PART 2

Report of the FAO Technical Workshop on Environmental Impact Assessment and Monitoring in Aquaculture

FAO HEADQUARTERS, ROME, ITALY, 15-17 SEPTEMBER 2008

CONTENTS

Acronyms and abbreviations

BMP	**Best Management Practice**
CoC	**Code of Conduct**
CoP	**Code of Practice**
EAA	**Ecosystem Approach to Aquaculture**
ECASA	**Ecosystem Approach to Sustainable Aquaculture (EU Framework 6 RTD project)**
EIA	**Environmental Impact Assessment**
EMP	**Environmental Management Plan (arising from an EIA)**
EQO	**Environmental Quality Objective**
EQS	**Environmental Quality Standard**
GAP	**Good aquaculture practice**
FIMA	**Aquaculture Management and Conservation Service of the FAO Fisheries and Aquaculture Department**
IAIA	**International Association of Impact Assessment**
ICZM	**Integrated Coastal Zone Management**
IMP	**Integrated Management Plan**
IWSM	**Integrated Watershed Management**
MSP	**Marine Spatial Planning**
NASO	**National Aquaculture Sector Overview**
NALO	**National Aquaculture Legislation Overview**
SEA	**Strategic Environmental Assessment**
TRIX index	**A composite trophic status index**

Introduction

FAO's Aquaculture Management and Conservation Service (FIMA) organized the Technical Workshop on Environmental Impact Assessment and Monitoring in Aquaculture which was held in Rome, Italy from 15 to 17 September 2008. The workshop was undertaken as part of Project Component 2 "Environmental Impact Assessment and Monitoring in Aquaculture" of the FAO project "Towards sustainable aquaculture: selected issues and guidelines", (GCP/INT/936/JPN), which was implemented by FIMA with the generous support of the Government of Japan.

The main objective of the workshop was to review the findings of five case studies and a global review synthesis report on environmental impact assessment and monitoring in aquaculture, and to develop an expert consensus view on the present use of EIA and monitoring in aquaculture, based on presentations, experiences and conclusions by case study authors and reviewers, as well as discussions of workshop participants. The workshop prospectus and agenda are given in Annex 1. The workshop was attended by 21 participants (Annex 2). Part 1 of this publication reproduces the four regional case studies, the special study on EIA in salmon aquaculture, the global review synthesis report, as well as two special contributions to this workshop.

Opening of the workshop

Mr Jiansan Jia, Chief of FAO/FIMA welcomed participants and briefly introduced the scope and targets of project component 2: the global review of EIA and monitoring practice, effectiveness, constraints and challenges, with a view to suggesting improvements and providing relevant guidance to further promote responsible development of aquaculture worldwide. Mr Jia's welcome remarks can be found in Annex 3. Following the welcome remarks, all participants provided short introductions of their background and professional interests.

Mr Uwe Barg of FIMA provided a brief background to the project, including its origins in the 1999 Fisheries Ministerial Meeting, and the first and second sessions of the Committee on Fisheries (COFI) Sub-Committee on Aquaculture in 2002 and 2003. These meetings reiterated the need for enhanced efforts by the international aquaculture community to work towards more sustainable aquaculture production practices. In 2003, the Government of Japan decided to support the project "Towards sustainable aquaculture: Selected issues and guidelines", including project component 2 on EIA and monitoring in aquaculture.

Project component 2 facilitated the preparation of five studies. Four regional case studies were prepared to cover the compilation and review of existing EIA and environmental monitoring procedures and practices in aquaculture in selected countries of the following four composite regions.

Africa:	Egypt, Madagascar, Nigeria, South Africa, United Republic of Tanzania, Uganda;
Asia-Pacific:	Australia, China, India, Indonesia, Japan, Malaysia, Philippines, Thailand, Viet Nam;
Europe & North America:	Czech Republic, France, Greece, Hungary, Italy, Netherlands, Poland, Spain, Turkey, United Kingdom, as well as Canada and United States of America;
Latin America:	Brazil, Colombia, Cuba, Ecuador, Honduras, Mexico

A fifth special case study focused on EIA in marine cage aquaculture of salmon in Canada, Chile, Ireland, New Zealand, Norway, United Kingdom and United States of America. A global review and synthesis report was prepared based on these four regional case studies and the salmon aquaculture study.

The expectation of project component 2 was that the conclusions and recommendations of this workshop would target the development of technical and policy advice on improved use of EIA and monitoring approaches in aquaculture as well as on complementary measures useful and effective in further promoting sustainable aquaculture development. Mr Barg emphasised the cross links with the FAO activity on "Ecosystem approach to aquaculture" which is running in parallel.

The key outputs of the project will include:

- Regional reviews on EIA and monitoring in aquaculture in selected countries in Africa, Asia-Pacific, Europe and North America, and Latin America and a special study on EIA and monitoring in salmon aquaculture;
- Global review and synthesis report on EIA and monitoring in aquaculture;
- Workshop report, including findings and recommendations;
- Workshop discussion guide;
- Elements for policy guidance.

These outputs will be published in an FAO Fisheries and Aquaculture Technical Paper.

Format of the workshop

The workshop was chaired by Mr Michael Phillips. Mr John Hambrey acted as workshop facilitator. The workshop included technical presentations and working group discussions. The technical presentations were intended to provide opportunity for all participants to discuss and review the findings resulting from the various case studies, the global review and synthesis, and two special presentations. These presentations included:

i) four regional studies on EIA and monitoring in aquaculture in selected countries in Africa, Asia-Pacific, Europe and North America, and Latin America,
ii) a special study on EIA in salmon aquaculture,
iii) the global review and synthesis of EIA and monitoring in aquaculture, including reference to the workshop discussion guide;
iv) a case study of environmental assessment in cluster farms in Bolinao Bay, the Philippines, and
v) a summary of EIA information from Code of Conduct for Responsible Fisheries (CCRF) reporting for aquaculture and from FAO's National Aquaculture Legislation Overviews (NALOs) and National Aquaculture Sector Overviews (NASOs)

Based on the above technical presentations and a workshop discussion guide (Annex 4), and following a plenary discussion on issues identification and priority setting, participants were divided into three working groups and tasked to examine the main issue areas of (1) environmental management framework, (2) EIA procedures and (3) environmental monitoring, with a view to further identifying critical issues and possible recommendations. The facilitator compiled and synthesized all working group deliberations and outputs, and presented to the plenary a set of conclusions and recommendations, for discussion and consensus among all participants. The final session provided opportunity for participants to discuss key messages of the workshop as well as ways of dissemination of workshop findings and possible related follow-up actions.

The following participants acted as rapporteurs of the workshop: José Aguilar-Manjarrez, Uwe Barg, John Hambrey, Doris Soto and Patrick White. The following provides a brief overview of presentations and discussions. Based on the rapporteurs' notes

the discussions were synthesized so that the essence of the discussion and the various points and perspectives raised are presented as fairly and accurately as possible, with some rationalisation to reduce repetition.

Presentation and discussion of review papers

Each of the review authors made a short presentation of their findings, followed by discussions which were chaired by Mike Phillips. All review papers presented are reproduced in Part 1 of this volume.

REVIEW OF ENVIRONMENTAL IMPACT ASSESSMENT AND MONITORING OF AQUACULTURE ACTIVITIES IN AFRICA

Presentation by Chris Nugent

Mr Nugent provided a brief overview of the review paper (see Part 1). In Africa aquaculture is a relatively new industry, and mostly small-scale and low risk. Broadly speaking, development has priority over environmental concerns and the application of EIA to aquaculture has been limited, other than for a few high profile large scale proposals. However, the legislation is relatively highly developed: 75 percent of countries have legislation for EIA of which one third make specific reference to aquaculture. Some pertinent issues for Africa include the differing perspectives of various agencies/departments involved; the possible conflict between internationally approved or promoted national environmental legislation and local traditions, procedures and interests; the complexity of some key environmental issues, such as the introduction of alien or genetically modified species; the bureaucratic burden and costs of EIA if applied more widely or rigorously; and the lack of capacity in many countries to implement EIA and monitoring.

Discussion

Legislation and guidance

While it may be important to introduce EIA laws, awareness should be raised that EIA does not solve all problems, and is not appropriate for all forms of aquaculture. Many countries have been pushed to accept "parachuted" EIA legislation. Some guidance for donors is needed: EIA is not always the solution to environmental management, and it is important not to impose the "EIA bible" and associated impact matrix. Agencies need to look carefully at traditional local and national law which often addresses many of the issues. We need EIA with "local flavour" perhaps building on local laws. In more strategic terms Uganda is perhaps showing the way forward with mechanisms already in place *before* the industry develops.

Screening and scoping

Better screening and scoping is needed to ensure that aquaculture development, especially small-scale development, is not constrained. EIA should focus on high risk developments. There are examples where EIA procedures halted development, for example, shrimp production in United Republic of Tanzania mangrove areas and small-scale lake aquaculture in Zambia. Generally, in developing countries the presumption should be to allow development – subject to basic screening – and to place the emphasis on monitoring rather than EIA for most aquaculture development.

Introductions and strategic environmental assessment

Introduced species would usually be classified as high risk, but how to manage such risk? For example, there are GIFT tilapia in Gambia. Under what conditions may

they be used? Similar issues are emerging in Lake Malawi. Is Strategic Environmental Assessment (SEA) at regional or national level appropriate to address such risks? Currently, legal provision for SEA exists in 6 countries in Africa. There is provision for the application of SEA in several countries in Asia, but so far no significant experience of their use in relation to aquaculture.

Human resources development

There is significant need for capacity building on environmental management among farmers, government, and academics. Typically there are general EIA experts rather than aquaculture EIA experts. EIA may be required as part of business plans for large projects, where capacity is not usually a problem because the technical skills can be found for such projects. With support by USAID, the network for Capacity Development and Linkages for Environmental Assessment in Africa (CLEAA) is working to strengthen EA capacity in the region (http://www.encapafrica.org/cleaa.htm).

Institutional issues

EIA has been driven by environmental legislation and regulation, not by sectoral fisheries interests, and there may be differing perspectives between different government departments. For example, different perspectives on environmental impacts lead the Ghana Fisheries Ministry develop a "Fisheries Impact Assessment" which mainly addressed impacts ***on*** fisheries. Role, competence and capacity are all important issues. EIA specialists seem to predominate while sectoral (aquaculture) specialists tend to be spectators in the process. There is a need to ensure cooperation between environment and fisheries agencies. Cross border implications of environmental impacts, for example, trans-boundary impacts on fisheries may require attention of a central or national agency. In general there is very little "sector" level management, despite the existence of waterbody management institutions such as those concerned with Lake Victoria and Lake Kariba. Often there is very little communication between countries. Generally, the allocation of resources to environmental agencies versus fisheries/aquaculture – *i.e.* sectoral management versus environmental management is an important practical policy issue.

The application of EIA for agriculture shows there are differences in approach to aquaculture and agriculture. Sometimes agriculture and business development are permitted relatively easily while aquaculture may suffer disproportionate attention and regulation. Aquaculture seems to be a more obvious point source of nutrients/pollution, and often is a relatively new activity. Aquaculture might fare better were it placed within an agriculture ministry. This is the case in Egypt where regulation is much more related to traditional rights and irrigation than to environmental assessment *per se*. Cages were removed from the Nile under old laws covering issues such as access and navigation. Ironically EIA is now proposed as a means to get them back. We need to avoid situations of: "law but no application" and "application but no law".

Public/stakeholder participation

Participation is new to many, not well understood, and not often utilized. But it can be useful – there are good examples from United Republic of Tanzania. It can open up many important issues. Equally participation can be controversial and may block development.

REVIEW OF ENVIRONMENTAL IMPACT ASSESSMENT AND MONITORING OF AQUACULTURE ACTIVITIES IN THE ASIA-PACIFIC REGION

Presentation by Michael Phillips

Mr Phillips introduced his presentation on the Asia-Pacific review (see Part 1) with a comment on available information. The review was specifically asked to cover a)

requirements; b) practice; c) effectiveness; and c) improvements. In practice while plenty of information is readily available on requirements, there is much less on implementation and practice, and very little indeed on effectiveness. To address this deficiency would require much more detailed and participatory case studies. Some key points made included:

- Many countries in the region are moving toward more decentralised systems, which is to be welcomed in many respects, but may be constrained through lack of skills and capacity at local level.
- Environment or fisheries departments may be assigned the lead role lead in terms of EIA and environmental management of aquaculture.
- EIA is rarely seen as an environmental management tool by farmers.
- EIA thresholds are typically area based rather than risk based.
- Carrying capacity remains largely a research issue with limited application to date.
- There is very limited experience of the use of Strategic Environmental Assessment in aquaculture. .
- Links between monitoring and management are usually poor, though there are good examples (*e.g.* relating to benthic impact in Australia).
- Codes of practice are becoming widespread and may substitute in part the need for EIA. In Thailand (where EIA is not required) ninety percent of farmers are engaged in a Good Aquaculture Practice (GAP) scheme, and Best Management Practice Initiatives are being developed in India.
- There is a need for more "cluster" level management for small farmers.

Discussion

Scope of application of EIA

There is a new policy for EIA in China since August 2008. A catalogue has been issued, with aquaculture projects being included. EIAs are required for aquaculture in enclosed areas, aquaculture in eutrophic areas, and cage aquaculture. The policy is stronger for marine cage culture.

There is a general issue about EIA for new entrants versus existing farms. Generally EIAs are required for new or expanding farms. How can existing farms be incorporated? What if farms are moved? This highlights the importance of monitoring which can and should be applied to existing farms.

A level playing field for aquaculture and agriculture?

Are EIA requirements for aquaculture more demanding than for other sectors such as fisheries and agriculture? Do other exports coming from Asia have similar demands? How do impacts from aquaculture compare with those from agriculture? It is arguable that they are relatively small. A 1998 study in China showed aquaculture contributed only 5 percent of nutrients compared with a higher figure from agriculture. A new project is undertaking risk assessment of different sectors. This raises the question whether Strategic Environmental Assessment should be undertaken for sector or for area. To ensure fairness and parity, there is a need for common (methodological) guidelines and environmental standards. Life cycle analysis is useful to compare aquaculture against other sectors. Carbon footprint analysis is likely to become the most important common assessment measure.

Risk based approach

Clear thresholds are needed for EIA, and effective monitoring for existing farms or those beyond the accepted threshold. Most thresholds are area or production based. A risk based approach offers an alternative or complement to this. However, is sufficient information available for useful risk analysis? Is there enough local knowledge to

define risks and focus? The consensus was that there was for most important issues. Risk assessment has always been part of best practice EIA – it should lie at the heart of screening and scoping – but has not been implemented very well, nor very often. Clearly sophisticated risk assessment cannot usually be done at small project level, but basic risk assessment should always be a key part of the process. It is important also to recognize that risk assessment is not a purely technical exercise – it is often quite subjective, so there is a need for some public/stakeholder participation. Costly sophisticated assessments should be avoided at lower levels. We need a hierarchy of risk assessment – sector level, area level, and farm level. It should get simpler as we get down to farm level, and the higher level assessments should set the frame and scope for lower level assessments. However, administrative authorities are often unwilling to decide/select critical issues at the scoping stage because tend to prefer comprehensive coverage of all issues which may provide a kind of insurance in case something goes wrong.

Industry structure

EIA is affordable to big players and important to producers with export orientation of production. But aquaculture is also important for poverty reduction. There is some consolidation in shrimp farming. Smaller farms are also being forced to consolidate/cooperate and work together in groups. Rationalization is being driven in part by food safety issues. It is possible to do EIA by zones which makes it easier to address the management and compliance (monitoring) for small farmers. This all becomes easier and more effective if it is possible to identify areas suitable for new entrants – i.e. prepare zones for farms and farm clusters. These can be set up with provisions for strategic management by a council of farmers. Assessment and management is much more difficult for existing farms.

Monitoring

In the region, there are some examples of monitoring but mainly in relation to improved management/operational efficiency. There are two kinds of monitoring. EIA typically generates an environmental management plan with specified farm level monitoring requirements. Government may monitor individual (large) farms and/or the wider environment. Monitoring of individual farms as follow up to EIA is not widespread. There is general monitoring in several countries, although this is not clearly related to the EIA process. There are, for example, monitoring networks in China and Viet Nam, but the feedback mechanism to management and response procedures is weak. In China site monitoring is the responsibility of the fisheries department – but is not always followed through. If pollution happens in a fishery area then the fishery department will be involved.

Codes of practice and operating standards

"Soft law" measures such as best practice certification schemes, etc., have proliferated in Asia and standards are beginning to get confused. There is a real need for harmonization.

There would be benefit in harmonizing the national/international schemes or analyzing common criteria between the schemes, and benchmark the different schemes. It is important to ensure equivalence and a level playing field. It is for government to provide a platform/framework and determine minimum standards or benchmarks. These can then be developed further by the private sector – with an eye to what the buyers want.

In the United Kingdom and many other countries large retail chains tend to dictate the standards. Food safety is a major concern/driver. These requirements tend to favour larger producers, but this eventually affects smaller producers. There needs

to be a balance between reasonable requirements and the need to keep things simple enough for smaller producers.

In Thailand there is a need for incentives to adhere to Good Aquaculture Practice (GAP). Buyers have particular interests in terms of quality standards, but these need to be balanced also with social standards. Further, foreign markets put pressure on environmental standards but for local markets there is little pressure. The result can be double standards. Now in Thailand shrimp farmers are complaining because standards are high and complex for aquaculture, whereas (for example) vegetable growers are subject to less demanding standards.

Institutions, delegation, coordination

Which takes precedence: EIA legislation or sectoral legislation? There is sometimes tension between sectoral and environmental agencies. It is usually better to implement EIA/monitoring at local level, but this raises capacity issues**.** Clear standards should be established before decentralization. Decentralization and delegation from central to local could involve also delegation from environmental central agency to local fisheries authorities. In all cases coordination between different levels, ministries, authorities etc is important. Capacity building is also of paramount importance, especially where there is decentralization.

In the Philippines there are 900 or more municipalities and the EIA issues are their responsibility. They group municipalities that share a common resource in integrated fisheries and aquaculture management councils. China is now zoning areas at provincial level for specific uses. Large projects are dealt with by the environment ministry and may be subject to EIA. Most small-scale projects, including aquaculture, are dealt with by local level environmental agencies associated with local government.

Institutional responsibilities are also relevant to the implementation of the Polluter Pays Principle. Who pays? The burden will be on the sector – but others may decide. Approaches must be practical, effective and affordable. There is a need for efficient and fair decision processes which effectively tackle problematic or controversial issues - especially where public consultation is used.

GIS

There is little use of satellite imagery and GIS in EIA. It could be better used for regional planning and the identification of zones. It is less useful for project level assessment.

REVIEW OF ENVIRONMENTAL IMPACT ASSESSMENT AND MONITORING OF AQUACULTURE ACTIVITIES IN LATIN AMERICA

Presentation by Alejandro Flores Nava

Mr Flores Nava presented a brief overview of the review paper (see Part 1). Latin America has the highest aquaculture growth rate in the world, with salmon, shrimp and tilapia being the top species, and Chile with the highest production (of which 90 percent is farmed salmon). The main impacts are reported to be mangrove destruction (*e.g.* Ecuador), introduction of exotic species and disease, and algal blooms associated with wastewater from shrimp farms. EIA legislation is mainly based on the US model. Procedures in most countries are quite detailed and look good on paper, but in reality procedures are often not followed. Key recommendations include the need to review standards and norms on a regional basis; to develop sustainability indicators; to establish baselines; to increase capacity and improve the quality and objectivity of information; and to undertake systematic monitoring. Codes of practice and product labelling are also important but there is much room for abuse.

Discussion

Disease

Licensing and quarantine procedures have been developed in Mexico for hatcheries allowing for disease free fingerlings. However, these procedures are not available for fish grow-out in cages. A network of laboratories for disease free fingerlings is coordinated by Mexico's National Commission for Fisheries (CONAPESCA). Quarantines are usually conducted for inland aquaculture.

Introductions and stock movements

All exotic species require EIA by law, especially high valued species for export. However, in practice EIA is not always conducted, especially for those farms that have government clearance/support. In Ecuador, fish and shellfish imports must be referred to a technical committee. However, in Mexico there is much uncontrolled movement across borders between small-scale fish farms. Thousands of live aquatic animals cross the border illegally between Mexico and the United States of America. It was noted that tilapia can be imported as ornamental species which is less strictly regulated. The interactions between aquaculture and fisheries may be positive and/or negative. Stocking of tilapia in many waterbodies in Latin America has had strong positive impacts. Tilapia is being farmed in reservoirs in Brazil where estimates of carrying capacity are being conducted to allow for cage farming development. In general, complex issues of this kind need to be addressed through higher level sectoral or strategic environmental assessment.

Thresholds and triggers for EIA

Although in law small farms need EIA, in practice the normal requirement is simply to have an agricultural soakaway, and a statement that the land does not have agricultural potential. In any case most farms are subject to license conditions, including reporting and random audit by the given environmental protection agency. In practice this is severely resource constrained, and EIA is usually just a piece of paper required to get a license with little if any follow through.

Role of the market

In general, there is no capacity in the region for EIA enforcement, except for aquaculture of high valued species for export. In Ecuador, for example, aquaculture on agricultural lands is not permitted, but many are still doing exactly that. The market is becoming increasingly influential. International trade is putting pressure on exporting countries to do EIAs, but it is important to clarify specifically what kind of pressure this is. For example, US retailer Wal-Mart imposes quite rigorous conditions on salmon suppliers. There is a need to distinguish between the two international trade forces: (1) to comply with public sector regulation, and (2) to see what the effect is of public sector EIA in a context of certification requirements. There is need to compare public sector measures with certification standards/criteria. Public sector initiatives typically have a stronger chance of going through. There are equivalence issues here.

Aquaculture parks

Aquaculture parks (comprising zone, infrastructure, organization) are increasing in Mexico and in Brazil (in Brazil mostly in coastal marine areas) in order to enhance aquaculture growth, facilitate short permit procedures, reduce bureaucracy, and better manage impacts derived from clusters of farms. However, these parks need to be managed properly to prevent farms from creating a "domino effect" when one farm affects a neighbouring farm. While clustering may be good for infrastructure and management, disease and biosecurity can become serious issues, and cumulative impacts may be more concentrated. Responsibility for particular problems is often not clear. And this in

turn can undermine management. The concept of aquaculture parks is also important, for example, for the mussel growing areas of Spain – and there are also examples from Asia. Liability is an important issue here –, if the government guides aquaculture into concentrated zones, is the government then responsible for problems that may arise?

REVIEW OF ENVIRONMENTAL IMPACT ASSESSMENT AND MONITORING OF AQUACULTURE ACTIVITIES IN EUROPE AND NORTH AMERICA

Presentation by Richard Corner

Mr Corner made a brief presentation of the Europe and North America review (see Part 1). Some key points made included:

- the need to consider EIA as a process which does not end with the production of an environmental impact statement, but is followed through with monitoring;
- the difficulty of measuring the effectiveness of EIA and monitoring;
- EIA procedures can be very complex and bureaucratic (for example Spain);
- the lack of requirement for aquaculture EIA in some countries (such as the Czech Republic, some states in the United States of America) and the more general lack of any EIA requirement for shellfish culture (except Canada).

Some key recommendations include:

- reduce complexity and numbers of institutions involved;
- make EIA and Best Management Practice complementary rather than overlapping;
- improve the rigour of screening and scoping;
- develop scientifically based environmental quality standards;
- more focused monitoring;
- build trust between farmers and regulators.

Discussion

Diversity of implementation

Environmental management is applied very differently in different countries. Implementation in Greece (monitoring) and Italy (EIA) is rather poor. In Greece there does not appear to be a statutory framework for monitoring, and rather limited implementation of the European Union (EU) EIA Directive. In Italy implementation is devolved and inconsistent. EIA responsibility is at municipality level, with varying levels of implementation or effectiveness. It is possible to get green or red light in adjacent municipalities.

In Spain each of the 16 regional governments has different EIA and monitoring procedures with different parameters, and different monitoring requirements. The process does not take account of social and economic needs. Often local communities, influenced by Nongovernmental Organizations (NGOs) do not want aquaculture, e.g. Galicia's government is under NGO pressure against aquaculture. Accurate unbiased information about aquaculture and impacts of aquaculture is not readily available. Turkey adopted EIA in 1993. In 2003 it specified EIA for fish farms of more than 1 000 tonnes. In 2007 new criteria were agreed for farms located in closed bays, and use of TRIX (trophic status) index is required. In practice all cage farms have been forced to move offshore. The EIA requirements are not necessarily appropriate for fish farming. EIA was previously subject to a size threshold; this is now more complex and depends on currents, depth, distance from shore, etc. Assessment and monitoring of benthos is not required.

There are some countries without major EIA/monitoring requirements (e.g. Czech Republic, Poland) where there is mainly pond aquaculture which is perceived as having little or no impact. The MARAQUA project carried out a useful review of regulatory monitoring requirements in European mariculture. Also a recent EU wide review of implementation of the EIA Directive should be checked. Definitions of EIA used in Europe and North America may not be appropriate to other countries.

Decentralization, decision-making and participation

Recommendations should be for flexible, local, participatory, devolved approaches with the caveat that devolution may be less effective without higher level guidance. There is a dilemma here: decentralization and flexibility are desirable whereas inconsistency and discrepancy are not.

EIA procedures tend to be dominated by a "tick box" mentality, and are often highly subjective. Models can help more rigorous decision-making, as can GIS and multi-criteria decision analysis. Some simple affordable approaches/techniques are available. A GIS based system is being developed in Norway; however such an expensive and data hungry approach cannot be afforded in poor countries.

A key issue is the appropriate degree of participation in decision-making in relation to different parameters or issues. Many are locally important or subjective and need participatory input; others are more technical and can be left to the specialists. If we mix them up we get inefficient participation. Perhaps we need a two stage process: a more focused technical EIA followed by more participatory planning. There is often a lack of trust between farmers and institutions/agencies. Often farmers need to know why they are asked for all the parameters. EIA and monitoring must make sense to the farmer.

REVIEW OF ENVIRONMENTAL IMPACT ASSESSMENT AND MONITORING IN SALMON AQUACULTURE

Presentation by Kenny Black

Mr Black offered a brief overview of the review on EIA in salmon aquaculture (see Part 1). Some key issues raised included:

- the poor response to the questionnaires sent out and therefore the potential for bias;
- the rapid rate of regulatory reform in many countries;
- the near universal application of EIA to large scale salmon farming;
- the existence of well developed monitoring guidelines;
- the historic emphasis on benthic impact;
- lack of follow up and information on the implementation of mitigation;
- the limited connection between EIA and monitoring;
- containment (escapes) as a major current issue;
- the widespread perception by farmers of environmental monitoring as burdensome, costly and over-complicated;

In terms of improvements suggestions included:

- there is a need to examine more carefully what appear to be arbitrary limits on farm size;
- a more consistent approach between countries in terms of the approach to chemical use and regulation;
- the need for more emphasis on cumulative impact, and more work on and application of assimilative and carrying capacity models;
- need for better engagement of stakeholders, especially in the United States of America;
- better public assurance with respect to aquaculture-environment issues;
- more/better use of Strategic Environmental Assessment;
- need for better data on social and economic costs and benefits;

Discussion

Independence of EIA and monitoring

In Scotland fish farm companies often contract their own independent EIA and have in house staff to do much of it. On the one hand the independence of such assessments

may be questioned. On the other hand the farmers themselves are building substantial knowledge and experience, and are subject to stakeholder and government review. Much of the modelling and monitoring is now also done by companies. This allows them to do site optimisation before EIA – *i.e.* they are making informed strategic choices. Nowadays most technical problems (*e.g.* pollution, environmental capacity) are addressed prior to an EIA submission, leaving only social issues and landscape as areas of uncertainty to be addressed in the EIA. However, the public agencies are to ensure quality control.

In Norway farmers do their own voluntary monitoring. However there is a trust issue: farmers are not trusted to carry out their own EIA. Contracted experts are used, and compliance with standards varies. Training in EIA methodology and monitoring is arranged, and there is a list of qualified specialists. It is the role of the Fisheries Directorate to establish standards for EIA conduct, including preparation of a standard template for reporting. The consenting process requires complete records of medicines used (*e.g.* sea lice treatments). In general the use of medicines is well regulated/ supervised. There is very little use of antibiotics. To date they do not measure medicine residues in the environment. Sea-lice and the associated chemical use are a big problem in the UK. However, access to chemicals is strictly controlled, and monitoring is done for residues in the environment.

In Chile many companies became specialized in EIA, but government authorities lack the resources to validate if EIAs are accurate. An FAO project is underway to develop an independent validation and certification process.

Public disclosure and transparency

Public disclosure of EIA documents contributes to quality control. In the UK, documents go into the public domain, and NGOs often scrutinize the documents carefully. In Chile the DIA (declaration of environmental impact) is not public, although a full EIA would be. The "environmental declaration" is effectively the same as a basic EIA. However, the full EIA is more comprehensive and includes socio-economic aspects. Certification of compliance is presently done by a non-government institution. It is not clear whether the procedure is effective - most farms report anoxic sediments.

A CASE STUDY: DEVELOPMENT OF PROGRAMMATIC EIAs AND MONITORING PROGRAMMES FOR CLUSTERS OF SMALL-SCALE CAGE FARMERS

Presentation by Patrick White

Mr White presented a summary of work conducted in Bolinao Bay in the Philippines strengthening capacity for environmental management of small-scale cage culture activities (see Part 1). There are currently 9 500 cages generating 120 000 tonnes of fish with little planning and management. The project involved a range of activities including GIS and assessment of carrying capacity, zoning and development of zone committees, cluster level environmental assessment and monitoring, training/ awareness, capacity building and institutional strengthening. The purpose of the project was to increase organisation and representation of farmers so that "clusters" of farms could be effectively monitored and managed, and the classic boom and bust cycle of small-scale aquaculture avoided.

Discussion

Monitoring costs

Low cost monitoring, a key issue, can be done, *e.g.* with simple environmental quality tests (*e.g.* using beer cans as sediment grabs) which helps raising awareness and getting the farmers involved.

Disease and biosecurity
The dangers of disease spread within and between clusters were discussed. Biosecurity measures are needed which can be implemented by the zone committee, possibly through bylaws. There is a need for simple good practice guidelines, and for appropriate management measures including the use of higher quality feed pellets.

Management strategy and responsibility.
There is also a management dilemma: is sediment better accumulating in one spot beneath the cages or dispersed through the lake? This will depend in part on the overall capacity of the lake. However, how do you promote individual responsibility? It should be possible to identify which are the worst performing farms, and the worst performing clusters, and then restrict or change production accordingly. What about illegal production? Can this be controlled?

Carrying capacity and strategic relocation of farmers
It seems there are already too many cages according to the calculations of carrying capacity. How can we reduce these and prevent new entry? The rationale for encouraging people away from the areas with high water flow (because this spreads the pollution to other areas and other farms) sounds fine, but this is precisely where most farmers would wish to be: at the best flushed sites. So it will not be easy to move them – irrespective of whether this is desirable or not. In any case location is not just about water quality. They may select a site close to a village or supply base. Over time they will select the best locations based on a range of practical criteria. This is a good example of change management; from an unmanaged to a managed situation where there will be social costs of displacing people. Equally there may be social costs of not moving people (*e.g.* toxic blooms, disease). What were the processes involved in changing habits? What incentives? This should be a major role for the municipality, and for issuing licenses. Capacity building is a key issue here.

GIS
There is a significant resource of high quality GIS data. Where will it reside? How will it be used or shared? This was a project with BFAR/University of the Philippines. There are problems of data sharing between institutions. However the data are already posted on the web.

EIA INFORMATION FROM CODE OF CONDUCT FOR RESPONSIBLE FISHERIES REPORTING FOR AQUACULTURE AND FROM NALOs/NASOs

Presentation by Doris Soto
Every two years a global survey is conducted by FAO relating to the implementation of the Code of Conduct for Responsible Fisheries (CCRF). Ms Soto presented a summary of findings of these surveys, particularly in relation to the use of EIA in aquaculture. The related paper is presented in Part 1. The analysis of survey responses revealed rather limited implementation and effectiveness of EIA in many countries.

Discussion
The workshop participants concluded from the presentation that there are serious issues with the implementation of EIA in many countries. Implementation is very limited for aquaculture and effectiveness questionable. The survey methodology was briefly discussed. The questions posed in the questionnaire and corresponding responses are mainly qualitative rather than quantitative, and quite general. There is no rigorous guidance on how to respond.

EIA is mentioned in the CCRF. Relevant recommendations can be found in CCRF Article 9, in particular in provisions 9.1.2 and 9.1.5:

> *9.1.2 States should promote responsible development and management of aquaculture, including an advance evaluation of the effects of aquaculture development on genetic diversity and ecosystem integrity, based on the best available scientific information.*
> *9.1.5 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.*

GLOBAL REVIEW AND SYNTHESIS OF REVIEWS OF EIA AND MONITORING IN AQUACULTURE IN FOUR REGIONS AND FOR SALMON AQUACULTURE

Presentation by John Hambrey

Mr Hambrey provided a brief overview of the main findings and conclusions of the global review and synthesis (see Part 1). The key finding is that while EIA and monitoring is applied to many large scale marine finfish farming and shrimp farming projects, it is not applied to the bulk of global aquaculture production which is dominated by small-scale producers mainly in Asia. Furthermore, it is questionable as to whether farm level EIA could be an appropriate mechanism for environmental management of small-scale aquaculture, since it typically fails to address cumulative impacts. The review also highlights the weakness in many countries in terms of feedback between assessment and monitoring procedures and sector management as a whole. Some key requirements in terms of strengthening procedures were presented.

Discussion

Comparison with agriculture

The potential for learning from agriculture was raised. Has there been benchmarking of aquaculture EIA with other sector's EA? Is EIA applied to agriculture? The view was that while there is usually provision for it in the legislation, it is not generally applied to agriculture except for a few major industrial scale projects, such as major livestock and irrigation schemes. More generally EIA requirements for aquaculture are perhaps more rigorous than for agriculture because of perceptions: fish farms are seen as new and un-natural, whereas agriculture is perceived as "natural", in harmony with nature/landscape *etc.* Chile for example is a country which exports large amounts of fruit. No EIA is required in fruit production. Dairies do have to comply with some environmental regulation, but again no formal EIA is required. Aquaculture is therefore relatively unique in this regard.

The approach used in different countries depends on the relative weight afforded to a sector (agriculture *versus* aquaculture). Agriculture often has much greater weight. There may well be conflicts of resource use also between aquaculture and fisheries. This highlights the need for integrated environmental management in coastal zones. Some sectors are beginning to address environmental management issues through the use of techniques such as environmental economics. Thresholds for requiring EIA are obviously a critical issue which should be further discussed. We also need indicators of the effectiveness of EIA.

Planning and assessment

The participants agreed that we cannot separate out EIA – it is just a part of environmental management. In Norway considerable time has been spent on defining regional goals

and objectives. In 1994 environmental objectives were set for each aquaculture area. This helps focus on important issues and better management. These are subject to regular review. Then we can set priorities: undertake risk assessment; rank risks in terms of severity; re-evaluate from time to time – then monitor. Norwegian authorities develop short, medium and long term goals, which are revised every 5 years. The use of Strategic Environmental Assessment may have potential to set the frame and context for EIA, but may be too broad. The key is to agree the environmental objectives.

In Spain there is a new example of the use of strategic environmental assessment in Galicia in relation to turbot aquaculture and the development of a coastal zone plan. Aquaparks are required to submit an overall "Park" EIA. EIA for an individual farm then becomes much simpler. In many countries there is a general tendency to seek to drive fish farms "off shore" to reduce planning conflicts.

Institutions

There is a clear distinction between environment agency driven EIAs, and sector driven EIA, and some participants expressed the view that the latter is better. For example there has been a move to give greater responsibility for environmental management to the fisheries department in Viet Nam. This department is better placed, and better resourced to meet the task, and better able to implement longer term management interventions.

The issue as to whether a clear recommendation should be offered on this was discussed, but there was no clear consensus. Much depends on the specific nature and capacity of the institutions in different countries; funding mechanisms; the scale at which intervention is appropriate – and the institutions that correspond to that scale. The latter is of particular importance if we are to implement the ecosystem approach to aquaculture where scale of management is a crucial issue. In some cases an environment ministry, department or agency may be better placed to do the job; in others the fisheries department. The key is to get the procedures right, and ensure that the skills and knowledge of all relevant institutions are drawn on.

Working groups and structured discussions

Michael Phillips (chair) introduced the tasks for this Session: an initial discussion of priority issues which the workshop could usefully discuss; followed by three break-out groups to deal with sets of related issues. The overall aim is to come up with key findings and recommendations in relation to these issues.

PRIORITY ISSUES FOR DISCUSSION

John Hambrey (facilitator) introduced the discussion guide prepared for the workshop (Annex 4), and some of the key issues identified there. Michael Phillips (chair) then solicited views from all participants on what they considered to be the key issues, bearing in mind those identified in the discussion guide. The points raised during the discussion were rationalised and grouped into the following three major categories to serve as a starter and framework for the deliberations of the three working groups. Some important cross cutting issues (*italics*) are included in more than one category. The three major categories identified are:

i) Management framework
ii) EIA procedure and practice
iii) Monitoring

BREAK OUT GROUPS

Participants were divided into three working groups (corresponding to each of the three categories) to discuss the relative importance of these and other issues and to prepare preliminary findings and recommendations. The three working groups provided their discussion outputs to the facilitator for consolidation and organization, and presentation to plenary for final discussion and agreement.

MANAGEMENT FRAMEWORK

Working group (1) focused on the following issues:

1. Joining up the components: making the environmental management system work.
2. Frameworks for applying concepts of sustainable development and management.
3. Strategic Environmental Assessment: potential and role.
4. More clarity on meaning and relationships between EIA, SEA, ecosystem approach.
5. Relationship between EIA, monitoring and integrated management plans.
6. Issues which alternative management tools (EIA, SEA, Codes of Practice, regulation, *etc.*) best able to address, *e.g.* how best to deal with alien species?
7. Decision-making and institutional framework.
8. Role and impact of aquaculture in the wider environment.
9. Best Management Practice (BMP) and EIA. Which works best for what?
10. Relationship with/use of ISO 14001
11. Developed and developing countries. Big farms and cluster management?
12. Inclusion of small farmers.
13. Refining focus and addressing priorities.
14. Simplifying procedures.

15. ISO 4001.
16. Dealing with species introductions.
17. Capacity building.
18. Farmer awareness/understanding/communication.
19. Need for/use of objectives and standards.
20. Linkage between EIA and monitoring.
21. Feedback mechanisms (assessment-monitoring-management).

EIA PROCEDURE AND PRACTICE

Working group (2) focused on the following issues:

1. Definition of EIA – do we usually have it but don't call it EIA? A suite of related procedures?
2. Are we "hung up" on EIA? A step to get a permit? Or something more?
3. EIA and the ecosystem approach.
4. Defining the scope and focus of EIA:
   a. Prioritisation, risk analysis;
   b. Avoiding duplication with other management tools.
5. Who should be the competent authority, coordinating authority?
6. Addressing social and economic issues – the roles of science and/or participation.
7. The use and value of tools – communication, visualisation, GIS, modelling, socio-economic *etc.*
8. Implications for extractive versus assimilative production systems (*e.g.* molluscs *versus* carnivorous finfish?).
9. The special features of aquaculture – what they are and how to take account.
10. Implementation of environmental management plans.
11. Coordination and integration, especially with respect to inputs/response to the EIA process.
12. Increased inclusion – how can/should EIA/monitoring be applied to small farmers?
13. Public disclosure and information sharing – EIA reports – data.
14. Refining focus and addressing priorities.
15. Capacity building.
16. Farmer awareness/understanding/communication.
17. Need for/use of objectives and standards.
18. Linkage between EIA and monitoring.
19. Feedback mechanisms (assessment-monitoring-management).

MONITORING

Working group (3) focused on the following issues:

1. Simple, practical monitoring regimes.
2. Defining the scope and focus of monitoring – risk analysis.
3. Human resources, capacity, costs, levels of detail.
4. Inclusion of social and economic issues?
5. Tools – communication/visualisation; socio-economic; GIS
6. Approaches to dealing with seasonality and complexity.
7. Environmental performance indicators.
8. Eco-efficiency benchmarking; socio-economic monitoring – how to feed into policy and practice.
9. Integration of socio-economic and governance aspects and targets.
10. Ecological baselines.
11. Use of sustainability indicators.
12. Public disclosure.

13. Refining focus and addressing priorities.
14. Capacity building.
15. Farmer awareness/understanding/communication.
16. Linkage between EIA and monitoring.
17. Feedback mechanisms (assessment-monitoring-management).

Presentation and discussion of key findings, recommendations and guiding principles

The facilitator, John Hambrey, integrated and rationalised the findings of the three working groups. During a plenary session opportunity was given to all participants to comment on, discuss and refine these findings and recommendations. The chairman, Michael Phillips, emphasised the need to focus on effectiveness and practicality.

The output of this session, which was developed mainly on-screen in direct response to the discussions, is presented below. Notes of the separate working groups have been added where relevant, and where they support the recommendations agreed in the plenary. The following findings and recommendations are grouped here into five main areas including (i) diversity; (ii) management framework; (iii) EIA procedure and practice; (iv) monitoring and (v) capacity building.

DIVERSITY

All participants agreed that the practical and effective implementation of EIA and monitoring must take account of the huge diversity of both aquaculture, and local geographic, social and economic conditions.

- Environmental management needs for aquaculture vary greatly throughout the world.
- Government response – in terms of the application, scope and detail of EIA and monitoring – should be proportionate to the level of environmental risk associated with aquaculture.
- Recommendations should be interpreted and applied according to national and local needs.

A MANAGEMENT FRAMEWORK OR "SYSTEM"

- EIA and monitoring requirements and procedures cannot be defined in isolation. They should be seen as tools or elements in a broader environmental management framework or system.
- This framework should comprise elements which apply at global, regional, national, watershed and farm cluster or farm level. Figure 1 and Table 1 show some of the tools and approaches that can be usefully applied at different levels.
- Monitoring can be conducted even without EIA and is an essential management tool; EIA on the other hand should be used in particular situations, *e.g.* large-scale projects, or high risk conditions, but is of little value if conducted without monitoring.

Key elements required in an effective environmental management system

The participants recognized a number of key elements which are important for an effective environmental management system for aquaculture (Figure 1; Table 1).

- Nested and coordinated regional, national and watershed aquaculture development and management strategies. Scales should be pragmatic though ideally national; watershed; local. The latter may be specially defined for purposes of aquaculture management, or related to existing governance boundaries. These are discussed in more detail below.

- Clear objectives, standards, and decision criteria – including reference points – appropriate to the level or scale.
- Licensing or permitting procedures, and associated environmental assessment (detail proportionate to level of risk)
- EMP/CoP/BMP relating to farm operation. Reinforced where possible through market mechanisms and/or the EIA-permitting process.
- Monitoring of farms: implementation of EMP/CoP/BMP; local environment; wider environment
- Feedback and adjustment mechanisms - assessment of effectiveness of strategies, standards and permitting procedures as required at all levels.

EIA as such may be more or less important depending on the nature of aquaculture. Typically it is only a useful tool for large scale aquaculture, or those developments with high environmental risk. There is a range of ways these various elements can be applied and brought together at different geographic and administrative levels. The following diagram and table illustrate some of the possible relationships.

A strategic hierarchy

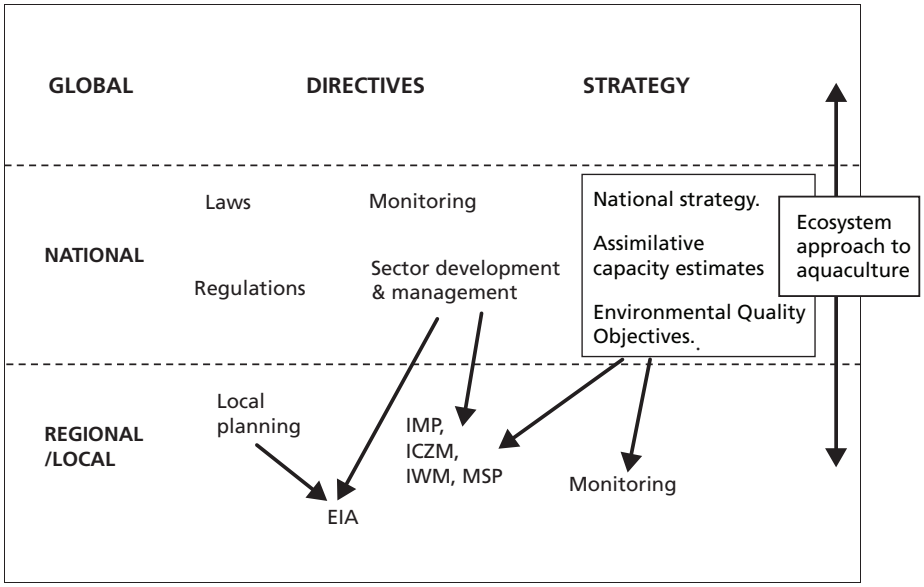
The workshop identified different scales and related levels of strategy (Figure 1; Table 1).

(1) National strategy

A key requirement is for a national aquaculture strategy, which would set out the mechanisms for support and management of the sector at national level, and provide a framework and guidance for mechanisms that should be applied at regional or local levels. The strategy should include the following:

- Clear purpose and objectives. The goal of any national strategy and subsidiary management measures is likely to be sustainable development.
- Nationally appropriate definitions of EIA, SEA, *etc*
- Relationship with legal framework.
- Requirements for lower level management units – ecosystem/watershed level; local management level (eco or governance units - *e.g.* Bolinao Bay; local authority); farm zones or clusters.

FIGURE 1
Elements in a hierarchical management system



IMP: Integrated management plan; ICZM: Integrated coastal zone management; IWM: Integrated watershed management; MSP: Marine spatial planning.

TABLE 1
Applicability of different management mechanisms at different scales

	Global	Regional*	National	Local	large farm	small farm or cluster
Strategy	Rio, EAA,EAF	X	X	X		
Planning		ICZM	ICZM	zoning	farm site	
Risk analysis		X	X	X	X	
SEA		X	X	X		
Local plan				X		
EIA					X	
Environmental declaration						X
Permit/license					X	X
Monitoring			X	X	X	X
Control				X	X	X
BMP/CoP					X	X
Certification	X	X	X	X	X	X

* Could also include international waters/watersheds.
EAA: Ecosystem approach to aquaculture; EAF: Ecosystem approach to fisheries; ICZM: Integrated coastal zone management; SEA: Strategic environmental assessment; BMP/CoP: Best management practices / Code of practice

- Analysis and screening of national threats/opportunities (*e.g.* exotic species, pollution, disease, food security, *etc*).
- Priority issues and associated objectives, standards, and where possible reference values. May need both process and outcome indicators.
- Screening guidelines (*e.g.* priorities for simple risk assessment) for EIA or other management controls.
- Tools and mechanisms with which to address priority management issues.
- Definition of appropriate ecological management units.
- Monitoring procedures to address national level threats and risks, and framework/ guidance for local monitoring.
- Links and coordination mechanisms between levels of assessment, individual EIA and monitoring.
- Support measures for smaller farmers/clusters/zones.
- Responsibilities (*e.g.* fisheries department, environment agency; local authority) for different functions: permitting, decision-making, monitoring, planning *etc.*
- Consultation and delegation procedures.
- Coordination of permitting procedures, operational regulation/control, voluntary codes, market incentives.

The group also discussed the desirability or otherwise of identifying particular "high risk" aquaculture systems or technologies. There were different perspectives on this. Some considered that the key was to manage the risks (such as pollution, escapes) and allow the private sector to use their own initiative to meet corresponding standards – using whatever technology they wished. Others thought it appropriate to specifically identify low risk (*e.g.* integrated multi-trophic aquaculture) and high risk (intensive monoculture) technologies.

(2) Strategies for waterbodies, integrated coastal zone or watershed management

The scale at which these strategies should be developed is not easily defined, but should take into account ecological systems and their connections, physical and "natural" boundaries, the spatial distribution of aquaculture activity, social structures, and administrative boundaries. The key here is to define and manage a "common resource".

Broadly speaking these strategies would have similar elements to those listed above for national strategies, but more highly specified and appropriate to local conditions. Additional elements might include, for example:

- A clear strategy about the place of aquaculture, its relationship with other sectors, and its use of resources (including areas/water, *etc.*)

- Carrying capacity (many dimensions) or maximum allowable capacity, and current status in relation to these, should be estimated and agreed by stakeholders (with proper scientific information).
- Co-management agreements over transboundary waterbodies (agreed management structures between neighbouring States) to foster sustainable aquaculture.
- Coastal/watershed planning and zoning should consider allocation of farmers licenses (rights) contingent upon compliance with environmental standards and requirements.

(3) Local management plan/cluster management plan/area management plan

Again the scale at which these may be developed will depend on a variety of factors including the nature and spatial distribution of aquaculture activity; the physical characteristics of the watershed/waterbody; the nature of important management issues; and the local governance structures. There are many examples of these from throughout the world, including local authority master plans or framework plans; area management agreements (e.g. to address the problems of sealice in Scotland); plans for particular zones (e.g. Philippines case study; marine management plans in New Zealand, etc.). These plans may be sectoral, or preferably nested within an integrated management plan covering all resources or users.

(4) Farm level

A new development should be subject to:

- a permitting or licensing procedure;
- screening and scoping;
- EIA if designated as high risk;
- simple environmental assessments or statements for smaller farms or low risk activities;
- monitoring related to local threats and risk levels.

If EIA is not required, there should be a clear higher level management/regulatory framework which might include for example Code of Practice/Best Management Practice and/or specific regulations, consents and monitoring which would apply to all new and existing development as appropriate. The way in which the various tools and mechanisms can be deployed most effectively should be a key consideration in the national strategy.

Role of Codes of Conduct, BMPs, *etc.* in a management system

These are of particular importance to manage existing and small-scale aquaculture, and may be complimentary with, or an alternative to, EIA. For some farmers adherence to CoC may be a precondition for a production licence or permit, and may be required to access important markets. The following actions may be considered:

- Design codes of practice and regulations and EIA approaches so that they are complementary and don't overlap to avoid duplication and unnecessary costs.
- Promote Code of Conduct (CoC) to reduce burden of EIA completion/ implementation
- (e.g. capacity building/training on CoC can assist in EIA adoption/ implementation;
- staff can be certified to ISO standard).

A risk based approach (regional, watershed, local)

Adequate assessment and communication of risks can be very useful for environmental management purposes.

- Risk assessments should define the application and scope of different levels of environmental assessment (SEA, farm EIA).

- Risks should be evaluated and prioritized through sound science based technical *and* participatory consultation process.
- There should be periodic review of risks.

Feedback and communication tools

There is a need for feedback mechanisms at all levels to ensure that environmental management responds to identified needs and steadily improves in terms of both focus and effectiveness. This relates partly to procedures and institutions, and should be spelled out in relevant strategies. It is also dependent on effective communication, especially between scientists, authorities, farmers and other stakeholders. Possible methods include:

- Extension work, workshops, seminars, training.
- GIS, internet, manuals, email newsletters, SMS (telephone).

It may be possible to address emerging environmental issues through better use of existing technology or through new technology. It is also important that monitoring and learning that takes place at farm or local level feeds back into national strategy.

Coordination and integration

A lack of coordination and integration is highlighted for many countries in the review papers. This lack of integration in some cases causes unnecessary delays in *e.g.* licensing or permitting procedures. Integration can be improved in several ways, for example:

- Institutional mechanisms to better integrate the departments involved in the process of aquaculture licensing (*e.g.* one stop offices where appropriate could facilitate/streamline licensing).
- Working task groups or council could be created to better coordinate activities.
- Relevant databases and information systems following agreed standards and methodologies are needed to enhance coordination, integration and consistency.
- Need for expert advice on different datasets/information (*e.g.* feedback from specialists such as GIS analysts, economists, modellers, *etc.*).
- Need to coordinate with international organizations and their agenda/guidance.

EIA PROCEDURE

EIA is a decision support tool which may apply to the permitting procedures for new aquaculture development. It was originally conceived as applying to major significant individual developments, and this remains its most effective area of application.

Definitions for EIA and SEA

A clear definition is a priority for EIA implementation. However, the process is different in each country. It is therefore appropriate to propose a global EIA definition (see box, for an example), and then prepare a specific definition of EIA for aquaculture in each country. Such a definition should however be consistent with those for other sectors.

It may be appropriate to refine EIA definitions according to species, culture systems, practices, scales and geography. An EIA definition should support implementation of an environmental management system for aquaculture. It should not allow for an interpretation as a one-off event designed to secure a piece of paper. Socio-economic aspects should be included in the EIA definition where these are not addressed in parallel permitting procedures.

In practice many different procedures, ranging from relatively simple "environmental declarations" to major research and public consultation exercises, may be referred

EIA definition

"The process of identifying, predicting, evaluating and mitigating the biophysical, social, and other relevant effects of development proposals prior to major decisions being taken and commitments made"

International Association for Impact Assessment, 1999.

to as EIA. Particular requirements will depend on all the other elements in the management system, and should be defined at national level.

Strategic environmental assessment (SEA) has been given a range of definitions in different countries/regions. In general terms it may be defined as *any* form of higher level environmental assessment - applied to a sector, programme, area, or ecosystem (*e.g.* as part of ICZM, national strategy, etc).

A context for EIA

- EIAs should always be informed by higher level policy and strategy, and reinforced/improved through monitoring as described above.

Screening and application

- EIA should only be applied to aquaculture development that represents a high risk. This may be defined on the basis of scale, technology, production, sensitive habitat, other users, *etc.* Risk analysis should support all such decisions.

Scope and focus

- The scope could be improved by
  - better defining objectives of EIA using national guidance (*e.g.* defining parameters) or a through specific legislation
  - setting priorities taking account of higher level analyses
  - conducting risk analysis taking account of higher level analyses
- Focus can be refined by avoiding duplication with other management systems (permits, licenses, planning) which already deal with specific environmental threats through generic measures;
- Focus should be on priority environmental threats *and* socio-economic values (where these are not already addressed through other mechanisms). In some countries a business plan is required as part of an EIA submission in order to ensure economic sustainability

In general EIA needs to be streamlined and simplified as much as possible.

Competent authority

It is important that there is a designated competent authority with responsibility for EIA of aquaculture. There are advantages and disadvantages for a fisheries department or environment agency having responsibility for EIA of aquaculture. Coordination and decision-making by a fisheries department may lead to more streamlined, predictable and better informed EIA, and more effective follow up in terms of implementation and monitoring. However, there is a danger of pro-sector bias. Either way, both should be involved, bringing together the neutrality and environmental expertise of the environment agency, and the technical knowledge of the fisheries department. In any case, responsibility for appraisal of EIA documents may be different from the overall management of the EIA process. EIA can also be appraised at different levels.

Delegation and decentralisation of responsibility is also an issue. Broadly speaking decentralisation is desirable, but there may be limited capacity at local level. These are both important issues to be addressed in the national aquaculture strategy. The main point is to make responsibilities clear, and ensure adequate financial resources and capacity to do the job effectively and without conflict of interest.

Public participation and peer review

Public participation is widely regarded as a key element of EIA.

- Public participation provides an important perspective, particularly on social and economic issues.

- There is a need for better strategies to allow for inclusion of public opinion.
- Public or third party participation, as well as technical peer review are essential for quality control of EIA.
- Public or third party audits of management initiatives developed jointly by industry and sectoral agencies also serve as quality control.

Tools

There are many tools that can be used to support more effective EIA. There was much discussion about their value and effectiveness, with a range of opinion expressed, and a general feeling that more discussion was required. The following were the main agreed points:

- Predictive models can reduce data needs.
- More tools and/or enhancements to existing tools are needed, *e.g.* communication, visualization.
- Tools to estimate environmental capacity are particularly important – and can be quite simple for some situations.
- Models are needed to better understand ecosystems (*e.g.* hydrology).
- Models may need to be species specific.
- Sharing of information between agencies/sectors involved in EIA process needs to be improved.
- Background (baseline?) data collection methods should be improved

There is an important question as to whether some of the models enhance or hinder communication and participation. This re-emphasises the need for better visualisation and communication tools.

General mitigation

- EIA should generate a farm level environmental management plan (EMP)
- Mitigation is a key part of EIA procedure and follow-up, and mitigation requirements may be defined at various levels
- Mitigating adverse interactions between fisheries and aquaculture is important.

Public disclosure

- Public disclosure of EIA data/information/results should be mandatory, except possibly in the case of sensitive commercial information
- Relevant/EIA information should be clear and should be disseminated in a timely fashion.
- Findings resulting from environmental monitoring should also be disclosed.
- Appropriate dissemination mechanisms should be developed.

Inclusion of small-scale farmers

It is noted in almost all the review papers that small farmers are usually excluded from the EIA process because many small-scale farming systems are considered as individually having insignificant environmental impacts. Although this is rational, there is a need to include small farmers more effectively in the environmental management process. This might be achieved in several ways:

- Official definition/recognition of small farmers, and identification of environmental management measures appropriate to them.
- Zoning (*e.g.* aquaculture parks/areas) could allow for increased participation of small farmers.
- Adoption of appropriate codes of conduct and incentives.
- Support by public authorities to small farmers to help them report on or monitor environmental conditions.

Links between EIA and monitoring

EIA usually generates an environmental management plan (EMP) – either directly as part of the EIA preparation, or subsequently as required by permiting authorities and informed by the EIA. The Environmental Management Plan arising from an EIA should include:

- What is going to be monitored according to risks and scales (farm, local, regional)
- How the monitoring will be incorporated in adaptive management (both at the farm level and for the wider environment).

Environmental monitoring is often weak and can be improved in a variety of ways as discussed below.

Incentives

Market mechanisms may be used to promote use of and compliance with EIA, monitoring and other management mechanisms.

MONITORING: "TOWARDS SIMPLE PRACTICAL (AND TECHNICALLY SOUND) MONITORING REGIMES"

The purpose of environmental monitoring is to determine environmental conditions and ensure that environmental impacts remain within acceptable agreed limits (environmental quality objectives/standards) as specified by the EIA, and at the same time to improve the conditions of production on aquaculture farms.

Monitoring of aquaculture development is an essential part of its management and should be an integral part of any aquaculture management plan. Monitoring associated with EIA is often not carried out in practice. Monitoring may be required by law and/or certification schemes.

Levels and types of monitoring

There may be several levels of monitoring, depending on the species, technology, or context:

- on farm (done by farmers);
- around the farm;
- among several farms;
- clusters of farms;
- strategic monitoring which addresses ecosystem level issues which might be at waterbody level or for a larger area (*e.g.* to monitor cumulative effects, disease, alien species, *etc.*).

The authority in charge of the "ecosystem level" should be defined at the national level (through legislation or national strategy), but the authority should remain at the lowest relevant scale.

All monitoring should be proportionate to risk and scale.

Standards and indicators

Appropriate indicators and standards should be chosen for evaluating the performance of aquaculture at different levels.

- Need agreed and practical environmental quality standards (EQS).
- Set up proper standards and indicators according to the culture system and identified impact;
- Indicators can be identified for the different levels identified above.

Indicators or standards may relate to maximum allowable change in the aquaculture areas; or they may relate more directly to the proper implementation of a management tool.

Authorities have an important role to disseminate advice on the availability and generation of baseline data. Ideally baseline environmental information should be available for a given environment in situations with no aquaculture development. Monitoring data would typically include similar areas with and without aquaculture (reference data).

Application

- Monitoring is more important than EIA. EIA without monitoring has limited value only.
- Monitoring should be done irrespective of whether or not EIA is undertaken or an EMP is in place (most aquaculture globally is not currently subject to EIA).
- Monitoring is important in relation to follow-through of EIA recommendations and EMPs, and provides important feedback to determine the impact of the development.

Simplification and consistency

- Monitoring is costly especially for small farmers, and must be made cost effective.
- There is need to greatly simplify requirements and practices of environmental monitoring in aquaculture, in order to facilitate its application and effectiveness more widely, so that it becomes a regular practice and an accepted practical management tool.
- Comparable standards should be applied so as not to burden aquaculture producers with varied complex and often contradictory standards.

Monitoring programmes

Monitoring should always take place in the context of a well managed programme, including the following elements:

- Objectives
- Parameters - minimal number
- Methods and procedures (including flow chart)
- Information management
- Responsibilities
- Authority for corrective measures (*e.g.* limits on medicine use)

Defining the scope and focus of monitoring: risk analysis

Many monitoring programmes are ambitious, expensive, and ineffective. It is essential to focus on the most important parameters which a) are sensitive to specific threats and b) good indicators of environmental health more generally.

- Risk analysis should be used at all levels (national to farm level) to identify monitoring priorities.
- Government authorities can provide a general framework and priority setting for overall monitoring requirements (*e.g.* in a national strategy).
- Strategic environmental assessments on larger area scales (including local / regional ecosystems) could provide information on high priority risks to be monitored in specific waterbodies.
- Monitoring should relate directly to management priorities and objectives.

Monitoring for small-scale aquaculture

"... common waterbodies need common thinking and joint action..."

Most aquaculture is still small-scale, so it is particularly important to develop monitoring which can be applied cost effectively to large numbers of small farmers:

- Government authorities should provide support to local communities/users groups area for waterbody management: organisation, facilitation, communication;
- Extension services may advise and assist with monitoring for individual farmers or farmer groups;
- Licenses should be linked to site specific monitoring, and implementation assured;
- Authorities may identify and encourage responsible and trustworthy advisors who may serve in dissemination of good environmental management practices, including monitoring.

Some participants had significant reservations about the last of these points. Suppliers may have a vested interest in high use of inputs which may not be in the interests of the wider environment or country at large. On the other hand these suppliers typically have highly effective links with many farmers and therefore offer an important opportunity to deliver messages and assimilate information from the field.

The need for communication of benefits of environmental monitoring

All working groups emphasised the need to engage farmers in assessment and monitoring for their own benefit as well as for others. Monitoring is:

- for farmers to improve performance and production; and to serve as early warning system on environmental and health conditions;
- for other local users, in order not to affect other commercial operations and living/livelihood conditions, or the use of local valuable habitats and resources;
- for consumers to be satisfied that utmost care is being taken to provide the highest possible quality product;
- for governments/authorities; to safeguard development of the industry and the environment as a whole; to help support decision-making and strategic environmental management.

Ideally, monitoring should be a partnership activity for both government and the private sector, with shared benefits arising.

Institutions and responsibilities

- The supervision (control/coordination/surveillance) of environmental monitoring should be the responsibility of one authority.
- The costs of environmental monitoring may be shared between individual farmers; between producers and government; among producers (organizations); between producers and other local users;
- Larger producers can play a major role in monitoring;
- Information management requires more attention.

Feedback

Mechanisms must be in place to ensure that monitoring data are analysed and the results used to adjust management at all levels (national to farm level) to ensure environmental objectives are met.

CAPACITY BUILDING

Capacity building was addressed by all three breakout groups, and the conclusions and recommendations have been rationalised and brought together in this section.

Capacity building is a key area to promote improved environmental management and is not just about professionals. Indeed all working groups emphasised the need to increase awareness, understanding and involvement of farmers – through better communication, dissemination, and extension. Equally, professionals need to better understand farmers and aquaculture. Better communication is required in both directions.

It is important also to come back to the issue of diversity. Capacity building needs will be tailored to the particular needs of different systems, environments, and people. Notwithstanding this, some general points can be made:

- Raise awareness of the nature of EIA, monitoring, and environmental management more generally.
- Improve governance to encourage participation of stakeholders.
- Devolve responsibility as far as is practical, ensuring consistency with higher level strategy.
- Support and strengthen farmer organisations (especially for small farmers – where possible in functional clusters), and give them incentives and responsibilities. Clear allocation of rights and responsibilities should in itself lead to increased capacity.
- Simple and practical manuals, guides, toolkits and training programmes on environmental management of aquaculture generally, EIA and monitoring should be developed and disseminated. These should draw on and strengthen existing knowledge and experience of aquaculture practitioners, many of whom have their own "informal" assessment and monitoring.
- Support (technical, financial, equipment, *etc.*) is needed to enhance capacity of local authorities in extension of good aquaculture practices, including regular on-farm, simple and practical environmental monitoring.
- Upgrade awareness, technical competencies and skills of producers, local authorities, extension workers, EIA advisors/consultants - on the selection and use of most important and simple environmental monitoring parameters and methods.
- Clarify and strengthen the role of those authorities supervising and deciding on environmental monitoring schemes and data, as conducted around individual aquaculture farms, farm clusters and aquaculture parks.
- Strengthen decision-making procedures, informed by sound science on the one hand, and efficient and balanced participation of stakeholders on the other.
- Ensure quality assurance of EIA and monitoring procedures.
- Promote better management, analysis, sharing and communication of important data and information relating to environmental management.

Some key messages

At the final workshop session Michael Phillips (chair) solicited participants to offer what they considered to be some key messages of this workshop. The responses have been grouped into similar or related messages or principles and rationalised where appropriate. There is no prioritisation.

Awareness

- Governments should take care of the image of aquaculture; recognize the positive aspects of aquaculture; recognise that it is not a major threat.
- Increase awareness of EIA and monitoring; get farmers more involved; increase responsibility of farmers; strengthen institutions.
- Change the way people think about EIA. EIA/monitoring should be seen as providing opportunities to improve sustainability.
- Recognize producer needs and their context.
- There is a need for practical guidelines and use of relevant tools for environmental assessment and monitoring in support of sustainable aquaculture.

Institutions, decision-making and capacity building

- Strengthen capacity of governance structures for aquaculture.
- Develop national aquaculture strategies to define an appropriate management framework for aquaculture appropriate to the particular conditions and nature of aquaculture in each country.
- Strengthen institutions and improve coordination between them.
- Clarify responsibility for EIA and monitoring.

The central role of monitoring

- Environmental *monitoring* is the most important requirement. This should apply to the entire management process and the wider environment. Governments need to engage actors and institutions at different levels to facilitate good monitoring, to ensure that the right management systems are working in the right place.
- Scientifically robust monitoring of environmental risks, with timely feedback to farm management - for both farmers and regulators.
- Monitoring should be made more effective, and procedures more integrated between departments/sectors /organisations.

Role and purpose of EIA

- There is a need to clarify the purpose and need for EIA
- EIA should be perceived as a tool for regulators to support the development of the aquaculture sector in the context of integrated area (coastal zone; watershed area) planning and management, and for the private sector to sustainably operate a commercial enterprise where public resources are used.
- EIA is largely ineffective and meaningless without a 'monitoring' programme.
- EIA can be used for management processes providing planning, monitoring and corrective measures.
- EIA is a useful tool for decision support and information generation.
- Focus on EIA as one tool - as a means of promoting sustainability. While EIA is a tool, monitoring is an essential process.
- EIA and monitoring should be informed by risk analysis.

Simplification, relevance, focus, efficiency

- Many EIA and monitoring procedures are too complex for less developed countries.
- Simplify the EIA process; focus on the real risks to make it more relevant; speed up decision-making processes; ensure procedures are in the hands of the most competent authority

Information

- Use EIA FTP sites as a valuable source of information for decision-makers working in institutions/governments, to help them better understand/prioritize activities/funds for EIA and monitoring.
- Promote a global framework for EIA aquaculture, with supporting guidelines.
- Institutional coordination in the delivery of EIA and monitoring is vital.
- Efforts should be made to formulate strategies to collect best quality information for resource poor countries.

Wider management issues

- Identify suitable zones for aquaculture and associated management needs

Dissemination of findings

The final workshop session also comprised a discussion of how to disseminate important findings and messages.

- There are important opportunities to develop web-based regional databases, and bring these together with resources such as "ECASA" (http://www.ecasa.org.uk/).
- There is a need for concise guidelines outlining key steps for environmental management of aquaculture. Materials should be specifically developed for non-technical people operating at the local levels (local government units);.
- The advantages and disadvantages of "cluster development" need to be more widely disseminated.
- There is a need for guidance and training on aquaculture information management systems (Thailand offers a current example of a project to address this).
- There should be an easily translated executive summary of all this work.
- A group of practical leaflets showing the different procedures and stages for EIA (*e.g.* "Scoping") would be useful to authorities, producers, and other interested parties.
- Regional Fishery and Aquaculture Bodies, where these exist may be a very good route through which to provide information and advice.
- Do we need EIA guidelines? Opportunities exist for developing guidelines, to clarify some issues, facts, terms and procedures for aquaculture purposes, although generalized guidelines on EIA do exist. However, the issue is not EIA only, there may be need for institutional reform and recognition of stakeholders. Capacity building is important.
- Legal recognition of the specific characteristics and needs of the sector would drive and focus demand for better advice.
- A key message to get across in any documentation is that EIA should not be a piece of paper allowing development, but rather one tool within an effective environmental management system

Closing

The workshop was completed with a discussion about finalisation of project outputs. Key points raised were:

- The need to ensure accuracy and consistency of bibliography;
- The need to finalise the global synthesis report and discussion guide;
- The incorporation of the Bolinao Bay Case Study into the technical report;
- The need for a *caveat* that details of legislation in the review reports may be out of date in some cases;
- The need to make cross reference to the parallel work on the "ecosystem approach to aquaculture".

Deadlines for the submission and finalisation of various products were then discussed and agreed. Thanks to all parties were expressed for the exceptional hard work that had gone into preparation of the review and synthesis documents and the running of the workshop.

ANNEX 1

PROSPECTUS AND WORKSHOP AGENDA

FAO Technical Workshop on Environmental Impact Assessment and Monitoring in Aquaculture 15-17 September 2008, Rome, FAO Headquarters

PROSPECTUS

Background and Scope[1]

"Environmental Impact Assessment and Monitoring in Aquaculture" is one component of the FAO project "Towards sustainable aquaculture: Selected issues and guidelines", (GCP/INT/936/JPN), which is being implemented by FIMA, FAO's Aquaculture Management Service, with the generous support of the Government of Japan.

The Project Component on Environmental Impact Assessment and Monitoring in Aquaculture aims to address key issues of environmental assessment and monitoring in aquaculture with view to generate strategic advice and technical guidance information for use in policy-making, capacity-building and training in the sector. Special attention is given to different aquaculture farming systems, different environments and different socio-economic contexts of development, with particular consideration of special circumstances and requirements of developing countries. The immediate objective of this Project Component is: ***To develop of a global overview, including comparison and synthesis, of existing procedures and methodologies of environmental impact assessment and monitoring in aquaculture.***

This Project Component covers two main activities:

- Compilation, review and synthesis (based on desk studies) of existing EIA and monitoring procedures and practices in aquaculture
- Identification - through scoping/ranking case studies and a technical seminar - of environmental assessment approaches and methodologies most suitable to different production systems, commodities and environments.

This Project Component facilitated the preparation of five studies. Four **Regional Case Studies** were prepared to cover the compilation and review of existing EIA and environmental monitoring procedures and practices in aquaculture in selected countries of the following four Composite Regions.

Africa:	Egypt, Nigeria, Mozambique, South Africa, Uganda, (others: Madagascar, United Republic of Tanzania, Zambia);
Asia-Pacific:	Australia, China, India, Indonesia, Japan, Malaysia, Philippines, Thailand, Viet Nam (others: Bangladesh, Sri Lanka, Republic of Korea)
Europe/NorthAmerica:	Czech Republic, France, Greece, Hungary, Italy, Netherlands, Poland, Spain, Turkey, UK, and Canada/United States of America
Latin America:	Brazil, Colombia, Cuba, Ecuador, Honduras, Mexico

A **Fifth Special Case Study** focused on EIA in cage aquaculture of salmon in Canada, Chile, New Zealand, Norway and UK. A global review and synthesis report is being prepared based on these four regional case studies and the special salmon cage aquaculture study.

[1] This prospectus is distributed together with the TORs for the 5 case studies for background / reference on the scope of this workshop.

The workshop will provide the opportunity to present and discuss the five case studies and the global review synthesis report, and, based on experiences and findings by case study authors, reviewers, and invited experts, to develop an experts view on the present use of EIA and monitoring in aquaculture.

Documentation

All four regional studies, the special study on salmon aquaculture and the global review synthesis will be presented at the workshop. In addition, a Discussion Guide (Aquaculture and EIA Key Issues, Challenges and Opportunities) is being prepared in advance of the workshop in support of workshop discussions and outputs.

Expected outputs

It is expected that the workshop will provide the materials for the report of the workshop, including guidelines, project synthesis and discussion papers and other contributions, in addition to the global review and synthesis and the five case studies, which will all be published in one FAO Fisheries and Aquaculture Technical Paper.

Venue and date

The workshop will be held from 15 to 17 September 2008 in Rome at FAO Headquarters.

Participants

The workshop will be attended by the five authors of the regional case studies and the special case study on salmon aquaculture, the author of the global review and synthesis, additional invited experts and FAO staff. FAO staff (aquaculture service; legal office) will provide technical secretariat and support for the workshop.

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WORKSHOP AGENDA

Monday 15 September 2008

Introduction

Jiansan Jia	Welcome remarks
All participants	Short introductions of background and interests
Uwe Barg	Introduction – scope – origins – expectations – outputs of the workshop
	Introduction to case studies TORs & methodology
	Reporting / writing / organizational arrangements

Presentation and discussion of Case Studies and Global Review Synthesis of EIA and monitoring in aquaculture

Chris Nugent	Africa Regional Case Study EIA in aquaculture
	Discussion
lunch break	
Michael Phillips	Asia-Pacific Regional Case Study EIA in aquaculture
	Discussion
coffee / tea break	
Alejandro Flores Nava	Latin America Regional Case Study EIA in aquaculture
	Discussion
Richard Corner	Europe – North America Regional Case Study EIA in aquaculture
	Discussion

Tuesday 16 September 2008

Presentation and discussion of Case Studies and Global Review Synthesis - *Continued*

Kenny Black	Special Case Study EIA in Salmon Aquaculture
	Discussion
Patrick White	Development of programmatic EIAs and monitoring programs for clusters of small-scale cage farmers - The Philippines, a case study
	Discussion
coffee / tea break	
Doris Soto, Jose Aguilar Manjarrez, Elena Irde	CCRF Progress Reporting Surveys, Responses and Analysis Results specific to EIA and monitoring and EIAs in NASOs and NALOs
John Hambrey	Global Review & Synthesis of Case Studies on EIA and monitoring in aquaculture
	Discussion
lunch	

Priority issues for discussion and special working groups: *identifying key findings and recommendations*

John Hambrey	Discussion Guide : Aquaculture and EIA - Key Issues, Challenges and Opportunities
Plenary	Discussion and identification of key issues
Working groups	Working group 1: Management framework;
	Working group 2: EIA procedure and practice
	Working group 3: Monitoring
John Hambrey	Assimilation and organisation of working group recommendations

Wednesday 17 September 2008

Presentation, discussion and refinement of key findings, recommendations and guiding principles

Plenary	Presentation of key issues for discussion (John Hambrey)
	Discussion and finalisation
lunch	
Plenary	Some priority messages
	Dissemination needs and opportunities
	Closing

ANNEX 2

FAO Technical Workshop on Environmental Impact Assessment and Monitoring in Aquaculture 15–17 September 2008, Rome, FAO headquarters

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ANNEX 3

FAO Technical Workshop on
Environmental Impact Assessment and Monitoring in Aquaculture
15-17 September 2008, Rome, FAO Headquarters

WELCOME REMARKS

Welcome Remarks
by
Mr Jiansan Jia
Chief
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FAO Fisheries and Aquaculture Department

Dear colleagues,

It is with great pleasure that I welcome you all to FAO and, in particular to the FAO Fisheries and Aquaculture Department. We hope you had a nice journey to Rome. It is in fact a significant opportunity to express our appreciation for all the work and efforts carried out by all of you in the preparations for this workshop.

The FAO Fisheries and Aquaculture Department, in particular, my unit, the Aquaculture Management and Conservation Service (FIMA) as well as colleagues from other FAO units, have been working on the Project **Towards sustainable aquaculture: Selected issues and guidelines.** FAO's normative tasks include the development and effective dissemination of technical, policy and strategic advice on aquaculture governance issues, at international, regional, local as well as sectoral and farm levels. This Project, generously funded by the Government of Japan, enabled us to undertake a number of initiatives in support of the promotion of sustainable aquaculture development worldwide. One of the components of this Project, the so-called Component 2, focused on Environmental Impact Assessment and Monitoring in Aquaculture.

Dear colleagues,

We all know that aquaculture is a continuously growing and important food production sector. Aquaculture provides income, employment and can significantly contribute to fish supply and food security in general. However, some aquaculture practices have also caused negative effects, including social and environmental impacts. Concerns and criticism had been voiced against some aquaculture developments. A key issue in this context is to provide adequate information about the environmental impacts of aquaculture operations.

At the same time, better management and planning of aquaculture developments are also needed. It is generally agreed that environmental assessment and planning of aquaculture will help ensure that aquaculture operations are better managed. Information about better environmental management of aquaculture operations will reach and convince the general public about the benefits, costs and other facts of aquaculture developments.

Considerable importance is given to environmental impact assessment and monitoring in aquaculture. The present Component 2 was designed to explore and review the present practices and experiences of development, implementation and, in particular, the effectiveness, of such EIA and monitoring procedures in aquaculture.

Component 2 facilitated the conduct of four regional studies (Africa, Asia, Europe/ North America and Latin America) and one specific study on salmon aquaculture as regards EIA and monitoring practices in selected countries. A global review and synthesis has been prepared and this workshop organized.

Dear colleagues,
We expect that the global aquaculture community will learn and in fact benefit from your reviews and studies, as well as from the findings, conclusions and recommendations of this workshop. It is important that our messages are clear and balanced, and above all that they contribute to the sustainable development of aquaculture. However, reality checks are important, and the challenges, constraints and problems of EIA and monitoring in aquaculture also need to be highlighted. We are expected to provide advice on such challenges, and to provide recommendations and guidelines for improvements.

We would like to thank you again for your efforts sofar. We would also like to encourage you to participate actively in the discussions, and to contribute to the success of this workshop. I wish you stimulating discussions during the workshop as well as an enjoyable stay in Rome.

Thank you.

ANNEX 4

FAO Technical Workshop on
Environmental Impact Assessment and Monitoring in Aquaculture
15-17 September 2008, Rome, FAO Headquarters

DISCUSSION GUIDE - AQUACULTURE AND EIA: KEY ISSUES, CHALLENGES AND OPPORTUNITIES

By John Hambrey

CONTENTS

INTRODUCTION

EIA is now widely promoted as an important tool to secure improved environmental management of aquaculture development. A key requirement for its effective application is to couple it with appropriate monitoring procedures. In reviewing their application and effectiveness it is also essential to consider the wider management and regulatory framework.

The FAO Technical Workshop on Environmental Impact Assessment and Monitoring in Aquaculture will be held in Rome from 15 to 17 September 2008. Four regional reviews of EIA and monitoring in aquaculture (Africa, Asia-Pacific, Europe and North America, Latin America), a special study on EIA and monitoring in salmon aquaculture (herebelow referred to as the ***Reviews***), and also a global review and synthesis have been prepared and will be presented and discussed during this workshop.

This document aims to:

Provide a stimulus and framework for workshop discussions, and the formulation of key findings, conclusions and recommendations.

This Discussion Guide draws on the regional reviews, and the review of EIA and monitoring for salmon aquaculture (the "***Reviews***"), as well as on the global review and synthesis report to identify some key issues that the workshop could usefully address.

Many specific questions are raised. Some of these, and/or some groups or combinations of these questions, will be used as a starting point for workshop discussions. Many are addressed in more detail in the global review and synthesis report.

It would be useful if you can mark up those particular issues and questions which you consider most important, and add others where you think there is a gap. This will help

us to hone and focus workshop discussions. It would also be useful if you could read the global review and synthesis document, where many of these issues are discussed in more detail, drawing on specific examples from the regional reviews and special salmon study (the ***"Reviews"***). More specifically, please review the compilation of conclusions and recommendations drawn from the review reports which are summarised in the final section of the global review and synthesis report. Please examine these, consider which are the most important, and how they might be developed into more detailed recommendations, taking account of the wider issues addressed above.

For definition/use of key terms, readers are invited to consult Appendix IV of this publication.

THE DEVELOPMENT CONTEXT: CONSISTENCY AND DIVERSITY

The ***Reviews*** cover a huge range of social, economic, political and geographic situations. Perhaps remarkably, where EIA is applied to aquaculture, it tends to be applied broadly following standard international guidelines. In other words - despite the diversity of contexts, there is substantial consistency of approach.

This has both strengths and weaknesses. There is a general desire to seek standardisation within and between countries, especially with respect to environmental legislation. This is driven in particular by the desire for a level playing field, especially for those involved in international trade. On the other hand it is clear that if EIA is to be effective as a key tool in aquaculture sector planning and management, it must be appropriate to local needs, and complementary to other planning and management tools promoting the sustainable development of aquaculture.

The ***Reviews*** also reveal that in practice EIA is not applied to the majority of aquaculture production worldwide. There are different reasons for this. In Japan and the United States of America the management and regulatory framework is already highly developed, and there may be little added value to be gained from applying standardised EIA procedures. In many countries the nature of fish farming - and in particular the very large numbers of small-scale producers, often developing traditionally owned agricultural land - means that EIA for every farm is neither desirable nor feasible. In some countries aquaculture is seen as very much "in tune" with nature, and therefore not requiring EIA.

This raises several related questions:

1. *Can we develop more flexible international or regional guidance for EIA which takes account of the diversity of context?*
2. *Should EIA be promoted as a stand-alone planning and management tool for aquaculture, as it has been in many countries; or does EIA serve as an unnecessary impediment to the sustainable development of aquaculture – and especially small-scale aquaculture?*
3. *Should we be promoting the development of national and local "environmental management systems", with EIA subsumed as one of a suite of tools?*
4. *Should the use of EIA be actively* ***discouraged*** *in favour of more strategic management coupled with codes of practice and specific regulatory tools?*

The answers to these and many of the questions raised below will depend upon context, and this should be considered as a cross cutting theme in all discussions.

THE PLANNING AND MANAGEMENT FRAMEWORK

The ***Reviews*** reveal tremendous diversity in terms of the wider regulatory and management framework. In many cases this framework has evolved piecemeal, and is often rather complex and bureaucratic. In other cases the framework has been developed specifically for the aquaculture sector – which is usually not much less complex, but may be more "fit for purpose".

Strategic environmental assessment (SEA) has long been recommended as a tool to allow us to address cumulative environmental impacts – a key issue for aquaculture development – and should also inform the development of sector plans and environmental management mechanisms more generally. The ***Reviews*** offer very little practical experience of its application or effectiveness.

5. *Is there more practical experience of SEA that we can draw on?*
6. *Is SEA a precondition for more effective, streamlined and predictable EIA?*
7. *At what geographic scale should SEA be undertaken?*

Standards (norms) and assessment criteria are widely regarded as essential preconditions for effective EIA. These are well developed in some countries and poorly developed in others. Usually they are developed at national level by technical specialists, though there are exceptions where there is a strong decentralised natural resource planning system. Standards may be developed:

- Nationally for classes of land or waterbody;
- Nationally for aquaculture effluents/discharges;
- Nationally for aquaculture "zones";
- Locally for aquaculture effluents/discharges;
- Locally for specified zones/waterbodies/land areas.

In some cases local standards are developed which must be equivalent to, or more precautionary/demanding, than those established at national level.

In order to support better environmental management of aquaculture, and where relevant streamline and improve the quality of EIA:

8. *At what geographic scale or scales should standards be developed?*
9. *Should standards be related to aquaculture, or to waterbodies/land/water use zones, or to both?*
10. *Who should develop these standards and how?*
11. *How does this relate to SEA and EIA?*

AQUACULTURE DEVELOPMENT PLANS AND INTEGRATED COASTAL/ WATERSHED MANAGEMENT

Countries vary greatly in the extent to which they "plan" aquaculture development, and the nature of such plans. Plans may be developed based on some form of SEA, as means to deliver national targets, or based on local discussions and needs. They may be highly *prescriptive* with clear zones and associated regulations, or simply offer higher level objectives and broad guidance on issues of growth, finance, location, management, *etc.* They may or may not have significance for the nature of, and outcome of, EIA. Plans may relate to the aquaculture sector, or to a range of activities within coastal zones or watersheds (see: integrated coastal zone management or intergrated watershed management).

12. *How useful is aquaculture development planning?*
13. *At what geographic scale is it most usefully undertaken?*
14. *Should it be informed by SEA?*
15. *Should it provide the framework and context for EIA?*
16. *If well done, does it remove the need for EIA?*
17. *Should aquaculture planning be subsumed under integrated coastal/watershed management or developed as a reasonably coherent sector plan?*

ENVIRONMENTAL CAPACITY

The need to understand and where possible estimate environmental capacity and carrying capacity in order to manage cumulative impact is widely accepted, and there are examples of its application from Asia, Latin America, North America, and Europe. These relate mainly to larger waterbodies such as reservoirs, lakes, and lochs, sea

inlets or enclosed bays but can also be applied to more complex systems. Assessment techniques range from relatively simple, rough, and low cost approaches (such as mass balance) to highly complex modelling of dispersion and assimilation processes. Once carrying capacity has been estimated, the tough question remains as to how to ensure that the levels of aquaculture do not exceed it, and how to allocate available capacity in an equitable way.

18. *Is an understanding of carrying capacity a pre-condition for effective EIA or SEA?*
19. *What are the most cost effective approaches to estimating environmental capacity? Do they vary according to physical/geographic and economic conditions?*
20. *What is the most appropriate geographic scale for the estimation of environmental capacity?*
21. *How can we make more effective use of estimates of environmental capacity in terms of limiting aquaculture and other activity within carrying capacity?*
22. *Is there a need and opportunity to produce/disseminate better guidance on estimating environmental capacity?*

USE RIGHTS

The issue of a permit or license to farm fish is now very widespread and regarded as a pre-requisite for better environmental management. In some cases a license is contingent upon production of a satisfactory Environmental Impact Statement (EIS) or Environmental Management Plan (EMP) - and other more specific conditions. In some countries several different permits or licenses are required (*e.g.* in relation to water use; waste discharge; chemical use; use of introduced species; conversion of land/habitat, *etc.*).

The duration of permits or use rights varies greatly – from one year (trial license) to infinity. A longer license period has the advantage of encouraging investment; a shorter period allows for the application of an evolving management regime, and for more adaptive management.

23. *How can permitting and licensing procedures be streamlined and simplified? Is one license better than many?*
24. *Should EIA be the catch-all assessment in relation to the many permits or the many dimensions of one permit?*
25. *Can guidance be offered on the duration of use rights/permits? What are the key issues to consider?*
26. *Can licenses/permits/quotas be usefully issued in relation to a certain proportion of environmental capacity?*
27. *Should most or all licenses/quotas be made tradable?*

ENVIRONMENTAL MANAGEMENT SYSTEMS

The key issue which emerges in the global review is the lack of clear "management system" in many countries. By environmental management system we mean here a process or regime (at anything from farm level to national level) encompassing at minimum the following:

- basic understanding of resources available and their relative value;
- clear and broadly agreed environmental objectives and associated indicators, targets or thresholds;
- a strategy and associated mechanisms through which the objectives will be achieved;
- a monitoring and review system which provides the information required to appraise success in terms of meeting objectives;
- a response/adaptation mechanism which adapts or changes the strategy and mechanisms in the light of monitoring and review.

Such a system would also integrate all the various tools and mechanisms for environmental management of aquaculture to ensure that they are effective and complementary rather than duplicating/overlapping.

28. *Should we/how can we shift the emphasis from EIA to environmental management systems (farm level; regional level; national level)?*
29. *How can we control the tendency to constantly add to regulation.*

SCOPE, PURPOSE AND EXECUTION OF EIA

The need for, scope, purpose and execution of EIA depends upon the nature of the industry, its state of development, and the nature of the broader environmental management framework. The ***Reviews*** suggest that this diversity of context is not fully reflected in the specific requirements and guidance for EIA. In order to improve the application of EIA it is important that the objectives for EIA are clearly spelt out in any guidance, taking full account of the national and local context and existing environmental controls.

More specifically – and this is reflected in several of the ***Reviews*** - there is a need to ensure that EIA focuses on those issues which it is most usefully able to address. Some form of risk analysis is often proposed, as part of the screening and scoping stages of a given EIA process. Risk analysis might also be applied at regional or national level in order to inform EIA guidance materials.

30. *What part should risk analysis play in refining the focus of EIA and/or in the environmental management framework more generally? Should it be applied as part of a national strategy to define the key issues to be addressed? Or as part of the EIA process itself? Or both?*

It is not unusual for EIA to address issues which are already dealt with through specific regulatory mechanisms (such as pollution/discharge controls) or industry codes of practice. It is important that where these are considered under EIA, duplication is avoided and any analysis is complementary.

31. *Can guidance on screening and scoping be improved to take account of the need for risk analysis and minimal duplication?*

Equally there are many issues which are very important, but which cannot easily be addressed through site specific EIA. These include issues related to species introductions, disease, environmental capacity, and some dimensions of social and economic impact.

32. *Should some key environmental issues be specifically excluded from EIA because they require regional or national strategies or specific regulation?*

Screening typically uses standard thresholds in terms of size, type, intensity or species to determine whether EIA is required. These vary significantly between countries.

33. *Are standard thresholds (e.g. scale, production) appropriate as a means of targeting EIA?*
34. *Should EIA be applied to proposals for expansion as well as establishment? How can this be done without undermining the attractiveness and growth potential of a proposed enterprise?*
35. *Shellfish farming and extensive or semi-intensive production techniques are commonly excluded from EIA requirements. Is this appropriate?*

In several countries (including Japan, Thailand, some parts of the United States of America) EIA is not required for fish farming, and other mechanisms are used to manage the environmental effects of aquaculture, including planning, regulation, codes of conduct, infrastructure, monitoring and response mechanisms.

36. *Is EIA appropriate as a tool for the environmental management of aquaculture? What are the advantages and disadvantages of EIA compared with alternative approaches and management frameworks.*

37. *Can we define more clearly the circumstances in which EIA is likely to be:*
    - *an essential tool;*
    - *a supporting tool, complementary to other approaches;*
    - *a costly and bureaucratic diversion.*

The quality of EIAs is questioned in several of the ***Reviews***. In some countries this is addressed through EIA practitioner approval or accreditation schemes. However, aquaculture EIA may be undertaken by EIA generalists with little understanding of aquaculture systems, and this is more difficult to address.

38. *How can the capacity of EIA practitioners be raised and the quality of EIAs improved specifically in relation to aquaculture?*

Predictive models are used increasingly to assess possible impacts of farms or groups of farms.

39. *How useful are predictive models, compared with monitoring and response procedures?*

DECISION-MAKING PROCEDURES

The development of a fish farm has potential environmental, social, and economic impacts. Deciding what is or is not acceptable has both technical/scientific and social/cultural dimensions. Some aspects of assessment and decision making can be relatively objective (e.g. use of toxic chemicals); others much more subjective (e.g. landscape impacts). Some may be objective but uncertain (e.g. impacts of escapes on wild fisheries or native flora and fauna).

Most countries address these issues through various forms of consultation. A panel or committee may be convened to make or review critical decisions. In many countries there is also a requirement for accessibility of documents and transparency of decision making procedures.

Unfortunately the subjective nature of much decision making (and especially the social/cultural dimensions) introduces uncertainty into the EIA/licensing process, and this can make investment in aquaculture less attractive. This may be compounded in countries where public consultation is given significant weight, and where some sectors of society (local, national or both) are opposed to aquaculture development. The site specific nature of EIA may serve as a focus for polarized viewpoints, for the attention of campaigns or particular national and international lobby groups.

40. *How can decision making procedures be improved to decrease uncertainty and avoid conflict?*
41. *How should economic benefits be balanced against possible environmental impacts, and how can the various trade-offs be clarified? What is the role of risk analysis? Should economic impact be given more attention in EIA?*
42. *How can the interests of diverse members of society, both locally and nationally, be more effectively accounted and balanced? Are there opportunities for "polling" approaches?*
43. *What should be the balance between national guidance, coupled with clear decision criteria, and informed professional judgement?*
44. *How do adversarial approaches ("constructive" tension between institutions representing different interests) compare with more "integrated" approaches?*
45. *Who/what kind of institution should make the final decisions?*
46. *How far can we take the idea of "transparency"?*
47. *How do decisions on particular (licence) conditions relate to decisions on a proposal as a whole?*
48. *Is higher level strategic planning an effective way to minimize conflict and uncertainty, and improve the quality of decision-making in relation to specific sites?*
49. *How can decision-making capacity be improved at all levels?*

IMPLEMENTATION, MONITORING AND FEEDBACK/ADAPTIVE MECHANISMS

The ***Reviews*** reveal that despite "best practice" recommendations, EIA tends to be a one-off permitting event. There is rarely significant follow-through in terms of ensuring that specific conditions, or more comprehensive environmental management plans arising from the EIA, are implemented or monitored. Indeed where monitoring of fish farms does take place this is often part of a wider government scheme related to specific regulations, or to government monitoring of the sector, or the wider environment more generally. Furthermore, although much monitoring information may be recorded, it is rarely analysed and fed back effectively into the planning and management regime.

Responsibility for monitoring varies significantly. This may be assigned to:

- producers themselves;
- independent auditors;
- government institutions.

Responsibilities and response procedures (*i.e.* action to take should problems arise, or initial conditions be violated) are often unclear.

Monitoring can be very costly, and the ***Reviews*** reveal several examples where ambitious monitoring schemes have run into difficulties in terms of cost, capacity and manpower.

50. *What are the most effective mechanisms for ensuring compliance with farm permits and associated conditions, and any associated monitoring requirements?*
51. *What should be the scope of farm level monitoring, and should this be defined through EIA, or through sector level regulatory regimes?*
52. *What is the role of EIA, if any, in defining or contributing to wider environmental monitoring requirements?*
53. *At what geographic scale(s) and at what level of detail is environmental monitoring most effectively undertaken?*
54. *How can monitoring be more effectively focussed on key parameters, and streamlined to reduce cost and increase effectiveness? Can risk assessment be usefully applied to improve focus? Is there a role for public participation in selection of parameters?*
55. *Can the numbers of indicators/parameters be reduced from a purely technical perspective (e.g. do we use too many highly correlated parameters/indicators?)*
56. *There are differences between countries in terms of key parameters used in environmental monitoring associated with aquaculture. What is to be learned from experience so far?*
57. *How does video transect monitoring compare with more traditional grab techniques in terms of cost and utility?*
58. *Are some monitoring parameters more effective than others in terms of eliciting farmer interest and response?*
59. *To what extent can calculation and prediction be substituted for actual monitoring more widely (e.g. relationship between biomass or feed input and nutrient output)?*
60. *Do we need to clarify the distinction between monitoring for management and monitoring for research?*
61. *Who should be responsible for different types/levels of monitoring? Who should be responsible for quality assurance?*
62. *How can feedback of monitoring information into farm level and sector level management be made more effective? How does this/should this relate to setting of environmental quality standards for farms/bays/ecosystems/use zones/national land/water classifications.*

COMPLEMENTARY PROCESSES AND REINFORCEMENT MECHANISMS

Codes of conduct, codes of practice and best management practices have been widely promoted and are increasingly adopted. They are promoted by both farmers and government. They are seen as a way to:

- promote farmer responsibility;
- reduce the needs for regulation;
- pass the costs of regulation directly to the farmer;
- access market opportunities.

In some countries (*e.g.* Norway, United States of America) codes of practice are embedded within the regulatory regime as part of the permitting process. In some countries the code is seen as the guiding management framework, with recommendations and protocols for environmental management at all levels from national strategy, through regional and local plans to site management.

63. *To what extent do codes and best management practice (BMP) initiatives - reinforced where appropriate through targeted regulation - reduce or remove the need for EIA and associated farm specific environmental management plans?*
64. *What are the strengths and weaknesses of compulsory versus voluntary codes?*
65. *How can the need for* ***sector*** *level management be reflected in codes of conduct directed primarily at* ***individual*** *farms?*
66. *Can BMPs be developed and used more effectively in education/extension?*
67. *Is there a role for EIA in complementing sector level codes with site level refinements? How could such a role be formalised?*

OVERALL

The ***Reviews*** reveal rather disappointing application and effectiveness of EIA as a significant tool for the environmental management of aquaculture.

68. *How do we reduce bureaucracy and increase cost effectiveness? What are the priorities?*
69. *How can effective environmental management systems – rather than individual management tools – be promoted more widely?*
70. *Can we summarize the strengths and weakness of different approaches to the use of EIA? Are there some groups or "classes" of approach which we can analyse and compare?*
71. *Can we offer generic guidance on how EIA should be integrated with other mechanisms for environmental management to maximise its effectiveness?*