being able to implement and maintain the required improvements.

7- Lack of proper communication between consultants and clients.

8- Clients' most important need is obtaining the certificate and by any means.

9- The clients, after obtaining the certification, are not being able export their products.

Refer to Fig. 4.

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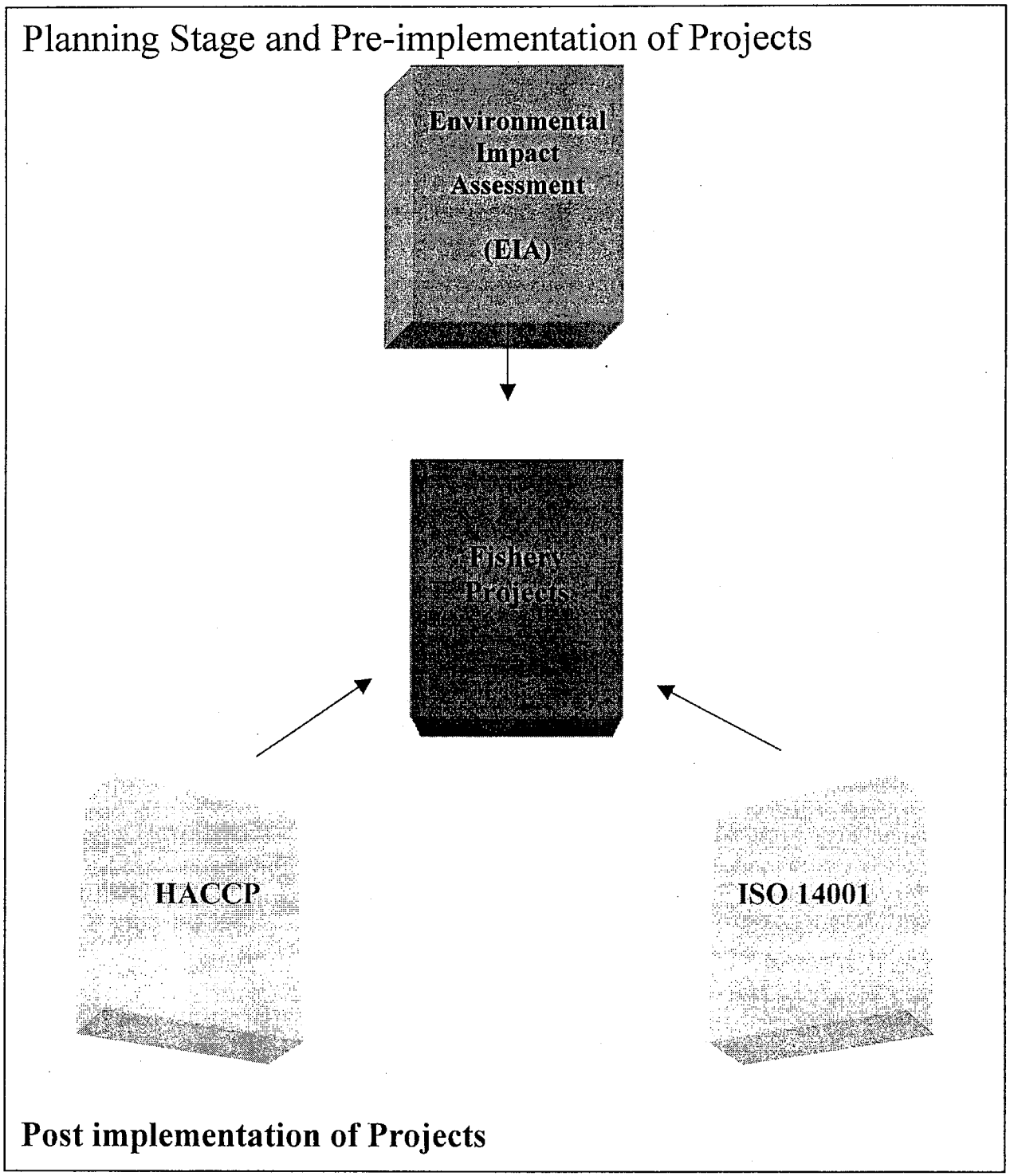

Fig. 1: The requirements for sustainable fisheries projects and their stages of implementation.

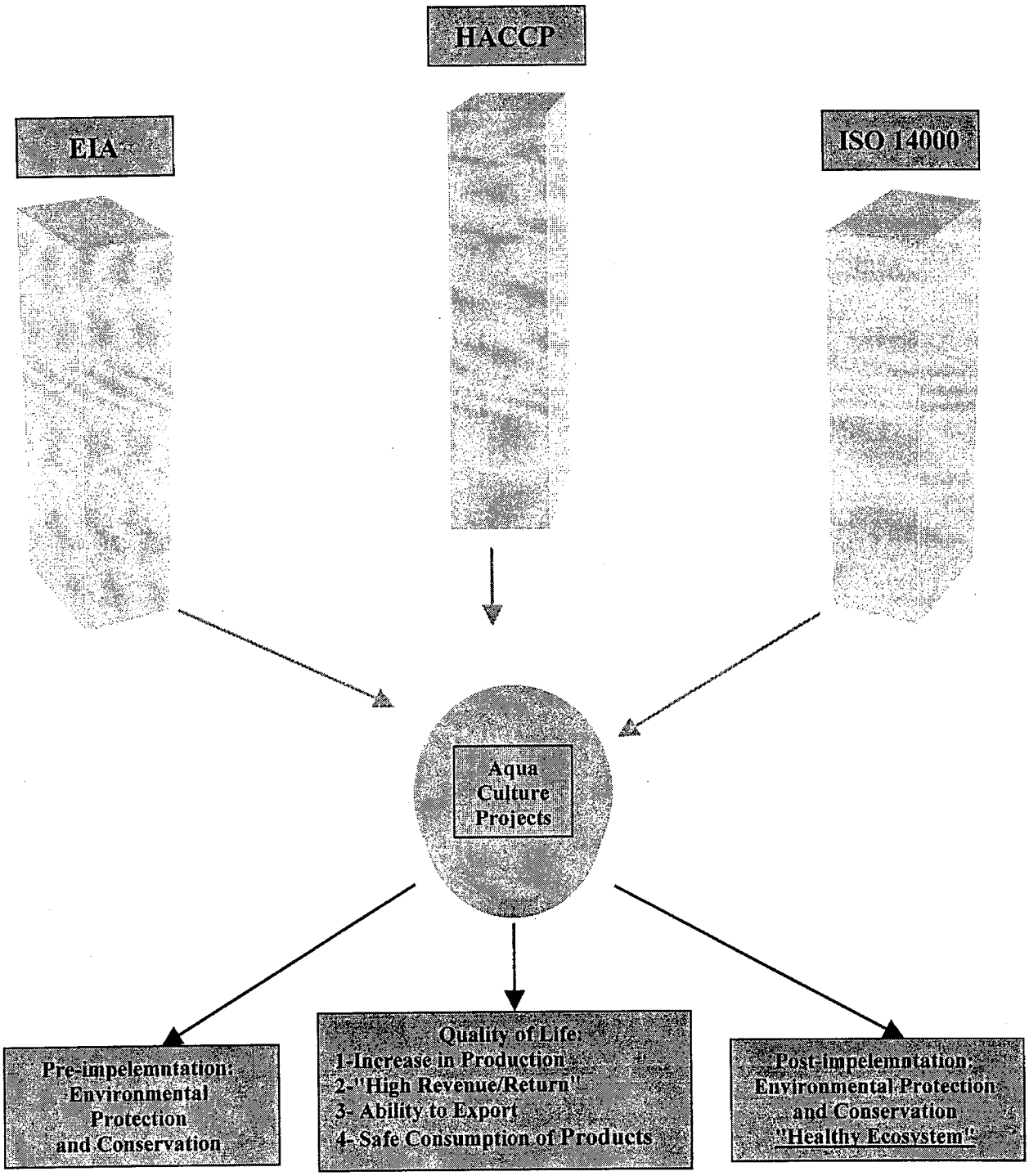

Fig. 2 The three pillars for sustainable aqua culture projects.

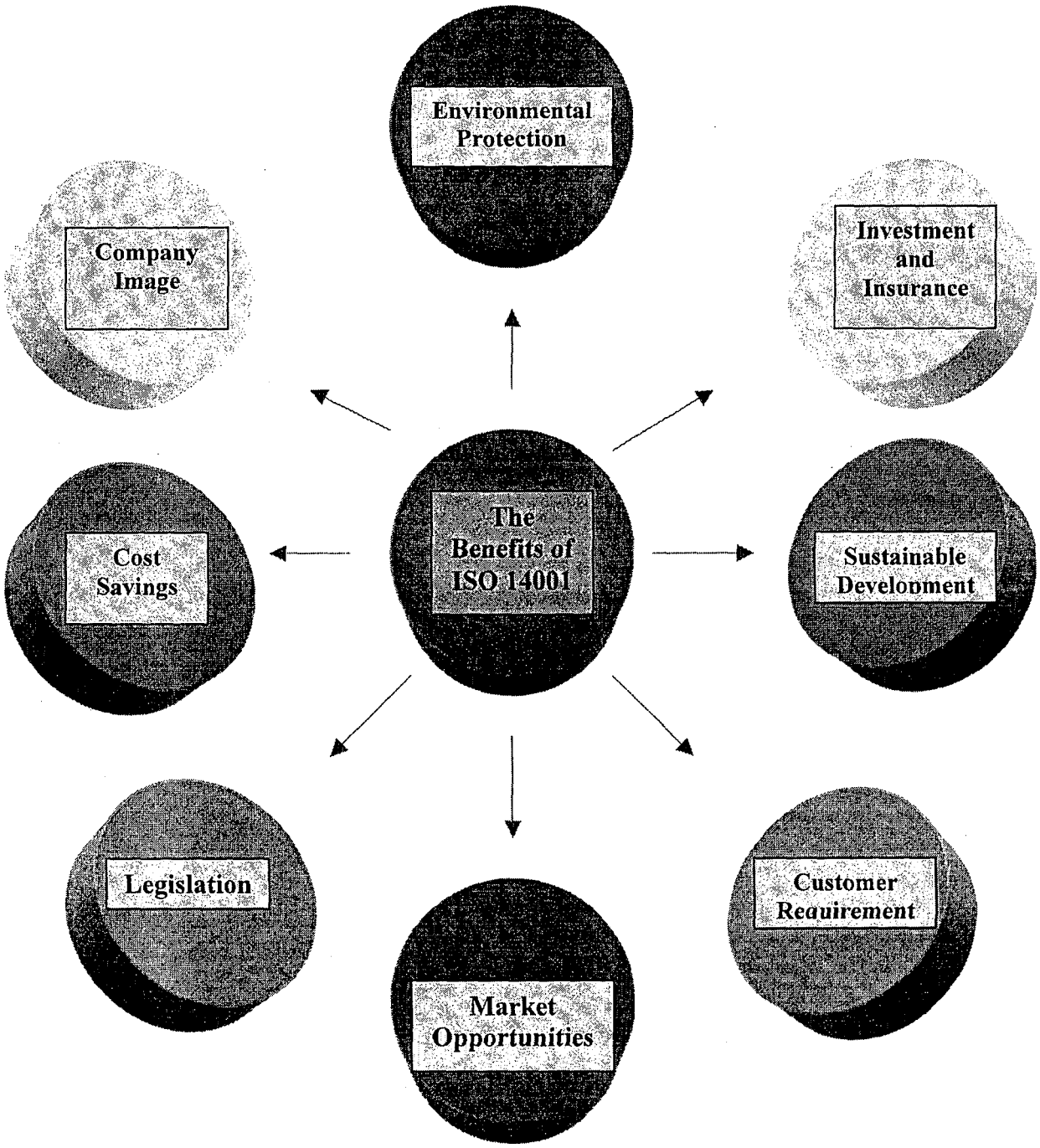

Fig. 3: The benefits of adopting the ISO 14000, after Al-Attar, (1999).

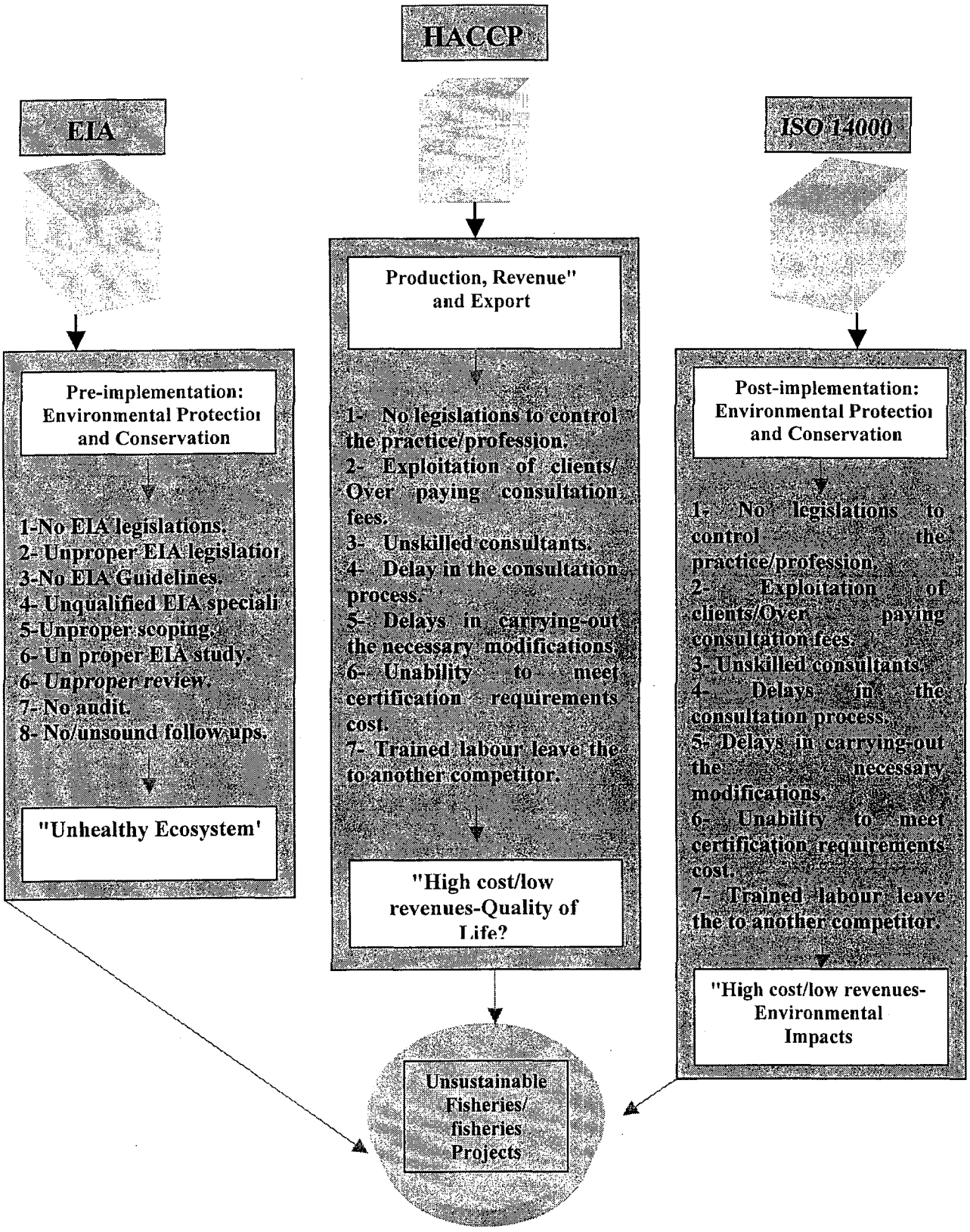

Fig. 4: The problems associated with the three pillars for sustainable aqua culture/fisheries projects.

Table 1 A: comparison between EIA, HACCP and ISO 14001.

	Environment and Food Safety Management Tools		
Parameter	**EIA**	**HACCP**	**ISO 14001**
Obligation	Obligatory by law and regulations	Not obligatory*/optional	Not obligatory/optional
Implementation	Required at the planning level and before the implementation of projects.	Can be carried-out once the project is implemented.	Can be carried-out once the project is implemented.
Aspect	Environmental protection also health and safety.	Food safety.	Environmental protection.
Consultants qualifications	Academic qualifications in related subjects, certification and registration.	Academic qualifications in related subjects, certification and registration.	Academic qualifications in related subjects, certification and registration.
Gap analysis	Not required.	Required.	Required.
Site assessment	Required.	Required.	Required.
Approval and accreditation	Approval is required through a government environment protection agency.	Approval is required through a certified and accredited body.	Approval is required through a certified and accredited body.
Project impacts and improvements	Required to look at the planning and pre-assessment level i.e. before projects implementations.	Changes and improvements are required to existing projects to comply with the HACCP standard.	Changes and continuous improvements are required to existing projects to comply with ISO 14001 standard.
Government inspection	Required	Not required in relation to ensuring compliance with the HACCP standard.	Not required in relation to ensuring compliance with the HACCP standard.
Internal auditing/ Auditors	Not required during the assessment task.	Required to ensure compliance.	Required to ensure compliance.
External auditing/ Auditors	Not required.	Required to ensure compliance.	Required to ensure compliance.
Certificate of approval/ Renewal	Certificate of approval is required in order to implement the project.	Accredited certificate, approval/renewal is required after each three years.	Certificate of approval/renewal is required after each three years.
Certificate upgrade	Not required.	Required each time the standard is upgraded/modified.	Required each time the standard is upgraded/modified.
Staff Training	Not required for the project staff.	Required for project staff.	Required for project staff.
Cost	Medium-High.	Medium-High.	Medium-High.

- *In some countries it is obligatory.*

Table 2 A: concise comparison between an organization with and without the ISO 14001 standard.

An organization without the standard	An organization with the standard
No management model exists and to be followed. Things are done according to his or her mind.	A management model does exist and is followed. There are written procedures, instructions, forms and records.
Things are not done systematically. Each member of the organization does not know exactly and clearly what his exact role is, that is, doing what, when, how, why and where.	Things are done systematically. Each member of the organization knows clearly and exactly his role, that is, doing what, when, how, why and where.
Money and human resources are not efficiently utilized. Therefore, the organization is not built on a strong foundation.	Money and human resources are efficiently utilized. Therefore, the organization is built on a strong foundation.
Auditing is absence and is not carried-out. There is a clear status of non conformity to procedures and instructions.	Auditing is carried-out to ensure that there is a clear status of conformity to the agreed standards that are set by an environmental expert.
Conflicts do exist with environmental legislations and authorities.	Adverse impacts associated with an organization activity are considered in order to reduce pollution. Therefore no conflicts exist between an organization and an environmental authority.

ENVIRONMENTAL IMPACT ASSESSMENT OF AQUACULTURE AND FISHERIES

By

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Paper presented as a keynote address at the "ENVIRONMENTALLY FRIENDLY AQUACULTURE AND FISHERIES PRACTICES" Workshop held at Hurghada, Egypt on September 15-17, 2002

WHAT IS EIA

EIA is a management tool like economic analysis and engineering feasibility studies.

EIA aims to:

1- predicts environmental impacts of projects,

2- finds ways to reduce unacceptable impacts and to shape the project so as that it suits the local environment,

3- presents these predictions and options to decision-makers

Objectives of EIA:

1. To identify beneficial and adverse environmental impacts

2. To suggest measures which might enhance beneficial impacts

3. To identify and describe the residual adverse impacts which cannot be mitigated.

4. To aid selection of the "optimum" alternative (if alternative sites or project designs are being investigated in an EIA study)

5. To suggest mitigation actions which might reduce or prevent adverse impacts

6. To identify appropriate monitoring strategies to "track" impacts and provide an "early warning" system

7- To incorporate environmental information into the decision making process relating to development projects.

International Commitment to EIA for Aquaculture Development

FAO Code of Conduct for Responsible Fisheries

Stated in Article 6-19 that:

"*States should consider aquaculture including culture based fisheries, as a means to promote diversification of income and diet. In so doing, States should ensure that resources are used responsibly and adverse impacts on the environment, and on local communities are minimized*".

And in Article 9.1.5 stated that:

"*States should establish effective procedures specific to aquaculture to undertake appropriate environmental assessment and monitoring with the aim of minimizing adverse ecological changes and related economic and social consequences resulting from water extraction, land use, discharge of effluents, use of drugs and chemicals, and other aquaculture activities*".

EIA Procedures relating to aquaculture are extremely varied throughout the world

- EIA not required for aquaculture projects
- Only specific forms of information and consultation, no EIA
- Screening only required to determine the need for EIA
- EIA required for aquaculture above certain scales
- EIA required in some sensitive areas
- EIA required above certain scales and in sensitive areas
- EIA required for all aquaculture activities

GUIDELINES FOR EIA PROCESS *(adopted from UNEP 1996)*

1- Screening

An initial assessment to decide yes or no for "EIA"
Short report on submission in the form of an initial environmental examination (IEE)

2- Scoping

- To identify the key impacts requiring further investigation
- Prepare the terms of reference "TOR" for the study
- Public involvement
- Leads into an *Initial Environmental* Assessment (IEA)
- Determine the need for a full EIA and the scope of the exercise

3- Assessment

The identification, analysis, and evaluation of the significance of impacts
Selection of best options from an environmental perspective
Economic valuation of impacts

4- Mitigation

Identifying and developing measures to prevent, reduce or compensate for impacts

5- Reporting

Presenting the results of the impact assessment in a Useful and accessible format.

6- Reviewing

Assessing the adequacy of the EIA report, view of stakeholders, and assessing the acceptability of the proposal in terms of existing plans, policies and standards.

7- Decision-making

To decide whether the proposal can proceed and under what conditions, the decision-maker has the option to request that the project be redesigned (or aspects of the project redesigned) so that the environmental effects are minimized.

8- Monitoring and Managing

- Apply mitigation
- Monitoring impacts
- Taking action to recover problems

1- SCREENING

Objectives:

- An initial assessment to decide Yes or No for "EIA".
- Submission of an *initial environmental examination* (IEE).

Decisive factors:

- Coastal aquaculture is typically developed in physically and ecologically valuable and sensitive areas including salt marsh, mangrove, lagoons, estuaries, and coral reefs.

- According to UNEP (1996) full scale EA is typically required for proposals, which involve:

• exploitation of natural resources
• infrastructure
• industrial activities
• extractive industries
• waste management and disposal and
• substantial changes in farming or fishing practices

• According to the above two distinct criterion, most intensive aquaculture, and extensive aquaculture developments that involve habitat conversion, however individually small, require some form of EA.

• Clear and simple criteria for screening coastal aquaculture developments, and defining the level of EA should be available:

- Location (sensitive natural habitat, resources, other activities)
- Size of the project
- Farm Design, Cultured species & Technology
- Management and mitigation measures

- It is important to have a regional or sector EA; this will form the basis for developing screening criteria.

• Decision criteria: should be made clear in legislation, regulations or guidelines.

• Report "Initial Environmental Examination (Evaluation) IEE" Is a simple form of EIA

2- SCOPING

Scoping is a procedure for interaction between the interested public, government agencies, technical specialists and proponents.

Scoping offers an important opportunity for an initial evaluation of alternatives in terms of zoning, sitting, design and management, and proper modifications to the plan or proposal.

Typical Steps in scooping (Ridgeway et al., 1996)

Prepare an outline of the scope, with following headings:

1- Objectives and description of the proposal (Constraints, alternatives, issues, public involvement, and timetable)

2- Develop the outline of the scope through discussion with the proponent, the EIA authority, and other key stakeholders and government agencies.

3- Make the outline and supporting information available to those whose views are to be obtained.

4- Identify the issues of concern

5- Evaluate the concerns and priority of technical and subjective perspective

6- Develop a strategy for addressing and resolving each key issue, including information requirements and terms of reference "TOR" for further studies.

Responsibility and administration

Responsibility for scoping may lie with the proponent, or with the EA authority, or with an expert group set up for the purpose.

The main output from scoping is normally "TOR" that include:

- Background to the proposal and summary of the proposal
- Objectives of the EA
- Cooperation amongst authorities, legal/policy basis
- Institutional capacity
- Alternatives
- Required information and data analysis of impacts (positive, negative, natural resources, human resources, cumulative impacts, impact significance)
- Mitigation and monitoring
- Conclusions and recommendations, non-technical summary
- Study schedule, study budget, and expected outputs

(adapted from OECD 1994)

3- ASSESSMENT

Objectives:

- Identifying and defining the impacts
- Analyzing impacts: the collection of baseline data; the important characteristics of impacts and the range of different analytical techniques
- Determining impact significance or acceptability

Impact Identification:

- Positive and negative impacts
- Effects on natural resources, ecosystem, climate, atmosphere, habitats
- Effects on social consequences
- Effects on human health
- Utilization and disposal of residues and wastes
- Tools for impact identification include:
    - *Matrices*
    - *Checklists*
    - *Networks*
    - *GIS*
    - *Expert systems*

Analyzing Impacts:

Quantification

- *Mathematical models*
- *Case studies*
- *Professional experience*

Significance

- *Compare with existing or proposed standards*
- *Sustainability (continuity, financial viability, efficiency, etc)*

NEGATIVE AND POSITIVE IMPACTS OF AQUACULTURE

Negative Impacts:

- Damage to natural resources

Over exploitation of wild seed or broodstock
Over exploitation of fisheries (fish meal, trash fish)
Direct conversion of semi-natural habitats

- Damage to sites of cultural or aesthetic value
- Water pollution (disinfectants, antibiotics, antifungal, vaccines, food additives, hormones, EDTA, antifouling, ... etc)
- Loss of biodiversity and wetland habitat
- Solid waste production and disposal
- Social inequity (increase in income for successful farmers, increased cost of land or resources)
- Demographic impacts (outside labor)
- Impact on worker health (pesticides, disinfectants, antibiotics)
- Disease spread of cultured species
- Construction material (borrow pits, painting, anti-fouling)
- Product quality (residues in product)
- Genetic problems

Positive Impacts:

- Increased natural productivity
- Reduced plankton and nutrient loadings (filter feeders)
- Increased bio-diversity
- Hatchery production of over-exploited species
- Support for nutrition of local people
- Increased individual income
- Employment generation
- Training and education

	Natural function and conservation value	Commercial function/uses		Possible physical impact from proposed farm	Possible biological impact	Possible economic impact	Affected groups or communities
		actual	potential				
Ecosystem							
mangrove	coastal protection, Sediment trap, Nursery. Medium-high Conservation value Migrant birds etc.	poles, fuel, charcoal, bait, manufacturers, shellfish, fishery nursery	tourism; conversion to rice/arable; conversion to salt production; new organic; chemical products (e.g. Drugs, dyes etc)	locally increased water flow; increased salinity in dry season; reduced oxygen; increased organic sediment; increased inorganic sediment (construction phase); pH change?	mangrove species change?, other species change?; increased productivity; positive or negative effects on nursery areas?	increased commercial yield of mangrove products? Improved coastal protection? Probably insignificant	artisanal fishermen; offshore shrimp fishermen; mangrove wood collectors (charcoal, poles, manufactures, firewood); villagers (subsistence products); charcoal manufacturers.
river system	hippo, crocodile etc.	FW fishery		increased salinity in dry season; increased nutrient; increased organic sediment (if no settling); piscicides.	possible increased productivity; possible shift in species composition; accidental fish kills?	probably insignificant	river fishermen, tourist operators
estuarine system		fisheries, milkfish, mud-crab; shellfish		little	little	probably insignificant	coastal fishermen
Seagrass	nursery for coral reef and offshore species	nursery for coral reef and offshore species		possible slight impact of sediments in absence of settling	possible loss of fisheries	Probably insignificant	coastal and offshore fishermen
coral reef (to the south of estuary)		tourism	more tourism	Possible suspended solids in absence of settling, but N flowing currents imply low risk	Fouling and loss of corals	Probably insignificant	Reef fishermen, tourist operators; collectors
floodplain Grassland and scrub		rice salt	variety of arable arable etc.	Local loss (up to 180 ha)		Probably insignificant	
wider environment				Antibiotics, nutrients	antibiotic resistance? red tides?	?	?

An example of simple quantitative model

Output of phosphorus and nitrogen from an intensive brackish-water pond

Total projected production P
Food conversion ratio FCR
Total food Required = P*FCR
Nitrogen content of feed = Nf
Total nitrogen to pond = Nf*(P*FCR)
Nitrogen content of fish or shrimp = Ns
Nitrogen harvested in crop = Ns*P
Nitrogen retained in pond sediment = R
Nitrogen in farm effluent = (Nf*(P*FCR)) - (Ns*P)-R

For a dry pellet formulated feed, and reasonable food conversion, these calculations will typically yield:

- around 60 -120 kg nitrogen waste per tone production
- and 15 - 30 kg phosphorus waste per tone production.

4- MITIGATION

Objectives:

The main target of EIA is to mitigate and manage environmental impacts of aquaculture.

This can be done through improving:

Planning and Design
Infrastructure
Waste management
Water quality management

Mitigation measures at the sector level:

- Environmental quality standards for sensitive habitats (coral reefs, sea grass, mangroves, sand beaches, recreation areas .etc)
- Management of environmental capacity
- Code of conduct
- Disease exchange and stock movement protocols
- Regulations (farm registration, waste treatment, seawater charge .etc)
- Incentives (Financial and Market)

Mitigation measures at the individual farms level:

- Location (problems of site selection)
- Construction and design (settling ponds, primary treatment, integrated culture, buffer zones between farms and surrounding area)
- Operation and management (feed management, feed quality, species and seed, disease control, effluent water management)

6- REVIEWING

The review process for project EIA should be clear and consistent, using standard criteria, for the sake of the proponent, the public, and the decision makers.

Objectives:

- To determine whether the information is:
  Scientifically correct and adequate
  Understood by public and decision makers
  Supporting recommendation for mitigation and environmental management

OR additional information are required

- To ensure that opinions of all stakeholders and parties are taken into consideration
- To ensure that the report and process conform with TOR
- To determine whether the proposal complies with existing plans, policies, standards and codes of practice.

7- DECISION-MAKING

Government politicians usually do decision-making, and they are generally depending upon their officials and technical specialists for a summary evaluation of EIA process and technical contents of report.

Outcomes:

- Proposal approved
- Proposal approved with conditions
- Proposal can be approved after on-going investigation
- Supplementary or new EIA is required
- Proposal is rejected

8- MONITORING

Objectives:

To ensure:

Adherence to conditions of approval
Expected impacts are maintained within the levels predicted
Mitigation measures are effectively applied

To provide:

Information on change in environmental management plan
Feedback on EIA process and how it works

Responsibilities:

Need to be defined and allocated:

Who will do, who will pay?
How information, results and actions will be managed?

Monitoring activities:

Baseline monitoring	(Pre-project)
Effects monitoring	(during project implementation)
Performance monitoring	(periodic)
Inspection	
Environmental audit	(regular assessment of performance)

Effective data collection:

- Sampling program (realistic, relevant methods)
- Quality control
- Data Compatibility (old and new)

Toward an Eco Friendly Aquaculture Development

Examples of Cultured Species and Their Echo-friendly Practices

Cultured Species	Potential Negative Impacts	Echo-friendly Practice
Finfish Culture Cage Culture	- Solid wastes from feeds - Chemicals - Feedback impacts	- Automatic feeders - Improved feeds - Water recycling
Seaweed Culture Line & net culture	- Fertilization - Fouling organisms	- Culture in tanks & raceways - Water treatment
Bivalve Culture Floating rafts and racks	- Reduced phytoplankton - Organic wastes (faeces)	- Relocation of cultured units - Polyculture & integration
Shrimp Culture Earthen ponds	- Habitat removal - Fertilizers, chemicals - Effluent discharge - Pathogens	- Intensive farming - Stress prevention - Settling ponds & integration - Strict quality control

Toward an Eco Friendly Aquaculture Development

Conservation and Protection of Environment

Farming of Echo friendly Species

Extensive culture and sea ranching

Sea cucumber
Giant clam
Lobsters
Top shell
Ornamental fish

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INTEGRATED COASTAL MANAGEMENTAL CONCEPTS AND DEFINITIONS

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Paper presented as a keynote address at the "ENVIRONMENTALLY FRIENDLY AQUACULTURE AND FISHERIES PRACTICES" Workshop held at Hurghada, Egypt on September 15-17, 2002

INTRODUCTION

The scholarly literature on integrated coastal management has tended to focus primarily on the land-sea interface and on approaches, options, and methods for controlling the uses of coastal land (see, e.g., UNDIESA 1982; Clark 1991; Sorensen and McCreary 1990; Chua 1993). A complementary but separate body of literature has examined the use and management of ocean areas under national jurisdiction, exploring such aspects as the organization of national agencies to address ocean issues and promotion and regulation of ocean uses (see, e.g., Vellejo 1993; Juda and Burroughs 1990; Vallega 1992; Cicin-Sain and Knecht 1985; Knecht, CiciSain, and Archer 1988; Van Horn, Peet, and Wieriks 1985). This separation in the literature reflects, in effect, historical practice by nations around the world. Traditionally, "ocean" management issues-such as the extent of a nation's maritime zone and its maritime boundaries with other nations and the nation's stance in international for a on such issues as freedom of navigation and conservation of highly migratory species (e.g., whales and long-distance fisheries)-have been within the purview of national governments, particularly of foreign ministries and specialized fisheries and maritime agencies (traditionally dealing with maritime transportation and ports), and often, as well, of military agencies such as naval departments. Coastal management, in contrast, traditionally began on the landside of the coastal zone, focusing on issues related to the special interface between the land and the sea, such as shoreline erosion measures, protection of wetlands, siting of coastal development, and public access to the coast. Because these issues initially centered on control and regulation of coastal land, they tended to be handled by planning-type agencies at provincial and local levels of government, sometimes with national-level intervention and at other times without it.

Increased use of the oceans and coastal zones in the twentieth century-including the establishment and operation of offshore oil production installations and aquaculture facilities, all forms of coastal recreation and tourism, use of the ocean for waste disposal, ocean mining, and so on-has posed considerable challenges to this often dual system of management-ocean and coastal, and has called attention instead to the "seamless web" that ties ocean and coastal activities together. Over the past several decades, for example, we have come to understand the important influences of land activities on the quality of the water on which ocean-based activities such as fishing, aquaculture, and tourism. It is now well recognized that land-based activities account for more than 70 percent of all marine pollution. Similarly, all ocean activities-from fishing to marine transportation to offshore oil production to recreation-emanate from and

have their bases on coastal and in the form of harbor and port space, onshore processing facilities, and the like.

Given the divergent historical evolution of ocean and coastal affairs in most nations, however, ocean and coastal activities may not be within the purview of the same government, agencies, thus often involving problems of coordination and harmonization of governmental activities in the coast and ocean. This is a typical problem in integrated coastal management.

Considerable work has been done in recent years in defining the major characteristics of integrated coastal management; see, for example, dark 1991, Sorensen and McCreary 1990, Chua 1993, Scura et al. 1992, Vallega 1993, FAO 1991, Bower 1992, Van der Weide 1993, and Cicin-Sain 1993. Although different authors emphasize somewhat different aspects of integrated coastal management (partly as a result of diverse disciplinary backgrounds and partly as a reflection of their varied experiences with integrated coastal management in different parts of the world), there appears to be growing agreement on the outlines of a general model of integrated coastal management. Further the models of integrate coastal management that several major international entities, such as the World Bank, UNEP, the OECD, the World Conservation Union, formerly the International Union for the Conservation of Nature and Natural Resources (IUCN), and others have put forth in recent years in the form of international ICM guidelines are by and large consistent with one another and reflect growing international consensus on what ICM is all about.

In this presentation we thus present a simplified model of integrated coastal management by addressing a set of questions which decision markers are likely to pose:
- What is integrated coastal management?
- What are its goals?
- What triggers the need for ICM?
- What does integrated mean in ICM?
- What is being managed (land, sea areas, resources)?
- What are the functions of ICM-what does ICM actually do?
- Where is ICM applied-what are the boundaries?
- How are management carried out and what guiding principles are used?
- Who should carry out the management-national or sub-national levels of government or both?
- What are the typical stages in developing ICM?
- What capacity is needed for ICM?
- What kinds of institutions should carry out ICM?

Although our discussion in this presentation is largely conceptual and presents basic definitions of different aspects of ICM, we provide example from countries around the world.

FUNDAMENTAL CONCEPTS

In this section, we pose and answer a series of questions as way of explaining the concepts that we believe are fundamental to an understanding of integrated coastal management.

What is integrated coastal management?

Integrated coastal management can be defined as a continuous and dynamic process by which decisions are made for the sustainable use, development, and protection of coastal and marine areas and resources. First and foremost, the process is designed to overcome the fragmentation inherent in both the sectoral management approach and the splits in jurisdiction among levels of government at the land-water interface. This is done by ensuring that the decisions of all sectors (e.g., fisheries, oil and gas production, water quality) and all levels of government are harmonized and consistent with the coastal policies of nation in question. A key part of ICM is the design of institutional processes to accomplish this harmonization in a politically acceptable manner.

Integrated coastal management is a process that recognizes the distinctive character of the coastal area-itself a valuable resource- and the importance of conserving it for current and future generations. The coastal area, be it continental or island based, is a special area where land and sea meet that includes various characteristics:

- The coastal area is characterized by dynamic and frequently changing physical feature such as changes in beaches and barrier islands due to the force of winds and waves.
- Valuable ecosystems of great productivity and biodiversity are present, such as mangrove forests, sea grass beds, other wetlands, and coral reefs-all of which provide crucial nursery habitat for many marine species.
- Coastal features such as coral reefs, mangrove forests, and beach and dune systems that serve as critical natural defenses against storms, flooding, and erosion.
- The area is generally of great value to human populations as they seek to settle in, use, and enjoy coastal marine resources and space.
- The coastal area provides the base for all human activities in the ocean-from marine recreation and fishing to marine transportation and offshore mineral development. Many of these activities represent significant

economic benefits-both actual, for those resources already under exploitation, and potential for resources yet to be exploited. All such activities depend, to various extents, on the coastal area for their operation.

- Because the coastal area is often highly desired by various users, coastal space is a finite resource over which there are often conflicts.

- Management of the two sides of the coastal area-land and sea-poses difficult challenges and complexities based, in part, on the public character of the ocean area and the generally mixed public and private character of the land area. typically, the presence of "general-purpose" government authorities for land and "single-purpose" authorities for the ocean further complicates the governance issue.

Islands, unique in being surrounded and enclosed by the sea, represent the maximum coastal condition and thus require a high degree of integrated coastal management. For small islands, the coastal zone and ocean may be the only potentially developable assets. Consequently, planning and management for these resources require great care if a long-term pattern of sustainable development is to be achieved.

What Are the Goals of ICM?

The goals of integrated coastal management are to achieve sustainable development of coastal and marine area, to reduce vulnerability of coastal areas and their inhabitants to natural hazards, and to maintain essential ecological processes, life support systems, and biological diversity in coastal and marine area. Integrated coastal management is multipurpose oriented: it analyzes implications of development, conflicting uses, and interrelationships among physical processes and human activities, and it promotes linkages and harmonization between sectoral coastal and ocean activities.

What Triggers the Need for ICM?

The need to establish a program of integrated coastal management in a particular nation may arise for a number of reasons, Depletion of coastal and ocean resource (e.g., through over fishing or exploitation of coral for building materials) typically is a powerful trigger. Another important catalyst may be an increase in pollution that endangers public health, or poses threats to water-based industries such as aquaculture, fishing, and tourism, a desire to increase the economic benefits obtained from use of the coast and ocean (as through fostering marine tourism) may also point out the need for ICM planning and management. A related catalyst may be desire to develop uses of the coastal and marine area previously not

exploited in a particular country, such as extraction of offshore oil or other minerals, marine aquaculture, or new forms of fishing for under-exploited stocks or in different areas.

What Does Integrated Mean in ICM?

Five main zones can be identified in the coastal-marine spectrum: *in/and areas,* which affect the ocean mainly via rivers and non-point sources of pollution; *coastal lands*-wetlands, marshes, and the like-where human activity is concentrated and directly affects adjacent waters; *coastal waters*- generally estuaries, lagoons, and shallow waters-where the effects of land-based activities are dominant; *offshore waters*, mainly out to the edge of national jurisdiction (200 nautical-miles offshore); and *high seas*, beyond the limit of national jurisdiction.

Although natural processes in these five zones tend to be highly intertwined, it is difficult to integrate management regimes across the zones because the nature of property, the nature of government interests, and the nature of government institutions tend to differ in these zones, as summarized in figure 2.1. Roughly speaking, with regard to the nature of property in coastal areas, there tends to be a continuum of ownership: in inland areas, private property tends to predominate; on coastal lands, there tends to be a mix of public and private property; and in coastal and offshore waters, public property concerns are dominant. This generalization, of course, varies somewhat from country according to cultural conceptions of private and public property. In many South Pacific islands, for example, coastal lands and waters are often communally controlled by village-level councils of elders (see, e.g., South et al. 1994).

With regard to the nature of government interests, local or provincial interests tend to predominate in inland areas, whereas there tends to be a mix of local, provincial, and national interests on coastal lands and in coastal waters. Moving farther out, ultimately of offshore waters and the high seas, national and international interests become most important. The nature of government institutions also differs in the various zones. On land, there are often well-established "multiple-purpose" government institutions at the local and provincial levels to address such questions as control of land use and conflicts among uses. On the waterside, there tends to be only "single-purpose" provincial or national agencies operating, each concerned primarily with a single use of the ocean, such as fisheries operations or oil and gas extraction. Given these differences, management of the five zones may require common and complementary, yet somewhat differentiated, approaches and institutions.

Several dimensions of integration need to be addressed as a part of an ICM process:

1. *intersectoral integration.* Integration among different sectors involves both "horizontal" integration among different coastal and marine sectors (e.g., oil and gas development, fisheries, coastal tourism, marine mammal protection. port development) and integration between coastal and marine sectors and land-based sectors that affect the coastal and ocean environment, such agriculture, forestry, and mining. Inter-sectoral integration also addresses conflicts among government agencies in different sectors.

2 *Inter-governmental integration,* or integration among different levels of government (national, provincial, local). National, provincial, and local governments tend to play different roles, address different public needs, and have different perspectives. These differences often pose problems in achieving harmonized policy development and implementation between national and sub-national levels.

3. *Spatial integration,* or integration between the land and ocean sides of the coastal zone, there is a strong connection between land-based activities and what happens in the ocean involving water quality, fish productivity, and the-like; similarly, all ocean activities are based or dependent on coastal land. And yet different systems of property ownership and government administration predominate on the land and ocean sides of the coastal zone often complicating the pursuit of consistent goals and policies.

4. *Science-management integration,* or integration among the different disciplines important in coastal and ocean management (the natural sciences, the social sciences, and engineering) and the management entities. Although, the sciences are essential in providing information for coastal and ocean managers, there often tends to be little ongoing communication between scientists and managers. (Here, the sciences are broadly construed to mean the natural sciences concerned with the oceans and coasts, such as oceanography, coastal processes, and fishery sciences; the social sciences, concerned with coastal human settlements and user groups as well as management processes that govern ocean and coastal activities; and coastal and ocean engineering, which focuses on all forms of coastal and ocean structures).

5. *International integration.* Integration among nations is needed when nations border enclosed or semi-enclosed seas or there are international disputes over fishing activities, transboundary pollution, establishment of maritime boundaries, passage, of ships, and other issues. Although in many instances, coastal and ocean management questions are within the purview of national and sub-national governments within national

jurisdiction zones (200-nautical-mile EEZs, extended fishery zones), in many other cases, nations face ocean and coastal management problems vis-à-vis their neighbors and thus must seek internationally negotiated solutions. Typically, the national government plays the leading role in such negotiations.

What Is Being Managed in ICM?

Authors differ in term of what areas, resources, and activities they include under the aegis of integrated coastal management. At its heart, ICM, in our view, is concerned with area management and with interactions among various resources and activities in specific coastal and ocean area. Although ICM must include both coastal lands and coastal waters because of the important reciprocal effects of processes and activities in these two areas, how far offshore and onshore an ICM regime should extend depends on the situation at hand.

What resources and activities should come under the aegis of ICM? The many resources and activities that take place in coastal lands and waters-fisheries, nonrenewable resource extraction, tourism, agriculture and aquaculture, residential and commercial real estate development, marine transportation, recreation, and so forth-all represent specialized activities that are generally already within the purview of specialized agencies. In most cases, ICM would not supplant such specialized sectoral management but would instead supplement, harmonize, and oversee it. Thus, for example, fishery managers would continue to concern themselves with fishery allocations and the like, but an integrated coastal management entity would take primary responsibility for the effects of land-based sources of pollution on fishery nursing areas as well as with the links (both positive and negative) between fisheries and other uses.

What Are the Functions of Integrated coastal Management?

In contrast to sectoral entities and processes, which tend to be concerned with only one use or resource of the coastal and marine environment, the ICM process is expected to address several important functions related to overall patterns of use, the well-being of marine and coastal areas, and the protection of key fisheries habitat.

Typical activities related to these functions are detailed in the following table.

- The most significant ICM activities practiced are.
- Studies or activities to *promote economic development,* especially for marine aquaculture.

- Studies or activities *stewardship resources by the* conduct of environmental assessments.
- Conduct of studies of multiple uses and their interactions.
- Studies activities related *protection of public safety;* the most common activity was construction of coastal defense measures such as seawalls.
- Finally, studies regarding *proprietorship of public submerged lands and waters.*

Where Is ICM Applied?

- The coastal area is a distinctive resource system that requires special management and planning approaches. The major resource systems of the cost and coastal habitats (such as coral reefs and mangrove forests) are not only distinctive but also extremely productive of renewable resources. Marine resources also are highly distinctive. The high mobility and interdependence of marine resources and processes also makes traditional land-based management not altogether suitable for coastal area management.
- Water is the major integrating force of coastal resource systems. Because it operates at the land-water interface, ICM relates to water in one way or another, whether making provisions for marine commerce, the ravages of sea storms, resource conservation, or pollution abatement. The water influence not only establishes special conditions but also dictates unusual and complex institutional arrangements (Clark 1992).
- Significant interactions take place across the land-water boundary and require that the whole system-upland, shore land, intertidal area, and nearshore waters-be recognized and managed as an integral unit.

Hence, the following principles are suggested:

a. Since landforms fronting on the water's edge (sand dunes, mangroves. fringing coral reefs) play a key role in combating erosion and sea-level rise and contribute to long-term sustainability, they should be maintained.

b. Care should be taken to maintain salt marshes, coastal wetlands, and other coastal habitats in their natural condition.

c. Emphasis should be placed on "designing with nature" -for example, using special vegetation rather than physical structures for erosion control.

d. In considering coastal development projects, interruption of the natural longshore drift system should be kept to an absolute minimum.

e. Special protection must be provided for rare and fragile ecosystems and endangered and threatened species in order to ensure that the biodiversity of the ecosystem is not reduced or lost.

3. Principles related to the use of coastal and ocean resources and space.

These principles relate to management of conflicts in coastal areas, development of guidelines for use, and public participation:

a. Generally, protection of living resources and their habitats should be given priority over exploitation of nonliving resources; nonexclusive uses should be preferred over exclusive uses; and reversible exclusive uses should be preferred over irreversible exclusive uses. Potential conflicts should be identified early and in an orderly fashion, and equitable solutions should be developed by processes that protect and enhance public order (Van Dyke 1992; Archer and Jarman 1992).

b. New developments in the coastal zone that are water dependent should have priority over those that are not. For example, construction of a new port facility should have priority over construction of a new office building.

c. The historically based claims of indigenous peoples to ocean space and ocean resources should be recognized an their traditional practices of dealing with ocean resources from a perspective of kinship and harmony should be followed whenever possible (Van Dyke 1992).

d. Based on recent assessment studies of climate change, adverse effects in the coastal zone, such as increased erosion, flooding, and saltwater intrusion should be addressed within the framework of ICM.

e. When considering retreat as an adaptation option in dealing with accelerating sea level, efforts should be made to create or make provisions for new habitats for coastal resources (e.g., wetlands) and species that otherwise would be lost.

Who Should Carry Out the Management?

Most analysts would agree that a combination of national and provincial or local authorities is needed to carry out integrated coastal management, although analysts will vary on the extent to which they emphasize a "top-down" or a "bottom-up" approach. Local community concerns, even in centralized political systems, are always important in integrated coastal management processes, particularly with regard to inland areas and coastal lands. On the other hand, as discussed earlier, the national government's role becomes more and more dominant as one goes farther offshore.

What Are the Typical Stages in Developing an ICM program?

As with any other public policy, the policy for integrated coastal management generally goes through a number of predictable stages of development-issue identification and assessment, program preparation or formulation, formal adoption and funding, implementation, operation, and evaluation (see figure).

Although circumstances in different nations will, of course, differ, we detail here typical stages in the development of an ICM program; these are adapted, in part, from international guidelines prepared by the World Bank (1993). We emphasize that these steps are merely illustrative of one possible path of ICM development. Many different ways of developing ICM programs are in evidence around the world, reflecting each nation's particular physical, socioeconomic, cultural, and political conditions.

Stage 1. Identification and Assessment of Issues

- The need for management action is recognized as a result of such factors as an environmental crisis, deteriorating resource conditions, or perceived economic opportunities in the coast or in the ocean.
- Consultative meetings with key agencies and stakeholders confirm the presence of problems and/or opportunities and the need for action.
- A concept paper outlining the need for ICM may be prepared.
- A team is created to formulate an ICM plan.

Stage 2. Planning and Preparation

- Necessary information and data on the physical, economic, and social characteristics of the coastal zone, as well as on existing politic jurisdictions and on governance issue, are assembled.
- A plan for public participation in the ICM process is developed.
- Management problems (causes, effects, solutions) and development opportunities are analyzed.
- Priorities are set for addressing problems and opportunities, taking into consideration technical and financial feasibility and availability personnel.
- Feasibility of new economic development opportunities is assessed.
- Appropriate coastal area management boundaries are considered. New management measures, such as zonation schemes, strengthened regulatory programs, and market-based incentives are considered.
- Institutional capacities are assessed. Options for development of suitable governance arrangements, including intersectoral and intergovernmental coordination mechanisms, are developed.
- Recommendations are made for policies, goals, and projects to include in the ICM management program.

- Appropriate monitoring and evaluation systems are designed.
- A timetable, a strategy, and a division of labor are established.

Stage 3. Formal Adoption and Funding

- Policies, goals, new management measures, and initial projects are adopted.
- Governance arrangements are established or improved, including establishment or strengthening of intersectoral and intergovernmental coordination mechanisms.
- Coastal management policies, principles, boundaries, zoning schemes and so forth are adopted, often by legislative action.
- Staffing and required organization changes are put into effect.
- Funding arrangements are put into effect.

Stage 4. Implementation, Operation, and Evaluation

- Governance body begins oversight of the ICM process and programs.
- New or revised regulatory programs come into effect.
- Individual sectoral line agencies continue to perform their regulatory a management responsibilities but now as part of the overall ICM program.
- Specific projects are designed and undertaken in connection with new economic opportunities in the coastal zone.
- A performance monitoring and evaluation program is initiated.

Hence, it is important that ICM efforts not concentrate for too long on planning and delay implementation. This has been the tendency in some situations-to spend many years on studies, inventories, plans, and the like without moving to the stage of adopting, implementing, and enforcing an ICM program.

What Capacity Is Needed for ICM?

Various kinds of "capacity" are needed to successfully carry out an integrated coastal management program:

- *Legal and administrative capacity* –for example, to designate a coastal zone, to develop and carry out coastal plans, to regulate development in vulnerable zones, and to designate areas of particular concern.
- *Financial capacity* -adequate financial resources to carry out the planning and implementation of coastal management efforts.
- *Technical capacity* -information gathering and monitoring of coastal and marine ecosystems and processes, patterns of human use, and the effectiveness of government coastal management programs. Establishment and maintenance of coastal database and information system.

- *Human resources capacity* -personal with interdisciplinary training in social sciences (including law and planning), natural and physical sciences, and engineering. Also, public awareness and understanding of the coastal ocean environment and the problems and opportunities it offers.

What Kinds of Institutions Should Carry Out ICM?

A fundamental part of most ICM programs is the institutional mechanism created to harmonize the various activities and programs that affect the coastal area and its resources. The proper functioning of such a mechanism is, of course, at the heart of a successful ICM process. To be effective, such a mechanism should have the following attributes:

- It must be authoritative; that is, it must have appropriate legal/legislative authority.
- It must be able effect the activities of all agencies and levels of government that have decision-making authority relative to the coastal zone.
- It must be seen as a legitimate and appropriate part of the process.
- It must be capable of making "informed" decisions; that is, it must have access to appropriate scientific and technical expertise and data.

The institutional form of the harmonization mechanism will, of course, depend upon the particular nation involved and its government traditions and philosophy. Agenda 21 calls for states to consider establishing (or strengthening) appropriate coordinating (such as a high-level policy-planning body), at both the local and national levels, to promote integrated management and sustainable development of marine and coastal areas and to consider strengthening (or establishing) national oceanographic commissions to catalyze and coordinate the needed research. Some options for developing coordinating mechanisms include creating an interagency committee, naming a lead agency, creating a new agency, and training agency personnel to instill an integrated, in contrast to a sectoral, perspective.

There are three features that tend to enhance the effectiveness of the integrated coastal management process: the coastal management entity and process should be a higher bureaucratic level than the sectoral agencies to give it the necessary authority to harmonize sectoral actions; the effort should be adequately financed and staffed; and the planning aspect of integrated coastal management should be integrated into national development planning.

ENVIRONMENTALLY FRIENDLY FISHERIES AND AQUACULTURE FROM INTEGRATED COASTAL ZONE MANAGEMENT PERSPECTIVE

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Paper presented as a keynote address at the "ENVIRONMENTALLY FRIENDLY AQUACULTURE AND FISHERIES PRACTICES" Workshop held at Hurghada, Egypt on September 15-17, 2002

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1. What is Coastal Zone Management?
2. Egyptian ICZM today's situation.
3. Scope of the Problem.
4. Can We Solve This Problem?
5. Recommendation

WHAT IS COASTAL ZONE MANAGEMENT

Integrated Coastal Management (ICM) is an interdisciplinary and intersectoral approach to problem definition and solutions in the coastal zone. The purpose of ICM is to maximize the benefits provided by the coastal zone and to minimize the conflicts and harmful effects of activities on social, cultural and environmental resources. The ICZM main goal and objective is to promote environmentally sustainable development of coastal areas. The process itself could encompasses a range of activities such as:

1-Encourage community based management of coastal resources.

2-Promote large-scale infrastructure development (ports, industrial and residential parks, etc.).

3-Design program for pollution and erosion control.

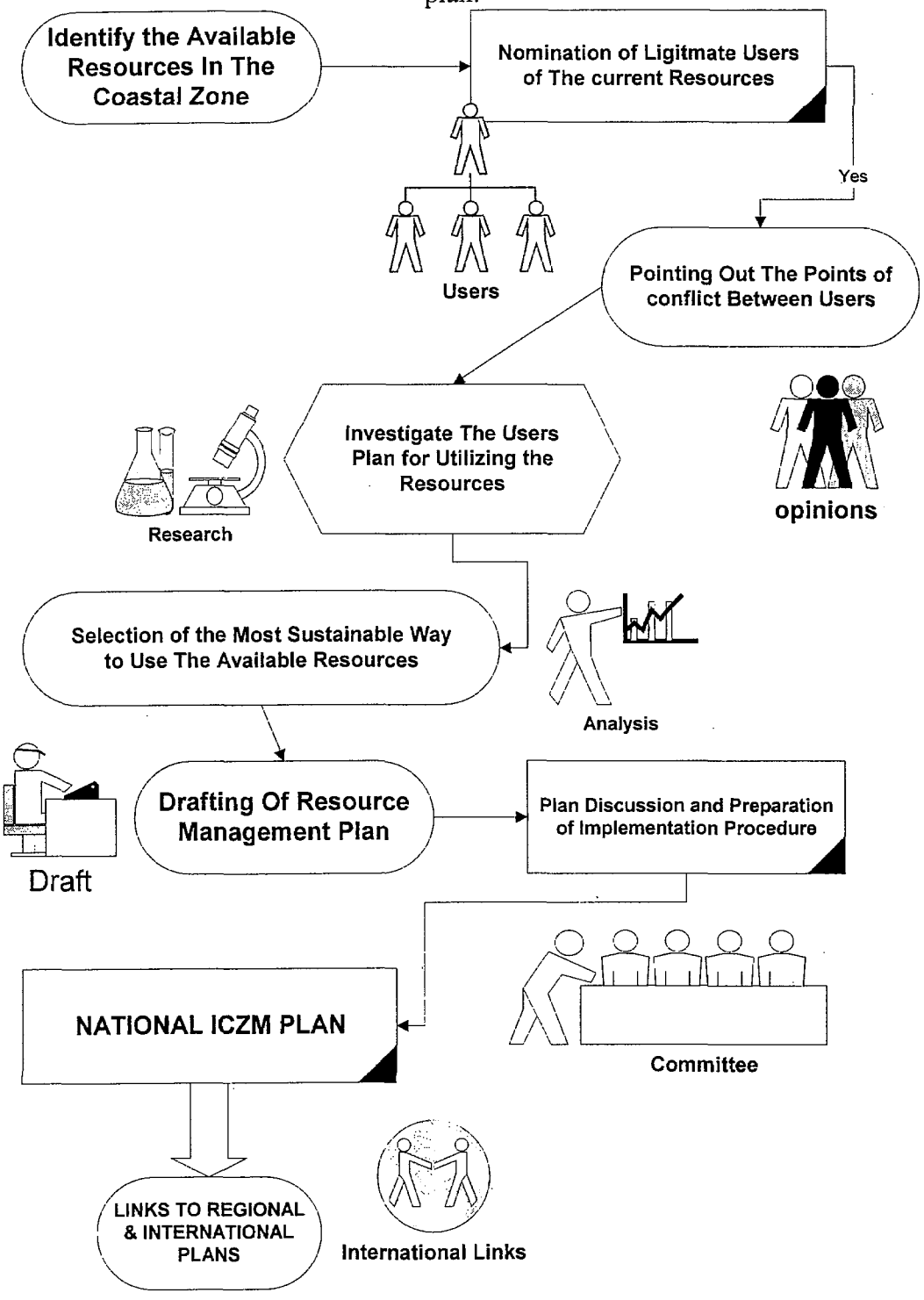
4-Co-ordinate Coastal activity such as: aquaculture, tourism and recreation.

5- Develop oil spill contingency planning, and navigational risk assessment plan.

A successful ICZM plan is a process of governance that consists of the legal and institutional framework necessary to ensure that development and management plans for coastal zones are integrated with environmental and social goals, and are developed with the participation of those affected.

ICZM starts with an analytical process to set objectives for the development and management of the coastal zone. ICZM should also ensure that the process of setting objectives, planning and implementation involve as broad spectrum of interest groups as possible, that the best possible compromise between the different interests is found, and that a balance is achieved in the overall use of a given country's coastal zones.

A simple diagram represents the steps toward preparation of coastal zone management plan:



Egyptian ICZM Today's Situation:

The Hurghada Effort:

During the meeting held in Hurghada 5-7 May 1995 under the supervision of EEAA and in cooperation with DANIDA and DGIS for development of ICZM strategy for Egypt 8 working papers were discussed including the following subjects:

- Marine Subsystems
- Coastal subsystems
- Land subsystems
- Western Mediterranean coast.
- Great Alexandria.
- Nile Delta Coast
- North Sinai Coast
- Red Sea Coast

The Hurghada workshop identify the problems of the Egyptian coasts is to be coming from the unsustainable use of resources and the unplanned development. And summarize the problems in five major issues:

- Coastal Pollution.
- Coastal Erosion.
- Decline of natural habitat
- Decline of Biodiversity
- Over exploitation of resources

The results of the workshop in Hurghada was the Framework document which identify the long term, medium and short term objectives in form of projects to study the five previous issues. One of the other benefits gained from this meeting is the formation of the National ICZM committee.

Do We have a policy,.....Yes.

The committee was formed by ministerial decree in 2001 after two meeting in EEAA as the head of this committee and with the attendance of representatives of 13 Ministry and Agency even included NGO and university representatives. The Committee convened only twice in the last 6 years for discussing several subjects.

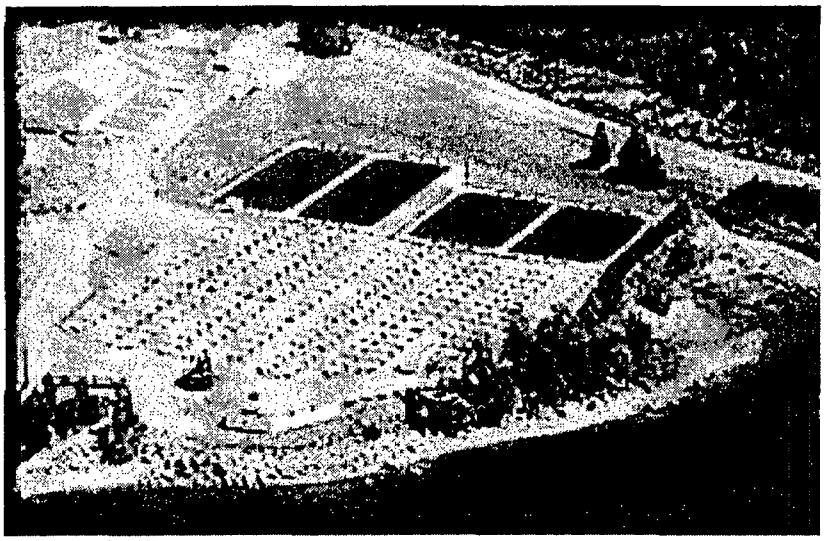
Do We Have problems in different sectors, ... *Yes.*
Several problems had been coming to surface which may be under the major issues nominated by Hurghada workshop but never been addressed properly. However, the identifying of the problem was not enough without suggesting a solution.

Does the National ICZM Plan working .....*May Be?*
To My knowledge the carrying out of ICZM implementation was in the mandate of EEAA according to the law 4/1994. The steps taken in this direction is too slow which makes the effect of the plan not clear for many sectors in our society.

Can We identify the priority for fisheries and aquaculture?
Sustainable Fisheries is a major concern of coastal and marine resources management, and Many International organizations in partnership with each other are working to develop strategies for sustainable fisheries throughout developing countries.

A special unit within the Egyptian committee should be formed for identifying the issues and focuses specifically on fisheries and aquaculture its major task is to provide current and background information on the technical parts concerning both fisheries and aquaculture.

Do they contradict with each other?
No the two subjects are completely separate taking in consideration that fisheries has the first priority because it is linked to a larger sector of the society and Aquaculture is more or less a compensating process for the drop in fisheries.



SCOPE OF THE PROBLEM (Fisheries)

Several questions should be answer concerning this subject of fisheries these including the following (Discuss the answer Interactively):

Q1: Knowing the history of fishing practices in the Red sea coast, Do we have previous problems concerning the fishing techniques? The problems of fisheries in the Red Sea come with the increasing of population and the demand of fishes by touristic establishments.

Q2: When and Where the fishermen use Line >< nets? It depends mainly on the understanding of the damage caused by using the wrong techniques to the marine habitat especially coral reefs.

Q3: Do we still have Legal ><illegal Fishing Practices? Yes we still from time to time have a dynamite fishing and small mesh nets in several parts of the coast specially the southern part.

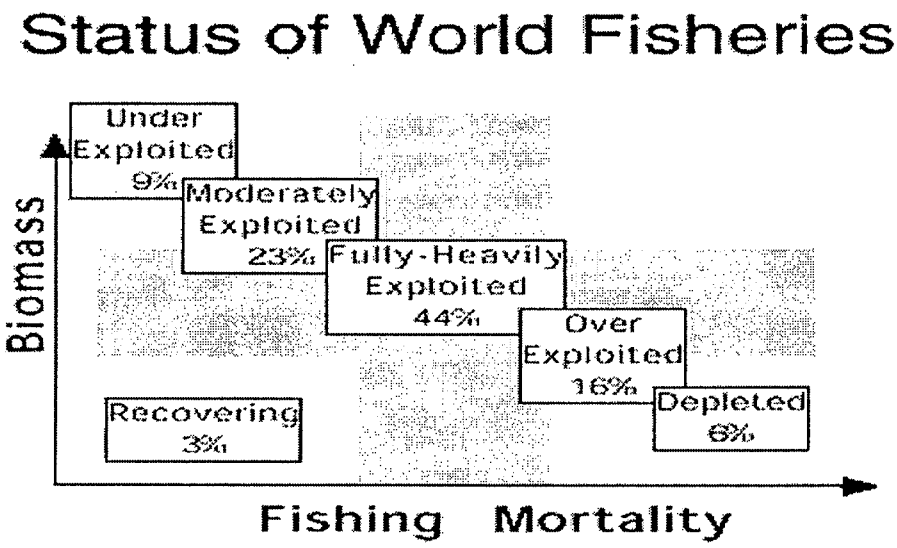
Q4: Do we have a defined Fishing grounds? I do not know??????

Q5: The problem of Fishing Permits and Zoning could be solved? Yes but with a great level of co-ordination between Fisheries officials and coast guards.

Q6: Do we apply Seasonality of Productivity concept? I do not know??????

Q7: Do the Original Red Sea Fisherman still exist? A very few of them still working and the rest have shifted his interest to tourism which bringing more money.

Q8: What the status of fisheries Worldwide and do we fit within. I do not think that the Egyptian Overview is clear?



SCOPE OF THE PROBLEM (AQUACULTURE)

The Need for Aquaculture

We have to ask our selves Do we really need Marine Aquaculture in the Red Sea coast? Does it worth the effort to develop? and if compared to other land use plans (e.g. tourism) what is the cost-benefit of having it? The answer to all of that should come from the previous experiences conducted in countries have the same situation.

Do the Aquaculture projects exist (the story of the 72 sites):

The story beginning was with dedication of 72 sites on the Red Sea coast by TDA (the land owner) to be used as base for aquaculture projects. The sites are to be managed by the GAFD and if it is not successful it will be back to TDA for reuse as touristic resources. The problem is this site never been examined by experts in this field for their suitability for aquaculture and the EIA for the project is the main issue in this case. Only Two projects (up to our knowledge) were successful to pass EEAA requirements for EIA and both are in the north of Hurghada. The rest are still struggling. Some of the project even make a start but on the wrong foot and got in trouble with EEAA.

The Major Dispute:

The components of Environmental Impact Assessment for Aquaculture project should contain the following items clearly defined:

- Who do I design the Intake from the seawater?
- Where the outlet going to be and the technology needed?
- The water Quality for the discharge?
- What species of fish I am going to culture (without contradict with Law 4/1994)?
- The type and method of feeding and coast?
- From where I am getting the Utilities (freshwater and Electricity)?
- Who much fish I am going to produce from the project?
- Do I have a marketing plan for the products?

The conflict between Aquaculture and Tourism

The whole idea of using the available resources in the coast is to increase the national income for our country and to achieve the ultimate goal of

sustainability of use for the resources. The conflict between aquaculture and tourism comes from the competition on the space available for performing the activity of aquaculture but it is a matter of scientific planning and management.

The need for further studies and past experience

Studies and experimentation on aquaculture is needed in combination with using previous experiences from other countries have the same situation (same habitat, water quality, weather,). Also the use of Technology transfer option is one of the solutions to the aquaculture problems.

Aquaculture for exotic species (an Alternative)

To most of the Egyptian aquaculture mean fish culture because the anthropological habits of the population is to eat only fish and very few eat other sea animals specially those on the coastal cities. The increase in public awareness about the benefit of depending on other sources such as shell fish and crustaceans, sea cucumber as source of food beside fish may encourage the investment in aquaculture of such exotic species for local use or for exporting which in both cases will result in increase in income.

Can We Solve the Problem?

The role of General Authority

The role played by the GAFD in the last few years in promoting fisheries by all means have created great arguments between them and the concerned ecological parties represented by EEAA and some other Authorities (RSG). The fact that the sustainable use of resources will

keep these resources for longer time for the future generations was not clear in the plan of GAFD and the main goal was to reach the highest amount of catch per year. The evolving of activities new to the area such as SHARK FINNING, the SEA CUCUMBER fishing and the trade in Small Coral Fishes for aquarium is a responsibility of the decision maker!!. *We hope that the understanding of the unique nature of the Red Sea will help in designing future programs and planning of the future policy.*

Some Suggestions for Development of Fisheries Industry in The Red Sea

Most of the following suggestions could be adopted by certain authority (s) as separate project help in the overcoming of current and future problems:

1- Promote the collection of fisheries real time data and the establishment of data base in each landing site and link them all with central database.

2- Prepare a new Red Sea fisheries map including all fishing sites and indicating the type of fishing practices that are allowed in the areas.

3- Study the Reef Fishing Capacity (or Reef Stock assessment) through an experienced firm specialized in this kind of study including training of the GAFD personal on such techniques.

4- Stop migration of fishermen from different parts to the Red Sea through controlling of the permit systems in co-operation with the Navy and Coast Guard.

5- Promote enforcement of the regulation against illegal fishing gear and practices in co-operation with EEAA for inspection of the gears and incriminate the use of illegal or destructive methods.

Some Suggestions for Development of Aquaculture in The Red Sea:

Most of the following suggestions could be adopted by certain authority (s) as separate project help in the overcoming of current and future problems:

1- Develop a new strategy for Aquaculture in the Red Sea to be included in the national ICZM and adding a representative to the National Committee.

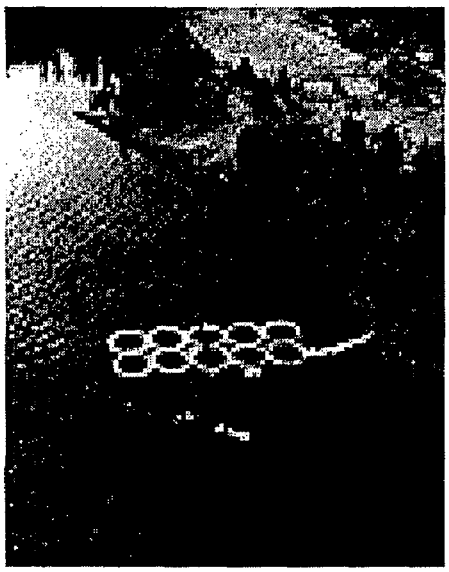
2- Reselect the sites for aquaculture projects according to scientific criteria.

3- Studying the best available technology in Aquaculture and select what is suitable for the Red Sea.

4- Develop a Standard EIA especially for Aquaculture agreed upon from EEAA.

5- Seeking the international experience through International Donor Agencies.

6- Develop and encourage the culture for exotic species (Shellfish, cucumbers etc).



Recommendations

1- The increase of the presence of fisheries and aquaculture in the national and Regional ICZM plans.

2- Develop a policy framework for offshore and inshore Aquaculture on the national level which could include: Encouraging the investment in such project; Promote efficient decision making process; Adapt a reliable way of data collection; and Applying a separate criteria for the assessment of such projects.

3- Promote the environmental friendly practices which protect biodiversity and maintain essential ecological process through media activities.

4- Enhance individual and community well being and increase their involvement in ecological problems.

5- Provide effective legal, institutional and economic frameworks for ecologically sustainable development.

6- Drew a new map of fisheries in Red Sea area depend on real data and updated information.

7- Develop a strategy for aquaculture development based on previous experiences.

8- Recommend new studied trends in aquaculture.

AQUACULTURE AND THE MARINE ENVIRONMENT

By

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Paper presented as a keynote address at the "ENVIRONMENTALLY FRIENDLY AQUACULTURE AND FISHERIES PRACTICES" Workshop held at Hurghada, Egypt on September 15-17, 2002

ABSTRACT: This lecture will discuss the importance of Mari-culture development taking in consideration the concerns of mangrove forest conservation. Factors such as type and intensity of culture systems, as well as water quality management, economic, social and environmental interactions will be discussed. Recommendations and suggestions will concluded with the participants of this workshop.

DEFINITIONS OF AQUACULTURE:

Aquaculture has been defined by many authors; but the most inclusive definition is: "The culture of aquatic animals and plants in fresh, brackish and marine environments". While Mari-culture is more of a restricted term to farming the sea or (sea farming). However, the type of culture techniques or systems needed to be specified (e.g. pond culture, raceway culture, pen culture, cage culture raft culture). Also it will more appropriate to address the type of organism cultured (e.g. fish culture, shrimp culture, oyster culture, mussel culture seaweed culture, hydroponics). As well as the character of the environment where the culture is used (e.g. cold water or warm water aquaculture, on shore, off shore open sea, coastal, estuarine), each has different development and management. Aquaculture could be named monoculture "raising one aquatic species" or poly-culture "raising more than one species with in the aquatic unit of culture".

Aquaculture in terms of production means "The commercial growing or farming a predictable crop in owned or leased waters". Aquaculture also may be characterized by its system of intensity or productivity per unit area. These culture systems are typically. Extensive, semi-intensive and intensive aquaculture.

HISTORY AND PRESENT STATUS OF WORLD AQUACULTURE

Aquaculture started more than 5,000 years ago in Indo-Pacific Region; as the earliest records documented the practice of common carp fish *Cyprinus carpio* artificial hatching and culture by the Chinese Fan Lai in 475 B.C. A mixture of Carp fish fry collection from rivers, transportation in bamboo baskets and rearing in ponds in mono and Polyculture; are described by Heu in A.D. 1639.

Elsewhere in the **Indo-Pacific Region**; 50 different species are cultured today in Taiwan. The milkfish *Chanos chanos* culture; which has started during the 15th century reared in brackish water ponds on a large scale in the Philippines and Indonesia. In Thailand the catfish *Pangasius* sp. was

cultured in ancient days. Java tilapia *Oreochromis mossambicus* opened a new world to aquaculture. This Fish could tolerate almost any condition and was grown in both fresh and brackish waters. In India 75 fish species of carps, catfishes, perches, and prawns are suitable for culture in ponds where the minimum water temperatures are above 15°C most of the year. In Japan a wide variety of species are cultured such as mullet *Mugil spp.*, yellowtail *Seriola quinqeradiata*, common carp, eel *Anguilla japonica*, rainbow trout, shrimp *Penaeus spp.* and oyster *Crassostrea gigas*.

Shrimp culture techniques began in 1934 when Fujinaga was successful in spawning and the partial rearing of the Kuruma shrimp *Penaeus japonicus*. In Hawaii freshwater prawn *Macrobrachium rosenbergii* has been cultured. In Australia oyster farming is the oldest form of aquaculture.

However, recently and for the last few decade; production of high-value species such as shrimp for hard currency. Culture techniques also improved from extensive type to a more intensive systems (high density stocking, use of formulated diets and continuous aeration). Indonesia has become the second most important producer of cultured shrimp in the world, behind China with an estimated production of 70,000 mt 1995, and was 50,000 mt of shrimp in the Philippines.

In **Europe** aquaculture started 2000 years ago, with common carp. Later the rainbow trout and other trout species were cultured as well as eels in Czechoslovakia, Hungary and Spain. Marine flatfish, turbot, salmon and Dover sole are cultured in England and Scotland. In Scandinavian countries, Salmonid culture is well established. The cultured Atlantic salmon *Salmo salar* in Norway was 154,000 mt during 1991.

In **North America** aquaculture started about a 100 years ago with trout and oysters. Commercial catfish farming had 62,800 ha in production, of which 37,000 ha were in the state of Mississippi. Crawfish farming in Louisiana began during the 1940s and then production ponds increased to 17,600 ha by mid-1980s. Elsewhere in North America, in Canada and Alaska the Atlantic salmon is the species of choice in aquaculture.

In **Latin America** Brown trout and grass carp are being grown in Mexico and Central America. Tilapia also has been cultured in Brazil and in other South American countries Huet 1970. Ecuadorian the leader Latin American country in shrimp farming developed a massive pond construction of more than 100,000 ha producing 110,000mt of shrimp

during 1996. Species have been mentioned for culture in this continent are*Penaeus vannamei and P. stylirostris*.

In **Africa** most of aquaculture consists of small family ponds ranging from 100-600 m^2 stocked with Tilapia, common carp has been introduced into many areas of Africa. Rising of trout is practiced in a small scale in Morocco and Kenya.

Aquaculture in **Near and Middle East** region; The Arab world despite that aquaculture production has increased from 22,000 tons to 73,000 tons during the period from 1985-1895, though comparative production to the rest of the world is poor (for every one ton produced by the world only 3,4 kg is produced by the Arab world). The total costal areas of Arabian waters are more than 22,000 km, which could give a yearly contribution of more than 700,000 tons if invested. In Egypt, Syria, Iraq, Sudan and Morocco several Carps and Tilapia fish species have been cultured. Shrimp as well as Tilapia and few finfish species have been experimentally cultured in Kuwait, United Arab Republic and Saudi Arabia.

Shrimp culture industry has been established in the Kingdom of Saudi Arabia more than other Middle Eastern countries, and exceeded the trial stages to the commercial era. The giant tiger prawn *Penaeus monodon* has been cultured in coastal ponds after broodstock collection from the sea, but poor survival has been observed. Despite the advanced growth of the giant tiger prawn *Penaeus monodon*, the Indian white shrimp *Penaeus indicus* has proven to be the specie for culture due to its ability of maturity in captivity with excellent survival. This specie is one of the dominant cultured aquatic animals in India, Taiwan, the Philippines, Indonesia, Thailand and Malaysia.

Penaeus indicus is one of the most valuable commercial shrimps included in the genus *Penaeus* that is distinguished from other genera of family *Penaeidae* by a rostrum toothed on dorsal as well as on ventral margin. The Indian white shrimp is more distributed mainly in the Indian Ocean from Southeast African coast to the Indonesia including the Red Sea. It inhabits the Shelf area up to depths of 90m but they are more abundant in shallow waters less than 30m deep on sand or mud with slight preference for sandy bottoms. Even though the culture of *P. indicus* is overshadowed by the culture of *P. monodon* in many areas in Asia, the potential of *P. indicus* for culture remain strong. The white shrimp is more preferred in the Japanese market where its cost is higher than the tiger prawn *P. monodon*. *P. indicus* grows fast and have a quick turnover rates in ponds.

Sizes of 15-20 g at high density and 20-30 g at low density can be attained after 3-5 months with harvest of 4-6 tons/ha/crop.

The Red Sea and Gulf of Eden countries (Table 1) have a great potential mire-culture future due to the vast coastal length, availability of man power, geographical location, adequate climate and on the tope of that is the world increasing demand for marine products from this part of the world.

Table 1: Population, coastal length, production, consumption per capita, exports and imports in the Red Sea and Gulf of Eden countries for the year 2000. (Approximately).

Country	Population (million)	Coastal length/km	Production (1000 mt)	Consumption/capita (kg)	Exports (1000 mt)	Imports (1000 mt)
Saudi Arabia	22.7	1770	42.3	9.2	2.8	67.3
Egypt	96.5	1400	429.8	8.2	1.9	97.9
Jordan	5.2	25	0.1	4.2	0.08	12.3
Sudan	36	864	35.4	1.3	0.08	0.5
Yemen	18.1	2000	102.3	6.8	4.2	1.7
Somalia	7.5	3025	16.8	1.6	3.2	-
Djibouti	0.46	312	0.4	1.4	-	0.5
Eritrea	4.3	2.234	-	<1.0	-	-

AQUACULTURE IN SAUDI ARABIA (in brief):

Aquaculture has been considered in an attempt to close the gap between production and importation (Table 1). In 1982 the Fish Farming Center was established as a unilateral trust fund project between the Saudi Arabian Ministry of Agriculture and water and the Food and Agriculture of the United Nations to direct and support the development of aquaculture in the kingdom. The aim was to apply and adapt the existing worldwide technologies and production systems suitable to local environmental conditions.

The center has established successful commercial culture for Tilapia *Oreochromis spilurus* in seawater in cages, pens and tanks. Other marine fin fish species have been successfully demonstrated the feasibility of being cultured in captivity such as the Rabbit fish *Siganus rivulatus*, the Groupers *Epinephelus fuscoguttatus* and the Asian sea bass.

The tiger prawn *Penaeus monodon* was imported to start penaeid culture in the kingdom. However *P. monodon* presents some technical problems for commercial culture. Poor adaptation to local high salinity conditions was demonstrated by low survival and slow growth which made the culture period too long and yield too low. In addition seed supply was limited due to poor maturation of cultured specimens and unavailability of local wild seed.

Penaeid shrimp have been known to inhabit the Red Sea since the last century. *Penaeus indicus* has been found among other penaeid shrimp in the Gizan area (Red sea coast southwest of Saudi Arabia) when a survey took place to study shrimp spawning grounds in the Red sea *P. indicus* juveniles were found abundantly, collected and brought to the Fish Farming Center to be studied. This species could grow up to 20g in captivity when a quality of shrimp feed is provided. Post larvae were produced from the center's hatchery from ablated and unablated females harvested from earthen ponds with seawater of 43‰.

The life cycle of *Penaeus indicus* has been completed in captivity without the need to collect new brood stock from the sea.

The Indian white prawn *Penaeus indicus* is distributed mainly in the Indian Ocean, but also has been reported in Australia, Indonesia, Philippines, India, Pakistan, East coast of Africa, Gulf of Aden, Red sea, and Gulf of Oman and has been farmed in the Arabian Gulf as well.

Production of cultured *P. indicus* larvae in an intensified culture system id dependent upon nutritionally effective and acceptable diets for each of the different developmental stages. Artificial feeds are produced also now in Saudi Arabia by a private company.

However, the successful experience of Saudi Arabia could conclude that The Indian white shrimp *Penaeus indicus* farming in the Red Sea and Gulf of Eden is very promising (Figure 1).

Figure 1: Typical growth of the Indian white prawn *Penaeus indicus* in coastal ponds on the Red sea, Saudi Arabia.

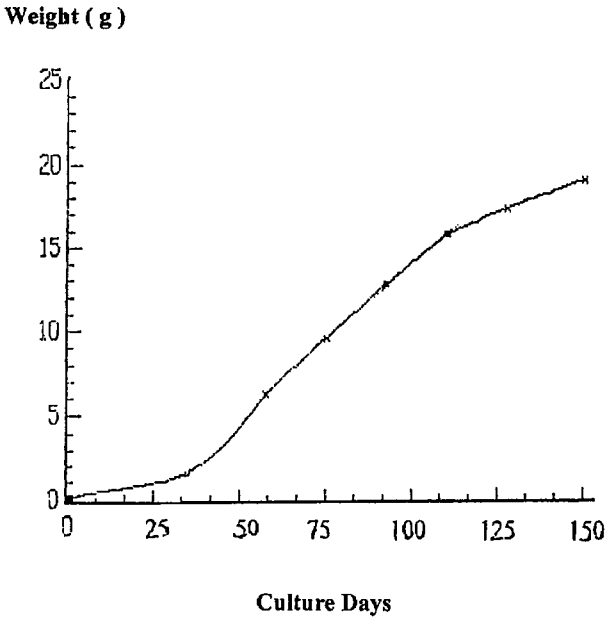


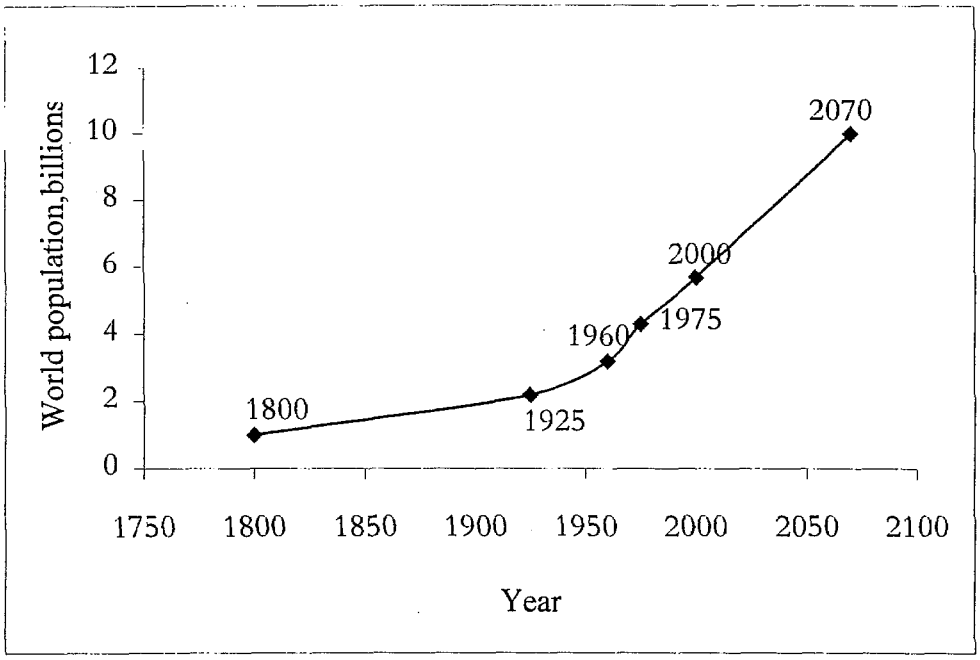
Fig. Aquaculture in Saudi Arabia:

AQUACULTURE ROLE AS FOOD FOR PEOPLE:

The word population by the year 2000 was about 6 billion people and growing by 96 million people each year. By the year 2050 the world population might reach 13 billion (Figure 2).

Desertification, erosion, pollution, acid rain and reduction of the ozone layer restrict the expansion in land farming.

Figure 2: World population projected over time. U.N. Demographic Yearbook, 1992.



An additional 29 million mt of food must be produced annually to feed the increasing word population. Marine ecosystems encompass most of the earth's surface, or nearly 71%. Freshwater lakes and streams cover approximately 0.4% of the earth's surface, yet fishery products contribute only a tenth of the animal protein in our diets. Since the early nineties, fishery catch began to level off round 100 million mt per year. Many ocean fisheries are depleted or in serious decline and most have reached or far exceeded sustainable yields. Over fishing, oil exploration and the environmental changes have caused the problem.

Obviously Aquaculture has to compensate for the fisheries shortage, increased population and per capita consumption. Aquaculture production estimated to be 5 million in mt 1972. In 1975, production of aquaculture has increased to 6 million mt. In 1985, production exceeded 10.6 mt in 1991; aquaculture production was more than 15 million.

Aquaculture production can be increased on existing operations and by expanding to new areas. Yields of 10-25 mt/ha/yr through polyculture. A major area for expansion of aquaculture is in ocean in pen or cage culture. The FAO would like to see 30% increase per capita fish consumption by the year 2025 which would reach 25 kg nearly. New (1991) estimated the total production to be more than 162 million mt in 2025. Sustainable

aquaculture will receive more emphasis on natural resources to expand in world aquaculture production (Table 2).

Table 2: World Aquaculture production and value for years 1990-1999.

Total Aquaculture. Production	1990	1993	1996	1999
Quantity (mt)	15 825 327	24 435 711	33 923 591	42 770 973
Value (US$ 1.000)	27 414 945	36 114 212	47 383 742	53 562 583

Source: FAO Yearbook, 2001.

ON-SHORE AQUACULTURE

Pond culture:

Culture systems:

Extensive Culture: The oldest in practice when prawn for instants traditionally cultured relining on wild fry catch and natural food. Ponds were located actually in mangrove areas and pond size ranged from 2-20 ha with water exchange depends on solely tidal flow.

Recently ponds extensive systems are usually 4 ha in size, and post larvae are stocked at less than 10/m^2. Food production in the pond may be enhanced by fertilization and some artificial feed may be given. In some areas at the Far East extensive culture is still practiced. This system is unlikely to contribute to increased organic loading.

Semi-intensive Culture: The stocking density of post larvae is 10-20/m2. Pelleted feed, pumps for water exchange and aeration are provided, fertilizing ponds with urea and triple super phosphate is commonly used. The organic loading from such a system is higher than of the extensive system. Disease outbreak are lower than in the intensive culture system and higher than the in the extensive.

Intensive Culture: The stocking density in this system is more than 20 postlarvae/m^2, and requires artificial feeding, aeration and water exchange through pumping. The organic load will be increased due to build-up of solid wastes from uneaten feeds and fasces. It has been reported that it causes water quality and pond sedimentation deterioration, which will result in the greatest risk of disease infection. Occurrence of disease requires the use of antimicrobials/antibiotics and other drugs.

The extensive shrimp culture system has an integral source of living for coastal communities for centuries and because of the lack of water pumps

in the past. This culture system had to be built in the tidal zone, witch meant within in the mangrove forests. Which resulted in destruction of large mangroves areas. Simply stated, extensive shrimp culture system was unfriendly to the mangrove environment.

The semi-intensive and intensive systems both efficiently utilizes land either behind mangroves above the tidal range or away from mangrove areas. Therefore shrimp culture intensification was the breakthrough due to being located behind mangroves above the tidal range, or in an area without mangroves. Associated with these developments was the widespread use of high volume water pumps needed to accomplish water exchange within the intensive culture ponds (Tables 3 and 4).

Table 3: Characteristics of Shrimp Culture at Three levels of Intensity.

Level of Intensity/productivity			
Characteristics	**Extensive**	**Semi-intensive**	**Intensive**
Land elevation (m)	0 to + 1.4 MSL *	0 to + 1.4 MSL *	> +2.0 MSL
Pond size (ha)	> 5	1 to 2	1 or less
Aeration	**Natural**	**Water Exchange** Or mechanical	Continual mechanical
Stocking rate (Pl/m²/crop)	< 5	5 to 15	20 or more
Feed type	Natural (No supplement)	Natural + supplement	Formulated
Production level (Kg/ha/yr)	100 to 300	600 to 1800	> 6000
* MSL = Mean sea level			

Table 4: Summary of World Shrimp Culture Areas and annual Production by Each Culture System, Based on 1992-1993 Data from Various Sources.

Culture systems	Pond areas Hectares	% of Total	Annual shrimp Metric tons	Production % of Total
Extensive	726 900	67	159 900	22
Semi-intensive	304 000	28	304 000	42
Intensive	52 000	5	258 800	36

Some Methods for more efficient Aquaculture (with emphasis on the environment):

Water management: Water quality is fundamental to the success of a fish farm. In large fish and shrimp farms water mixing and oxygenation are very important for optimal use of the farm and helps to degrade nitrogen compounds. It is essential in all stages of aquaculture to monitor water quality continuously. Water exchange should only be used when necessary, such as to flush out excessive nutrients and plankton or to reduce ammonia concentrations. Daily water exchange usually dose not improve water quality in ponds. Cost of continues water pumping should be taken in consideration. If water exchange is great, ponds cannot assimilate nitrogen, carbon and phosphorus inputs that have not been converted to fish or shrimp flesh. Thus pollution potential from pond waters increase.

Site selection: A site with good soils (avoid aside soil and wetland areas) and adequate supply of high quality water to prevent environmental problems.

Farm construction and design: Farm construction and design are important in the management of environmental interactions. The pond must be designed to have proper drainage system. Pond embankments should be well compacted to prevent seepage of saline water into the under ground freshwater. Mangrove buffer zones between farms and surrounding land is essential to minimize the impacts on surrounding ecosystems, protect nursery grounds for aquatic life, maintain traditional fisheries, improves water quality and provide protection from storms.

The water supply and drainage canal should be designed to facilitate optimal water circulation in ponds and adequate disperse of effluents.

Residues: The effluent impacts of shrimp ponds on the environment are most significant during the final stages of harvesting and pond cleaning because of the discharge of material (feed, faces, fertilizers and chemicals) bound to the particulate matter in the sediments. These effluents could be very polluting with total nitrogen level and phosphorous. Such effluents should be discharged into sedimentation or treatment ponds and not directly into the coastal waters. Pond cleaning should be carried out during high tide when there is good dilution and flushing. Some Far Eastern countries require shrimp farms to be equipped with wastewater treatment or sedimentation with no less than 10% of the

total pond area. Growth in production should only be encouraged if sustainable farming is practiced.

Feed: Normally, feed comprises more than 60% of the operational cost of a fish farm, so it is necessary to consider accurately this input. The quality of protein is very important in diet formulation. High quality feed improves feed conversion ratio, because of better feed assimilation by fish and also this will result in less pollution, and saves on feed cost. For example, phosphatase converts organic phosphorous into more assemble phosphorous compound, can be add to the feed to increase phosphate assimilation and reduce the level of phosphorous in the discharged water. Better feed quality reduces the cost of treatment. Also some of the excreted nitrogen might pollute the surface or the ground water through seepage. Therefore the feed quality should be measured appropriately. Feed must be accepted by fish, uneaten feed on the pond bottom will contribute to increased pathology and pollution.

Farmers must be advised on proper farm management and husbandry to avoid over-feeding.

Constructed wetlands: Wetlands has the ability to transform and store organic matter and nutrients. Wetlands need to be exploited for improving water quality after separating the liquid slurry.

Using macrophytes for wastewater treatment: Different macrophytes from the dominating environment could be used. Macrophytes exist floating, submerged or rooted. Macrophytes tend to extract nutrients from discharged waters.

Using animal – fish farming for wastewater treatment: Polyculture with cages containing filter-feeding fishes in ponds (example *Tilapia* sp. or *Sigandae* sp.) that feed on the suspended phytoplankton and zooplankton in water column.

Polyculture: Polyculture in fish and shrimp ponds could lower sedimentation levels, nutrient inputs, reduce the deterioration of water quality and improve dissolved oxygen concentrations.

Mangrove areas and shrimp farms: Mangrove lands must be avoided when shrimp ponds are constructed. Mangroves are not well suited for shrimp ponds due to acid soils, limitation to shallow depths, inability to drain and dry bottoms, and high construction costs. Studies have shown that only 3% of Mangrove lands were converted to extensive shrimp

ponds earlier in time (decades or centuries ago) when these inter tidal ponds were used in Asia or Latin America. Recently in some areas, satellite imagery indicates that forested mangrove areas have begun to increase in shrimp farming regions.

Aquaculture industry needs assistance from governments to improve education, enforcement of conservation policies, and development to balanced strategies for integrated use of coastal areas.

Economic significance: Shrimp farms generate considerable economic Globally; it earns around US$6 billion yearly at farm gate price. In 1995, shrimp aquaculture production estimated to be worth US$20 billion in Asia alone.

Social interactions and impacts: Exact numbers employed in shrimp farming are unknown. The estimated global number is around 1 million people in developing and developed countries in hatchery operations, feed sales, producers, processing, distribution, marketing and trade.

In rural areas of Southeast Asia shrimp farming business provided jobs for those that were previously rice farmer or shrimp fishermen.

OFF SHORE AQUACULTURE

Cage culture

Waste production and solutions: Sea-cage farming operations are widely acknowledged as being point sources of organic and non-organic pollution in the form of particulate and dissolved carbon, nitrogen and phosphorus. Similarly in cage culture feed management and engineering advances have significantly reduced sea-cage aquaculture waste. Waste from sea-cages is characterized by large amounts of suspended particulate organic carbon, increased biochemical oxygen demand and large increases in dissolved nutrients and insoluble fats and oils. Example; waste beneath salmon cages was 10 kg/m²/yr and in the immediate vicinity 3 kg/m²/yr.

Bruce (1997) found comparable accumulation rates to those for salmon cage farms. Relocating the fish cages to a new area, where cage inputs are more dispersed under the influence of higher wave energy has solved the problem.

Waste accumulation beneath sea-cages for finfish aquaculture has environmental effects causing structural and functional changes to the local systems (e.g. increasing in densities and composition of scavenger population such as fish and birds). Due to these effects, caged fish could

have a serious phytoplankton blooms, parasites, microbial infections, increase of oxygen demand and organic sediments.

To combat the build up of waste beneath sea-cages and to limit the health risks of the reared caged fish; the following steps are required:

1- Moving cages regularly and allowing the site to be recovered. The recovery period of time vary from 10 weeks up to 18 months, depending on various factors such as benthic systems and their assimilative capacity, farmed species, stocking density, water movement and temperature (Ritz et al. 1987 and Anonymous 1997).

2- A minimum distance of one kilometer is required between cage farms, to reduce the risk of spreading diseases.

3- Poly-culture of filter feeders with the caged finfish (e.g. mussels) and edible macro algae to deposit particles and nutrients under cages, which might help in stirring up sediment and maintain oxygen levels.

4- As in pond culture feed inputs quantity and quality are all very important for caged fish also. High quality feed improves feed conversion ratio, because of better feed assimilation by fish and also this will result in less pollution, and saves on feed cost.

Fish pen culture:

Fish pen culture originated in the Philippines during the 1960s. Mainly milkfish were cultured which relied on the capture of fry from the wild, but recently Tilapia, Carp and other species are being cultured in pens. The technique has spread to a number of other countries.

Fish pens can only be located in certain suitable areas. Commercial fish pens can vary in size from 100 m^2 to 100.000m^2. Fish pens utilize the shallow lagoon and bay areas to the shore for fish production. Another advantage beside low capital and operational costs, the fish pen is a simple system that does not rely heavily on mechanization such as water pumps, air blower's etc.

The disadvantages of fish pen system includes: low fish production compared to fish cage culture, large areas of netting prone to be clogged by algal mollusc predators, less control over environmental parameters which might increase risk of fish mortality from low water currents, low oxygenation, algal blooms, etc.

Beveridge (1996) and Straniford (1997) found, few literatures on environmental monitoring and many more on aquaculture development. It must be recognized that because off shore aquaculture (cage and pen

farms) directly use aquatic resources - unlike on shore aquaculture (ponds or tank systems), they can have a pronounced impact on the aquatic environment. Cages and pens occupy space and may alter current flows and increase local sedimentation rates. Cage and pen culture operations can be responsible for the introduction of pathogens or the distribution of diseases and parasite cycles, changing the local flora and fauna and altering the behavior and distribution of local fish. Intensive cage culture operation release uneaten feed, faces and fouling materials into the marine environment, stimulating primary productivity and adversely affecting water.

The impacts of cage or pen culture operations on the marine environment can excrete negative feedback effect on cage culture operations themselves. Therefore it is important to understand and be able to quantify the impacts of off shore aquaculture practices on the marine environment and develop a baseline (possibly guide line) for the rational exploitation of the marine resources.

The organic wastes from the cage and culture operations comes from the un-eaten feed, fecal and urinary products, fouling material which have become either dislodged or have been discarded. Excretory products are dispersed in the water column by currents, while solids (uneaten feed and feces) fall towards the seabed. In the marine environment, flushing rates are relatively high and dilution is rapid, therefore effect on the water column are often transitory and only apparent during slack tides, when temporary elevations in ammonia levels or decreased in dissolved oxygen concentration can be measured. Except in highly enclosed, poorly managed sites that can show signs of eutrophication.

The impact of organic wastes fallen on sediment and sediment communities are more apparent than those on the water column are (Rosenthal, 1994). The solid wastes cause an increase in the levels of organic matter and nutrients in the bottom sediment below and in the immediate vicinities of cages or pens. Sedimented organic wastes stimulate microbial production, changing sediment chemistry, structure and function. Changes are positively correlated with waste loading and accumulation, oxygen demand increase and sediments become increasingly anaerobic and reduced. The subsequent impact on benthic fauna is generally a positive correlation between sedimented material and biomass of the macrobenthos and a negative correlation between organic matter and diversity. At heavily impacted sites the sediment under the cages may become anoxic devoid of oxygen and macro benthos. Beyond this an area of organic enrichment where exceptional high numbers of

opportunistic species (e.g. *Capitella*) occur, this zone has a characteristically low diversity. The area of benthos affected by cage culture typically extends for 20-50m, although in some poorly managed sites or because of unusual hydrographic conditions, effects are evident up to 150m from the cages. In pen culture, the benthic area affected appeared directly pen bed if not in the seawater column, due to the shallow depth of this coastal facility.

Therefore; Preferably fish pens are not to be restocked with fish, when sediments starts changing in color or odor, allowing a self cleaning interval of weeks maybe months. Poly-culture helps cleaning the pen bottom and water column. Proper operational management avoids over fry stocking and over feeding.

The environmental impacts of cage and pen culture practices have been usually determined by a comparison of changes in the physico-chemical and biological characteristics of water and sediment at varying distance from the culture center. In some cases the temporal variation in the culture site or comparing it with control site. To assess the environmental impact associated with net pen operations in waters, the important parameters are: dissolved oxygen, pH, total phosphorus, nitrogen, organic matter in the sediment and macrobenthic invertebrates.

Models based on current velocity, depth, loading ratio, and other functions are now available to select sites where impacts of new cage culture farms will be minimal.

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Guidelines for Country Report Environmentally Friendly Aquaculture and Fisheries Practices

Hurghada, Egypt 15-17 September 2002

The followings are the proposed items to be covered in the country papers bearing in mind to concentrate on the coastal zones which cover the areas where land and sea water interact.

Please write your country paper including the following items:

1- General properties of the coastal areas in regard to: size, reefs, regional divisions, and population (number and density).

2- Main economic activities in brief i.e. urbanization and settlement, tourism and recreation, industry, fishing and aquaculture, energy, transportation, agriculture and others.

3- Aquaculture and fisheries practices in the coastal zones:

3.I. Aquaculture: practices (land based, cages, ...), species (native, introduced, ...), level of intensity, level of inputs (feed, chemicals, ...), water discharge (raw, treated, ...).

3.II. Fisheries: Practices, Fishing operations, and constraints to development (destructive methods, pollution, overfishing, ... etc.)

3.III. Fisheries and aquaculture management activities. i.e. data collection analysis and utilization for policy and plan making.

4- Describe the main environmental problems and conflicts between fishing and aquaculture activities on one hand and other economic activities, on the other hand.

5- Institutions involved in coastal zone management.

6- What tools and means have been applied in coastal zone management, i.e. laws, other regulations, decisions, local decrees, code of conduct for responsible fisheries.

7- Are these tools, whenever used, being efficient and to what extent?

8- What difficulties are most frequently encountered in the implementation of these tools?

9- Describe the status of the application of EIA in Aquaculture and Fisheries projects.

SOME ENVIRONMENTAL ASPECTS OF AQUACULTURE AND FISHERIES ACTIVITIES IN THE KINGDOM OF BAHRAIN

Country Report

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Presented as a country report at the "ENVIRONMENTALLY FRIENDLY AQUACULTURE AND FISHERIES PRACTICES" Workshop held at Hurghada, Egypt on September 15-17, 2002.

INTRODUCTION

The Kingdom of Bahrain comprises an archipelago of 36 low lying islands, with a total land area of 706 km^2. The total land area of Bahrain has increased by about 33 km^2 between 1976 and 1995, largely due to reclamation activities. The land is made up primarily of sand covering limestone bedrock and supporting sparse vegetation, with only a narrow fertile strip along the North and North Western coast. It is situated off Saudi Arabia between Kuwait and Qatar peninsula in the middle of the Gulf between latitude 25°32'N to 26°20'N and longitude 50°20'E to 50°50'E **(Directorate of Statistics,** 2000).

Bahrain's climate is warm and dry with a little rain, the average rainfall is 74mm per year with relatively high humidity and the most dominant wind is the northern (Shamal) wind which brings moist air, while summer brings warm and dry wind from the southwest (Kauws). Wind speed rarely exceeds 30 knots. The atmospheric temperatures range from 12-46°C. The relative humidity ranges between 29-90% **(Directorate of Statistics,** 2000).

The sea around Bahrain is generally clear and is characterized by a relatively high salinity ranging from 40-60 parts per thousand (high readings on the Western side), a high water temperature ranging between 8 °C and 37 °C, and an average pH value of around 7.9. Daily water temperature can also fluctuate widely. Changes of 3.5°C have been recorded within a 24-h period. The seabed substrate is mostly silt, sand, limestone pavement and rocks, with extensive remains of coral beds fringing the islands, but few live coral reefs. The inter-tidal zone, particularly in the northern parts of the island, is very extensive and may extend 3-5 km. from the shore. Major habitats include: sea-grass areas, algal areas, oyster beds, coral reefs, and mangrove areas.

The population of the Kingdom of Bahrain is 650,604.00, of which 37.6% are non-Bahrainis. Population growth declined from 3.6 for the period from 1981-1991, to 2.7 in 1991-2001.

Fishing is an ancient profession in Bahrain, this profession gradually declined in recent years giving ground to more secure land based industries. Fishing in Bahrain was divided into two sectors, the artisanal and the industrial, but since 1995 there was a ban on industrial steel trawlers. The per capita consumption of marine products fluctuates between 18-27 kg per year, which reflects the importance of fish in Bahrain. The gross value of fisheries output in 1998 was BD. 9.2 million **(Fisheries Statistical Service, 1999).** This only represents about 0.4% of

GDP. The fisheries sector employs about 4,770 people directly (Radhi et al, 1999) and about 700 indirectly (Uwate, 2000a).

Bahrain, once thriving with freshwater springs both on land and in the sea, now has very meager fresh water resources. Out of the $25{,}663 \times 10^6$ gallons of water that was consumed in 1999, more than half (52.5%) was from desalinization plants (Directorate of Statistics, 2000).

Marine habitat:

The coastal outline of Bahrain is rather straight with no significant inland projections. There is one important bay, Tubli bay, which is a partially protected area. This bay is a major shrimp nursery, it is also one of the few, if not the only one, area where the last remnants of mangroves still exist.

The marine environment of Bahrain displays a variety of habitats. There are mainly sandy coastlines, but rocky and muddy habitats are also available. Offshore, sea grasses are one of the major soft sediment habitat types within the coastal waters of Bahrain. They cover entire sea bed areas on the eastern coast extending through coral reefs.

The other major marine habitat around the country is the coral reefs. The islands of the kingdom of Bahrain are fringed by large coral reef zones, but the shoals and banks about 1 km offshore is not believed to comprise hard corals. Corals exist on outcrops in certain offshore areas. Massive coral bleaching especially in 1998 and environmental pollution has destroyed massive areas of reefs. What are left now are mainly dead coral reefs.

These habitats face increasing environmental stress from man made activities that include improper land reclamation, dredging for sand, and increased industrial discharges to the marine environment.

Man culture Activities:

There is a National Mariculture Center (NaMaC) located on the northern side of Manama. The Center is currently the leader in the region in the production of marine fish seed.

A feasibility study of mariculture development was planned in three phases. The three phases mainly included expanding the center by adding new infrastructure, during which research studies on aquaculture techniques for suitable culture species were carried out on small scale to facilitate its implementation on larger semi-commercial scale once all the facilities were completed.

At the hatchery level, NaMaC fish production has increased steadily since 1993 (Table 1).

Table 1. Fish fry production at NaMaC, 1993-2000

Year	Species	Fry produced (>1g)	Fish released to sea	Fish harvest (MT)
1993	Grouper	6,500	-	-
1994	Rabbit fish	4,000		0.5
	Grouper	19,000	10,000	1.0
	Shaem	17,000	7,000	-----
		----------	---------	1.5
		40,000	17,000	
1995	Rabbit fish	59,000	300	3.0
	Grouper	11,000	10,000	0.7
	Shaem	7,400	3,000	0.3
		---------	--------	-----
		77,400	13,300	4.0
1996	Rabbit fish	59,000		2.4
	Grouper	12,000		
	Shaem	120,000	124,250	

		191,000		
1997	Sobaity bream	650,000	150,000	-
1998	Sobaity bream	142,000	-	1.1
1999	Sobaity bream		7,500	2.5
2000	Sobaity bream		-	11.5
2001	Sobaity bream		100,000	-
2002	Sobaity bream		150,000	2.5

Fisheries Activities:

There are three types of commercial activities in Bahrain, commercial, semi-commercial and recreational fishing. Fishing gears used in the artisanal sector include: gargoors, Haddrah, hook and line, gill-net and shrimp trawl.

Landings in 2000 totaled 11,710 tons valued at BD 9,432 million. The main species were crab (2,380 tons), rabbit fish (2,114 tons) shrimp (2,104 tons) and perch (1,403 tons). A total amount of 4,563 tons of fish and marine products was imported in 2000. Exports totaled 4,728 tons. The per capita seafood consumption was estimated at 16.7 kg/person.

In 2000 the trap "gargoor" fishery contributed the most in weight (4,992 tons) followed by the trawl fishery (3,996 tons) and the barrier trap

"haddrah" (1,783 tons). Licenses were issued for 387 trawlers. Out of these, only 220 were for dhows, the remaining 167 licenses were issued for small open boat trawling. The total number of commercial fishing vessels, using "gargoors" and trawls, was 2,022 (including the trawlers) but only 631 fished with a license. In 1998 it was estimated that the full time fishermen included 1,655 Bahrainis and 2,547 foreigners. Bahrainis made up most of the occasional and part-time fishermen (2,628). A number of species are facing over-fishing with catch declining, some very significantly.

Management Issues:

Management of fisheries & mariculture in Bahrain is under the Directorate of Fisheries and Marine Resources. Other organizations, which have interest in the marine environment, include Environmental Affairs, Wildlife Committee, University of Bahrain, Bahrain Center for Studies & Research.

There are a number of laws and regulations that govern the fishing activities; these are illustrated in the new (2002) fisheries and marine resources protection and utilization law. These laws deal with ban of use of fishing methods that are harmful to the marine habitat like explosives, drift nets, trawling in reef areas. But more regulations and implementation methods are needed to cover other harmful practices like anchoring on coral reefs and littering. One major threat to the marine environment which comes from fishing activities comes from shrimp trawling and the use of other destructive fishing practices, like drift nets. The Directorate of Fisheries & Marine resources have used various deterrent methods to discourage such activities in shallow areas and on or near coral reefs. Some methods used include establishing artificial reef sites, planting heavy objects, hooks etc., which catch and cut trawl and other nets.

Other organizations also have laws and regulations dealing with issues concerning the marine habitat, such as industrial effluents into the sea, marine pollution etc. Bahrain is signatory to various environment treaties, and a member in regional and international organizations concerned with the protection of the marine environment.

Such laws and regulations are important and contribute significantly towards preserving the marine environment, but more decisive implementation is needed.

At this time, there is no commercial mariculture industry in Bahrain. All research and production efforts are focused on development and

refinement of appropriate economically-efficient technology. The major part of activities at the National Mariculture Center is now aimed at producing fish juveniles for sale and for release programs, a modest contribution of mariculture towards natural resource rehabilitation, and also for use in a limited grow-out activity in concrete ponds. The only effect on the marine environment from the center could come from the effluent water, which at present does not exceed $100m^3$/hour. This effluent water, however, goes to a settling reservoir before discharging into the sea.

With the absence of any aquaculture activity, there is no clash between aquaculture and fisheries. But the economic development, represented by encroachment of urban development into the sea has created a clash with fisheries. Such clash is evident in the damage to fishing grounds and complaints from the fishermen community.

There are huge coastal urban development projects in the country. These include causeways, large tourist beach and offshore development projects, industrial expansions, commercial land encroachment into the sea. All big projects are preceded by environmental impact assessment studies. Fisheries activities are not currently linked to EIA studies.

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COASTAL AQUACULTURE AND ENVIRONMENT ISSUES IN I.R.IRAN

Country Report

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Presented as a country report at the "ENVIRONMENTALLY FRIENDLY AQUACULTURE AND FISHERIES PRACTICES" Workshop held at Hurghada, Egypt on September 15-17, 2002.

FISHERIES BACKGROUND

Fisheries activities have a significant economical roll in Iran, particularly in coastal areas. Total production of fisheries sub-sector is 424500 mt, 98000 mt from northern Caspian fisheries and 260500 from southern fisheries and the rest comes through aquaculture and inland water fisheries activities. The important Coastal aquaculture in southern Iran almost starts with pond shrimp farming. Other activities, like fish farming, seaweed culture, pearl farming and *Artemia* culture are in experimental phase or in embryonic stage of development.

Shrimp Culture:

Primarily studies shows that there is a high potential for development of shrimp farms along the southern coastline of Persian Gulf and Sea of Oman as well as along the southern coast of Caspian Sea, where the salinity is very low and only about 13 ppt. These studies have indicated that there are at least more than 100,000 ha. Of suitable lands throughout the coastline. The 3rd National Five-year Development Plan aimed to produce 30000 mt of shrimp at the end of the plan (year 2004). At the present, more than 34000ha of land has been allocated to private investors (Table 1).

Shrimp culture in commercial scale has begun since 1995. It had an exponential growth rate in past five years. Average growth rate of the 3 past years is estimated 100%. Farming system is semi-intensive adopted with local climatic and water quality specifications. Shrimp species is Indian White Shrimp (*Fenneropenaeus indicus*) gaining average body weight of 13 to 16 gr. in 120 days of culture. Characteristics of shrimp farming system in Iran are summarized in Table 2.

Because of weak market price for last and this year (2002), there was a decrease in total active pond area. Therefore, from 6180 ha which was ready for operation this year, only 2800 ha of ponds were stocked. The outbreak of White Spot disease in Khuzestan (Cobden Village) also cut down some 480 ha of pond as well. Fortunately, the disease was controlled immediately and continuous monitoring showed that there were no signs of virus in other areas.

Fish Farming:

With the assistance of a Nordic Company, Shilat had studied potential for marine fish farming in northern coast of Persian Gulf and Oman Sea. The result shows a good potential for cage culture in various areas. Khark, Farour, Qeshm, Hengam and Larak Islands, Bandar Mogham, Bandar Charak and Chabahar, are some of the suitable areas.

Major fish species candidate for cage culture are Silver pomfert, Milkfish, Cobias, Asian sea bass, Rabbit fish and Gilthead sea bream, taking into account the environmental issues.

At present 5 companies have gained primary permission for cage culture in the Persian Gulf. Bi-culture of shrimp and Milk fish showed a good result using a lower FCR and higher production of both shrimp and the fish.

Artemia Culture:

Cyst and *Artemia* biomass production in sea water reservoirs of petrochemical plant is a profitable industry in Khuzestan province. There are also good experiences of artemia pond culture in shrimp farms as secondary product. Unstable market price for the cyst and low demand for biomass are major constraints for expansion of the activity.

Pearl farming

Persian Gulfs pearl is well known in the world. In spite of many research done by Fisheries Research Institute, artificial seeding and pearl farming was not successful. More applied expertise and more experiments are needed to carry out this important business back to work.

Seaweed culture

Another potential coastal aquaculture activity is seaweed culture. There is more than 130 species of seaweeds in Iranian coasts of Persian Gulf and Oman Sea. *Gracillaria sp., Sargassum sp.,* and *Euchima sp.* are some commercial seaweed species.

Laws and Regulations:

In 1996, Parliament approved the new Fisheries Law, Entitled: *"Protection and Exploitation of Natural Aquatic Resources Law ".* According to this law, all responsibility of fisheries sector including the aquaculture activities have been given to Fisheries Company of Iran (Shilat). On this basis, Fisheries of Iran also has responsibility to provide related regulations and code of conducts for aquaculture practices. These include:
"General Guideline for Aquaculture and Fisheries" which was approved in 1999, makes the legal framework for aquaculture activities. The guideline includes the authority of four major related organization, i.e. Department of the Environment (DOE), Veterinary Organization, Department of Natural Resources and finally. Ministry of Energy (Dept. of Water Resources).

1- Dept. of Environment has responsibility for considering environmental issues in National Development Plan. DOE 's permission is a must for

any aquaculture activities in Iran. On the other hand, DOE'S rules are superior to Fisheries ' regulation.

2- Veterinary Organization is responsible for aquatic's health and disease issues, incl. Import and, trade and apply of some certain chemicals and drugs in the farm and hatcheries.

3- Department of Natural Resources is responsible for leasing of public land conservation of un-protected forests and pastures.

4- Dept. of Water Resources regulates supply of freshwater to aquaculture facilities.

Since there is not an ICAM plan in the country, coastal aquaculture activities need permissions from some other ministries and Organization including:

- Ministry of petroleum
- Ministry of Industry and Mining
- Ministry of Defense.
- Port and Shipping Org.

In most of the cases the plans and programs of the above mentioned ministries and organization could have more importance and priorities than aquaculture projects. So Fisheries of Iran should consider these matters.

Lack of Integrated Coastal Area Management (ICAM) program is the most important weakness point in fisheries development planning (Figure 2).

Recently, the Government held the bid for finding proper consultant for ICAM study and the study will start in very near future.

EIA and Coastal Aquaculture Activity:

On the basis of Environment Protection High Council's decision, published on Dec. 23rd of 1997, certain projects required environmental impact assessment (EIA).

Article 2 listed aquaculture projects in area of 400 ha and more as EIA requested activities .The guideline has drown procedures of licensing of these projects.

It should be noted that all aquaculture activities inside or near to the protected areas should follow an especial procedures that usually ask for EIA studies. Because of the presence of mangroves, protected areas and wild life refuges along the Persian Gulf and Oman sea coastline most of the shrimp projects require EIA and Environmental Management Plans. For instance, EIA studies for Bouveirat, Mond (Busher Province) Koleghan, Sayeh khosh. Shore (Hurmouzgan Province.) sites have carried EIA and submitted to the Dept. of the Environment (DOE) for approval.

In Tiab Shomali site, some changes were made to the original design to meet the requirements of DOE, resulting in 500 ha reduction in total area of the site. In Qeshm Island, a big shrimp farming project is waiting for approval by DOE after submitting its EIA study. These are just some examples of implementation of the EIA's guideline in coastal areas. Major constraints for implementation of EIA in all the projects are:

Lack of particular framework
Lack of a database
Lack of qualified experts and companies
and also (in some cases) pressure from local authorities for employment

Table 1: Allocation of land to investor for shrimp farming purpose

Province	Total Area ha	Farm Area ha	Pond area ha	Land allocation plan (ha)		Present status of land		
				Large farm	Small farm	Operational	Construction	Permission
Khuzestan	13000	9750	7800	5900	7100	1600	500	5480
Busher	10250	8270	6616	2000	8250	2080	2740	10250
Humouzgan	13085	10525	8420	8435	4650	1450	1090	11615
Sistan & Balochestan	6050	4350	3480	3550	2500	1050	2950	6050
Golestan	3000	2100	1600	0	1600	0	0	1000
Total	45385	34995	27916	19885	24100	6180	7280	34395

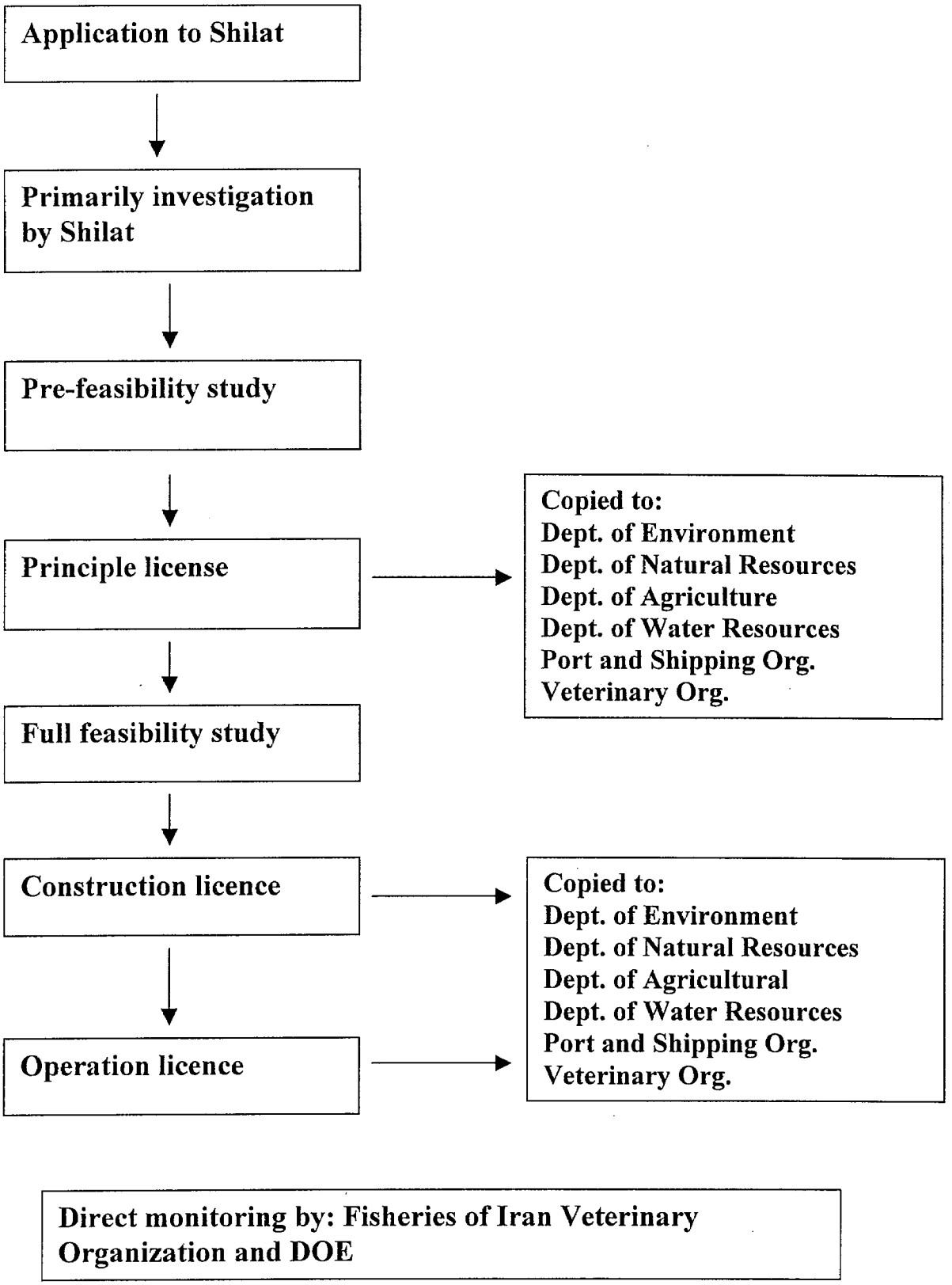
Table 2. Specifications of shrimp farming system in Iran

Parameter	**Value**	**Parameter**	**Value**
Pond size (ha)	0.75 – 1.3	Average body weight (g)	13 – 16
Dike and bottom	Earthen	Polyculture	None
Water supply system	Pump	Aeration	Natural + aerator
Water drainage system	Gravity + pump	Water salinity (ppt)	37 – 47
Production (mt/ha)	1.5 – 3.0	Survival rate	70%
Seed source	Hatchery	Production cost (US$/kg)	3 – 4
Stocking density (pl/m2)	22 – 25	Labor (person/ha)	0.6
Feed source	Supplementary + natural	No. crop/year	Usually 1, sometimes 2
Days of culture	120	Disease problem	yes

Table 3. Selected sites for cage culture development

Area/Region	**Production potential (tons)**
Bandar Mahshahr	1000-2000
Khark – Kharku Island	5000-10000
Kangam – Tombak – Aktar - Taheri	15000-20000
Bandar – Jabodul el-aam	5000-10000
Bandar Mogan – Chiru – Corzeh – Bandar Charak	20000-30000
Hendourak Island	5000-10000
Kish Island	4000-10000
Farour Island	1000-5000
Queshm Island (SE)	15000-20000
Hengam Island	5000-8000
Larak (N+NW)	>10000
Questach	10000-20000

Figure 2: Process of aquaculture licensing in Iran



Legal Framework for Protection and Management of Coastal Areas

By the National law of I.R. Iran, Dept. of the Environment (DOE) of Iran is responsible for the environmental protection and development. Except for few cases related to fisheries, the national law is referred to the entire environment. They could be enumerated:

- *Law of Environmental Protection and Development,*
- *Law of Protection and exploitation of the Fisheries Resources,*
- *Law of protection of the Seas and internal water-bodies against the oil and non oil-product Pollution,*
- *Law against over-fishing,*
- *Law of proper use of-water resources,*
- *Law of Protection against the Natural Environmental Damages,*
- *Law of Environmental Protection against the Water pollution,*
- *Law of Protection of the National Parks, Protected Areas and Sensitive Areas,*

Coordinated Agency:

In order to make a better coordination amongst the maritime and marine organization, High Commission on Oceanography was established in 1991 with 7 Committee as:

1- physical oceanography (National Meteorological Organization)
2- Marine services and navigation (National PSO)
3- Marine engineering and mapping (Ministry of Petroleum, environmental protection and marine pollution (DOE),
4- Marine living resources (Fisheries Dept.),
5- Marine non-living resources (Ministry of Higher Education),
6. Oceanographic education and knowledge (Min. of Higher Education).

The Main Environmental Acts

Regarding the fisheries activities and environmental issues. The following Acts are now in force which was mentioned earlier. These are:

- *The Environmental Protection and Enhancement Act (1974),*
- *Text of Protection and exploitation of the Fisheries Resources,*
- *Framework of the Environmental Impact Assessment (EIA) undertaken by the DOE,*
- *High Council for the Environment*

The High Council for the Environment is headed by the president and other relevant ministers are a member of this committee. Decision taken by this committee is practiced throughout the country and is obeyed in all aspects. EIA guidelines have been approved by this Council and its components are as follows:

Environmental Impact Assessment

BY-LAWS (GUIDELINE) OF ENVIRONMENTAL IMPACTS ASSESSMENT

In order to implement the decision of Environment Protection High Council made on 23rd marchl994, the guideline for preparing report on environmental impact assessment (EIA) should be as follows:

Article 1- The implementing bodies of plans and projects, inserted in article 2, should prepare the report on EIA according to this guideline, as well as the report on project feasibility and site selection studies.

Article 2- Plans and projects, falling under this guideline, are as follows:

a. Petrochemical factories at any size.

b. Refineries at any size.

c. Power plant station with the capacity of 100 mw and more.

d. Steel industries under the following two sectors:

1- Firms producing raw material for steel mills with the annual capacity of 300,000 tons and more.

2- Rolling and forming plants with the annual capacity of 100,000 tons, and more.

e. Dams and other water structures in the following three sectors:

1- Dams with the height of 15 m, and more or having side structures of more than 40 ha or lake with the area of 400 ha and more.

Note 1- Inactive dams (for maintaining polluted substances) at any size, are subject to EIA.

2- Man-made lakes with the area of 400 ha, and more.

Note 2- The size of the lakes for fish farming with the area of 400 ha and less should be decided in coordination with the Ministry of Jihade Sazandegi and Department of Environment (DOE).

3- Irrigation and drainage plans and projects with the area of 25000 ha and more.

f. Industrial estates (of any type) with the area of 100 ha, and more.

g. Airports with the runway length of 2000 m, and more.

Article 3- above types of projects (regardless of their dimensions) coming within the impact able limits of the plans and projects, inserted in article 2, are subject to the EIA.

Article 4- above types of projects (regardless of their dimensions) coming within the impacted limits of projects or inside the special biotic regions, are subject to the EIA.

Note 1- list of special biotic regions together with their situation and the impact able distance, approved by the official authorities, are published regularly by DOE.

Note 2- list, situation and impact able and impacted distance of the existing 7 types of projects in country (according to the definition of article 2) are prepared, and published by DOE.

Article 5- The implementing bodies of the plans and projects which are subject to the EIA, should submit a preliminary report to DOE, and DOE after studying it announces the important and key points (at most within a month) that are to be considered by the implementing bodies during the assessment.

Note - All the environmental by-laws and regulations which are approved by the official authorities and should be observed during the EIA, are prepared by DOE.

Article 6- The implementing bodies of projects, falling under this pattern, should prepare the report on the EIA with regard to the announced points by DOE and the related by-laws.

The reports should be prepared by experts, scientific centers and specialized firms whose competence is confirmed by related authorities.

Note - Until the establishment of the appropriate firms and centers falling within this guideline, the Plan and Budget Organization in coordination with the DOE is responsible for publishing the preliminary list.

Article 7- The EIA is prepared for two situations by main activities:
1- Construction period
2- Operation period
Producers of the assessment suggest the necessary measures for reducing the negative environmental impact as well as the expenses.

Article 8- At the end of the report, the recommendation of the producers of the EIA is stated in one of the following three ways:
a. Implementation of the plan or project is not recommended.
b. Implementation of the plan or project is possible provided that the necessary measures for reducing the environmental impact are taken.
c. Implementation of the plan or project is possible needless to take any important measure.

Article 9- DOE announces its viewpoint within 3 months (at most) regarding the announced criteria.
Note 1- In order to coordinate affairs related to the EIA of plans and projects, a scientific committee, consisting of experts and academicians, under the supervision of head of DOE is formed. The committee is

responsible for the scientific side of the assessment and consists of the following members:

Head of DOE as the chairperson of the committee.
Five experts and academicians who are appointed by the head of DOE.
Representative of Plan and Budget Organization.
Representative of Forests and Pastures Organization.
Representative of Iran standard and Industrial Research Institute.
Representative of the ministry or organization pertaining to the proposed plan or project.

Note 2- If the implementation or operation of development plan(s) or project(s), regarding the results of the EIA, contradicts the laws and regulations of the environment protection, D.O.E will inform the related ministry or Institute of the case, so that a solution could be found and the project would be reviewed. In the case of disagreement, The Iranian President's decision will be put into effect.

Article 10- The dimensions to be studied for the environmental impacts, in the case of all 7 types of projects, after studying the existing environmental situation, are as follows:

a. Environmental impacts on physical environment:

1- Impacts on land: morphology and qualitative.
2- Impacts on water: water quality and quantity.
3- Impacts on land, air and sound: air and rainfall changes, air quality.
4- Secondary impacts on soil, water and air.

b. Environmental impacts on natural environment:

1- Impacts on the plant species
2- Impacts on the animal species
3- Impacts on habitats, landscapes and birds' migration route.

c. Impacts on social and cultural environment:

1- Impacts on the people's health and environment.
2- Impacts on social environment: employment, housing, education.
3- Impacts on cultural environment: people's religious and cultural beliefs, cultural heritage.

d. Environmental impacts on the development plans:

1- Impacts on the other agricultural, industrial and service development plans in the region.
2- Impacts on the regional spatial plan.
3- Impacts on the regional lands use.

FISHERIES AND AQUACULTURE IN THE STATE OF KUWAIT

Country Report

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Presented as a country report at the "ENVIRONMENTALLY FRIENDLY AQUACULTURE AND FISHERIES PRACTICES" Workshop held at Hurghada, Egypt on September 15-17, 2002

INTRODUCTION

Kuwait lies at the northwest of the Arabian Gulf, between latitudes 28° 32' and 30° N and between longitudes 47° 43' & 48° 50' E. To the north and west it shares a border of 240 km with the republic of Iraq, and to the south & south -west it shares a border of 250 km the Kingdom of Saudi Arabia. To the east it has a coastline of 290 km on the Arabian Gulf. The total area of Kuwait is about 18,818 km^2.

THE COAST

- Kuwait has a coastline that extends 500 km (including the coast of its nine islands).

- Kuwait's marine area covers 822 km^2 that equals only 3.5% of the total area of the Arabian Gulf.

- The 290 km coast can be divided into two main parts; one extends along the Arabian Gulf and other lies around Kuwait bay and khor subiya. The two areas are basically different. Most of the first area, 70 km in length, is characterized by mud flats, especially in the shallow area in the bay of Kuwait. Where the maximum waves height is 16 cm opposite Kuwait City.

Main Economic Activities

The economic activities on the coastline can be divided into seven categories as follows:

1. Industrial area

water desalination and power plants
sewage treatment facilities
industrial facilities
oil refineries

2. Commercial area

seaport facilities

3. Urban area

about 500 km^2

4. Military and security area

5. Recreational area

6. Natural reserves

7. Privately owned area

Institutions involved in coastal zone management

1. Public Authority for Agriculture Affairs and Fisheries Resources (PAAFR).
2. Kuwait Institute for Scientific Research (KISR).
3. Environment Public Authority (EPA).
4. The Kuwait Foundation for Advancement of Sciences (KFAS).

FISHERIES

Objectives:

1. Protecting and developing the fisheries and optimally investing the fisheries in a manner to preserve and avoid exhaustion of the same due to random fishing or other harmful practices.

2. Developing the domestic research, studies and statistical practices in the field of fisheries.

3. Enhancing the modem fish industries programs and projects.

Policy and procedures

1. Reviewing and updating the legislation, laws a ad regulations and setting up the rules to protect the fish stock in the Kuwait waters and endeavor to enforce the same.

2. Specifying no fishing zones and seasons, preventing harmful fishing methods and specifying the various methods of fishing.

3. Setting up marine control programs for the work of fishing boats in the Kuwaiti waters to ensure their compliance with the law and the resolutions promulgated for the protection of the fish stock, and setting up fish assessment programs on the imports and consumption of marine specie", in the local market.

4. Training the national staff qualified to work in the fisheries sectors.

5. Adopting modem technological ways, encouraging fisheries programs and projects to eliminate the deficit in the local market imports of fresh fish, preparing control programs over the local markets marine species imports and applying regulations on the fish sizes.

6. Implementing programs on the applied studies and research to tackle the problems and difficulties facing the fisheries sector or the purpose of developing the fishing methods in the Kuwaiti waters.

COASTAL LINE

Objectives

1- Preserving the natural characteristics of the coastal environment and its balance.

2. Preventing sand drifts, coastline erosion and unnatural sedimentation of sand or mud.

3. Tackling the expected problems of higher sea level and beach and mud protection techniques, if necessary.

Policy and procedures

1- Studying the impact of earth covering and drilling operations on the coastal areas, port construction and expansion and construction of the various industrial and residential areas along the coastline.

2- Creating a kind of balance between the usages of coastal areas for establishing settlements, tourists chalet, fishing, constructing ports or any other constructions along the coastline.

3- Preparing maps on the sensitivity of the various coastal areas to the pollution accidents and their importance, as sports, for fish and marine species reproduction, particularly in certain areas of special value, such as al-khiran area.

4. Specifying the areas affected by the erosion, random expansion and conflict between the usages and requirements of proper management.

5.Preparing programs for control over the coast conditions and preparing emergency plans to prevent beach pollution.

6. Preserving the biological diversification in the tide and ebb areas.

Fishing Practices:

1. Hand line fishing
2. Drift net fishing (surface gill-net fishing).
3. Resting gill-net fishing.
4. Stable gill-net pots fishing.
5. Stable traps fishing (Hadhra).
6. Bottom pot fishing (Garageer).

Fisheries

The fisheries resources can be divided into:

1. Shrimps: the mean catch is about 2200 tons every season, 70% for local consumption and the rest is for exportation.

2. Fishes: the mean catch is about 6000 tons per year that covers about 60% of the local demand, while the rest is imported.

Aquaculture

1. Land based: about 100 land based farms exist, producing about 30 tons per year for local consumption. The main species is Tilapia.
2. Marine cages: one mariculture company established in 1992 produces 400 tons per year of Local and European sea bream mostly for local consumption, while the rest is exported.

The constraints to fisheries development:

1- Human causes:

a. Over fishing.

b. Pollution.

c. Fishing in restricted area such as Kuwait Bay and the area located within three miles from the shore, which represents an important nursery for several species of fishes and shrimps.

d. Lack of legislation to organize fishing operations and monitoring.

2- Natural causes:

a. Limited fishing area

b. Climate

c. Limited Biodiversity

d. Feeding habits

Environmental problems affecting fisheries and aquaculture

1. Oil pollution
2. Sewage and rainwater drains
3. Power plants
4. Industrial and hospital waste
5. Dredging and land filling
6. Environmental phenomena (Red tide)

ENVIRONMENTALLY FRIENDLY AQUACULTURE AND FISHERIES PRACTICES IN SULTANATE OF OMAN

Country Report

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Presented as a country report at the "ENVIRONMENTALLY FRIENDLY AQUACULTURE AND FISHERIES PRACTICES" Workshop held at Hurghada, Egypt on September 15-17, 2002

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BRIEF OVERVIEW

Geography & Topography

Oman is located in the southeast corner of the Arabian Peninsula. It has more than 3165 km of coast from Musandam in north to Salalah in south which faces three seas: Arabian Gulf, Gulf of Oman and Arabian sea (Figure 1). Oman has 8 regions with 6 coastal ones. The total area of Oman is about 309500 km^2 that contain the main land and some of islands such as Masirah and Al-Halaniyat islands. The total area for Exclusive Economic Zone (EEZ) of Oman is about 163800 km^2, while the area for continental shelf is about 17800 km^2 (Edris, 1987). Oman has about 11 topographical areas such as (Anonymous, 1990):

1. Mountain.
2. Mountain & Plateaus affected by monsoon.
3. Dissected rocky plateau.
4. Accumulation plain.
5. Accumulation / denudation plains.
6. Coastal alluvial plain.
7. Sabkha and dunes.
8. Nearly level pediplains.
9. Gently undulating pediplain.
10. Umm As-Samim sabkha.
11. Sand dunes areas.

There are two coastal alluvial plain in Oman; one in Al-Batinah region and the other in Salalah. These plains were formed from the deposition of wadis mainly fine sand and granules. Sabkha areas appear dominantly in Al-Wusta region and Eastern coastal plain in Sharquiah region.

In general, the climate of Oman is semi-tropical desert climate, except for the mountains of Salalah, which has tropical climate with seasonal rain. The latitude position of Oman between 16° N and 27°N, place it under the influence of equatorial convergence zone (Anonymous, 1985). This is a belt of converging trade wind systems that encircle the earth near the equator. The coastal areas of Oman are characterized by hot & humid weather in summer and relatively cool weather in winter. The interior region has hot & dried weather during the summer, while in winter it has cool weather. The mountain areas of Oman have in general a moderate climate around the year.

The average air temperature in Oman is about 17-29 °C (Anonymous, 1999). The lowest average air temperature in Oman was found in Jabal Al-Akhdar (Green mountain) & Qairoon Hairiti (17.8 & 21.4) respectively. The regular rainfall in Oman is found only in southern region of Oman and Al-Hajr mountains. For the other area, the rainfall is scarce and not regular. In general the annual average rainfall range between 14.1-36.02. The highest average rainfall occurred in Saiq in Jabal Al-Akhdar. The average relative humidity in the coastal area varies between 50-90 %, while in the interior region which is more dried. The relative humidity is less than 50 %. The relative humidity in the interior region may sometime reach 1 or 2 %.

Population

The total population of Oman in 2000 was 2,402 million people of which 624000 was expatriates or 26 % of the total population (Anonymous, 2000 a). The total population in 1997 was 2,225 million of which 613000 was expatriates or 27.5 % of the total population (Table 1).

Table 1: Population of Oman by region (in 000) from 1997-2000.

Region	1997	1998	1999	2000
Muscat	625	622	635	661
Al-Batinah	625	641	649	667
Musandam	32	33	33	34
Adh-dhahirah	202	205	208	215
Ad-Dakhliyah	254	261	265	272
Ash-Sharqiyah	286	293	298	307
Al-Wusta	19	19	20	20
Dhofar	212	214	218	225
Total	2255	2287	2325	2402

Economic activities

The gross domestic production was increased from 104 million O.R. in 1970 to 5288 million O.R. in 1995 (51 times more). In 1999, it reached 6011 million O.R. The income/person from GDP was increased from 158 O.R. in 1970 to 2292 in 1999, (Anonymous, 2001 b). The oil sector is the major contributor to the GDP of Oman, hut due to the economical policy of the government; this contribution was decreased from 69% to about 31%. The non-oil sectors contribution was increased from 862 million O.R in 1980 to 3287 million O.R. in 1995 and 3901 million O.R. in 1999 represented about 69 % of the total GDP.

The export increased from 1294 million O.R. in 1980 to about 2787 million O.R. in 1999 and this is mainly through oil export. On other hand, the import was increased also from 678 million O.R. in 1980 to 1846 million O.R in 1999, and this is due to the major development in Oman, which implies continuous increased in the importation of commodities.

The foreign trade increased by 9.8% (2877 million O.R.) in 1998 compared to 2643 million O.R. in 1997. From table 2, we can see that contribution of fisheries sector to the GDP varies from 0.6-0.9%, while the contribution of crude oil to GDP was 47.5 % (Anonymous, 2001c). The future vision of Oman economic sector expect that the contribution of oil sector to the total GDP will decreased to 9% in 2020 and the natural gas will contribute about 10 % of GDP in 2020 (Anonymous, 2001b). Table (3) shows the main imported items. The main exporting commodities are fiber materials & its products, live animals & its products, plant products, electrical materials (Table 4). These export

commodities were sent to about 60 countries around the world with United Arab Emirates as the main commercial partners in addition to Japan, UK, USA, Germany, France, Saudi Arabia, China and India.

Table 2: Gross domestic product by kind of economic activity (million O.R).

	1997	1998	1999	2000
Crude oil	2387.3	1609.7	2299.2	3618.3
% of GDP	39.2	29.7	38.1	47.5
Natural gas	56.3	62.9	66.6	101.6
% of GDP	0.9	1.2	1.1	1.3
Agriculture	106.7	102.3	106.7	101.1
% of GDP	1.8	1.9	1.8	1.3
Fisheries	52.8	50.9	52.3	48.7
% of GDP	0.9	0.9	0.9	0.6
Industry activities	517.3	536.9	490.7	645.9
% of GDP	8.5	9.9	8.1	8.5
Service activities	3081.9	3169.5	3140.0	3273.3
% of GDP	50.6	58.5	52.0	42.9
Total GDP at market price	6089.5	5415.9	6040.6	7622.8

Table 3: Recorded import by value (million O.R) and by weight (000 ton)

	1998		1999		2000	
	Value	**Weight**	**Value**	**Weight**	**Value**	**Weight**
Food & Live animals	231.1	988.8	246.6	1069.2	233.0	1175.7
Fish & fish preparation	2.0	17.7	2.0	9.7	2.1	11.2
Beverages & tobacco	110.9	165.5	140.2	126.0	167.5	121.2
Crude materials, inedible except fuels	36.4	329.7	35.4	350.9	56.1	727.1
Mineral fuels, lubricants & related materials	21.2	119.3	24.2	265.1	31.7	215.7
Animals, vegetables, oils, fat and waxes	15.1	59.2	16.2	69.2	12.8	71.5
Chemicals and related products	141.6	213.8	132.5	206.2	140.4	227.3
Manufactured goods classified chiefly by materials	396.8	1297.6	263.0	969.9	267.9	982.8
Machinery and transport equipment	1010.0	314.2	744.4	246.6	838.1	261.0

Table 4: Non-oil export products by value (million O.R.) and weight (000 ton).

	1998		1999		2000	
	Value	Weight	Value	Weight	Value	Weight
Live animal & animals products	30629	59236	39791	63776	41608	68365
Vegetables products	18572	111911	12617	98257	19797	166375
Animal or vegetable fats & oil	9023	24614	8355	24890	9608	30305
Minerals products	18191	108472	24380	533438	30337	876125
Products of chemical or allied industries	12704	31393	14839	42849	19228	58677
Plastics & Rubber	6225	9473	9453	15616	11498	16135

STATUS OF FISHERIES AND AQUACULTURE IN OMAN

Introduction

While aquaculture is still in its infancy in the Sultanate, the same global trends that maneuver the industry in the world are also evident. As the total value of Omani Fisheries production has stabilized and, for some commercially important species, even declined over the last five years, interest in mariculture as an alternative source of high quality protein has increased. The Sultanate of Oman possesses the potential to capture a significant proportion of projected aquaculture growth, not only within the Gulf Cooperation Council States, but also regionally. Aquaculture investment opportunities have been generated due to national strategies that look forward 10 industrial diversification, the obvious market potential than many cultured species have, and because the Sultanate otters many competitive advantages production-wise. Compared with many overseas locations. Oman boasts a clean tropical growing environment for marine aquaculture.

Fisheries

The total production of fish in 2000 reached 120421 ton (52.77 million O.R.) with an increase in production about 11 % and decreased in value about 5 % from year 1999 (Anonymous, 2001 a). The total production of fish in Oman from 1997 -2000 is shown in table 5.

Table 5: Total landing (mt) of fish from 1997-2000.

Year	Catch	Value (million OR)
1997	118994	59.41
1998	106165	54.42
1999	108809	55.52
2000	120421	52.77

The export offish reached 46408 ton with a value of 37 million O.R. with an increased of 1.7 % from 1999 (Table 6). The percentage of export of fish to the total landing was 39 % in year 2000 (Anonymous, 2001 a). The main imported country for Omani fishes is Emirates, which contributed about 48 % of the total export quantity. Other main countries include Saudi, Korea, China, Qatar, Jordan, Lebanon, Spain, France and Thailand. The main fish species which are imported include Salmon, Carp, Tuna, Tilapia, mussel, crab, shrimp and lobster.

Food consumption pattern in general depends on imported and convenience foods. The increased in per capita income has brought increased purchasing power to the people, and (lie nutritive value of the diet has improved as a result of an increase in the consumption of animal protein, vegetables and fruits. Fish is consumed more frequently than meat and chicken. In one study, it was found that 26% of mothers

consumed fish daily, 44.6% and 27% consumed it 1-3 times and 4-6 times per week respectively (FAO, 1995). This consumption differs with regions with more consumption being utilized in coastal areas. Last statistics by FAO showed that about 11740 mt of fish & fishery products in Oman were for non-food uses (FAO, 1999). The portion for food supply is 53605 mt. The consumption of fish in Oman is about 24 kg/year. Dates are also very important part of the Omani diet and are consumed both with meals and throughout the day.

Table 6: Total fish export (ton) & value R.O. (1000) and import (mt) during 1997-2000.

Year	Total landing	Export	Export value	% (export/total landing)	Import
1997	118994	36476	27137	31 %	2178
1998	106165	34847	28127	33%	1087
1999	108809	45632	35457	42%	942
2000	120421	46409	37182	39%	1121

Aquaculture

For the reason of aquaculture development, Ministry of Agriculture & Fisheries established the aquaculture laboratory at Marine Sciences & Fisheries Centers in 1992. These laboratories take the responsibility of conducting the scientific researches in aquaculture. In 1996, the Ministry of Agriculture & Fisheries established an aquaculture committee to study the applications submitted by the private sector. In year 2000, aquaculture development section was established in the Fisheries Directorate to deal with the private sector and investment opportunities in aquaculture sector.

Aquaculture laboratory

The aquaculture laboratory was established within the frame of the Marine Science & Fisheries Centre (MSFC) with the main objectives of:

1. Undertaking applied research and select methods suitable for the Sultanate of Oman.
2. Survey of spawning grounds and identifying suitable sites for future mariculture projects.
3. Technical evaluation of the proposed projects from the private sector.

Since 1992, the laboratory conducted different research projects in aquaculture. These projects were successful and revealed the possibility of conducting commercial projects in Oman.

Project 1: Preliminary site survey

This project was conducted in 1992. Specific sites were visited and analysed for aquaculture projects possibilities. These sites were in Musandam, Muscat and Salalah.

Project 2: Experimental Shrimp & Shellfish Culture in Sultanate of Oman

This project was divided into two parts for shrimp and for oyster. The main objectives of the project was to study the growth of whit shrimp *Penaeus indicus* (native species) shrimp growth in cement pond culture system (Figure 2), identify oyster resources, species, spawning season, monitoring physicochemical parameters influencing the growth of shellfish and establish suitable methods for spat monitoring and collection using artificial collectors.

The estimated production from pond trials using high stocking rates was very encouraging and reached up to 5376.6 kg/ha/120 days, with a survival-of 71.8%. and at FCR of 2.53: 1. Data collected from the hatchery trials showed that larvae can successfully reared from nauplius to post-larvae with, 22.8% (PL15) survival. For oyster, an average growth of 66.39mm/ year was obtained; average meat weight of 7g per piece was also obtained. At the collection site larval number of pearl oyster *Pinctada magaritifera* and *P. radiat* reached up to 100/m^2, with a dominance *of P. radiat* spats were also collected, this gives good indication for the possibility establishing commercial pearl oyster culture project.

Project 3: Finfish cage culture

The project concentrates its activity in testing the viability of finfish cage culture in the Omani environment. In 15 months the gilthead sea bream (exotic species) *Sparus aurata* attained an average weight of 329.3g with a survival rate of 85.9%, the Sobaity (native species) attained an average weight of 604g in 12 months only, with a survival rate of 96.54% and with food conversion ration of 2.1-1. The project proved to be technically feasible and similar projects could be implemented in the Omani conditions. This project was a joint project with private company (Oman Fisheries Company).

Project 4. Abalone pilot seed production project

The project started in the Southern Region with the help of Japanese experience (JICA) with basic objectives to applying the rearing technology of seedling production on the Omani species (*Haliotis mariae*) and the evaluation of food consumption and growth of abalone juveniles. The A lot of basic biological knowledge regarding artificial, conditioning, spawning inducement, larval management and settlement, rearing of juveniles and abalone spawning season were obtained. Seeds were raised up to a size of 50mm; reaching up to a commercial size need more time and was not among the project objectives. This project is still going and there is a future plan of stock enhancement of abalone.

Potential species for aquaculture in Oman

Some of the listed species are tested before in the research projects of the aquaculture laboratory (Table 7).

Table 7: Possible cultured species in Oman

English name	Species	Arabic name
	FINFISH	
Groupers	*Epinephelus sp & others*	الهامور
Seabream	Several species*	الكوفر
Rabbitfish	*Siganus oramin*	الصافى
Pomfret	*Stromateus niger*	
Sobaitv	*Acanthopagrus cuveiri**	السبيطى
Mullets	Several species**	** البياح
Mussel	*Perna virids P. pictus*	بلح البحر
	CRUSTACEEANS	
Shrimp	*Penaens indicus** ; *p. monodon***; *P. semisulcatus*	الربيان
Crabs	Scylla serrata	سرطان البحر
	MOLLUSCA	
Rock oyster	**Saccostrea cucullata ***	*محار الصخر
Pearl oyster	**Pinctada sp**	محار اللؤلؤ
Cockle	*Anadara sp*	
Clams	*Paphia gallus; Mercenaria sp.*	
Abalone	*Haliotis mariae**	* الصفيلح
Scallop	*Pecten erythracensis*	الأسكالوب
	SEAWEEDS	
	Gelidium pusillum	
	Gracilaria canaliculata	
Red Kelp	*Ecklonin radiata*	الكلب الأحمر
Red seaweeds	*Hypnea sp.*	الأعشـــاب الـــبحرية

* tested before **being tested commercially know

Aquaculture development section & aquaculture committee

The main work of this section is to deal with the companies want to invest in the aquaculture sector and also increase the investment opportunities in this sector. The aquaculture committee is under responsibility of Ministry of Agriculture and headed by the Director General of Fisheries Resources and contains members from this ministry and also Ministry of Regional Municipalities Environment & Water Resources, Ministry of Housing & Electricity & Water, Ministry of Trade & Commerce, Ministry of Transport & Telecommunications and Oman Chamber for Commerce & Trade.

This committee meat four times a year to study the applications and give recommendations about them. The process for submitting the application for aquaculture projects is as follows:

1. Submit the application (letter, preliminary form 1 and pre-feasibility study) to Director General of Fisheries (Head of Aquaculture Committee).
2. Studying and site evaluation of the application by the aquaculture laboratory and also by the other ministries in the committee.
3. Giving the primary approval
4. Filling the comprehensive second form and submit the detailed feasibility study.
5. Revising item 4 by the committee and give recommendations to the Minister.
6. Giving the final approval.

Current activities of aquaculture

Government sector

There are two current projects in the aquaculture laboratory; the first one is the environmental studies in the Omani waters & aquaculture site selection. This project divided into parts, the ecology parts held by the Ecology laboratory and the aquaculture site selection held by aquaculture laboratory. The aquaculture part of the project aimed to find the suitable sites for aquaculture projects in Oman and also to formulate the guidelines for development of aquaculture. The other part of the project aimed to collect the important environmental data such as temperature, salinity, dissolved oxygen, and nutrients. All the collected data of this project will be incorporated in Geographical Information System (GIS) to better use of them in future.

The second project is the feed development for the aquaculture in Oman. The main objective of this project is to use the by catch from industrial trawl to formulate a feed for farmed fish in order to reduce the cost of imported feeds for aquaculture projects in Oman.

There is also a unit for abalone culture and seed production activities in Mirbat in Southern region. This unit is under the technical administration of marine Sciences & Fisheries Center. It has the facilities to collect and produce small abalone. The abalone project was held in this unit and the activities of abalone culture are still going there.

The laboratory is in the process of building a small unit for plastic tanks to conduct the trials on fish feeding in the feeding project. Currently, there is 8 staff in this laboratory (6 Omani & 2 experts). The Omani staff are all educated in fisheries researches (4 master in aquaculture & 2 bachelors in Fisheries sciences and 1 high diploma in aquaculture). The Staff was trained in aquaculture through the researches projects conducted at the center and also through the outside training courses. There were courses in Malaysia, Iran, China, Brunei, Japan, Korea and Egypt. At the aquaculture development section, there is only 1 Omani staff with Bachelor degree in Fisheries Sciences.

After the successful of the researches projects of the aquaculture laboratory, the private sector started to invest in this growing business in Oman. Many companies applied for shrimp culture and also for cage

culture of finfish along the Omani coast. About 16 applications have been approved either primary or final (Table 12). Six projects for cage culture, 9 for shrimp and 1 for abalone. Currently, there are only two projects, which are actually works and have facilities.

Table 8: Application for commercial aquaculture projects by region.

Project	Area	Number
Finfish cage culture	Musandam	2
Finfish cage culture	Muscat	2
Finfish cage culture	Quriyat	1
Finfish cage culture	Qalhat (Al-sharqiuah region)	1
Earthen pond for shrimp	Shinas (Al-Batinah region)	2
Earthen pond for shrimp	Musaniah (Al-Batina region)	3
Earthen pond for shrimp	Quriyat	1
Earthen pond for shrimp	Masirah island	1
Earthen pond for shrimp	Duqm (Al-wusta region	1
Earthen pond for shrimp	Bintot (Al-Wusta region)	1
Plastic tanks for abalone	Mirbat	1
Total		16

Private sector

Finfish cage culture (Quriyat aquaculture company)

This company has two sites in Muscat, one in Bandar Khyran and the other in Quriyat. The former site was the trial site for the aquaculture laboratory project with 4 cages (40 m circumferences). The company added anther 6 large cages (60 m circumferences, 6 m deep) and cultured three species which are imported from Greece:

European sea bream (Sparus aurata), sea bass *(Dicentrachus labrax) and* mullet *(Mugil sp)*. This site is taken by an agreement between the Ministry and company by which the company offered training for the Omani staff of the Ministry and help in establishing the diseases laboratory at the marine center. In Quriyat, there are 10 large cages with only 6 used ones.

Currently, the fishes at Bandar Khyran attained about 500g for sea bream, 356g for sea bass and 350g for mullet. The expected production of this company in this year is about 400 ton. This company employee about 24 worker of which 14 are Omani staff.

Shrimp project in Duqm (Oman-International Shrimp farm)

This company has an area of 2000 hectare and it started with only 11 hectare as quick trial (1 five hectare pond and 6 one hectare ponds). They produce about 200 kg of shrimp. Currently, they entitled to produce about 10-15 ton of shrimp. This Company cultures an exotic shrimp species Tiger shrimp *(Penaeus monodon)*. They import the brooders from Tanzania and they send them to USA for diseases tests in two stages. The

first one before the reproduction (sample of stock). The second one, the whole brooder stock. The results were negative and no diseases were encountered in the shrimp.

This company builds a temporary hatchery-maturation facility at the Marine Sciences & Fisheries Center to produce the fry for the farm in Duqm. Currently, the employees in this company are about 11 with 1 Omani.

Aquaculture Development

National plan for aquaculture development

Because intensive aquaculture does not exist within Oman, diseases, which have caused catastrophic losses among aquaculture industries worldwide, have not been introduced. It is, therefore, important to establish strict national level controls in order to maintain the country's excellent starting position from a disease perspective. The Government regulatory agencies, especially the Marine Science and Fisheries Center (MSFC), under the Ministry of Agriculture and Fisheries, are very conscious of the need to ensure that the development of aquaculture proceeds in a manner that does not jeopardize its ecological advantages and sustainability.

In recognition of the considerable potential that mariculture offers in job creation and in supporting regional business development, the Government of the Sultanate has recently focused attention upon developing and implementing measures that not only stimulate further development of the industry throughout the country but also safeguards its sustainability. Accordingly, it is within the national interest to establish leading-edge guidelines that will provide sustainable strategies for controlled development. This focus has brought with it the need to develop an aquaculture master plan for the 3 systems that are applicable to local conditions *viz.* inland-based aquaculture production units (ponds. tanks, raceways); offshore-based production systems (cages), and, lastly, hatcheries. This strategy, the draft of which is being developed under the leadership of the MSFC, demands an approach that encompasses inputs from all government agencies involved in the licensing and control of the industry and by its nature, demands significant contributions from industry, environmental groups and the communities who will be participating in or impacted by, development. This important national planning document will be a landmark for aquaculture in Oman and will assist investors, consultants and planners in preparing and submitting development applications, leading to ecologically sustainable aquaculture practices.

The proposed master plan, which will present a holistic approach to aquaculture development, will also help local authorities and regulatory agencies to assess development proposals. An ability to streamline the

approvals process should increase investment opportunities along the coast while providing excellent incentives for economic development and benefits to the national strategy of industrial diversification. The following document overviews some of the proposed components for the master plan and, where appropriate, discusses specific mechanisms of regulation.

Master plan organization

The Plan aims to promote a viable and environmentally sustainable aquaculture industry. Policies are presently being developed in relation to site selection, facility design, effluent control, translocation and culture of aquatic species, health management issues and general good aquaculture practice.

Legislation and integration of the approvals process

In Oman, any person or organization wishing to commence a commercial aquaculture enterprise must obtain a permit from the Ministry of Agriculture and Fisheries. The integrated approvals process of the Master Plan will aim at providing an assessment and approval framework that is being streamlined, for efficient evaluation, appropriate development controls, and holistic decision-making. The Master Plan will require effective collaboration between government; industry and the community to bring together the interests of economic development, land use planning and development control, and environmental conservation to form a partnership that can lead to sustainable aquaculture and employment in the region.

Environmental monitoring

Aquaculture is a groundbreaking industry in Oman. It is, therefore, important to prevent such developments from degrading the marine environment and spoiling coastal resources that possess value other than to mariculture *(e.g.* tourism). An environmental program, incorporating surveillance, monitoring and reporting systems will thus be required to consolidate information on, and to protect Oman's aquatic environment by facilitating the detection and reporting of, and response to environmental degradation due to industry operations. However, it will be very important for Omani aquaculture development to evaluate upper limit impact data so that realistic values are employed, and the cost of aquaculture production remains competitive in the international market. It must be recognized that the cost of complying with regulations could be a significant economic setback for small aquaculture businesses when compare with larger production facilities that may enjoy economies of scale.

Aquatic disease monitoring component

Disease-related financial losses in aquaculture represent the highest risk for intensive. The natural specific pathogen free (SPF) status of Omani aquaculture, due to the lack of aquaculture history represents a tremendous asset for future potential investors. To sustain this investment attraction a disease prevention plan must be developed to reduce the risk of disease introductions. However, for the worst-case scenario, a national level aquatic disease-monitoring program will be an essential tool to minimize the risk of spreading introduced pathogens. Such disease monitoring would require the development of a National Diagnostic System that would contribute to the identification of pathogens associated with the prescription of drugs with due regard for residual monitoring plans presently under development in the MSFC Quality Control Center. These monitoring systems will provide valuable management tools to allow government and industry to take rapid, but educated management decisions during disease outbreaks. The proposed aquatic disease-monitoring plan will also incorporate a quarantine program that will contribute to ensuring that the Sultanate retains its aquaculture SPF status.

Best sustainable aquaculture management

Sustainability can't be achieved if the aquaculture industry does not base its practices on environmental and socially responsible utilization of natural resources. In the event that such practices are ignored, the long-term impact could result in the national failure of the industry as well as significant degradation to the marine and coastal environment. This might lead to a reduction in biodiversity that is extraordinary in Oman's coastal waters (see Wilson *el* al., 2000) and is demanding of greater study for natural product development purposes and otherwise.

Non-Governmental Organizations, such as the FAO, GESAMP and the Global Aquaculture Alliance, have developed best management codes of practice for aquaculture. It is, therefore, the intention of the MSFC to develop a code of aquaculture practice based on principles applicable to all aquaculture production systems relevant to the Sultanate. The best sustainable aquaculture management component will provide a basis for developing Oman's Aquaculture Development Plan. It will identify best management for business' planning, species selection, site selection and design, and planning and operation of facilities. Moreover, it will link to relevant regulations associated with environmental monitoring. This component will present a clear message to the existing aquaculture industry, as well as to new investors, as to the environmental performance objectives expected of them.

Opportunities and constraints

There are many severe constraints to the development of Oman's aquaculture industry. Table 12, outlines some of those that are more readily apparent. Many regions have fisheries resources that are, or soon

will be, leveling-off, requiring restocking, or market substitution with cultured animals. Vast large flat areas with abundant supplies of clean, warm seawater present potential sites for aquaculture ventures. Table 13, shows the major advantage to aquaculture in Oman. There is high opportunity to develop employment within the aquaculture industry for individuals at all levels of educational attainment. The traditional reliance on family or village cooperation is a distinct advantage to aquaculture ventures that requires intermittent but large labor pools for pond construction or harvest. While the opportunities are unique, so also are the constraints that have thus far restricted aquaculture development. If aquaculture is to succeed in Oman, then each of the constraints must be thoroughly (and honestly) identified, evaluated and subsequently, proposals agreed upon to circumvent foreseen bottlenecks. The broad mission of the Development Plan will be to guide and promote the development of sustainable aquaculture in order to enhance the social and economic well being of the people of Oman while diversifying the economy in line with national goals.

Research Institutions:

The major aquaculture and fisheries research institutes under the Ministry of Agriculture and Fisheries are:

1. Marine Science and Fisheries Center (MSFC), Muscat
2. Fisheries Resource Libratory, Salalah.
3. Department of Fisheries, Musandam.

Ministry of Regional Municipalities, Environment and Water Resources

Sultan Qaboos University:

Department of Marine Science and Fisheries Technology

Recommendations

The followings are important for more sustainable development of aquaculture and fisheries at national and regional levels:

1. Produce aquaculture regulatory handbook, which define the rules, and regulations that control the development of this sector.
2. Integrate mariculture within ICZM plan of the country to minimize the conflict between the aquaculture and other sectors.
3. Adopt the environment impacts assessment for the aquaculture and fisheries projects.
4. Encourage the cooperation between the regional hatcheries.
5. Encourage pilot projects especially with the private sector.
6. Increase the awareness of aquaculture and fisheries in the local communities through seminars and public media.

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MEPA
GUIDELINES AND PROCEDURES FOR COASTAL DEVELOPMENT ACTIVITIES IN SAUDI ARABIA

By
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Saudi Arabia

Presented as a country report at the "ENVIRONMENTALLY FRIENDLY AQUACULTURE AND FISHERIES PRACTICES" Workshop held at Hurghada, Egypt on September 15-17, 2002

USES OF COASTAL ZONE

- Implementation of economic and strategic projects
- Implementation of private projects & Residential groups
- Implementation of Touristic project

IMPACT OF IMPLEMENTATION WITHOUT SOUND PLANNING

- Ownership of the Coastal Areas
- Destruction of Coastal Areas and loss of natural resources
- Loss of financial resources in maintaining and existing problems
- Hindering touristic activations
- Failure to achieve security watching as required
- Hindering implementation of contingency plans
- Failure to achieve the objectives of benefits
- Failure to achieve commitments to Regional and International conventions

MAIN CAUSES OF DESTRUCTION OF COASTAL ZONES

Absence of a plan for the CZM

Interference of tasks of concerned agencies (conflicts)

CONDITIONS TO BE FOLLOWED BY MUNICIPALITY FOR INVESTIMENT IN THE COASTAL AREAS

The touristic projects should be away from:

- National Security areas
- Strategic areas
- Environmentally sensitive areas

Appropriate distance should exist between one project and the other

No boundary fences should exist in the development activity areas

Availability of public coastal areas equipped with public services

Formulation of EIA studies

To be bound by the requirements of relevant agencies

Formulation of contingency plans

Formulation of a mechanism for monitoring the implementation of projects by relevant agencies

SOLUTIONS TAKEN INTO CONSIDERATIONS

Issuing General legislations for designation of public coastal areas not to be propertied.

Formation of Technical committee from relevant agencies to look into the existing state and to deal with each case separately with the following objectives:

Achievement of security aspects

Removal of environmental degradation

Achievement of the objectives of public benefits

Formulation and implementation of a plan for CZM with the following objectives:

Formulation of a mechanism for coordination among relevant agencies

Differentiation of different activities and uses in the coastal areas

Formulation of clear Guidelines, procedures and Standards for coastal developments activities.

Implementation of EIA For the developmental projects

ENVIRONMENTALLY FRIENDLLY AQUACULTURE AND FISHERIES PRACTICES IN SUDAN

Country Report

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Presented as a country report at the "ENVIRONMENTALLY FRIENDLY AQUACULTURE AND FISHERIES PRACTICES" Workshop held at Hurghada, Egypt on September 15-17, 2002

GENERAL

The Sudanese Red Sea coast, which is about 750 km long, divided into three main regions or provinces, which are making the Red Sea State (RSS). These regions are: Northern region-Halauib province (HP). Central region-Port Sudan province (PP). Southern region Tokar province. There are three main fishing landing centers along the coast: Mohamad Gol (HP) is of 1,400 populations. Pot Sudan (PP) is of population 360,000. Suakin (P.P) is of population 20,000 people. There are about 6000 farmers and 2000 fishermen in the RSS. These populations are based on 1993 records.

MAIN ECONOMIC ACTIVITIES

The main economic activities in the coast are:

1. Sea ports: there are two old Seaports: Port Sudan and Suakin (PP) and recently another two seaports: Bashair and Suakin for exporting petroleum and gases have been established. In addition to these the fifth one, Oseif seaport is constructed in the north (HP).

2- Refinery: Port Sudan refinery and other petroleum companies are located in Port Sudan city (PP).

3. Free zone markets area: It is located south Port Sudan city and constructed recently. It becomes active during the last two years.

4. Port Sudan airport that is used for domestic and international airlines is located by 20 km south of Port Sudan. A high way was constructed in 19970s starting from Port Sudan and going parallel with the coast up to Suakin city connecting the capital Khartoum and the other states of Sudan.

5. Salt bans: there are about 7 salt bans in the central region (P.P.) located south Port Sudan. They are of different sizes (small bans and large bans) and they are highly productive.

6. Industry: there are good numbers of factories. More than 10 different factories located in Port Sudan city. Examples of these are: tire, textile, food oil and 4 power stations.

7. Nomads activity: most of the native people along the coast grow few crops (seasonal in the winter) because of very little rainfall in the area. The others mainly grow goats and camels.

8. Agriculture activities: Small activities in agriculture activities at Arbat area (North Port Sudan) but large scale agriculture activities are found in the southern region (TP) where farmers plant different crops and vegetables supplying the Red Sea state for both humans and animals.

9. Fishing: Most of the coastal communities practice fishing in the central region (P.P.) and in the northern region (HP.) But there are less activities in southern region (T.P.), only in the area between Suakin and

Ashad, then the rest of the province have large scale agriculture activities. In total there are about 300 boats (see the table) found in the whole coastal area. Currently, only 50% of these boats are in operation. They practice fishing of the finfish, shellfish (oysters and trocus), shrimps and sea cucumbers. There are 10 active private companies that are producing fin fish (coral reef fishes) for local consumption and export. Three companies are working in fishing and processing sea cucumbers mainly for export. There are other four companies working in trawling fishing in joint ventures with Egyptian fleets totaled 25 fishing vessels producing bottom trawled fishes and sardine fishes for export.

10. Aquaculture: There are two types of aquaculture activities in the Red Sea of Sudan. The first one is oyster and pearl cultures in the northern region (HP) located at Arikii, M. Gol and Dongonab. The second type is shrimp culture, which is recently approved and located in the central, and the southern regions (PP and TP). In the oyster aquaculture there are about 60 family farms (small scale production) and a big pearl culture farm in the north (Dongonab). In shrimp aquaculture, there are recently 4 companies got licenses to have in total about 25 shrimp farms to be erected in phases (2002/2004).

AQUACULTURE PRACTICES

Oyster and Pearl Culture:

The mother of pearl oyster *Pinctada margritifera* as a native species is cultivated to produce shell and the pearls. Family farms are scattered at localities Arikii, Dongonab and M. Gol to produce shells only and to sell live oysters to the pearl culture company in Dongonab. More than fifty family farms are erected of annual stock 500,000 oyster spat in the three - years culture cycle to produce about 5 tones of shells annually. The pearl culture company has produced about 20,000 pearls and about 20 tones of shells of which pearl crops harvested during the last two years. In oyster farming two culture systems are used, the bottom culture system and the suspended culture system. In both culture systems no feed or chemicals are used. Oysters feed naturally. Very small land of the coast area is used in oyster culture used only for camping facilities at Dongonab.

Shrimp Culture

Most of the shrimp culture sites are selected and located in the central region (P.P.). All companies have licenses to grow the native species, the giant tiger prawn, *(P. monodon)*. Four companies owned 7 sites for shrimp farming along the coast. Four of these sites are located in the central region (P.P.). The other three sites are located in southern region (T.P.).

Shrimp Farming Companies

1. Arab- German company farms (6 farms) are located north Port Sudan of an area of 31.5 km^2. They have another four farms located at Ashad site (TP) of an area 21km^2.
2. Babboud company farm is located south port Sudan of an area about 5k m^2
3. Araaf company farms, six farms are located south to Suakin (30 km2) and the other small-scale family farms (10 farms) are approved at Trinktat near Tokar in southern region (45 k m^2).
4. Basheir Elshiek Company has 5 farms located at Elsheik lagoon (25km^2).

The coastal land that signed and reserved for shrimp farming for the above four companies is about 158 km, which is about 7% of the total coastal area (750km = the coast line).

Related shrimp culture factories

There is good number of factories associated with the shrimp farming industry:

1. Shrimp hatcheries
2. Shrimp feed factories
3. Shrimp processing plants
4. Ice factories
5. Tuna canning factory

Feed and Chemicals of water Discharge

In the case of shrimp farming, feed and chemicals are going to be used in the hatcheries as well as in the grow out shrimp ponds. The water discharge is partially will be reused in salt bans, for producing salt by natural drying. Also the discharge water will be used in fish culture (the main channels at farm site and finally, this water can be back dumped in deep seawater. In the case of the tuna-canning factory, the water supposed to be pumped from the sea to melt the frozen tuna that going to be delivered from the Indian Ocean can be treated and then dumped back in the sea deep water.

Fisheries

The main practices and operations in the fisheries are traditional fishing methods long line and hooks and gillnets on one hand and bottom trawling and mid water trawling on the other hand.

Small canoes

There are about 60 canoes operated by 120 fishermen. They go outside for fishing with out using ice. They may produce annually about 100 tons of fishes, wild oysters, trocus, in addition to shrimps and sea cucumbers. Usually, their operations near the shore and they cannot go far from it. They are concentrated near the small villages and small fishing camps. Most of them are found in northern and central regions.

Small boats

About 200 wooden and fiberglass boats (5m long) with out board engines are in operation. The capacity of these boats is 600 fishermen. Usually, the operations depend on the season. In the summer they work on the shells, sea cucumbers and finfishes. They practice fishing in the northern and central regions and this depends on the fishing season. In the winter they work on finfishes, sharks and shrimps. They produce about 800 tones annually from all these different resources.

Medium-sized boats

In total the number in operation is 50 medium -sized wooden boats (9-12 meter long) with are equipped with inboard engines. There are about 250 fishermen working in these boats. They produce dried fins of sharks, shellfishes and Sea cucumbers. They process all of these products on board. They produce more than 900 tones of these sea products.

Gill net fishing

About 10 groups of fishermen (more than 50 fishermen) practice gill nets fishing in the coastal lagoons. They use more than 50 gill nets of 2cm to 4cm mesh size to produce mainly mullet and parrotfishes. They may produce more than 200 tones of fishes annually.

Foreign vessels

Egyptian and Chinese fleets (25 vessels) achieved 60 trips as bottom trawling and mid water trawling operations in 2000/ 2002. This was carried out in the southern region. They produced about 1000 tones of all finishes and shrimps annually. The following table summaries the operations in the marine Sudanese fisheries (2001/2002):

Boat size	Number of boats	Number of fishermen	Annual Production	Production Value $
Canoes	60	120	100	100,000
Small	200	600	800	800,000
Medium	50	250	900	900,000
Gillnets	Pick up cars	50	200	160,000
Large vessels	25	400	1600	960,000
Total	345	1380	3600	2,920,000

Main Environmental Problems and Conflicts:

- Small-sized produced shrimps using cast nets by the local fishermen.
- Small-sized sea cucumbers produced by the fishermen and sea cucumber companies by using diving equipment.
- Destruction of the mangrove habitat by cutting mangrove trees both (fishermen and the sea cucumbers companies by cutting trees for fire in cooking and processing sea cucumber.

- Discards of the bottom trawling averaged 25% of the total catch which is thrown away as noncommercial products.
- Water cooling systems of the power stations, refinery, and other factories.
- Sea ports-oil discharge from the ships.
- Collecting shrimp post larvae and parents will have conflicts with shrimp producers if they are not allowed practice their cast net fishing for shrimps in the coastal lagoons located for the shrimp farming activities. Shrimp farming located at these coastal lagoons (Haloud, Haidoub, Elshiek and Ashad lagoons) will affect the operation of cast net and gillnets fishing.
- Oyster farming has resulted in increasing the spat collection yield of the mother-of-pearl oyster during the last few years in Dongonab bay.

The Main Institutions Involved

Marine Fisheries Administration.
Red Sea Fisheries Research Centre
Higher Council for Environmental conservation
Faculty of Marine Sciences and Fisheries, Red Sea University
Faculty of Science, Khartoum University

Tools and means

- Marine law have been revised and updated to meet new economic activities coming up.
- Regulations have been made for approving new projects or schemes in the coastal areas on the level of the Red Sea State (Port Sudan) and the Central government (Khartoum) to consider the environmental impact of these projects and to follow up this in the future.
- Environmental impact assessments of the new projects is proposed and included in feasibility studies of these new economic activities (Fisheries, Aquaculture, and other industrial activities).

Efficiency of the tools

For most of the recently approved economical activities such as free zone area. Petroleum seaports pipe line scheme, aquaculture projects. Surveys have to be done by a group of scientists for initial environmental impact assessments before the start of these projects. And also a plan should be made to repeat these assessments every two years. But we need to have a close contact with these projects by signing a specialist as a counter part for every project.

Laws and regulations are not very effective in some way as in the activities in fishery example for that is over fishing of sea cucumbers, shrimps, trocus shells and the destruction of the mangrove trees during the last few years.

Examples are:

- Produced small-sized giant tiger prawn and the white Indian prawn by the local shrimp fishermen are going on.
- Produced small - sized sea cucumbers particularly at Ashad area south to Suakin, which currently is very active.
- Destruction of the mangrove habitats by using the wood of these trees in cooking and processing of the sea cucumbers.

Difficulties

1. Very little funds are located to involved departments.
2. Most of the qualified people have moved from these departments.
3. The infra structures of these departments are not fully completed.
4. Means of transportation and communications are not improved.
5. A mechanism or a method to get all of these departments in good contacts and coordination in this issue are needed.

Applications of Environmental Impact Assessments

In aquaculture-yes it is to some extent, it is just started. Fisheries-It is not strongly implemented and in forced as the case of the sea cucumber and shrimps producers in coastal lagoon shrimp fisheries because these resources are over fished and still camps for such activities are approved in 2002.

الثروة السمكية فى الأردن

تقرير قطرى

مقدم من

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Presented as a country report at the "ENVIRONMENTALLY FRIENDLY AQUACULTURE AND FISHERIES PRACTICES" Workshop held at Hurghada, Egypt on September 15-17, 2002

مقدمـة:

فى ظل التزايد السكانى فى العالم والتطور التقنى والوعى الغذائى، ازداد الطلب على الموارد المختلفة مما أدى فى بعض الأحيان إلى استغلال هذه الموارد بشكل مفرط بحيث زادت المخاوف من نضوب هذه الموارد الذى دفع العالم للبحث عن الوسائل والطرق التى يمكن بها تحديد وضع هذه الموارد ليتم استغلالها بشكل أمثل.

الصيد البحـرى:

المياه الأقليمية الأردنية

يعتبر خليج العقبة المنطقة البحرية الوحيدة إذا ما استثنينا البحر الميت حيث يبلغ طول الشاطئ الأردنى مما يقارب 27 كيلومتر وذلك فى أقصى شمال الخليج الذى يمتد إلى ما يقارب 180 كيلومتر. ويقع خليج العقبة ضمن الأخدود القارى المحورى العميق كأحد امتدادات البحر الأحمر حيث يتميز خليج العقبة بعمقه الذى يبلغ فى معدله 800 متر ويبلغ أقصى عمق 1800 متر فى حين يبلغ متوسط عرضه 20 كيلومتر. يفصل خليج العقبة عن البحر الأحمر منطقة ضحلة يبلغ عمقها من 170-200 متر عند مضائق تيران. وبنفس الطريقة، نجد أن البحر الأحمر مفصول عن خليج عدن بمنطقة ضحلة شمال باب المندب عمقها 100 متر وهى نقطة التقاء بالمحيط الهندى.

بعض الخواص الفيزيائية والكيميائية:

يعتبر المد ضئيل ويصل مستوى المد والجزر 85 سنتيمتر وتصل درجة الملوحة إلى 40, 6 جرام فى اللتر كما تبلغ درجة الحرارة وحتى عمق 200 متر 20, 7 مئوية فى الشتاء وحوالى 26, 5 مئوية فى الصيف وقد تصل إلى 29 درجة مئوية فى المناطق الضحلة فى الصيف. ويعتبر الماء نظيفا وذو شفافية عالية وتكون الرياح شمالية فى 85% من الوقت تتحول إلى جنوبية فى حوالى 9% من الوقت. يتميز خليج العقبة بتنوع عالى لبيئات الحيد المرجانى.

الأسمـاك:

بتحليل بيئى لأسماك البحر الأحمر نجد أن معظم الأسماك هى أسماك قاعية (84%) benthic والقليل منها (16%) يعتبر من الأسماك طليقة السباحة pelagic. أما بالنسبة للعادات الغذائية، فإن حوالى 90% من أنواع الأسماك تقتات على اللافقاريات و10% من الأسماك تقتات على الأعشاب. ومع افتتاح قناة السويس هاجرت من البحر الأحمر إلى البحر الأبيض المتوسط وبالعكس.

يبلغ عدد الأنواع التجارية فى الجانب الأردنى حوالى 80 نوع يتبع أهمها العائلات التالية: Holocentridae, Fistulariidae, Seranidae, Pricanthidae, Carangidae, Lutiganidae, Haemulidae, Lithrinidae, Mullidae, Mugilidae, Scaridae, Siganidae, Scombridae.

كميات الأسماك:

يعتبر إنتاج الأسماك متدنيا فى خليج العقبة حيث لا يتجاوز 8, 0% من الاستهلاك السنوى للأسماك فى الأردن وأحد أهم الأسباب فى تدنى إنتاج الأسماك فى المياه الأردنية يعزى إلى الانخفاض الواضح فى محتوى مياه العقبة بالنسبة للأملاح المعدنية الغذائية التى يحتاجها نمو الهائمات النباتية (الفيتوبلانكتون) والحيوانية (الزوبلانكتون) والتى تمثل بدورها الغذاء الرئيسى ليرقات الأسماك. ويعنى ذلك أن عدد كبير من يرقات الأسماك لا تجد الغذاء اللازم لنموها الأمر الذى يتسبب فى نفوقها مما قلت معه بمرور السنوات الأعداد المتبقية من الأسماك التى يتم حصادها حتى بلغ المصيد من الأسماك 2 طن فقط فى عام 1985 بعد أن كانت حوالى 200 طن فى عام 1971. ولم يسجل المصيد من الأسماك بعد 1985 نتيجة صغر حجمها. ّلك فى حين أنه اعتبارا من عام 1997 وحتى 2002، تقدر كمية الأسماك من الصيد البحرى ما بين 300-450 طن فى العام وذلك بناء على دراسة ومراقبة ميدانية قام بها باحثوا محطة العلوم البحرية. وبوجه عام يعزى انخفاض كميات الأسماك المصادة إلى الأسباب التالية:

- صغر حجم المياه الأردنية
- منع الصيادين الأردنيين من الصيد فى المياه الأقليمية العربية المجاورة
- الصيد الجائر والغير منظم
- اتساع الميناء التجارى
- التلوث البيئى (الفوسفات، الأسمدة، موانى التصدير، حركة البواخر والأسمنت)
- إشغال جزء من الساحل بالمنشئات السياحية والترفيهية
- استخدام قوارب الصيد التقليدية
- ميل الصيادين للتوجه إلى المهن الأخرى والتى تدر دخلا أعلى من الصيد ومنها القوارب الزجاجية

المياه الداخلية:

تشكل المياه الداخلية من بعض السدود ونهر الأردن وقناة الملك عبد الله ويوجد فى المياه الداخلية ما يقدر بحوالى 25 نوع من مياه الأسماك العذبة منها 12 نوع متوطنة فى حين تم إدخال الباقى إلى المنطقة عن طريق النشاطات البشرية.

الســدود:

أكثر استعمالات السدود فى الزراعة. وأهم هذه السدود:

- سد الملك طلال ويتسع إلى 82 مليون متر مكعب
- سد وادى العرب ويتسع إلى حوالى 20 مليون متر مكعب
- سد الكفرين ويتسع إلى 8, 4 مليون متر مكعب
- سد زقلاب ويتسع إلى 3, 4 مليون متر مكعب
- سد وادى شعيب ويتسع إلى 3, 2 مليون متر مكعب

وتبلغ السعة القصوى لهذه السدود مجتمعة فى حدود 4, 113 متر مكعب تعيش فيها بعض الأسماك المحلية كالحفافى Barbus . كما تم إدخال أنواع مستجلبة مثل الكارب الموراثى كما يوجد فى سد وادى العرب أسماك المشط.

ولم تنظم عملية الصيد فى هذه السدود كما لم تمنح رخص للصيد فيها لوجود مخاطر مختلفة قد تحيط بالصيادين فى هذه السدود ولم يقدر المخزون السمكى فى هذه السدود وإن تم تقدير المصاد منها ب 50 طن سنويا.

المياه الجارية:

نهر الأردن: ينبع هذا النهر من جبل الشيخ ويسير بمحاذاة الحدود لمسافة 120 كيلومتر ليصب فى البحر الميت. يتمتع هذا النهر بتنوع الأسماك التى تعيش فيه.

قناة الملك عبد الله: مصدرها الأساسى من مياه نهر اليرموك وسد وادى العرب، يوجد فى هذه القناة معظم أنواع الأسماك التى تعيش فى نهر الأردن كالمشط وغيرها. وتقدر كمية الأسماك المصادة ب 300 طن سنويا.

الزراعة السمكية:

فى المجال البحرى: بدأت تجربة زراعة أسماك القاروص sea bass وذلك فى أول يوليو 1988. ولقد قد تم اختيار هذا النوع لسرعة نموه وارتفاع قيمته الغذائية بعد وصول قرابة 12200 فرخ متوسط الواحد منها 47, 0 جرام وضعت داخل أحواض طولية لفترة 3 أشهر تقريبا إلى أن بلغ متوسط أوزانها 6, 16 جرام حيث نقلت إلى كل من الأحواض والأقفاص مناصفة.

ولقد خلصت التجربة إلى ما يلى:

- جودة مياه خليج العقبة وكذا ملائمة درجة الحرارة لنمو هذا النوع من الأسماك متواصلا على مدار العام. ولقد حققت هذه الأسماك تحت هذه الظروف معدلات نمو تزيد 50% عنها فى مزارع الأسماك الأوربية.
- ازداد متوسط الوزن من 57, 0 جرام إلى 173 جرام خلال 353 يوم أما الزيادة السمكية الكلية فلقد ازدادت من 7 كيلوجرام إلى 1340 كيلوجرام خلال نفس الفترة (353 يوم).
- بلغت أقصى كثافة سمكية 9 كيلوجرام/متر مكعب وتعد هذه الكثافة منخفضة إذا ما قورنت مع المزارع الصناعية والتى عادة ما تصل فيها الكثافة إلى 20 كيلوجرام/متر مكعب.
- مثلت نسبة النفوق خلال ال 45 يوم الأولى 73% من النسبة الكلية للنفوق ويعود ذلك إلى الإجهاد الذى تعرضت له الأسماك نتيجة التغير السريع فى الظروف البيئية (ملوحة وحرارة). أما معدل النفوق خلال مرحلة النمو والتى بلغت 27% من إجمالى النفوق فإنها تعزى إلى الإجهاد الذى تعرضت الأسماك إليه نتيجة جمع البيانات البيولوجية ويعتقد أن معدلات الفقد هذه يمكن خفضها فى الإنتاج التجارى.
- كان نمو الأسماك فى الأقفاص أعلى منه فى الأحواض بمقدار 30% ويقلل هذا من خفض تكلفة الإنتاج إذا ما تم الاعتماد بشكل أكبر على الأقفاص العائمة بالتقليل من الطاقة. شكلت عملية شراء الفراخ وأعلافها 2, 65% من الإنفاق الإجمالى وهذه النسبة سوف تنخفض بدرجة كبيرة فى حالة إكثار هذه الزريعة والحصول على الأعلاف (الغذاء) المناسب محليا.

الدراسة متوفرة وذلك لتشجيع المستثمرين من أجل القيام بمشروع تجارى كما يجب إجراء دراسة تسويقية للمشروع فى الأسواق الخارجية.

الزراعة فى المياه الداخلية

مزارع الأسماك: بدأ استزراع الأسماك فى الأردن بمشروع ريادى فى محطة وادى اليابس فى غور الأردن بعد عدة توصيات من قبل خبراء دوليين ومنظمة الأغذية والزراعة للأمم المتحدة حيث تم إنشاء المشروع فى عام 1966 بإقامة أحواض ترابية أسمنتية وقد أتى المشروع بأولى ثماره حيث تم إنتاج 20-30 ألف فرخ من أسماك الكارب المرائى وتوقف المشروع عام 1978 نتيجة نقص المياه ولعدم توفر الدعم الكافى. كما قام الفنيون فى وزارة الزراعة بتجربة زراعة سمك الكارب فى المياه الجارية فى منطقة السخنة.

نشاطات القطاع الخاص فى مجال تربية الأسماك:

قام القطاع الخاص بدور هام بإدخال أنواع جديدة من الأسماك مثيل لما قام به القطاع العام حيث تأسست أول شركة لإنتاج الأسماك عام 1983 تحت إسم شركة الأسماك العربية حيث أقامت وحدات للتفريخ ووحدات للتسمين ووحدات أخرى مثل وحدة الأكسيجين السائل. ولقد استهدف المشروع إنتاج 420 طن من سمك المشط الهجين سنويا. إلا أن العثرات التى واجهت المشروع أدت إلى تدنى إنتاجيته إلى 10% من طاقة المشروع المستهدفة. ومن العوامل التى تسببت فى انخفاض مستوى الإنتاج فيضان نهر الأردن شتاءا، تدفق مياه الأمطار وزيادة عكارة المياه وانخفاض درجة حرارتها الأمر الذى أدى إلى نفوق معظم الأسماك. يتجه المشروع إلى التخصص فى إنتاج زريعة الأسماك فقط.

كما يوجد حاليا مشروع لجمعية الأزرق التعاونية وما يقارب من 25 مزرعة خاصة ينتشر معظمها فى نهر الأردن ويعانى معظم هذه المزارع من سوء الإدارة ولا يتجاوز الإنتاج الحالى منها 100 طن فى العام.

استيراد الأسماك ومعدل استهلاك المواطن الأردنى من الأسماك:

تعتمد الأردن على الاستيراد لسد حاجة المواطن الأردنى من هذه المادة كون الاكتفاء الذاتى لا يزيد عن 2, 2% ولذا يتذبذب معدل استهلاك الفرد الأردنى من الأسماك بناء على كمية الأسماك التى يتم استيرادها. هذا، وقد تدنى معدل استهلاك الفرد الأردنى من الأسماك إلى 8, 2 كيلوجرام لعام 1994 مقارنة بما كان عليه فى العام السابق 9, 3 كيلوجرام والذى يعد أقل من معدل استهلاك الفرد فى الوطن العربى أو العالم. يوضح الجدول التالى كميات الأسماك المستوردة والإنتاج المحلى ومعدل استهلاك الفرد من الأسماك للأعوام 1985-1998.

كميات الأسماك المستوردة (بالطن) والإنتاج المحلى خلال الفترة 1985-1998 ومعدل استهلاك الفرد من الأسماك.

السنة	كميات الأسماك المستوردة			المجموع	الإنتاج المحلى	الاستهلاك المحلى	استهلاك الفرد فى العام (كيلوجرام)
	أسماك طازجة مبردة مجمدة	أسماك مجففة، مدخنة، مملحة	أسماك معلبة				
1995	3225	61	2962	6248	91	6316	2,3
1996	2351	211	2828	5390	100	5489	1,9
1987	6064	111	3632	9807	70	9856	3,4
1988	3247	179	2322	5748	70	5776	1,9
1989	4618	110	2050	6778	70	6841	2,2
1990	3937	137	1956	6030	370	6400	1,75
1991	6014	197	2712	8923	370	9293	2,5
1992	11546	774	1819	14139	373	14512	3,8
1993	12285	430	3292	16007	410	16417	2,9
1994	3226	117	3046	11389	426	11815	2,9
1995	3144	176	3641	11961	520	12481	3,0
1996	4589	79	2633	7301	531	7834	1,8
1997	8064	214	2981	13259	550	12809	2,8
1998	8827	108	3208	12143	750	12943	2,7

الاقتراحات والتوصيات:

- ضرورة العمل على إجراء مشروع للإحصائيات السمكية وتقدير المخزون السمكى فى الأردن حتى تتوفر البيانات الأساسية واللازمة لتطوير الثروة السمكية.
- عقد اتفاقيات تعاون مع الدول المجاورة للسماح للصيادين الأردنيين للصيد فى مياههم الأقليمية.
- إعداد كوادر فنية عالية الاختصاص فى المجالات التى تتعلق باستزراع الأسماك.
- دراسة دورة حياة الأسماك وخاصة التجارية منها ومنع الصيد فى فترة تكاثرها.
- تقييم مصادر المياه المتوفرة وإمكانية استغلالها فى تربية الأسماك وخصوصا مياه الرى.
- إقامة محطة لإنتاج الزريعة المختلفة وتوزيعها على المزارعين بأسعار رمزية أو بدون مقابل.
- إمداد مناطق الصيد المغلقة بالزريعة لتعويض الأسماك المصادة.
- تعزيز التعاون فى مجال تبادل المعلومات والخبرات بين الأقطار العربية وخصوصا الدول المجاورة.
- التوجه نحو زراعة الأسماك فى البحر وذلك لتوفر المياه وذلك بالاستفادة من تجربة محطة العلوم البحرية فى هذا المجال.

أهم القوانين التى ساهمت فى حماية وتنمية الثروات المائية الحية فى دولة قطر

تقرير قطرى

مقدم من

عيسى يوسف المرزوقى* و عبد الرحمن صديق**
*Supreme Council for Environment and Natural Esources
**Fisheries Department

Doha, **Qatar**

Presented as a country report at the "ENVIRONMENTALLY FRIENDLY AQUACULTURE AND FISHERIES PRACTICES" Workshop held at Hurghada, Egypt on September 15-17, 2002

مقدمـة:

مساحة دولة قطـر

تبلغ مساحة دولة قطر 11521 كيلومتر مربع، وهى تقع شرق شبه الجزيرة العربية، وتمتد شبه جزيرة قطر داخل مياه الخليج العربى فى منتصف الساحل الغربى منه، تحيط مياه البحر من الشمال والشرق والغرب. أما الجنوب فتشترك مع دولة الإمارات والسعودية.

عدد السكـان:

يبلغ عدد سكان قطر 522 ألف نسمة تقريبا وفقا للإحصائيات الأخيرة.

موقع قطر بالنسبة لخطوط الطول والعرض:

تمتد دولة قطر فى اتجاه الشمال بين خطى
عرض 30 24 و 34 26 شمالا
طول 40 50 و 45 52 شرقى جرينتش

اقتصاديا:

تعتمد دولة قطر على البترول والغاز المسال المصاحب كمصدر رئيسى لاقتصاد الدولة بالإضافة إلى الصناعات الأخرى مثل البتروكيماويات والحديد والصلب.

مسـاحة السواحـل:

تبلغ مساحة السواحل القطرية شرقا وغربا 750 كيلومتر وتبلغ المساحة الكلية للمياه الإقليمية حوالى 35 ألف كيلومتر مربع.

عمق البحـر:

البحر حول قطر ضحل حيث أن متوسط العمق فى المناطق الشرقية 30 متر أما فى المناطق الغربية (خليج سلوى) فإن العمق يبلغ 20 متر.

أهـم الجزر:

هناك الكثير من الجزر أهمها جزيرة حالوال وجزيرة شراعو والساقلية والبشيرية والعالية.

طبيعـة قاع البحـر:

بالقرب من السواحل القطرية يغلب عليه الرسوبيات الرملية والصلبة والصخور والمرجان. أما فى الأعماق، فإن قاع البحر هو خليط من الرسوبيات الرملية والطينية أى حوالى 45% من القاع مغطاة بخليط من الرمل والطين فى حين يغطى 10% من القاع بالشعاب المرجانية والصخور.

عدد السفن العاملة فى دولة قطر 515 سفينة وعدد العاملين فى مجال صيد الأسماك 4721 عامل.

يبلغ الناتج المحلى من الأسماك الطازجة 8863 طن وهو يمثل 84% من جملة الاستهلاك الكلى من الأسماك بدولة قطر (إحصائية 2001).

المصايد البحرية:

هناك عدة طرق لعمليات الصيد منها:

1- **القراقير**

وتصنع من الأسلاك وهى بيضاوية الشكل ولها فتحة لدخول الأسماك من خلالها وعدم مقدرتها على الخروج ويوضع بداخل القرقور طعام لجلب الأسماك إلى داخلة.

2- الشباك الخيشومية (الغزول) Gillnets

وهى تصنع من الخيوط القطنية وتوضع أثقال على الحبل السفلى وتختلف فتحتها باختلاف الشباك.

35 ملليمتر بالنسبة لشبكة صيد البيان
40 ملليمتر بالنسبة لشبكة عائمة ذات طبقة واحدة
40 ملليمتر بالنسبة لشبكة ثابتة ذات طبقة واحدة
40 ملليمتر بالنسبة لشبكة لمصيدة ثابتة
40 ملليمتر بالنسبة للقراقير والشباك
40 ملليمتر بالنسبة لشبكة السالية

3- الخيط والميادير (السنانير)

حيث الخيط مصنع من البلاستيك ويتفرع منه 4 خيوط فرعية ينتهى كل منها بميدار وثقل مطعم بالربيان أو الخثاق.

القوانين التى ساهمت فى حماية وتنمية الثروات المائية الحية:

1- إرجاع جميع الأسماك الحية التى تقل عن القياس القانونى إلى الماء إذا ما وجدت ضمن الأسماك المصادة.

2- لا يجوز صيد الثروات المائية فى مواسم الإخصاب أو التكاثر (فبراير، مارس، أبريل، مايو).

3- يمنع الصيد فى مواقع معينة بصفة دائمة أو فى مواسم معينة.

4- لا يجوز أن يطرح فى مياه الصيد أو المياه الداخلية أو على قاع البحر فضلات المعامل أو المختبرات أو المصانع أو مجارى المياه القذرة أو المواد الكيماوية أو البترولية أو زيوت السفن.

5- لا يجوز وضع سدود أو عوائق تحد من حرية تنقل الثروات الحية.

6- لا يجوز نزع أو استغلال الأعشاب النباتية المائية بمختلف أنواعها.

7- لا يجوز استخدام الأسكار والحظور وغيرها من معدات الصيد فى المياه الضحلة.

8- لا يجوز استخدام أو استعمال الوسائل أو المعدات أو الطرق الضارة ببيض أو صغار الثروات الحية.

9- لا يجوز استخدام طرق الإبادة الجماعية للثروات الحية بواسطة السموم أو المتفجرات أو المواد الكيميائية أو الطرق الكهربائية.

10- لا يجوز الصيد بالقرب من المنشئات البترولية أو العسكرية.

11- تحدد المسافات المسموح بالصيد فيها بالنسبة للسواحل والجزر والمنشئات البترولية والشعاب المرجانية على النحو التالى:

أ- السواحل

الابتعاد بمسافة لا تقل عن 300 متر من المساكن أو الممتلكات الخاصة الموجودة على السواحل دون المناطق الساحلية المفتوحة الأخرى.

ب- الشعاب المرجانية

الابتعاد بمسافة لا تقل عن 300 متر فى حالة الصيد بالشباك.

أهم الدراسات التى تمت فى المنطقة:

مشروع تقييم مخزون الربيان فى الجزء الغربى من الخليج العربى بواسطة دول مجلس التعاون لدول الخليج العربى. تلقى هذا المشروع الدعم المالى من عدة جهات وهى:

- البنك الإسلامى للتنمية (جدة) وساهم بمبلغ 400 ألف دولار أمريكى.
- الصندوق العربى للإنماء الاقتصادى والاجتماعى (الكويت) وساهم بمبلغ 320 ألف دولار أمريكى.
- مؤسسة الكويت للتقدم العلمى بمساهمة 160 ألف دولار أمريكى.

ولقد استمرت الدراسة 22 شهرا حيث استمر المسح من مارس 1999 وحتى ديسمبر 2000 وكانت نتيجتها:

- بلغ متوسط الصيد الجانبى للأسماك 181 كيلوجرام للشبكة الواحدة فى الساعة وبسرعة 303 عقدة بحرية.
- كانت من التوصيات الإدارية للمخزون من خلال هذه الدراسة القيام بموسم تجريبى لصيد الربيان بعدد محدد من السفن بحيث يمكن السيطرة عليها ولمدة مقيدة، وإذا ما تم بالموسم التجريبى هذا والذى هو إحياء المصايد التى لم تستغل لمدة تربو على 10 سنوات بسبب ارتفاع كمية المصيد الجانبى وذلك فى حين استمرار الموسم التجريبى كمظهر منتظم للمصايد.

هذا بالإضافة إلى أن تكون كافة نشاطات الجر الخلفى محددة فى مناطق بعيدة عن أماكن الأعشاب البحرية التى هى بمثابة مواطن حضانة قيمة وذات إنتاجية عالية للكثير من الربيان والأسماك البحرية.

الاستزراع السمكى

تمت فى قطر عملية استزراع أسماك الشعم بنجاح وذلك عن طريق جمع بيض الأمهات وتلقيحها بواسطة الحيوانات المنوية الذكرية وحتى ظهور اليرقات وتغذيتها بالروتيفيرا إلى أن تكبر إلى حجم الإصبعيات ومن ثم تغذيتها بغذاء خاص صناعى Taplates مستورد من الخارج ومن ثم تكبيرها فى خزانات كبيرة مصنوعة من مادة الفيبرجلاس.

يسحب الماء المستخدم فى الاستزراع بشكل مباشر من ماء البحر عن طريق مضخات سحب كبيرة وتزود الخزانات بالتهوية اللازمة لإذابة الأكسيجين فى الماء. أما بالنسبة للماء المستهلك فإنه يخرج عن طريق فتحة فى أسفل الخزانات حيث يرجع إلى البحر.

البيئة ومصايد الأسماك والاستزراع السمكى

تقرير قطرى

مقدم من

صالح بن عمر صالح مغربى
Marine Environment Pres. Of Met. & Environment Protection
Jeddah, **Saudi Arabia**

Presented as a country report at the "ENVIRONMENTALLY FRIENDLY AQUACULTURE AND FISHERIES PRACTICES" Workshop held at Hurghada, Egypt on September 15-17, 2002

صيد واستزراع الأسماك

تؤدى حرفة صيد الأسماك على الجزء السعودى من البحر الأحمر والخليج العربى إلى استخدامات بعض الأراضي الساحلية، إلا أن هذه الاستخدامات لا ينتج عنها تأثيرات بيئية خطرة، فتنتشر العديد من قرى الصيد الصغيرة على طول الساحلين وتتجمع موانئ الصيد ومنشآت المعالجة بشكل رئيسى بالقرب من المناطق الحضرية وكلما تطورت هذه الصناعات كانت الحاجة إلى إنشاء معالجة وموانئ أخرى على الساحل.

مصائد الأسماك

كان لمصائد الأسماك ولقرون من الزمان دور اقتصادى واجتماعى هام فى المملكة العربية السعودية على البحر الأحمر وعلى الخليج العربى ولفترة طويلة حقلا للصيد التقليدى وفى السنوات الأخيرة تطورت المصائد التجارية فى كلا الجزئين.

التأثيرات البيئية للاستخدامات الساحلية والبحرية

1 – الردم

يعتبر الردم من اكثر النشاطات المسببة لتدهور الموارد الساحلية والبحرية وللردم تأثيرات عكسية خطيرة على البيئة ويمكن ان تشمل هذه التأثيرات فقدان المورد ذاته (الشورى) أو تغيير الموطن الطبيعى مثل تجفيف الأراضي الرطبة المصاحبة، ويعتبر موت بعض الشعاب البارزة فى مدينة جدة أوضح مثل على الدمار الناجم عن هذا النشاط.

2 - التجريف

تتسبب عمليات التجريف مثل عمليات الردم تدميرا لموارد المنطقة المجرفة ولها فى الغالب تأثيرات غير مباشرة نتيجة الترسيبات المتزايدة ويمكن لها التدمير على المدى الطويل تأثير مضر بالبيئة الساحلية من خلال تدمير المجموعات النباتية والحيوانية القيمة.

3- تلوث الماء

هنالك مصادر عديدة لتلوث المياه فمثلا الناقلات الضخمة التى ينتج عنها أحيانا تفريغ مستمر للزيت والمواد الكيميائية، والتلوث من مصادر صناعية وسكنية (التصريف المعالج وغير المعالج) لأنه يتسبب فى تغيير التوازن الغذائى فى المياه الساخنة.

4 – تلوث الهواء

تعتبر المنشآت الصناعية المتركزة فى المناطق الحضرية مصادر رئيسية لتلوث الهواء.

5 – ممارسات الصيد

إن مصائد الأسماك لها أهمية كمصدر طعام ومورد اقتصادى إلا أن نشاطات الصيد المكثف فى بعض المناطق تتسبب فى تدنى المخزون (الشباك المخروطية التى تسبب بإعطاب أعشاب القاع البحرية التى تعتبر مهمة للعديد من الأنواع الحيوية) (وتثبيت المرساة على الشعاب المرجانية يمكن أن يسبب ضرر للمرجان).

6- الرعى وإزالة الإحراج والتأثيرات الزراعية الأخرى

يمكن أن يكون للزراعة والنشاطات ذات العلاقة تأثيرات مفيدة أو ضارة على البيئة البحرية (فمثلاً تزيد عملية إزالة الإحراج من حمولة الرواسب فى المياه الجارية التى تصل إلى البحر كما أن الأسمدة والمواد الكيميائية التى تذوب فى المياه الجارية تدخل فى السلسلة الغذائية وتلوث أحياناً أنواع مهمة من الأسماك.

7- النشاطات الترفيهية

بشكل عام تشكل النشاطات الترفيهية المكثفة تهديد وضغوط كبيرة على البيئة.

ملخص التأثيرات البيئية

تتركز المشاكل الناجمة عن إنشاء وتوفير مشاريع التسهيلات البحرية على طول الساحل السعودى للبحر الأحمر فى مدينتى جدة وينبع. كما أن الموارد الساحلية والبحرية حول رابغ وشرم أبحر وجيزان لا تزال تتعرض للتدهور بواسطة الأنشطة التنموية.

وعلى الساحل السعودى للخليج العربى تتركز التأثيرات البيئية الرئيسية الناجمة عن الاستخدامات الساحلية والبحرية فى وحول الجبيل وخليج تاروت كما لوحظ التلوث الزيتى الواسع فى أماكن عديدة من الساحل.

مدى التعارض بين الاستعمالات الساحلية والبحرية وبين الموارد

1- تعتبر أنماط التنمية الصناعية والمنشآت الصناعية البترولية أو محطات توليد الطاقة بالإضافة إلى الأنشطة الترفيهية متعارضة مع موارد بحرية مثل الربيان والأسماك والحشائش البحرية والشعاب المرجانية (رأس مشعاب إلى منيفة بما فى ذلك المناطق المجاورة فى اتجاه البحر).

2- يعتبر التجريف والردم والصرف الصناعى وإقامة الميناء ونشاطات صيد السمك متعارضة مع المسطحات بين المدية والشورى والطيور والمرجان وضفاف الحصباء وموارد الثروة السمكية (منطقة أبو على).

3- تعتبر نشاطات الردم والتجريف والصرف من المصافى ومصادر أخرى والصيد بالشبكة المخروطية والتنمية العامة متعارضة مع موارد مثل الشورى والنخيل والحشائش البحرية والمرجان ومصائد السمك والربيان والضفاف الحصبية والطيور (منطقة خليج تاروت وتمتد من شمال رأس تنورة إلى الخبر).

4- يعتبر إنشاء مساكن الاستراحات وطرق الكورنيش مصدر التعارض الرئيسى ويسبب هذا تعدياً على الشواطئ الترفيهية والمواطن الطبيعية للأعشاب البحرية (دوحة الظلم (خليج نصف القمر بمدينة الدمام) .

5- يعتبر صيد السمك وجمع بيض السلاحف والطيور والأخشاب المنجرفة والغوص والحرف الترفيهية الأخرى المسببة للتعارضات الرئيسية مع المواطن الطبيعية والحياة الفطرية المصاحبة مثل تعشيش السلاحف والطيور (الجزر المرجانية فى عرض البحر).

أهداف البرنامج الوطنى لإدارة المناطق الساحلية:

حددت المملكة العربية السعودية كثيراً من أهدافها العامة لإدارة المناطق الساحلية من خلال إجراءات دولية ووطنية.

1- ضمان أن تدار الموارد الساحلية والبحرية لتوفير فوائد طويلة الأمد لمواطنى المملكة العربية السعودية من خلال الاستخدام المرشد لهذه الموارد.

2- الاستجابة لالتزامات المملكة نحو القوانين الوطنية والاتفاقيات الدولية المتعلقة بحماية البيئات الساحلية والبحرية ، فى الحاضر والمستقبل.

3- ضمان أن تستمر الموارد الساحلية والبحرية فى دعم استخدامات الأراضى والنشاطات البشرية الساحلية فى الحاضر والمستقبل على أسس دائمة.

4- حماية ألأنواع الحية ذات القيمة التجارية والنادرة والمهددة أو المعرضة للانقراض كالسمك والروبيان والأطوم والسلاحف البحرية وكذلك مواطنها الطبيعية.

5- إعادة أعمار وتجديد البيئات الساحلية والبحرية التى كانت قد أفسدت.

6- حماية المناطق الحساسة بيئياً بالاستمرار فى تطوير نظام المحميات الساحلية والبحرية فبالإضافة إلى ضمان استمرار تنوع الأنواع الحية النباتية والحيوانية فإن المناطق المحمية ستوفر كذلك فرصاً عملية وتعليمية هامة.

7- إيجاد مناطق ترفيهية ساحلية توفر فرصاً ترفيهية محسنة وتفهم أفضل لها من السكان المحليين والزوار.

8- إشراك كافة الجهات الحكومية على مختلف المستويات لضمان أن ينجز العمل المنسق والشامل لإدارة المناطق الساحلية.

9- زيادة الوعى والإدراك لدى مواطنى المملكة عن أهمية إدارة وحماية البيئة الساحلية والبحرية.

10- إبقاء وتحسين الأنشطة البشرية القائمة والمستقبلية ذات التأثيرات المفيدة للبيئة الساحلية والبحرية.

إن الهدف الرئيسى للبرنامج الوطنى يضع فى الاعتبار حياة أجيال تنعم بفوائد الاستخدام المرشد للموارد الساحلية والبحرية حيث أن موقع ونوع وامتداد نشاطات التنمية تعتبر عوامل حاسمة فى تعيين ما إذا كانت قدرة تحمل هذه الموارد الساحلية والبحرية قد تم تجاوزها. وبتفهم التأثيرات البيئية لاستخدام الأرض والتدخلات البشرية وموضع الموارد الرئيسية أيضا، فإنه يمكن أن يخطط لتنمية مستقبلية بطريقة تسمح بالاستخدام المرشد طويل الأمد لهذه الموارد ويمكن أيضاً خفض أو إزالة التأثيرات العكسية من المنشآت الحالية. كما نحتاج إلى الإبقاء على النشاطات الساحلية التقليدية التى تحفظ أو تؤدى إلى التحسين الفعلى للبيئة البحرية.

Aquaculture Group

Report by:

Dr. Mohamed Abou Zaid ***(Group Leader)***

Members of the Aquaculture Group:

Egypt
Iran
Jordan
Oman
Qatar
Saudi Arabia
Sudan
Syria
Yemen

Aquaculture Working Group

The examination of the status of Aquaculture in the region depending on the country reports presented by the participants in the workshop showed that the marine aquaculture is already introduced to certain countries in the area with degree of application differ from one country to another. Despite this fact, the group decided that certain massages should be delivered to countries without any of just thinking about introducing Aquaculture with one goal in mind is to achieve more friendly aquaculture application.

1- The introduction of aquaculture as a part of coastal zone management plan should be considered in the participating countries, each depending on the status of ICZM plan in the country and a special EIA should be formulated as a tool for assessment of the negative impacts of having such activity.

2- The introduction of exogenous species to our habitat for aquaculture purpose could cause many problems to the environment such as diseases, competition with the local species, some genetic disturbances. The following was suggested in order to overcome such problems:

a- We only introduce new species when the local is not so good for aquaculture practices depending on scientific data.

b- The new species should be introduced at inland facilities first to ensure its suitability for the habitat.

c- All the transportation and handling of the species in any stage should be complying to the international regulations (EIFAC).

3- The inbreeding for long periods may cause loss in genetic characters and deformed population so it is mandatory to renew the stock on regular basis.

4- The lack of experience in some countries may cause repeated application problems, which make the presence of aquaculture network sponsored by one of the donor agencies a must in such stage to link the activities in regional base.

5- The countries in the area should be encouraged to use advanced and environmentally friendly methods in aquaculture such as closed system of water circulation and the integrated culture systems which are approved to be more environmentally friendly.

6- A guideline for establishment of aquaculture projects and best practices guide should be issued by one of the specialized international agencies (FAO) which will help in promoting environmentally friendly applications.

During the group meeting it was felt that the most urgent thing needed to achieve the goal of this workshop, is to draft an EIA criteria to be used as a tool for making the aquaculture practices that are more friendly. The main frame of this EIA is to be simply applied in any country.

The committee emphasized on the necessity of exchange of experiences among the regional countries. It suggests establishment of a regional network of aquaculture with the assistance of FAO necessity to encourage database.

Fishery Group
Vision and Final Output

Report by:

Dr. Ali Muhammad Khuraibet, *(Group Leader)*

Members of the Fisheries Group:

Bahrain
Djibouti
Egypt
Iran
Kuwait
Saudi Arabia
Somalia
Sudan

Additional input from:

Oman *(Aquaculture Group)*
Syria *(Aquaculture Group)*
Yemen *(Aquaculture Group)*

The Fishery Group Systematic Approach in Dealing with Fisheries Impacts

Impacts

Causes

Measures and Tools
&
Current Situation

Constraints

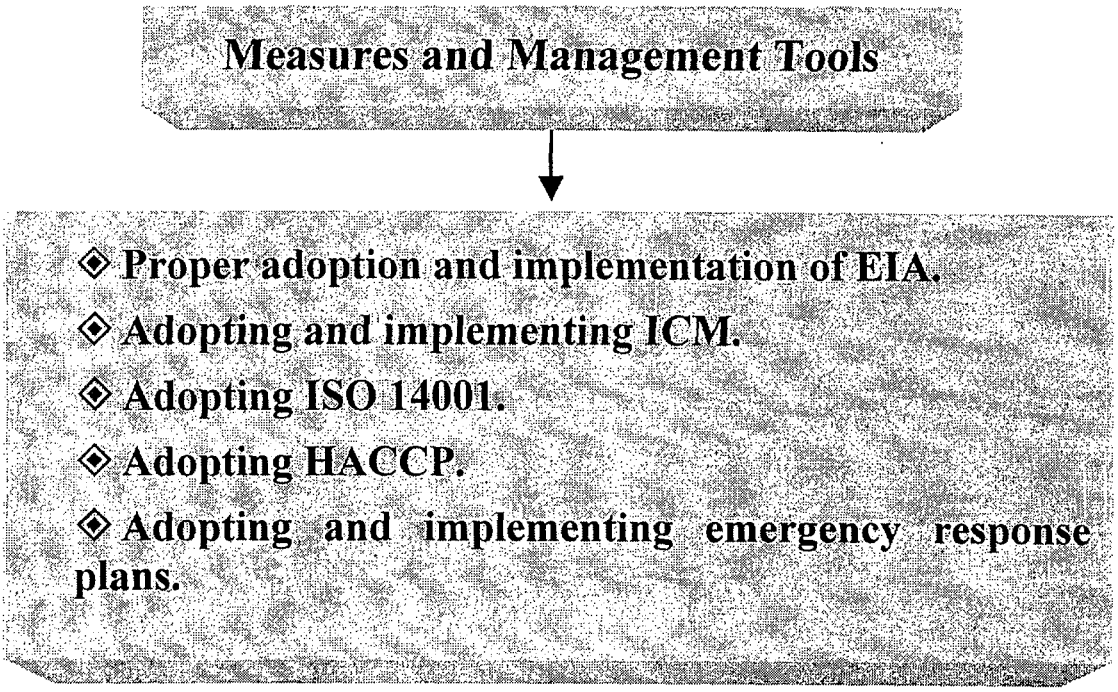
Action Plan

Impacts

Impacts of unsustainable Fishery Practices on Environment	Impacts of Unsustainable Development Activities and Practices on Fishery Resources
1. Unsustainable fishing practices. Examples include: A- Over fishing. B- Destructing fishing habitat.	1. Coastal reclamation.
Pollution. Examples include: A- Oil spills. Waste from fishing activities and fleets.	2- Pollution. Examples include: A- Discharging partially treated sanitary wastewater. B- Thermal pollution. C- Oil spills. D- Industrial.
2. Illegal fishing e.g. local and foreign.	3. Dredging activities and the disposal of dredged material.
3. Occurrence of toxic and non-toxic phytoplankton blooms incidents.	4. Deep sea mining.
4. Introduction of alien species.	5. Unsustainable fishing, sport fishing and diving activities.
5. -	6. Unsustainable urbanization.

Causes

- Lack of laws and regulations and/or improper implementation of laws and regulations.
- Lack/or poor coordination between concerned organizations and establishments at both local and regional levels.
- Lack and absence of awareness programmes for both decision makers and public.
- Socio-economic conditions e.g. over population.
- Lack of/or improper land-use planning and assessment.
- No public involvement.
- Political factors.
- Poor management of fishery resources due to lack of financial resources, expertise and research.


Measures and Management Tools
◈ Proper adoption and implementation of EIA.
◈ Adopting and implementing ICM.
◈ Adopting ISO 14001.
◈ Adopting HACCP.
◈ Adopting and implementing emergency response plans.

The Current Situation of Measures and Management Tools in Relevant Countries

Tool	Countries										
	Sudan	Iran	Bahrain	Kuwait	Somalia	Egypt	Djibouti	KSA	Oman	Syria	Yemen
EIA (Fishery)	☒	☒	☒	☑	☒	☒	☒	☒	☒	☑☒	☒
EIA (Guidelines)	☒	☑	☒	☒	☒	☒	☒	☒	☑	☑	☒
ICM (A) (Existence of ICM)	☑	☒	☑	☑	☒	☑	☒	☒	☑	☑☒	☑
ICM (B) (If Fisheries is part of the ICM)	☑	☒	☒	☑	☒	☒	☒	☒	☒	☒	☑
ISO 14001	☒	☑	☒	☒	☒	☒	☒	☒	☒	☒	☒
HACCP	☒	☑	☒	☑	☒	☒	☒	☒	☑	☒	☒
Emergency Response	☒	☑	☑	☑	☒	☒	☒	☑	☒	☑	☒

Constraints

- Lack of/or improper legal framework.
- Lack of human resources or/and trained human resources.
- Lack of financial resources or/and improper spending of financial resources.
- Poor coordination and cooperation at local and regional levels with concerned bodies.
- Poor or lack of research tools/technologies and research.
- Conflicts between the need for fast economic growth and sustainable development.

Action Plan

- The need of decision-makers understanding and support (through awareness).
- The need to enhance coordination and cooperation between concerned organizations (through meetings, seminars and workshops and through legal framework in order to resolve issues of conflicts and enhancing coordination).
- The need to enhance the relevant infrastructure (through introducing or updating legal frameworks, asking for technical support from expertise and consultants, working toward having well trained man power, working toward enhancing public awareness and participation, formulating data bases and establishing GIS and seeking financial support from relevant bodies).
- Introducing or/and enhancing the use and implementation of existing management tools such as EIA including related guidelines (Through reviewing of existing regulations, seeking the support of professionals, organizing and controlling the profession, establishing guidelines and carrying EIA in a sound and professional way).
- Introducing or/and enhancing the use and implementation of existing management tools such as ICM including related regulations (Through proper land use planning, emphasizing on habitat and sensitive ecosystems, identifying existing and future development activities, establishing GIS, identifying and understanding factors that might impact the quality of existing habitats, coordination and cooperation at different levels).
- Introducing or/and enhancing the use and implementation of new management tools such as ISO 14001 and HACCP to ensure proper environmental management and food quality and safety (Through the proper implementation of related standards).
- Carrying-out monitoring programmes, inspection and controlling pollution (Through updating standards, purchasing equipment, having enough trained power and proper facilities and enforcing legislations,).
- Formulating a technical committee to ensure commitment and follow ups at both local and regional levels of what has been agreed upon (Through nomination of representatives from each concerned country in order to be in contact with the FAO, and the other way around, to ensure sound implementation).

WORKSHOP OUTCOMES

ENVIRONMENTALLY FRIENDLY AQUACULTURE AND FISHERIES PRACTICES WORKSHOP

Held at

Hurghada, Egypt **on** September 15-17, 2002

Sponsored by:

FAO Regional Office for the Near East (Cairo)

Regional Organization for the Protection of Environment of the Red Sea and Gulf of Eden (PERSGA)- Sustainable Use of LMR Component – SAP

Regional Organization for the Protection of Marine Environment (ROPME)

Agriculture Policy Reform Project USAID/Egypt (APRP)- Reform Design and Implementation Unit (RDI)

WorldFish Center (Regional Center for Africa and West Asia)

The key intended objectives of the workshop were:

- Exchange of relevant information experiences and expertise related to environmentally friendly fisheries and aquaculture in the region.
- Enhance and expand professional networking for catalyzing mutually beneficial experiences.
- Identify priority areas of special focus for improving quality of the products and for increasing production.
- At the end of keynote addresses and country report presentations and discussions, participants were divided into two groups for producing key conclusions and specific recommendations.
- The reports of two groups, keynote addresses and country reports are included.

WORKSHOP OUTCOMES:

Recognizing that:

1- The world population and especially that of the Region, is growing at a significant rate.

2- The terrestrial ecosystem and especially limited size and capacity of the agricultural land and fresh water resources, are already under considerable stress.

3- The regional governments need to increase the production and supply of good quality and safe food to meet nutritional needs of the current and expanded future population.

4- The sustainable marine fisheries and aquaculture establishments provide the best alternative for increasing good quality and nutritious food supply for the current and future generations.

5- The past investment in marine fisheries and aquaculture practice has contributed significantly to the national economics of the regional countries.

6- An increased investment and greater efforts to enhance and expand this vital industry will improve further the production and availability of good quality and safe food to the people of the Region.

CONCLUSIONS

Consequently, the workshop participants concluded that:

1- The workshop on this vital topic was a very timely event which happened right after the World Summit on Sustainable Development which ended in Johannesburg, South Africa during the first week of September 2002.

2- The workshop successful as it was, must be considered as a "first step". Prompt and systematic efforts are required to build on this "very good beginning".

3- Regional and sub-regional governments and organizations are encouraged to develop and implement action plans to improve friendly fisheries and aquaculture practices in the Region. FAO office in Cairo will be willing to provide the necessary guidance in the development of workable action plans.

4- The draft plan should deal with various major aspects such as relevant regulatory reforms and restructuring as well as other important areas including:

i- Better protection of marine resources through integrated coastal zone management and land use planning processes.

ii- Development and implementation of improved EIA guidelines for all proposed new facilities built for aquaculture and fisheries production.

iii- Systematic and sustained efforts for producing skilled professionals needed by the industry for its sustained growth and for conducting EIA's in an efficient, cost-effective and professionally credible fashion.

iv- Establishment of relevant data bases in the region for strengthening the knowledge-base and for saving and sharing corporate memory of past and future experiences in aquaculture, marine fisheries and EIA.

v- Identification of key measures for raising public and industry awareness of the potential cumulative effects on the Regions ecosystems resulting from uncoordinated and rapid development along the coast and in the surrounding areas.

vi- Development and distribution of electronic and print publicity material as an educational tool for raising awareness about the substantial economical and ecological benefits of friendly aquaculture and fisheries practices.

vii- The concerned government organizations, should encourage fisheries and aquaculture industries to adopt environment and food management tools such as ISO 14001 and HACCP.

5- The meeting was terminated on September 17th, 2002 by 12.30 whereas the workshop was concluded.

ANNEX 1

Environmentally Friendly Aquaculture and Fisheries Practices Workshop

Hurghada, Egypt 15-17 September, 2002

Programme

Date	Activity		Speakers (Moderators)
14 September	07:00	Departure to Hurghada	
15 September	8:00-8:30	Registration	
	8:30 –9:00	Welcome talk of the organizers Dr. Mohamed Saif	Dr. Mohammad Saif (Moderator)
	9:00 –9:30	Opening talk (H.E. Governor of Red Sea)	
	9:30-10:00	Short introductions Sponsor representatives	
	10:00-10:30	Group picture Break	
	10:30-11:30	Environmental Impact Assessment (EIA) and the Quality of Life	Dr. Husain Sadar
	11:30-12:30	EIA, HACCP and ISO 14000 as Three Pillars for Sustainable and Environmentally Friendly Aquaculture Projects: Advantages and Concerns	Dr. Ali Khuraibet
	21:30-13:30	Environmental Impact Assessment of Aquaculture and Fisheries	Dr. Soliman Hamed
	13:30-14:30	Lunch	

Date	Activity		Speakers (Moderators)
	14:30-15:30	Integrated Coastal Zone Management, Fundamental Concepts and Definitions	Dr. Ali Beltagy
	15:30-16:30	Environmentally Friendly Fisheries and Aquaculture from Integrated Coastal Zone Management CZM Perspective	Dr. Mohamed Abou Zaid
	16:30-16:45	Tea Break	
	16:45-17:45	Aquaculture and the Marine Environment	Dr. Faisal Bukhari
	20:00	Reception	
16 September	08:00 –10:00	Country reports	Dr. Ahmed Barrania (Moderator)
	10:00-10:30	Tea Break	
	10:30-13:00	Continue the country reports	
	13:00 – 14:00	Lunch	
	14:00 – 19:00	Working groups	
17 September	08:00-10:30	Presentations of working groups and discussions	Dr. Abdel Rahman El Gamal (Moderator)
	10:30-11:00	Tea Break	
	11:3-12:30	Recommendation and Conclusions	Dr. Mohammad Saif (Moderator)
	13:00-14:00	Lunch	
	14:30	Departure to Cairo	

ANNEX 2

Environmentally Friendly Aquaculture and Fisheries Practices Workshop

15-17 September 2002 Hurghada, Egypt

Registration List

Name	Position	Employer	Address (Work)	Country/ Organization	Tel & Fax	E-mail
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