

# Summary of Discussions and Recommendations from The Workshop

The consultation was divided into four main sessions in which the background papers were presented, followed by the working group sessions. The summary of the main points discussed during the working group sessions is presented below:

## Potential and constraints for aquaculture development in Africa

**Potential.** Through aquaculture, opportunities exist both in terms of providing a source of income and employment and in improving the overall livelihood of farmers in Africa. However, compared to other continents, the aquaculture production of Africa remains insignificant. Africa's contribution to global aquaculture production in 2000 was only 1.1 per cent. Despite this, aquaculture development in the region shows considerable promise due to available resources (about 37 per cent and 43 per cent of surface areas are appropriate for artisanal and commercial fish production, respectively), suitability of farming in many different aquaculture systems (traditional, low-input, and commercial), and increasing demand for aquaculture products in local and world markets.

The acreage, productivity, and aquaculture operations that are contributing to rural development and national economies were used as criteria for discussions on the potential for aquaculture development in Africa. The participants concluded that the potential for aquaculture development in the region is high, but there are variations in terms of the relative potential of various production systems on national and sub-regional levels. There is a need for reliable aquaculture production data from these levels for better understanding of the status and trends of African aquaculture. It was pointed out that aquaculture production statistics from the national level are not very accurate, often due to weak and inconsistent data collection techniques and poor facilities for data analysis.

**Constraints.** While there is potential for aquaculture development, a number of constraints (i.e., biophysical aspects, marketing, inputs, policies, institutional and human resources) need to be addressed before the potential for aquaculture development in Africa could be achieved. These include: lack of knowledge of indigenous species for culture; cash-strapped local markets with limited purchasing power; consumer preference for larger fish in some countries (for example Egypt, Nigeria, and Uganda); competition from capture fisheries; non-availability of low-cost feeds; poor quality of fish seed and its insufficient quantity; lack of conduciveness of existing policies (for example land ownership and investment); lack of credit facilities (for both low-input and commercial culture systems); poor infrastructure for aquaculture (such as hatcheries in the public and private sectors); inadequate knowledge of farmers; and insufficient number of skilled extension personnel and their lack of skills.

**Recommendations.** Low management capacity has been identified as the main constraint to the development of small-scale aquaculture systems in Africa. To overcome this, adequate training for aquaculture research and extension personnel and the development of an information system for farmers' access to aquaculture technology should be provided.

There is, at present, high demand for quality fish seed in commercial aquaculture systems. However, this demand could not be met in view of the present constraints and limitations faced by the governments. Government hatcheries in many countries are either defunct or not able to provide quality seed in the required quantities. Few hatcheries started functioning in the private sector and most fish seed in culture operations, which are often of low quality, come from other farmers' ponds. New developments suggest that private sector hatcheries will play an increasingly important role in fingerling supply; hence there is a need to redefine the role of public and private sector hatcheries.

Overall, there has to be a strong commitment of government policy-makers and formulation of appropriate policies that will allow for the development of aquaculture in the region.

## Status and potential for genetic improvement

**Status.** Genetic improvement of aquaculture species offers substantial opportunities to improve production, product quality and profitability of aquaculture. It was pointed out that in Africa, genetically improved fish breeds are both needed in commercial and small-scale aquaculture operations.

The development of Genetically Improved Farmed Tilapia (GIFT) technology that is based on traditional selective breeding and is meant to improve commercially important traits of farmed fish is one of the major advancements made in tropical aquaculture. This technology is now being applied for the genetic improvement of the growth rate, and extension of environmental tolerance of native tilapias in Africa. The work is being undertaken in government aquaculture stations of Cote d'Ivoire, Egypt, Ghana, and Malawi and in collaboration with the WorldFish Center. In South Africa, *O. mossambicus* populations from several water bodies have been recruited for initiating the selective breeding at the University of Stellenbosch.

The participants recognized that while the application of selective breeding to native tilapia stocks may be the suitable strategy for Africa, the main limitation is that improvement of fish through this technique takes a long time and is costly. In view of this, there is likelihood that instead of improving the native tilapia stocks, some commercial farmers may resort to importing improved tilapia strains developed elsewhere or introducing alien species (for example, introduction of *O. niloticus* to Zambia and Zimbabwe as this species grows faster than indigenous species).

**Constraints for undertaking responsible genetic enhancement.** Poor institutional structure and capacity were identified as the major constraints for genetic enhancement programs. Fish are not regarded as a priority in national food production and, therefore, resources allocated to genetic enhancement programs are either inadequate or lacking.

The existing infrastructure owned by governments or built through public funding can be used for producing improved breeds, but these are generally inappropriate for genetic studies since they are either poorly maintained or non-functional due to the lack of funds. It was also acknowledged that if these facilities were made operational, multiple functions and use of the same facilities for research and production may result in conflicts, but possible synergies might also exist to benefit genetic enhancement initiatives.

Capacity of staff at all levels for genetic enhancement studies is limited. In many countries, there are few geneticists and the small critical mass makes it difficult for them to influence decisions on genetic enhancement issues. This was also exacerbated by weak institutions and low capacity to train staff in this discipline. The lack of opportunity has resulted in poorly motivated staff.

**Recommendations.** There is an urgent need to address the ongoing genetic degradation of aquaculture species due to improper management. Genetic management of stocks is essential and must be the priority from the onset of domestication to prevent the degradation of stocks.

Strengthening the capacity (human and infrastructure) of national institutions in Africa on aquaculture genetics should be given priority. In view of the increasing interest of the private sector and farmers in improved tilapia strains and their important role in aquaculture development of the region, these stakeholders should also be involved in decision-making processes concerning genetic improvement programs and must be provided with training on the genetic management of stocks.

Genetically improved tilapia breeds are now available in the international market and there is likelihood that these improved strains will be introduced into Africa. In view of this, there is an urgent need for guidelines and policies for the genetic management of improved tilapias.

## Risks of introducing improved strains and alien species

The introduction of improved fish breeds and/or alien species is likely to provide benefits. However, these may also present potential risks, especially in the countries of Africa where there is rich diversity of indigenous aquatic species that includes tilapias. When an introduced species escapes into waters where it is not native, it could become invasive and might pose a threat to native diversity and damage the aquatic ecosystem.

Apart from possible contamination of native diversity due to escapes of domesticated and introduced tilapia strains, the poor breeding facilities, lack of genetic enhancement capacity and limited number of individuals used as founder stock could aggravate the many risks involved in introducing improved tilapia strains.

Risk assessment and risk management need to pay attention to several dimensions that include: intervention techniques, species, habitat and ecosystem, level of intensification and traits for selection. For each of these dimensions, it should be possible to develop parameters for assessing the risks and (subsequently) monitoring the impacts.

It was felt that human health risk (however uncertain) should also be addressed pro-actively. It appears that the genetic interventions commonly applied in aquaculture would pose no risk of developing new proteins, a risk associated with some other genetically modified organisms and considered harmful to human health. Aquaculture stakeholders need to be aware that the subjective perception of health risks can in itself pose a considerable economic risk.

The level of risk to natural fish production will also differ according to countries. For example, risks are higher in Uganda because of its rich freshwater capture fisheries than in countries without significant water bodies. Decision-makers need to consider these differences when making decisions about introductions.

Risk assessment includes identifying hazards, events that could pose harmful consequences and quantifying risks – the probability of hazards occurring. Risk assessment must take a multi-sectoral and multidisciplinary approach, drawing on the expertise from different biological and social sciences. The time frame is an important dimension of risk assessment and is a crucial factor in the development of whatever consequences an introduction may entail.

The participants emphasized that risk management requires continuous monitoring, rather than individual assessments.

**Recommendations.** Introductions may be necessary for the development of aquaculture. However, any movement of fish between watersheds will need to be controlled and monitored. Mechanisms for the wider application of fish movement protocols and greater awareness in terms of their existence need to be considered. States in the region are responsible for the development and implementation of such protocols and regulations.

Decisions about the introductions need to balance the ecological impact (neutral or negative) and socio-economic impact (negative, neutral or positive). Guidelines based on available evidence must be developed for decision-makers (investors and consumers). Assessments as to whether impacts are “negative” or “positive” are to some extent subjective judgments. Different stakeholders may hold different opinions on the same evidence. This is true for ecological as well as socio-economic impacts.

There is a need to differentiate between the introduction of “new” and modified strains and the introduction of existing and wild strains into new water bodies (translocation).

Indiscriminate introductions and translocations by individuals and institutions are prevalent. These need to be addressed separately as they are likely to pose different types of risks and will require

other kinds of mitigation measures. Experience seems to indicate that translocation may in some cases pose a greater risk than the introduction of modified strains, since existing strains appear more robust and more likely to become invasive.

## **Tools and protocols for the introduction and movement of improved fish breeds and alien species**

**Tools and protocols.** A number of international codes of practices and protocols have been developed to deal with introductions, but there is a lack of clarity on the status of their implementation in the region. Protocols are useful in view of the following: (i) the already existing framework for regulating and monitoring the movement of plants and animals can be adjusted to include and handle the transfer of aquatic germplasm; (ii) the voluntary nature and user friendliness of most protocols allow for those committed to regulate and monitor movement of aquatic germplasm and to follow the protocols; and (iii) the precautionary nature of measures in most protocols allows for restricting movement even without establishing the exact impact of the movement of aquatic germplasm.

**Constraints to implementation.** While tools and protocols exist, to a large extent, their implementation has not been effective. This is mainly due to the voluntary nature of the protocols, which makes them non-binding, and the poor functioning of regulatory institutions. The latter is largely attributed to: (i) the lack of financial resources; (ii) inadequate knowledge and training in regulation of the movement and transfer of germplasm; (iii) lack of accountability; and (iv) inadequate quarantine facilities and services for aquatic germplasm, a major requirement for most of the protocols.

**Recommendations.** To address the constraints, it is necessary to: (i) provide knowledge and training on movement of aquatic germplasm and the need for its regulation and monitoring; (ii) increase efforts to make the protocols available; (iii) set up quarantine facilities for aquatic germplasm; (iv) improve the coordination and strengthen the present infrastructure to empower and train staff in the management and regulation of the movement of aquatic germplasm; and (v) for international and specialized agencies to monitor the use of existing protocols and report to interested countries the status of implementing them.

The presently available guidelines on managing the movement of aquatic germplasm in the region could be expanded to include the assessment of possible risks in the movement of aquatic germplasm. Developing local capacity is essential to accomplish this. FAO could be useful in monitoring the compliance levels and reporting this information back to the member countries and the international community in general.

There is much information that could help in managing the movement of aquatic germplasm, most of which is freely available and easily accessible; hence countries and individuals in the region should be encouraged to access it. The protocols and tools need to be fine-tuned on a country basis and must take into account the varied socio-economic and geographical systems to make them more useful and appropriate to the varied situations in the region.

The tools and protocols should be adapted as soon as possible, within current resource availability. It is also essential that these be improved at the national and regional levels through participatory and consultative processes.

As for non-binding international protocols, (for example the FAO Code of Conduct for Responsible Fisheries), it was thought that this could be made more binding and obligatory in all countries in the region with the enhancement and dissemination of knowledge and awareness at the national level.

In summary, five major conclusions were agreed on, based on the five key tools required in managing the movement of aquatic alien species and genotypes in the African region:

- (i) Extensive databases on genetic diversity, environmental integrity and current practices are needed for background and baseline situation analysis. These data should be made available

regionally as well as in each country for use in developing guidelines, protocols, management and impact assessment. Some of this information exists in partial form that may be further developed. However, there is, in general, a lack of awareness, knowledge and means to access and use them. It is suggested to establish a regional mechanism that could compile and disseminate the needed information and data including existing databases and collecting new information to allow for the effective use of the existing protocols and tools.

- (ii) Internationally accepted protocols for reducing the risk of trans-boundary movement of pathogens through transfers and introductions of aquatic species exist. At present, such protocols for the movement of alien and modified genomes do not exist. The applicability of existing protocols seems currently difficult in Africa due to inappropriate models on which the protocols are based, lack of awareness, knowledge and absence of quarantine services required for the effective use of most of the existing protocols. It is suggested to examine the existing protocols and evaluate their applicability to African conditions. If found adequate, these should be applied immediately, and progressively ved through a feedback process. If not adequate, a new set of regionally applicable guidelines needs to be developed and for this technical and financial assistance may be necessary.
- (iii) Risk assessment is an essential tool for making a priori decisions concerning the movement of aquatic organisms. It is a theoretical framework that incorporates knowledge of the species attributes such as trophic level, life history strategy, and taxonomic relatedness. The existing protocols for risk assessment were developed for non-African ecosystems and may not be directly applicable to the African situation in which case they may need adapting to specific situations. At present, there is a lack of complete data on the biological attributes of some species. It is suggested that the data collected be incorporated into simple versions of existing models, and begin to apply them in the region. This will permit immediate application of principles that can then be refined through a dynamic feedback system, eventually leading to well adapted systems.
- (iv) Monitoring the environmental, social and economic impacts of alien species introductions should be an integral component of the process. Information and data collection processes do not appear to be widely in use in the region at the present time. However, based on existing databases and the state of knowledge on the African ecosystems, target reference points can be set for the achievements and limits for impacts of aquatic species movement. There is a lack of awareness, knowledge, and appropriate measures, and failure of information to be passed on among countries. It is suggested to establish and implement systems of monitoring that include data and information on basic species attributes.
- (v) Awareness building is essential to support the management of the transfer of alien aquatic species and genomes, and to facilitate enforcement. Awareness in the region is not currently adequate within enforcement agencies and the general public. The protocols for moving aquatic germplasm are too recent, and financing and institutional structures for environmental awareness are inadequate. It is suggested that an awareness and communication strategy for the general public and enforcement agencies should be developed on the costs and benefits of moving alien genotypes. Governments should designate contact persons or institutions as information sources and put in place mechanisms for intra and international consultations and conflict avoidance.

**Policies.** Governments in Africa and regional and international bodies have formulated policies, laws, and legal instruments and protocols to regulate and control species introductions and protect the region's remaining biological resources. Examples are the National Environmental Policy; Policy on Wetlands; Plant Protection Act; Animal Breeding Bill and Fish Act of Uganda; National Environment Policy of Rwanda; Fish Act of Kenya; Coastal and Marine Act and Wildlife Act of Tanzania and Kenya; New Aquaculture Policy of Namibia that precludes the use of alien species in some areas; and Fisheries Protocol of the Southern Africa Development Community (SADC).

Most of the countries in the region are parties to relevant international conventions and subscribe to relevant Codes of Conduct. Examples of these are the CBD guidelines, the Cartagena Protocol on Biosafety, and the FAO Code of Conduct for Responsible Fisheries (CCRF). While such international conventions and agreements exist in the region, these have not been translated and adapted into national and regional policies. Moreover, international laws do not oblige nations to comply; hence, in general, they have not been implemented.

In addition, there are a number of regional agreements that regulate the translocation of germplasm within Africa. For example, in Eastern Africa, there is an agreement not to introduce Common carp (*Cyprinus carpio*) in the Lake Victoria Basin of Kenya, Uganda and Tanzania. Twelve SADC countries have signed the fisheries protocol and this includes some provisions on the control of introducing alien species. Apart from these, regional and sub-regional bodies (for example the Economic Community of West African States), although formed for economic and political issues, can be used as instrument for harmonization of policies. One of the weaknesses, however, is that in some regions (such as Eastern Africa), these agreements are only on paper and are not implemented in practice.

Several countries in the region have existing national policies or have produced policy drafts pertaining to the translocation and introduction of alien species. In Eastern Africa, some countries have fisheries laws (Fisheries Acts), which mention issues about translocations and introductions of alien fish species. In Southern Africa, some national policies are in place and institutional structures and regulating bodies exist to implement these.

However, while the above policies exist at the national level, they are either in draft form or outdated and have not taken into account new pressing and emerging issues (for example, the introduction of genetically modified and alien species). Moreover, most of these national policies are not specific to the conservation of aquatic biodiversity and have been focused largely on the protection of plants (mainly agricultural crops), and animal diversity.

The policies also lack strategies for development and implementation. The process of developing and implementing policies is not consultative or participatory and the interval between reviews of policies is too long. The development of policy is usually not based on scientific data and the responsibilities are often split among government ministries and agencies that act independently. Most often, these ministries lack a comprehensive understanding of fisheries and aquaculture. In some countries of West Central Africa (such as Ghana), there is absence of an appropriate ministry for fisheries, although an attempt is being made to create this. It was also felt that cross-cutting activities and multi-use of natural resources have resulted in overlapping and confusion of responsibilities.

Consequently, resultant policies may be incomplete and less than coherent. Often, policies are too complex; institutions lack enforceable regulations and communications between related institutions due to limited transparency and consultation processes and accountability may be low. In some instances, policies did not match legislation and available laws are not updated as institutions are becoming more multi-sectoral. The value of research in this field was also raised. It was felt that the value of the peer review process is not appreciated, and the results from some studies are questionable.

The participants have identified the following constraints for the implementation of existing policies:

- Lack of awareness and knowledge of legislation by the general public at all levels – resulting from a lack of participation by a wide range of stakeholders;
- Lack of coordination at the national, regional and international levels;
- Limited funding resulting in a lack of capacity (human and infrastructure) and strategies for implementation of the legislation;

- Outdated laws due to quickly changing socio-economic realities;
- Conflicts of interest (development versus conservation) and mandates of various authorities;
- Implementing authorities not being the right ones; and
- Lack of accountability, transparency and political will for implementation.

**Recommendations.** At present regional policies are formed by regional groups at the political and economic levels and ecological realities are not taken into account when establishing regional policies. Whereas national policies are paramount, these should be aware of sub-regional and watershed and basin-wide considerations. Efforts should be made to develop and implement effective policies and arrangements relating to the management of introductions into trans-boundary waters and watersheds.

Countries do occasionally examine the policies and legislation of their neighbors and sometimes adapt or adopt them. This occurs both within and across sub-regional groupings. In view of this, countries are encouraged to look beyond their borders for examples of workable policies and legislation, and adopt them in order to fill national policy gaps and harmonize them where necessary.

There is substantial variation in the development of aquaculture policy at the national level; however, there is a general absence of policies specific to the introductions, biosafety, and genetic enhancement. This reflects the recent history of genetic manipulations and improvements. In formulating policies, both conservation and development issues should be considered together to avoid conflicts of interests. Countries should develop, strengthen and implement policies on biosafety and genetic enhancement.

Countries are not sufficiently aware of the need for a biosafety policy and, therefore, this is not high on national agendas. Efforts should be made to improve awareness of policy-makers and resource managers and the general public (user groups) of the policies through campaigns, information exchange, and training. It is recognized that policy development is a long-term activity and in the short-term, awareness-raising may be more practical.

National adoption of international instruments and fulfillment of obligations are difficult because of the lack of resources (technical, human, infrastructure) and inappropriate assignment of responsibilities. The effectiveness of existing policies, laws and agencies also depends on the capacity of countries to engage in scientific analysis of the nature of living modified and improved species and related biotechnology processes. Countries should assign clear roles, responsibilities and budgets to agencies for the adoption and implementation of biosafety policies. The formulation and implementation of policies should be granted to the appropriate responsible authorities and should be guided by sound scientific data (for example an inventory of existing aquatic germplasm to provide baseline data for reference and identification of areas with undisturbed genetic materials for conservation). Countries without a ministry of fisheries and aquaculture should also consider establishing one.

There are strong provisions in the FAO CCRF dealing with alien species, genetically altered species, and conservation of aquatic organisms. Many countries in Africa are members of FAO and, therefore, have committed to implement these provisions. However, this will also require external assistance. National governments should link the implementation of the CCRF to their own policy-making and regulatory frameworks for aquaculture, fisheries, and nature conservation.

Policies are often formulated with limited consultation and participation; hence they are often unknown to users or viewed by users as restrictive. Policy and legislation formulation and implementation should be transparent, consultative, and participatory. They should consider the interests of all affected parties. They should involve all stakeholders and users. Incentives should be included for user compliance with the policy.

There is a need for impartial advice on the use of alien species and genetically improved species. Independent and scientifically competent expert bodies should be constituted at the sub-regional level, preferably as part of existing organizations, for example East Africa – BIO-EARN, West Africa - ECOWAS, and Southern Africa – SADC. These organizations should seek technical support and linkages with relevant national institutions and international bodies such as the FAO and the WorldFish Center.

There are a number of gaps in policies dealing with alien species and genetically improved species that should be corrected. For example, there is a clear lack of quarantine facilities and capacity in the region. Policies should be formulated that promote the establishment of quarantine facilities and fish health procedures, risk analysis and risk management procedures, and provisions for liability and rehabilitation.

## **Main Conclusions and Recommendations**

Following four days of discussions, the participants endorsed the *Nairobi Declaration on the Conservation of Aquatic Biodiversity and Use of Genetically Improved and Alien Species for Aquaculture in Africa* (see following pages). The document, which outlines the main conclusions and recommendations of the workshop and has also been published under separate cover, serves as a guideline that will help foster the development of aquaculture in the region while maintaining biodiversity.