International mechanisms for the control and responsible use of alien species in aquatic ecosystems

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Preparation of this document

This document contains the report of and papers presented at the Ad hoc Expert Consultation, International Mechanisms for the Control and Responsible Use of Alien Species in Aquatic Ecosystems, held 27-30 August 2003, in Xishuangbanna, People's Republic of China. The Consultation was sponsored by the Asian Institute of Technology (AIT), Food and Agriculture Organization of the United Nations (FAO), Mekong River Commission (MRC), Network of Aquaculture Centres in Asia and the Pacific (NACA), University of California Sea Grant College Program (UCSG), World Conservation Union (IUCN), Ministry of Agriculture of the Peoples Republic of China, the FAO Fish Code Programme and the FAO/Netherlands Partnership Programme (FNPP); it was hosted by the Yunnan Provincial Bureau of Agriculture and the Xishuangbanna Fisheries Administration and Regulation Station. The contents were compiled and edited by Devin M. Bartley (FAO), Ram C. Bhujel (AIT), Simon Funge-Smith (FAO), Paul Olin (UC SeaGrant), and Michael Phillips (NACA); Devin M. Bartley was overall editor with layout and design by Daniela Scicchigno.

Abstract

The use of alien species is a proven means to increase production and value from aquatic ecosystems. In the Mekong/Lanchang Basin, alien species such as tilapia (*Oreochromis* spp.) play an important role in providing cheap and readily available protein to rural and poor sectors. However, alien species are now recognized as one of the most significant threats to aquatic biodiversity. Members of FAO and signatories to the Convention on Biological Diversity have obligated themselves to manage and control alien species that may adversely impact ecosystems. There are a range of international mechanisms that have been established to assist countries in meeting international obligations and responsibilities. The coverage of these international instruments, the signatory countries and the degree to which they are implemented varies throughout the world. Implementation is often difficult due to lack of awareness at national level of responsibilities under the respective instruments, problems with enforcement, and lack of basic information and capacity to undertake risk assessment. Several steps are necessary for effective use and control of alien species, but one of the most important was identified to be following codes of practice similar to that developed by the International Council for the Exploration of the Sea. The development and use of indigenous species are options to the use of alien species. However, indigenous species have not received the same amount of attention, research, development and use as many alien species. Regional coordination of policies and practices on alien species is needed for effective national management. National policies need to be in place and the population needs to be aware of issues before countries can implement international mechanisms. Thus, regional coordination and national policy development are necessary actions that should go hand in hand in order to facilitate implementation of broader international agreements.

Bartley, D.M., R.C. Bhujel, S. Funge-Smith, P.G. Olin, M. J. Phillips (eds and comps), 2005.
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Report of the meeting

"The use of alien species is a proven means to increase production and value from aquatic ecosystems"

The use of alien species is a proven means to increase production and value from aquatic ecosystems. However, alien species are now recognized as one of the most significant threats to aquatic biodiversity. As such, Members of FAO and signatories to the Convention on Biological Diversity (CBD) have obligated themselves to manage and control alien species that may adversely impact ecosystems. Furthermore, the movement of aquatic species has importance to international free trade, but as well as providing benefits, may concurrently incur significant risk. Members of the World Trade Organization (WTO) have duties and responsibilities to promote free-trade whilst at the same time, taking measures for protecting human and animal health.

There are a range of mechanisms that include conventions, codes of practice, agreements and guidelines that have been established to assist countries in meeting international obligations and responsibilities. Important mechanisms that relate to the introduction or movement of aquatic species are:

Code of Conduct for Responsible Fisheries (FAO), created in 1995, sets out principles and international standards of behaviour for responsible practices with a view to ensuring the effective conservation, management and development of living aquatic resources, with due respect for the ecosystem and biodiversity.

Code of Practice on the Introductions and Transfers of Marine Organisms (ICES), created in 1973 and updated in 2003, gives recommended procedures and practices to reduce the risks of detrimental effects from the intentional introduction and transfer of marine (including brackish water) organisms. Endorsed by FAO Regional Fishery Bodies.

Beijing Consensus and Implementation Strategy, created in 2000, a detailed implementation strategy for the Asia Regional Technical Guidelines on health management for responsible trans-boundary movement of live aquatic animals.

Cartagena Protocol on Bio-safety, adopted in 2000 under the Convention on Biological Diversity and in force from September 2003, seeks to protect biological diversity from the potential risks posed by living modified organisms resulting from modern biotechnology.

Convention on Biological Diversity, adopted in 1992 and in force from 1993, its objectives are the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

Convention on Wetlands, adopted in 1971 and in force from 1975, also known as the Ramsar Convention, provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.

World Trade Organization (WTO), established in 1995 is the only global international organization dealing with the rules of trade between nations.

World Organisation for Animal Health (OIE), established in 1924, in association with WTO helps, *inter alia*, guarantee the sanitary safety of world trade by developing sanitary rules for international trade in animals and animal products.

The coverage of these international instruments, the signatory countries and the degree to which they are implemented varies throughout the world. Part of the problem of implementation is related to lack of awareness at national level of responsibilities under the respective instruments. Additionally problems may also relate to conflicts between national aspirations and international obligations. The practical implementation of many of these instruments is also limited by institutional, financial and human capacity in many countries. The relationship between these various instruments and their relevance to the movement and introduction of aquatic species needs to be clarified and brought to the attention of those responsible for their implementation. Importantly, the development of practical and meaningful strategies for their implementation is urgently needed.

The workshop

To address the above concerns regarding international action on alien species in aquaculture and fisheries, an international workshop, *International Mechanisms for the Control and Responsible Use of Alien Species in Aquatic Ecosystems*, was convened from 27–30 August 2003, in Xishuangbanna, People's Republic of China. The workshop was sponsored by the Asian Institute of Technology (AIT), Food and Agriculture Organization of the United Nations (FAO), Mekong River Commission (MRC), Network of Aquaculture Centres in Asia and the Pacific (NACA), University of California Sea Grant College Program (UCSG), World Conservation Union (IUCN), Ministry of Agriculture (Fishers of the Peoples Republic of China and the FAO/Netherlands Partnership Programme (FNPP)). The workshop was hosted by the Yunnan Provincial Bureau of Agriculture and the Xishuangbanna Fisheries Administration and Regulation Station. The list of participants is included in Annex I.

Purpose and objectives

The purpose the workshop was to enable policy-makers and senior resource officers in the Greater Mekong/Lancang sub-region to use international mechanisms for the control, movement and responsible use of alien species in aquatic ecosystems. The objectives of the workshop were to review the international mechanisms, to identify major constraints to their implementation in the sub-region, and to identify future actions needed to promote the control, movement and responsible use of alien species in the greater Mekong/Lancang Sub-Region.

Process of the workshop

The programme of the workshop consisted of:

- presentation and discussion on relevant international mechanisms concerning alien species and trans-boundary movements, and their practical applicability in the Greater Mekong/Lancang sub-region;
- presentation and discussion of country status analyses and case studies and review on alien species in fisheries and aquaculture, in order to facilitate debate on development of practical strategies for the sub-region;
- development of recommendations for follow-up actions that can support countries of the the Greater Mekong/Lancang sub-region to work collaboratively, or individually, to promote responsible transboundary movement and use of alien species, in the sub-region;
- development of elements of an outline that will serve as a framework for the development of Technical Guidelines on the Control and Responsible Use of Alien Species in Fisheries and Aquaculture[1].

Output of the Workshop

The workshop affirmed the fact that alien species provide valuable food and economic opportunity to rural sectors of the Mekong/Lancang River Basin. However, there are also environmental and social risks associated with their uncontrolled introduction and use. Aquaculture and fisheries in this region are composed of a mixture of native and alien species – management must acknowledge this mixture and strive to balance benefits and risks. In order to provide useful information on this issue, the workshop

- evaluated existing mechanisms dealing with alien species and their application in the Mekong/Lancang River Basin,
- identified main drivers of the practice of moving species into new areas,
- identified constraints to effective control of alien species,
- identified practical control measures, and
- identified elements of technical guidelines for the responsible use and control of alien species in fisheries and aquaculture.

Evaluation of international mechanisms and their application in the Mekong/Lancang River Basin

A variety of international mechanisms exist to assist with the responsible use and control of alien species in fisheries and aquaculture. However, awareness of the instruments and of the obligations they entail is lacking in the region. Many general conventions such as the CBD and Ramsar Wetland Convention were thought to be less relevant to the fishery sector and harder to implement practically than those mechanisms dealing specifically with fishery issues. In general, the participants were more familiar with mechanisms that dealt with trade issues and these were seen to be extremely relevant. Once participants were familiarized

[1] In order to help implement the Code of Conduct for Responsible Fisheries, FAO et al. have produced a Technical Guideline Series including such topics as Aquaculture, Health management, Inland Fisheries, Coastal Area Management, etc. This will be another in the series

with the mechanisms dealing with alien species in the fishery and aquaculture sectors, there was general agreement that these mechanisms could be useful and should be more widely promoted.

The workshop felt that there are enough international agreements/mechanisms and that generally they were satisfactory; changing international mechanisms was thought not to be a feasible option. A summary table of the main international mechanisms, their relevance to the region, and general comments is presented in Table 1.

Major drivers of the practice of using alien species in aquaculture and fisheries

In order to control and use alien species responsibly, it is important to understand how these species are being used in the region and the reasons for their use. Alien species are primarily used in aquaculture to generate income for both the rural poor and more industrialized sectors of society. Additionally, low-cost alien species are an affordable commodity for the poorer sectors of the region that do not have access to native capture fisheries.

The workshop identified the following main drivers of the practice of moving species into new areas:

Commercial / economic drivers

- Regionally – a country/territory or business organizations benefit from starting culture of a species ahead of neighbours - early entry profits for aquaculture;
- the industrial/commercial demand for new aquaculture products to try new markets, diversify, or replace existing species that have problems e.g. white shrimp being used to replace black tiger shrimp;
- development of recreational fisheries (interest in game/sport species or bait species);
- development of ornamental fish trade, often profit oriented and moves rapidly to novel species.

Stock enhancement and genetic improvement

- Many alien species were introduced to stock into the natural water bodies to increase catches. They were also re-introduced and re-stocked assuming that it would help improve the local stock through crossbreeding.

Ready-made technologies

- Many alien species used in aquaculture have been the subject of genetic improvement, domestication, and health programmes and there has been substantial work on their farming and husbandry. Thus, culture technology is well developed for many species moved around the world for fishery/aquaculture development. There has not been a corresponding investment in research into indigenous species. Therefore their culture requirements are not well known and they are often difficult to farm. Breeding and domestication of indigenous species takes time and resources and the common perception is that alien species, already domesticated to an extent, will perform better.
- Promotion of new technologies Specific Pathogen Free and Specific Pathogen Resistant stocks) easily convince farmers and governments to import new species or strains;

Table 1. Review and evaluation of international mechanisms and their application in the Mekong/Lancang River Basin. *Descriptions of the mechanisms are found in the following section as noted.*

Mechanism (Reference in report)	Relevance to aquatic alien species in Region	Level of Awareness	Comments
Convention on Biological Diversity (Bartley & Fleischer)	Very relevant, but perceived bias towards environment ministries rather than fisheries or development ministries	Good among international organizations, but poor within the fishery sector	Convention is too general, does not provide guidance on issues and decision making, or on how to implement its articles
Cartegena Protocol (Bartley & Fleischer)	Limited relevance at present due to absence of LMO's in aquaculture	Poor awareness at present	Protocol only covers living modified organisms; may have more relevance if aquaculture begins using LMO's
Ramsar (Moore)	Has indirect relevance through protection of wetlands from alien species	Moderate awareness	Several countries have Ramsar sites, but there is an impression that the convention favours conservation over use
WTO/SPS (Moore)	Very relevant	Moderate awareness, but not on full meaning and content of articles	More relevant for trade going outside region, not used within the sub-region as much
OIE (Phillips and Subasinghe)	Very relevant	Good awareness as it relates to animal health issues	Relevant to control of pathogen spread associated with aquatic animal movements but, quarantine measures and disease reporting obligations are difficult to enforce within the sub-region
FAO Code of Conduct for Responsible Fisheries (Bartley *et al.*)	Very relevant	Good awareness of general principles, but poor awareness of specific articles on alien species	Practical application difficult and many articles are vague. Promotion of consultation with neighbours on alien species supported by group. Desire for regional adaptation of the Code
ICES/EIFAC Code (Bartley *et al.*)	Very relevant	Poor awareness at all levels	Countries have different capacities to implement. National laws/policies should be implemented before regional mechanisms can be effective. Should be adapted to Mekong/Lancang region
FAO/NACA/OIE/ Regional Disease Reporting System (Phillips and Subasinghe)	Very relevant	Low awareness	Provides a structure for sharing information on status of aquatic animal diseases and assis)t to design risk reduction measures
ASEAN/AFTA Sanitary/Phytosanitary Protocol (Phillips and Subasinghe)	Very relevant	Low awareness	
Beijing Consensus and implementation strategy (Phillips and Subasinghe)	Very relevant for health aspects	Moderate awareness	Provides a framework covering key issues. Countries need to develop practical approaches for implementing the strategy
ASEAN SEAFDEC Code of Conduct (Phillips and Subasinghe)	Relevant	Moderate awareness	Based on the CCRF, with general principles for implementation of the CCRF in the ASEAN region

- Farmers and governments do not want to invest the time in developing farming techniques for many indigenous species but want to bring the available technology to help the people as soon as possible.

Research, education and training

- Alien species serve as gateways for knowledge and skills, therefore, Government, academic and private sectors import alien species for applied and basic research to carry out on-station and on-farm, and for education and training purposes.

Food security and rural development

- Small-scale private and public organizations and large numbers of small-scale farmers use aliens as cheap food for the poor e.g. tilapia;
- Governments use and promote some alien species to meet their obligations to increase production and food availability to those lacking food security.

Cultural and religious drivers

- Religious festivals, e.g. 'fish releasing day' at temple areas are important aspects of the culture in the Mekong/Lancang Basin;
- Cultural aversion to killing ornamental fish – simply release those fish too big or unwanted.

Major constraints to the control and responsible use of alien species

The workshop identified the major constraints to the control and responsible use of alien species to be:

- general lack of clear, consistent and practical government policy;
- lack of awareness of international policies, agreements, and mechanisms that do exist;
- lack of adequate government capacity (human resources, financial and physical facilities & equipment) to regulate, enforce and monitor use of alien species;
- lengthy bureaucratic processes but ease of bypassing/influencing the government control mechanisms;
- lack of mechanisms to assign liabilities and levy fines on those causing damage or bypassing regulations;
- lack of knowledge, public awareness and perception of the risks to both environment and social/economic base;
- lack of advance planning regarding the use of alien species;
- lack of confidence in government information and expertise by private industry;
- lack of scientific evidences or research on the negative impacts of alien species in the region that could be the bases for policy formulation;
- lack of clear and easy-to-read guidelines or code of conduct specific for the region and individual countries/territories;
- lack of materials to create/ help public awareness such as brochures, internet sites and links, etc.

In addition to these policy and education constraints, there are physical and logistic constraints associated with patrolling long coastlines and international borders. Eradicating, confining and controlling alien species that have become established in the new environment is often expensive, difficult or impossible.

There are also political, social and economic constraints to enforcing existing regulations on alien species. Many rural farmers in the region use alien species for food and income generation; many rural households purchase alien species as an inexpensive alternative to more expensive wild fish or other meats. Although some of this use is illegal or unapproved, governments are reluctant to confiscate the fish without providing alternative sources of revenue or food to the rural households. Enforcement agencies often do not want to fine rural farmers with limited financial resources for infractions of alien species laws.

Information exists that relate to most of the above constraints in the form of international, regional and national legislation, guidelines and codes of practice, information sources, and databases. However, this information is often poorly organized, found in numerous locations and formats and is therefore difficult to access.

Practical control measures

There are differences between control measures at the regional and national levels. Control measures at regional level and above are not always easy to apply at national level. Therefore, a national approach should be developed within the framework of existing international/regional agreements.

Regional coordination on the use of alien species will be essential in order for national programmes to be effective. It would be counter-productive to try to manage alien species within a country, when neighbouring countries and countries sharing international or trans-boundary water systems do not also manage alien species. A regional advisory and review body could be created with representatives from all countries in the basin. Although this body would be financed by the participating countries, it need not be formal nor produce legally binding decisions, but would constitute a forum that countries could voluntarily consult. Such a regional approach is taken in Europe and North America by the countries belonging to the International Council for the Exploration of the Sea (ICES) and those Members of FAO's European Inland Fishery Advisory Committee. The ICES/EIFAC Codes offer an excellent model that could be adapted to the Mekong/Lancang River Basin.

At the National level, the following actions can lead to better control/management of alien species:

- join in, contribute to, or otherwise participate in a "Regional Review Board to advise on the use of alien species in fisheries and aquaculture, including development of a common regional policy;
- revise national policies to include a requirement that when an introduction would potentially affect one or more countries, the decision on introduction should also be referred to the regional independent review body;
- establish a "National review board" that should include representatives of all stakeholders in a watershed who would be affected by an introduction;
- develop a list of relevant criteria on which the regional and national review bodies would base decisions. Monitoring requirements should be incorporated into each proposal and if at all possible should be tied in with other ongoing activities nationally and in the region.

Enforcement of any existing policies and laws regarding alien species is difficult due to the ease at which the early life-history stages of many aquatic species can be transported, as well as the difficulty in patrolling long coastlines, numerous small islands and bays, and long borders of many countries. Thus, increased awareness and education on the risks and responsible use of alien species were judged to be a practical means of control.

Related to increased education, training programmes on alien species should be offered to fishery resource officers. Content of the training, education and awareness material is also discussed in the following section. However, a list of alien species of special concern (already introduced as well as potential to be introduced), how to identify them and the risk they pose could be drafted for the Mekong/Lancang region as a means to promote awareness.

Zonation or practice of designating specific geographic areas with defined uses of already introduced aquatic species alien species or where alien species on expressly prohibited could also be effective in the region based. One type of zoning that exists in the region are Ramsar sites, i.e. wetlands of special importance; countries are obligated to monitor and protect these areas or "zones". Zonation has been used in Europe to designate "disease free" areas where import of specific fishes with risk of specific disease-transfer is prohibited. Import consideration for zoning is the ability for animals to move among different zones, either by transboundary waterways, or through human assisted movement. Mapping and geographic information systems, well developed in some areas of the Mekong Basin would provide useful information on how to establish zones and the potential for inter-zone transfer, for example during flood periods.

Movement of alien aquatic organisms increases the probability of introducing new pathogens, which can have dire consequences on aquaculture, capture fisheries and related resources, as well as the livelihoods which depend on them. The adverse social, economic, and environmental impacts which have resulted from the irresponsible or ill-considered movement of alien species have led to global recognition of the need for health management protocols to protect aquaculture, fisheries resources and the aquatic environment. In many cases, these impacts have been a direct result of the absence of effective national and regional health management strategies. Formulation of effective quarantine measures developed as a result of risk analysis to reduce the disease risks associated with the transfer of disease agents with the trans-boundary movement of alien species includes pre-border, border and post-border health management processes. However, development of health certification and quarantine guidelines applicable on an international scale is complicated. but is important. A wide range of social, economic and environmental circumstances have to be considered, along with the range of aquatic animal species involved and their pathogens and diseases. In addition, differing reasons for moving live aquatic animals and products impose a further set of variables to the process.

Nevertheless, the serious impacts of unrestricted regional and international movement of aquatic animals merit international recognition — a fact clearly reflected in the *Aquatic Animal Health Code* and the *Manual of Diagnostic Tests for Aquatic Animals* of the Office International des Épizooties or World Organisation for Animal Health (OIE 2003a, 2003b), which provide guidelines and recommendations for reducing the risk of spreading specific pathogens considered relevant to international trade of aquatic animals. Regionally, the Asia-Pacific regional aquaculture health infrastructure support documents of FAO and the Network of Aquaculture Centres of Asia-Pacific (NACA), including a Technical Guidelines and Implementation Strategy (FAO/NACA, 2000), Manual of Procedures (FAO/NACA, 2001) and an Asia Diagnostic Guide (Bondad-Reantaso *et al*., 2001), also provide valuable guidance on reducing the risk of pathogen transfer through safe trans-

boundary movement of live aquatic animals, including alien species. All these documents take into full consideration the provisions of the World Trade Organization's Agreement on the Application of Sanitary and Phytosanitary Measures (WTO-SPS Agreement) (WTO 2002), as well as Article 9 – Aquaculture Development – of the Code of Conduct for Responsible Fisheries (CCRF) (FAO 1995).

In order to minimise or avoid the risk of pathogen transfer via alien aquatic animal species movements, concerted actions are essential, involving individuals and organisations which appreciate, and participate in, such activities taking into account the overall health management process.

Improved control of alien species may also come about through efforts of importing and exporting groups in the form of certification and provision of basic information. Importers of alien species have obligations to define the intended use of the species, for example with the use be for commercial aquaculture, recreational or ornamental use, where the species will be used and the benefits it will provide. The ICES/EIFAC codes include these obligations, plus including additional information on the species, such as harmful impacts. associated with it. Exporting groups could similarly provide basic information on the impacts of species, its disease status, e.g. disease free, specific pathogen free, specific pathogen resistance, and its reproductive status, e.g. sterile, triploid, hybrid, or fertile. This information will be useful in the risk assessment of a specific introduction.

Effective control includes wise decision making in order to prevent "bad" introductions being made in the first place. Thus pre-planning and risk assessment are vital elements that will promote good decision making. In this context, a flow diagram or decision tree could be prepared of of the national and regional review process that extracts specific information found in the ICES/EIFAC model, region-specific and country-specific adaptations of OIE list of pathogens, and other applicable models. One such example of a decision tree is the "opinionnaire" (Annex III).

Creation of a species list that designates the level of concern or potential harm from alien species in a certain area wasere identified as an effective control measure that could also help raise awareness on the issue of alien species. The workshop identified three broad levels of concern: 1) not much concern (not harmful), 2) some concerns (possibly harmful) and 3) serious concerns (probably harmful). Some lists already exist that may have some application for example in the USA, Australia and other countries, and the lists in the CITES Appendices – that could be used as examples of how to create area-specific lists of alien species that could be used to help raise awareness and guide decision making on other introductions. and elsewhere. CITES list regulates international trade and the monitoring of movement of endangered or threatened species. These specific examples of alien invasive species can illustrate general principles that will help raise awareness and guide decision making on other introductions.

Member countries of OIE are obliged to report to OIE on the occurrence of diseases listed in the *Aquatic Code*. OIE in-turn publish these reports annually thus allowing member countries to take measures to avoid incursions of those pathogens through international trade. OIE Aquatic Code provides guidelines and advice on procedures to be followed during international trade. However, the OIE Aquatic Code does not take into account the emerging pathogens and the pathogens are not considered in the OIE List.

FAO, NACA, OIE Asia-Pacific Quarterly Aquatic Animal Disease Report takes into consideration of all OIE listed pathogens as well as the pathogens of interest concern to Asia-Pacific region. Potentials of surveillance and zonation as a tool for reducing the risks of pathogen movement through trans-boundary movement of live aquatics, including aliens,

are being considered and necessary guidelines for developing countries are currently being prepared by FAO and OIE.

List of non-harmful species can also help facilitate aquaculture and fisheries development and avoid over-regulation of the sector. Lists of alien species already in use in a country and that have demonstrated that they are not causing problems would be appropriate. However, nearly all species can become harmful under specific environmental conditions or in sensitive habitats. Such a list should take into account on the potential environments available to the species and should consider areas where the species is not allowed to enter (see zoning above).

Information and materials derived from above should be aimed at various levels for different audiences, especially the introducers:

- **Farm level** – simple brochures of 2/3 pages or other material that are graphics rather than text oriented, focused on specific issues (species of concern, legislation) and written in local languages are appropriate. Brochure would stress economic gains from responsible use and economic losses from poor decisions.
- **General public level** – similar to farm level with emphasis on the role the public sector has in responsible use and control.
- **Higher level for scientist/policy-maker** – should be easily understood, with pre-analyzed information allowing decision makers easy access to principles on which to base policy.

The information could be disseminated through:

- schools,
- existing extension system,
- multi-media format, video, CD,
- TV to get messages across to a wide audience.

Manual based on the flow diagram of the national and regional review process that extracts specific information from the ICES/EIFAC model, region-specific and country-specific adaptations of OIE lists of animals and pathogens, and other applicable models would be appropriate.

Elements of Technical Guidelines on the Responsible Use and Control of Alien Species in Aquaculture and Fisheries

The workshop reaffirmed the value of the ICES/EIFAC Codes, the FAO Code of Conduct for Responsible Fisheries and the Technical Guidelines to assist in its implementation. Whilst the workshop appreciated the numerous guidelines and codes of practice on alien species that already exist, it non-the-less stressed the need for creating specific guidelines for developing countries and coalescing the variety of information on alien species into one easily accessed and understood document that could be part of the FAO Technical Guideline Series. Key elements of the Guidelines include:

- summary of agreements and other guidelines/codes of practice on alien species,
- summary of risks and benefits,
- description of an ICES like Code adapted to developing country conditions,

- the development of a set of criteria in order to establish a list of alien species of special concern in the region could further promote awareness and responsible use,
- risk assessment procedures including social and economic risks as well as environmental and ecological risks,
- decision trees (Annex III),
- recommendations for national implementation,
- recommendations for zoning areas where introductions can or can not be made, similar to OIE zoning based on disease status,
- special procedures for on-going practices, i.e. the continued use of alien species.

In addition to the Technical Guidelines, the workshop recommended the production of other videos, TV spots, posters, leaflets and pamphlets to raise awareness in general public and private industry. International aid agencies should also assist in the collection of case studies and examples of situations that have evolved that could have been avoided had this process been in place and applied. Examples should include the economic losses that have occurred to society and the aquaculture industry.

MAJOR CONCLUSIONS

Several significant conclusions emerged from the meeting:

- Among senior policy-makers and line officers in the region, there is still little awareness of the contents of the CCRF in general, and much less awareness of codes of practice and guidelines such as the ICES/EIFAC codes of practice on introductions. Once these codes and guidelines were explained, there was general agreement that they provided a useful means to manage introductions of alien species.
- Whilst many countries in the region advocate some form of environmental risk assessment, less formal queries on potential impacts are often directed to resource managers and aid agencies. Assessments or answers to informal queries can not often be given because of a lack of readily available information on the potential impacts of alien species on the environment in general and on the specific habitats of the Mekong/Lancang specifically. Thus, many countries expressed the need for additional assistance to increase capacity in order to undertake preliminary environmental impact assessment and import risk assessment. Additionally, countries noted the difficulty in accessing relevant information for impact/risk assessment and there was a clear call to organize the various types of information on impacts of alien species into a central repository or clearing house for the region.
- Alien species, such as tilapia (*Oreochromis* spp.) play an important role in providing cheap and readily available protein to rural and poor sectors of the basin. Alien species tend to be easier to breed, are tolerant to pond condition and are therefore suitable for mass production (this is important for those areas which do not enjoy massive inland capture fishery resources).
- The development and use of indigenous species are options to the use of alien species. However, indigenous species have not received the same amount of attention, research, development and use as many alien species. Therefore, in order for indigenous species to compete the workshop recommended much more research and development be devoted to domestication and husbandry of native species. The MRC

programme on Aquaculture of Indigenous Mekong Species was highlighted as a good example of this type of development.

- There is an urgent need for and interest in the creation of sub-regional guidelines on the responsible use of alien species in fisheries. Associated with this is the desire to establish a international body or group of experts to advise on introductions of alien aquatic species. Participants felt this group could be informal and non-mandatory, and that there were several organizations operating in the region that could offer assistance; FAO and NACA were identified as lead partners in this endeavour.

- There is still the need to standardize terminology and concepts related to alien species and invasiveness. The definitions of the CBD and FAO Code of Conduct on Responsible Fisheries help in this regard, but more is needed. The workshop noted that "invasiveness" of a species, depends on the specific environment, potential disturbances to the environment and on societies perception of what "harm" is. Similarly, many genetically differentiated stocks within a species constitute alien "genotypes" yet these organisms are often not thought of as "alien".

- Much of the regulation and control of alien species is based on political boundaries and not on ecological conditions or watersheds. Thus, within a country species may be moved across natural boundaries, or into ecologically sensitive areas, and subsequently cause adverse impacts. Countries and regions should look at the distribution of species within their borders and prevent the unrestricted movement of species within a country. Zonation and GIS could assist in this regard.

- In light of the difficulty of enforcing regulations on movement of alien species and patrolling long coastlines, borders and airports, participants thought that awareness of the dangers of irresponsible movement of alien species should be improved among the general public and fishery line officers. This should be done through training courses with the assistance of international and regional organizations and popular media with the assistance of local governments.

- Several steps are necessary for effective use and control of alien species in the region. Regional coordination of policies and practices on alien species is needed for effective national management. National policies need to be in place and population needs to be aware of issues before countries can implement international mechanisms such as the CBD or CCRF. Thus, regional coordination and national policy development are necessary actions that should go hand in hand in order to facilitate implementation of broader international agreements.

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