

**REGIONAL REVIEW ON AQUACULTURE DEVELOPMENT  
4. SUB-SAHARAN AFRICA – 2005**



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## **REGIONAL REVIEW ON AQUACULTURE DEVELOPMENT 4. SUB-SAHARAN AFRICA – 2005**

by

**Thomas Hecht**  
Rhodes University  
Grahamstown, South Africa

With additional contributions from:  
John Moehl  
FAO Regional Office for Africa

Matthias Halwart  
FAO Fisheries Department

Rohana Subasinghe  
FAO Fisheries Department

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## FOREWORD

The world population is on the rise, as is the demand for aquatic food products. Production from capture fisheries at the global level is levelling off and most of the main fishing areas have reached their maximum potential. Sustaining fish supplies from capture fisheries will, therefore, not be able to meet the growing global demand for aquatic food.

At present, the aquaculture sector contributes a little over 40 million tonnes (excluding aquatic plants) to the world aquatic food production. According to recent FAO predictions, in order to maintain the current level of per capita consumption at the minimum, global aquaculture production should reach 80 million tonnes by 2050. Aquaculture has great potential to meet this increasing demand for aquatic food in most regions of the world. However, in order to achieve this, the sector (and aqua-farmers) will face significant challenges.

A major task ahead for sustainable aquaculture production will be to develop approaches that will increase the contribution of aquaculture to the global food supply. These approaches must be realistic and achievable within the context of current social, economic, environmental and political circumstances. Accurate and timely information on the aquaculture sector is essential in order to evaluate the efficacy of these approaches and how they can be improved.

Under the FAO Fisheries Department's current work programme, the Inland Water Resources and Aquaculture Service (FIRI) of the Fishery Resources Division, using a wide-ranging consultative process, regularly conducts reviews on the status and trends in aquaculture development (FAO Fisheries Circular No. 886 – Review of the State of World Aquaculture and FAO Fisheries Circular No. 942 – Review of the State of World Inland Fisheries). The last review (both regional and global) was conducted in 1999/2000 and was published following the Global Conference on Aquaculture in the Third Millennium held in Bangkok, Thailand, in 2000 (NACA/FAO, 2001, Aquaculture in the Third Millennium). These reviews are seen as important milestones and the documents produced are recognized as significant reference materials for planning, implementing and managing responsible and sustainable aquaculture development worldwide.

As part of this continuing process and with the current objective of preparing a global aquaculture development status and trends review, FIRI had embarked on a series of activities. These are:

- National Aquaculture Sector Overviews – NASOs – in all major aquaculture producing countries in the world;
- five regional workshops to discuss the status and trends in aquaculture development in Asia and the Pacific, Central and Eastern Europe, Latin America and the Caribbean, Near East and North Africa, and sub-Saharan Africa; and
- seven regional aquaculture development status and trends reviews in Asia and the Pacific, Central and Eastern Europe, Latin America and the Caribbean, Near East and North Africa, North America, sub-Saharan Africa and Western Europe.

This document presents the sub-Saharan Africa regional synthesis of all the information collected from the above activities.

## ACKNOWLEDGEMENTS

All country representatives are acknowledged for giving freely of their knowledge, wisdom and understanding of aquaculture in their respective countries at the Mombasa Workshop in September 2005, as per list of participants (see Part II, Appendix 1). The Workshop report was compiled by Mulonda Kalende, Beatrice Nyandat and John Moehl.

### **Hecht, T.**

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### **ABSTRACT**

The FAO Fisheries Department conducts reviews of aquaculture development status and trends on a regular basis. This document is a result of such an activity conducted during 2005 and 2006. This review was made by synthesizing National Aquaculture Sector Overview (NASO) from 16 countries in sub-Saharan Africa. The 16 countries included, Côte d'Ivoire, Ghana, Liberia, Nigeria, Sierra Leone in West Africa; Cameroon, the Republic of Congo and the Democratic People's Republic of Congo in Central Africa; Uganda, the United Republic of Tanzania and Kenya in East Africa; and Angola, Mozambique, Madagascar, Zambia, Malawi in southern Africa. South Africa was also included. The production volume and value data have been derived from the latest FAO FISHSTAT Plus database. As part of the review process, a regional expert workshop was conducted in Mombasa, Kenya, in 2005, to discuss the regional aquaculture development status and trends. The report of this expert workshop is also included in this document. The synopsis provided here summarizes the current status and recent advances that have been made by the aquaculture sector in the sub-Saharan Africa region during the last decade and the last five years in particular.

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**ABBREVIATIONS**

ADF	Aquaculture Development Funds
AqWG	Aquaculture Working Group
AWRD	Africa Water Resource Database
BCLME	Benguela Current Large Marine Ecosystem
FAO	Food and Agriculture Organization of the United Nations
FCR	Food Conversion Ratio
FDI	Foreign Direct Investment
FIRI	Inland Water Resources and Aquaculture Service
GDP	Gross Domestic Product
HACCP	Hazard Analysis and Critical Control Point
HPZ	High Potential Zones
IGO	Intergovernmental Aquaculture Organization for Africa
MOU	Memorandum of Understanding
NACA	Network of Aquaculture Centres in Asia-Pacific
NADC	National Aquaculture Development Committees
NASO	National Aquaculture Sector Overview
NEPAD	New Partnership for Africa's Development
NGO	Non Governmental Organization
PAFAD	Prospective Analysis of Future Aquaculture Development
R&D	Research and Development
RAFI	Regional Office for Africa
REC	Regional Economic Communities
SSA	Sub-Saharan Africa
SWB	Small Water Bodies

## SUMMARY

The synopsis provided here summarizes the current status and recent advances that have been made by the aquaculture sector in the sub-Saharan Africa region during the last decade and the last five years in particular.

- Sub-Saharan Africa contributes 0.13 and 13.6 percent to total World and Africa aquaculture production, respectively.
- Total aquaculture production in the 17 target countries (see Introduction for details) between 1998 and 2003 has increased by 61 percent from 44 962 to 72 334 tonnes.
- The contribution by aquaculture to Gross Domestic Product (GDP) in the target countries is negligible, ranging from 0.001 to 0.715 percent.
- Farming technologies range from simple, low-input – low output pond systems to high-density re-circulating systems in Nigeria and South Africa. Cage culture is expanding rapidly in many countries. Mariculture technologies are generally more sophisticated and capital intensive.
- Production technologies in the non-commercial sector have not changed appreciably though some advances in the use of inorganic fertilizers and farm-made feeds were evident and the average production in this sector (0.95 tonnes/ha/year) remains low.
- The non-commercial sector makes an insignificant contribution to fish supply in the region but makes an important contribution to household or community livelihoods. The non-commercial sector is unlikely to make any significant contributions to national protein supply in any of the target countries in the short- to medium-term.
- Mainly because of economic and bio-technical constraints, the transition from non-commercial to commercial fish farming is not common.
- Fingerling availability, quality and distribution remains a serious constraint to non-commercial and commercial aquaculture development in all countries and this presents unique business opportunities.
- Feed availability, quality, distribution and acceptable food conversion ratios remain major constraints to both non-commercial and commercial producers. Most non-commercial farmers use protein limiting diets, the use of farm made feeds is increasing slowly, while manufactured feeds are generally of a low quality. High quality extruded feeds are only manufactured in South Africa. All shrimp feed is imported.
- During the last five years, there has been a marked emergence of commercial aquaculture and this appears to be related to increasing fish price.
- It was estimated that the commercial sector contributes approximately 65 percent to the total fresh and brackish water fish production, while nearly 100 percent of mariculture production is from the commercial sector.
- The most significant advances seem to have been made in anglophone countries, suggesting the need for a greater degree of capacity building in francophone countries.
- Most government stations are abandoned or in a state of neglect and disrepair and cannot fulfill their intended mandate. Some stations have been successfully privatized, though in most countries privatization policies and strategies need to be developed and implemented to serve the interests of the commercial and non-commercial sectors.
- Awareness campaigns of aquaculture business opportunities in some countries have resulted in a shift in emphasis to commercial farming and the emergence of progressive new small- and medium-scale investors.
- To increase fish supply, it is incumbent upon lead agencies to focus their support on the emerging commercial sector.
- There have been major paradigm shifts with respect to the promotion and development of the sector in several countries. In these countries, the sector has responded and made the most

significant advances. This suggests that lead agencies should focus on facilitating the provision of enabling legislative and regulatory platforms for development and investment by the appropriate organs of state accompanied by the development of realistic national aquaculture strategic frameworks and the implementation of practical plans.

- Aquaculture statistics in most countries are poor. Maintenance of databases is constrained by lack of capacity and financial resources. There is an urgent need to address this shortcoming throughout the region to provide better decision support.
- Little cutting-edge aquaculture research and development is noted in the region. Given the benefits of research and development, this is a major concern for the future of the sector as a whole.
- In most countries, the legislative and regulatory environment is weak and does not encourage the development of the sector. The problem is recognized and is being addressed by several countries in the region. As part of this process, a core of countries has now adopted strategic sector development plans, while others are following suite.
- Extension services have not improved and in many cases have regressed, making delivery of satisfactory extension one of the overarching challenges.
- The most appropriate and successful extension method appears to be the on-farm participatory extension approach, which is currently used on a trial basis in several countries. The sustainability of the method however still needs to be demonstrated.
- Financial institutions are poorly informed about aquaculture and access to credit by emerging commercial farmers is severely limiting in all countries. Lead agencies must promote aquaculture to lending institutions and assist farmers to develop bankable business plans.
- Mariculture is generally underdeveloped, with current investment concentrated in Madagascar, Mozambique, South Africa and Namibia. It is nascent in all other countries where there is notable potential for responsible development.
- The advantages and opportunities offered by cage culture at different levels of scale and intensity are now widely recognized and are being adopted. There is a need to build capacity to monitor environmental effects.
- Non-food aquaculture is restricted, in order of priority by value, to Nile crocodile, ornamental fish, seaweed and baitfish. Lead agencies need to create awareness of opportunities in this sector.
- The market for aquaculture products is generally poorly developed, except in urban and peri-urban areas, though sophisticated market chains exist for mariculture products.
- It is projected that aquaculture production in sub-Saharan Africa by 2013 will be between 208 600 and 380 400 tonnes per annum.

## BACKGROUND

In July 1975, FAO organized the First Regional Workshop in Aquaculture in Sub-Saharan Africa (SSA) (FAO, 1975). This workshop recognized the importance of the sector and the priority attached to it by many governments. This was followed by the 1976 FAO Conference on Aquaculture, held in Kyoto, Japan, which established an approach to aquaculture development (FAO, 1976). This was a technology-centred approach that focused on the transfer of proven technologies through regional programmes.

In 1986, UNDP, FAO and the Norwegian Ministry of Development Cooperation undertook the *Thematic Evaluation of Aquaculture* to evaluate the results achieved by the Kyoto Strategy (FAO, 1987). It was found that successful projects: (a) had been preceded by a careful selection of species and culture system combinations; (b) had lasted for a long period (a decade or more), and (c) had been supported by strong government commitment. However, it was also found that projects tended to concentrate on physical results as opposed to transferring know-how to farmers. Regarding aquaculture in Africa, the Evaluation noted: “Impact achieved through UNDP/FAO technical assistance to aquaculture is most visible in Africa. Primarily this has been achieved through the reintroduction of pond-based tilapia culture. Efforts have been successful where assistance has been continued for a long period, generally not less than a decade. A recurring weakness, which places sustained impact in jeopardy, is the fact that rural freshwater aquaculture in most countries is still dependent upon government support, particularly for seed. However, fish produced has brought nutritional benefits in the producing areas”. It was further noted that the production did not lead to direct exports, is unlikely to have reduced imports and there had been no impact on earnings of foreign currency.

African aquaculture also came under the spotlight at the 1988 FAO Expert Consultation on Planning for Aquaculture Development (FAO, 1989). This Consultation concluded that output from sub-Saharan Africa was still very low, with Nigeria, Côte d’Ivoire, Kenya and Zambia being the most important contributors to the region’s estimated 10 000 tonnes of aquaculture production at the time. Most of this production was attributed to small-scale semi-intensive farming of tilapia, with few large-scale commercial ventures able to demonstrate long-term economic viability. It was recommended that seed production be privatized and resources devoted to upgrading extension through training and improved information flow to producers.

In 1993 FAO assembled reviews from twelve countries in the region that were responsible for 90 percent of production the region (Coche, Haight and Vincke, 1994). The major constraints to development that were identified included amongst others; the absence of reliable production statistics, limited credit availability for small-scale farmers, unavailability of local feed ingredients, lack of well-trained senior personnel, prohibitive transport costs and the lack of juvenile fish for stocking of ponds. In 1999 FAO (2000) organized the first Africa Regional Aquaculture Review to evaluate the preceding 30 years of development initiatives with particular focus on extension and public sector support, to review the present status of aquaculture in the region, to identify trends in aquaculture development and to prepare an outline of the key elements in a general aquaculture development strategy. On aggregate, it was found that there was little government support for aquaculture; that many government stations and hatcheries as well as private fish ponds had been abandoned; that feed and seed shortages were significant limiting factors; that aquaculture extension activities had decreased; that there was a shortage of field staff and a significant loss of institutional memory; that there was a lack of access to available aquaculture information and that the deficiency of reliable aquaculture statistics still persisted. However, it was concluded that: (i) *aquaculture was now known throughout Africa as a result of previous extension efforts*, and (ii) *adoption/acceptance, even if on a modest scale, had been noted in most countries*. Moreover, the review identified common elements of a strategy for future aquaculture development in sub-Saharan Africa and these guided the FAO aquaculture programme initiatives in the region. Where appropriate the progress made in the region with respect to these strategy elements, listed below, will be evaluated in this review.

- Establish national development policies and an Aquaculture Development Plan in consultation with stakeholders.
- Reduce expensive and unsustainable aquaculture infrastructure.
- Promote and facilitate private sector production of seed and feed.
- Encourage credit for medium- and large-scale producers.
- Revise aquaculture extension, establishing a flexible and efficient structure to meet producers' needs.
- Advocate farmer-friendly existing technologies that use readily available culture species and local materials.
- Promote collaboration, coordination and information exchanges between national and regional aquaculture institutions and agencies.
- Facilitate the formation of Farmers' Associations.

The most recent information on aquaculture in a representative group of countries in the sub-Saharan Africa region is summarized in Moehl, Halwart and Brummett (2005). The proceedings of this meeting in Cameroon in March 2004 also culminated in the “Limbe Declaration” on aquaculture development in the region. An attempt was made at this workshop to develop a set of practical recommendations that can be used by national governments to insure that the major constraints are being addressed and that the major opportunities for aquaculture are capitalized upon to increase the contribution of aquaculture to food security and economic growth. The major constraints that were identified at this workshop were seed, feed, inefficient extension and outreach and institutional weaknesses. The constraints identified and recommendations made at this meeting do not differ much from the general literature on the subject.

In 2004 the FAO Committee on Fisheries (COFI) Sub-Committee on Aquaculture requested FAO to assess regional and national aquaculture growth and development and to prepare a global review of aquaculture development for presentation at the third session of the COFI Sub-Committee on Aquaculture in 2006.

This review of aquaculture (see Box 1 for definitions of commercial and non-commercial aquaculture) provides a synoptic overview of the sector in the region to feed into that process. In particular it focuses on progress that has been made during the last five years since the publication of the 1999 regional sector review (FAO, 2000).

This review was initiated by requesting National Aquaculture Sector Overviews (NASOs) and a set of questions prepared for obtaining additional information not presented in NASOs from 19 countries in the region. Data and information from 16 country reviews (Burkina Faso, Central African Republic and Guinea were not available) were used for compiling this synopsis. The 16 countries initially considered in the review are; Côte d'Ivoire, Ghana, Liberia, Nigeria, Sierra Leone in West Africa, Cameroon, Congo (Republic of), Congo (Democratic Republic of) in central Africa, Uganda, United Republic of Tanzania<sup>1</sup>, Kenya in east Africa and Angola, Mozambique, Madagascar, Zambia, Malawi in southern Africa. South Africa was later included into the review and information on advances made there were obtained from the Aquaculture Association of Southern Africa, the Division Marine and Coastal Management and Hecht and Britz (1992), Brink (2003), Britz *et al.* (2005). These 17 countries, from which national information is mainly used in this synopsis, are referred to as “Target Countries”<sup>2</sup> here after.

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<sup>1</sup> United Republic of Tanzania: herewith after referred to as Tanzania

<sup>2</sup> The 17 “Target Countries” are: Angola, Cameroon, Congo (Republic of) and Congo (Democratic Republic of), Côte d'Ivoire, Ghana, Kenya, Liberia, Malawi, Madagascar, Mozambique, Nigeria, Sierra Leone, South Africa, Tanzania, Uganda and Zambia

In instances where data were inadequate or absent (this was a major constrain in doing this regional review) other appropriate sources were consulted and additional information was obtained by way of personal interviews of country representatives during the regional aquaculture trends review workshop held in Mombasa, Kenya (20–22 September 2005).

**BOX 1. Definitions of commercial and non-commercial aquaculture**

There are a wide range of aquaculture practices in SSA, with respect to systems employed, the level of intensification and production, species, capital investment and technologies. To make any sensible comparisons it is necessary to clearly define and categorize the various practices. The most appropriate categories, with some modification, are those adopted in Moehl, Halwart and Brummett, 2005.

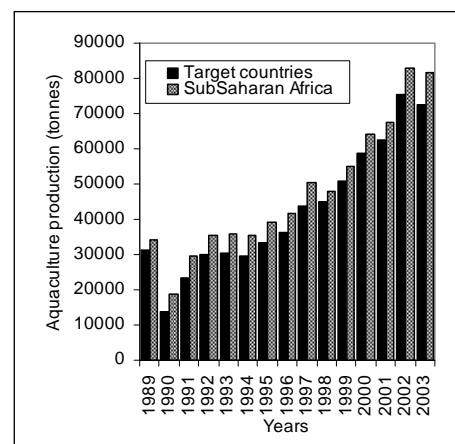
In the aggregate, the categories are part of a spectrum that covers the full scope of production systems. If the spectrum reflects production intensity and investment level, individuals at the low end will likely internalise their aquaculture activities with little contribution to the public purse and little benefit from public services. Conversely, individuals at the high end of the scale may make important contributions to national aquaculture production. For the purposes of this review, producers have been divided into two categories: commercial and non-commercial. Commercial producers can be small, medium or large-scale, and are active participants in the market. They purchase inputs (including capital and labour) and engage in off-farm sales of the fish produced. For these individuals, aquaculture is a principal economic activity<sup>2</sup>. Non-commercial producers may also purchase inputs, such as seed and feed, but rely chiefly on family labour and on-farm sale of produce. An additional feature of non-commercial aquaculture is that it is one of a variety of enterprises comprising the farming system; it is undertaken to diversify production, and income, improve resource use and reduce risks of such events as crop or market failure. In reality, however, the underlying motivation of “non-commercial” farmers is often similar to that of commercial farmers, i.e. profit is more important than food security (van der Mheen–Sluijter, 1990; Hecht, 2000). In the NASOs “non-commercial” aquaculture is most often referred to as small-scale subsistence, small-scale artisanal or integrated aquaculture and is normally practised by resource poor farmers.

<sup>1</sup> An aquaculture system is a combination of: type of culture unit, level of intensity, culture species and scale or size of exploitation

<sup>2</sup> Commercial aquaculture can be defined as the farming of aquatic organisms, including fish, molluscs and crustaceans and aquatic plants with the goal of maximizing profits. Thus, the distinction between commercial and non-commercial aquaculture operations relies primarily on the existence or absence of a business orientation and on how factors of production such as labour will be paid.

The trend in total production of the target countries mirrored that of the whole sub-Saharan Africa region (Figure 1), suggesting that the restricted review of 17 countries provides a realistic picture for the region.

**Figure 1. Aquaculture production in target countries and for the sub-Saharan Africa region as a whole (FAO FISHSTAT Plus).**







# **PART I**

## **REGIONAL REVIEW ON AQUACULTURE DEVELOPMENT: SUB-SAHARAN AFRICA – 2005**

### **1. CHARACTERISTICS AND STRUCTURE OF THE SECTOR**

#### **1.1 History and general overview**

In many countries throughout the region aquaculture was introduced at the turn of the century, mainly to satisfy colonial angling needs (ICLARM and GTZ, 1991; Lazard *et al.*, 1991). Aquaculture with the emphasis on social objectives, such as improved nutrition in rural areas, generation of supplementary income, diversification of activities to reduce risk of crop failures and the creation of employment in rural areas, was introduced mainly during the 1950s, when many of the government fish farming stations were built. Since the 1960s aquaculture development in the region has been spearheaded by the FAO, in association with governments, donor countries and their development agencies, Non-Governmental Organizations (NGOs) and the national and international research community (Coche, Haight and Vincke, 1994). From the early 1970s to the early 1990s, generally regarded as the “golden age” of donor support for the sector, the development was facilitated by increased technical and financial assistance from multilateral and bilateral donors amounting to around US\$500 million (Coche, Haight and Vincke, 1994) for more than 300 externally financed projects (Harrison *et al.*, 1994). For various reasons donor support for aquaculture, and the natural resources sector as a whole, has regressed significantly since then. Donor emphasis has shifted towards other priorities such as good governance, health, HIV/AIDS, education and democratization. However, as a direct consequence of these interventions the sector was popularized and is now widely practised.

The development of the sector in all target countries can essentially be divided into three phases.

**Phase 1:** 1950–1970. The introductory phase, during which the sector was popularized but with limited knowledge and understanding. Most government stations were built during this era.

**Phase 2:** 1970–1995. The expansion phase, significant donor support, active R&D, government involvement in seed supply and extension. Commercialization of the sector in some countries (e.g. Nigeria, Madagascar, Côte d’Ivoire, Zambia, South Africa).

**Phase 3:** 1995 to present. Reduced donor support, re-orientation of public support towards facilitation, emergence of the commercial sector.

#### **1.2 The current status and the need for aquaculture**

Total world aquaculture in 2003 amounted to some 54 786 000 tonnes, to which Africa as a whole contributed 531 000 tonnes (0.97 percent). The SSA contribution of 72 334 tonnes to the African total in 2003 was a mere 13.6 percent or 0.13 percent of the world total (FAO FISHSTAT Plus).

Because of these figures it is often stated that aquaculture in sub-Saharan Africa has not met expectations in the 50 years since it was first introduced in the region (Hecht, 2000; FAO, 2000; Moehl, Halwart and Brummett, 2005) and this has been ascribed to a suite of problems, constraints and other reasons (see Box 2). It is reasonable to suggest that this has contributed in some measure towards the decline in donor and public support for the sector. At the First Regional Workshop on Aquaculture in Africa (FAO, 1975) it was noted that, “failures of some of the ill-conceived programmes during the early part of the century have continued to remain a major constraint in convincing the farmers and investors of the economic viability of aquaculture. Insufficient appreciation of the basic requirements of an effective aquaculture development programme and consequent inadequacy of governmental support activities, have handicapped the orderly and rapid

development of the industry". The statement above is probably still valid in many instances. However, there are good indicators that the sector is changing rapidly in some countries.

***BOX 2 Institutional, bio-technical and economic reasons for the slow progress of sub-Saharan aquaculture.***

Institutional

- Focusing on fish in isolation from other farming activities and related community structures. Projects did not take into consideration the full range of opportunities and constraints faced by small-holder farmers.
- Lack of experience in appropriate extension methods, resulting in a top-down relationship between extension and farmers that effectively prevented joint learning.
- Poorly trained extension personnel who neither understood the technologies they are promoting nor where they adequately trained to communicate effectively with smallholders.
- Absence of reliable production statistics
- Poor planning and lack of prerequisite national strategies based on realistic levels of resources
- Lack of well-trained staff at all levels in aquaculture development, including shortage of competent and experienced technical and managerial manpower in the aquaculture industry
- Inadequate research-extension back-up for aquaculture development
- Institutional instability
- Inadequately resourced institutional structures to support aquaculture development
- Inappropriate target group focus by donors, e.g. poorest of the poor or non-fish eating communities
- Mismanagement of funds/poor governance
- Donor dependency

Biotechnical

- Reliance on technologies developed on experimental stations that were not applicable to prevailing agronomic or economic conditions at the farm level.
- Approaches that relied on rigid technology packages rather than the application of flexible principles.
- Poor quality of fingerlings (mature stunted fish) and shortage of supply.
- Low quality feeds and inadequate information on farm made feeds.
- Access to and supply of affordable formulated fish feeds, particularly feeds for fingerlings and brood stock for the expansion/development of the commercial sector

Economic

- Low price of fish
- Non-availability of credit for producers
- High transport costs and poor access to markets
- High opportunity costs for commercial start-up
- Absence of business planning and lack of capacity to do so

(Lazard *et al.*, 1991; Coche, Haight and Vincke, 1994; FAO, 2000; Hecht, 2000; Moehl, Halwart and Brummett, 2005 and others)

The poor performance of the sector in the region also needs to be viewed from a geo-political and climatic perspective. Since the early 1970s in 12 out of the original 19 target countries, there has been civil unrest, strife and war ranging from 5 to 27 years, with an accumulated total of 167 years ([www.cia.gov/cia/publications/factbook/index.html](http://www.cia.gov/cia/publications/factbook/index.html)). Recalculating the period of intervention reveals that the sector has in reality only been supported for an average of 21 years per country. Given the time required for post-conflict reconstruction, as well as the stop-start nature of donor support, the

average period of support may even be shorter. Moreover, it must be recognized that apart from some traditional fish retention systems, such as brush parks and post-flood, drain-in ponds, aquaculture, *sensu strictu*, is not a traditional activity in sub-Saharan Africa (COFAD, 2002). In addition, the technical and social extension methods that were used in the past are now generally considered as having being inappropriate (COFAD, 2002). Finally, the aquaculture development programmes in all countries were focused almost entirely on the promotion of the small-scale non-commercial sector for food security and improved nutrition, to the virtual exclusion of the commercial sector. This was probably one of the biggest mistakes made by the pioneering proponents of aquaculture in SSA (Hecht, 2000). To expect significant advances and progress in a region with such a legacy and, which is prone to drought and famine, is unrealistic. However, aquaculture is now in a period of rapid transformation in many countries in the region.

Most commercial and artisanal capture fisheries in sub-Saharan African (SSA) countries are declining or are optimally exploited (FAO, 2004a). On the aggregate, this is of serious concern for a region where per capita fish consumption is falling (see Section 4). To maintain the current per capita fish supply in SSA of 6.6 kg/person/year requires a 20 percent increase in production within 10 years and a 32 percent increase by the year 2020 (Delgado *et al.*, 2003; NEPAD, 2005). Juxtaposing the declining capture fisheries of the region, the high population growth rate in SSA and the current shortfall of fish emphasizes the need for rapid growth of the aquaculture sector. Aguilar-Manjarrez and Nath (1998) show that SSA has the bio-physical resources to increase production significantly and estimated that small-scale fish farmers on only 0.5 percent of the total area potentially available, could produce 580 000 tonnes, or 35 percent of Africa's increased fish by 2010. Ironically, but perhaps not intentionally, this projection again neglects the role of commercial aquaculture. It will be shown later that it is highly unlikely that small-scale fish farming could conceivably achieve these targets and emphasizes the urgent need to grow the commercial sector. Aquaculture is no panacea for hunger or nutritional or economic deprivation. However, it can supplement and complement fish supply (ICLARM and GTZ, 1991) and can contribute towards the creation of wealth. For the region to realise greater self sufficiency a quantum shift in institutional and private sector interest and investment, as well as donor support (though with a different focus as before) is required.

### 1.3 Regional demographic and economic review

Table 1 summarizes some demographic and economic indicators to gain some perspective on the region. The total population of the 17 target countries is 465 million people. The average population growth in the region is 2.5 percent. There is a high degree of poverty in the region. This is illustrated by the high mean (HP1) poverty index of 41.0, the percent of people living in poverty (68.5 percent) and in extreme poverty (38.3 percent), the low average per capita GDP of US\$603, the high average infant mortality of 106 per 1 000 births, and the low average life expectancy of 43.9 years. The situation in SSA is compounded by the HIV infection rate in the age range of 15 to 49 years, which ranges from a low of 1.7 percent in Madagascar to 21.5 percent in South Africa. The GDP spread among the countries ranges from US\$442 to US\$159 886 million. Except for South Africa, Nigeria, Ghana and Côte d'Ivoire where more than 40 percent of the population has access to electricity, access to power in the remainder of the countries ranges from 4 to 21 percent of the population. In six countries less than 10 percent of the population has access to electricity (World Resources Institute, [www.earthtrends.wri.org](http://www.earthtrends.wri.org)). Nigeria and South Africa are the two economic giants in the region though there is no relationship between GDP ( $r^2 = 0.0012$ ) or per capita GDP ( $r^2 = 0.009$ ) and aquaculture production. The majority of the population throughout the region is rural (60.5 percent). The rate of urbanization for the period 2000 to 2005 is high with a mean of 4 percent, ranging from 1.9 percent in Zambia to as high as 5.7 percent in Sierra Leone.

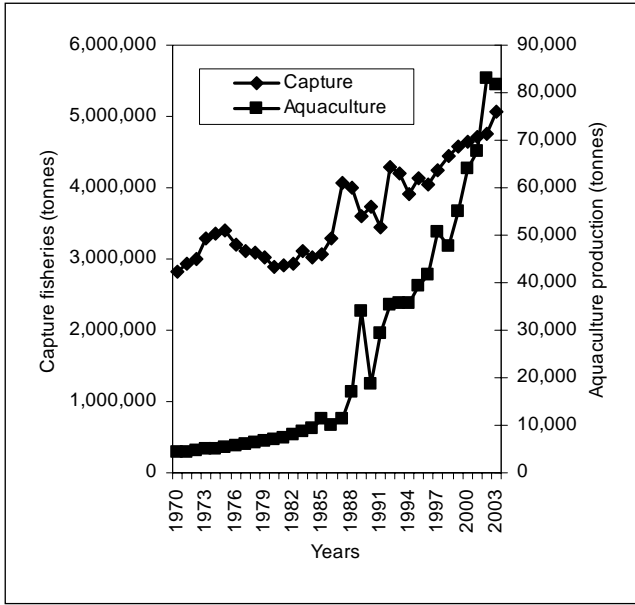
**Table 1. Summary demographic, economic and human indicator statistics (arranged by decreasing GDP).**

COUNTRY	GDP (\$millions)	GDP (\$ per cap)	Pop. (millions)	Growth rate (%)	Rural population (%)	Urban growth rate (%)	Infant mortality (per 1000)	Life expectancy (years)	Poverty <\$2 (<\$1) per day (% of pop)	Access to electricity (% of pop)	HIV inf. rate(15-49) (% of pop)
South Africa	159 886	3 554	45.02	0.6	44.5	1.4	52	47.7	24(7)	66.1	21.5
Nigeria	50 202	405	127.1	2.5	51.7	4.4	100	51.5	91(70)	40	5.4
Kenya	13 842	431	32.4	2.3	58.4	4.4	78	44.6	59(23)	8	6.7
Côte d'Ivoire	13 734	824	16.9	1.6	54.2	2.6	116	41.0	50	50	7.0
Angola	13 189	969	14.1	3.2	62.8	5.4	154	40.1		12	3.9
Cameroon	12 449	774	16.3	2.9	47.1	3.4	95	46.2	50(17)	20	6.9
Tanzania	9 872	267	37.7	1.9	62.5	4.9	104	43.3	60(20)	11	8.8
Ghana	7 659	366	21.4	2.7	53.7	3.2	60	57.9	79(45)	45	3.1
Uganda	6 198	240	26.7	3.4	87.6	3.9	83	46.2	79	4	4.1
Congo, DRC	5 600	106	54.4	2.8	67.3	4.4	129	41.8		7	4.2
Madagascar	5 459	314	17.9	3.0	73.0	3.6	84	53.6	83	8	1.7
Mozambique	4 320	229	19.2	2.4	62.0	5.1	128	38.1	78(38)	7	12.2
Zambia	4 299	398	10.9	1.2	63.5	1.9	102	32.4	87(64)	12	16.5
Congo	3 510	943	3.8	3.2	45.6	3.4	81	48.2		21	4.9
Malawi	1 731	143	12.3	2.0	82.8	4.6	113	37.5	76(42)	5	14.2
Sierra Leone	793	160	5.2	1.9	59.8	5.7	166	34.2	75(57)		
Liberia	442	131	3.5	4.1	52.1	5.3	157	41.4			5.9
Total	313 185		465								
Mean		603.1		2.5	60.5	4.0	106.0	43.9	68.5 (38.3)	21.0	7.9
Range	442-159 886	131-3 554	3.5-127.1	0.6-3.4	44.5-87.6	1.4-5.7	52-166	32.4-57.9	24.0-65.5 (<\$2) 7.0-70(<\$1)	4-50	1.7-21.5

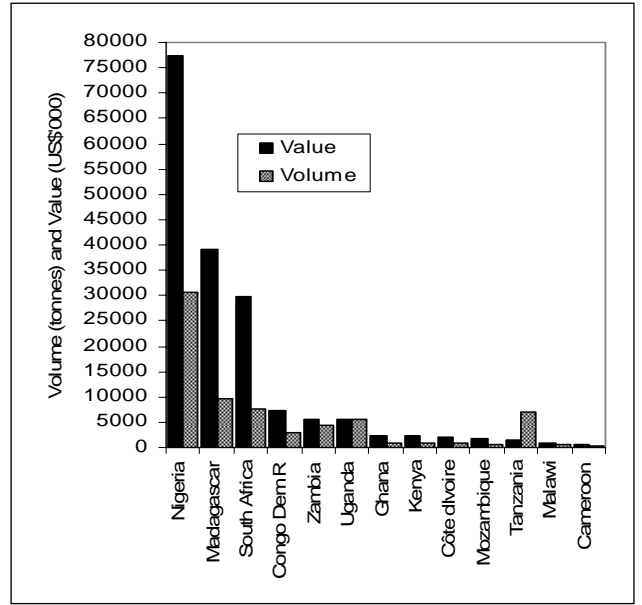
Source: World Resources Institute, Washington (<http://www.earthtrends.wri.org>), World Bank (<http://www.worldbank.org>), FAO

Figures 2, 3, 4 and 5 (FAO FISHSTAT Plus data) provide a perspective on the state of aquaculture in SSA and reveal the following salient points.

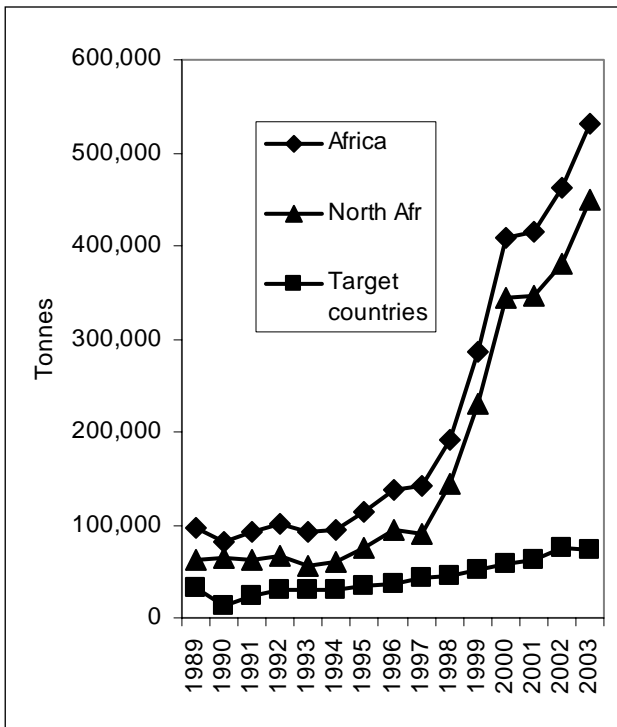
- Aquaculture production only contributes 2.03 percent (72 334 tonnes) to the total fisheries yield of the target countries (3.6 million tonnes) (Figure 1).
- In terms of volume and value Nigeria, followed by Madagascar, South Africa, Uganda and Zambia are the five top producing countries in the region (Figure 2). These countries produce close on 58 000 tonnes of the target country total of 72 300 (80 percent), while the remaining 12 countries only contribute some 14 300 tonnes.
- Aquaculture production in the target countries has increased at a mean annualized rate of 7.1 percent in the last 15 years and by 10 percent during the last five years (Figure 3). In comparison, the annualized growth rate of African aquaculture during the last 15 years was 30.2 percent principally because of the massive increase in production by Egypt.
- In comparison to North Africa the growth of the aquaculture sector in the SSA target countries is extremely modest (Figure 3).
- On a proportional basis, aquaculture in SSA has not kept pace with the growth of the sector on the continent. During the last 15 years (1989–2003) production has increased by 107 percent in the SSA target countries, while the sector has grown by 453 percent in Africa as a whole. Figure 4 shows that the contribution by SSA has since around 1993 declined in proportion to the contribution by North Africa. However, there are encouraging signs in many target countries that the sector is rapidly gaining ground and this will be discussed later in the report.



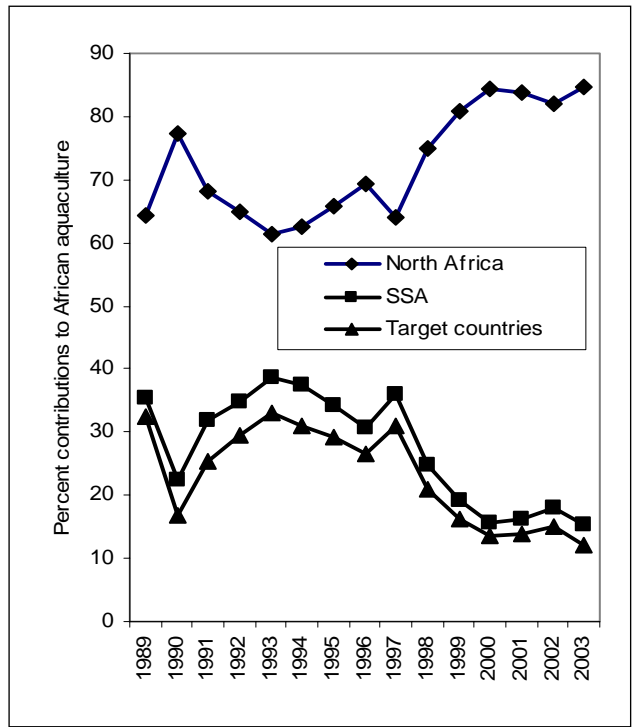
**Figure 2. Capture fisheries yield and aquaculture production in target countries.**



**Figure 3. Aquaculture production in target countries by value and volume.**



**Figure 4. Aquaculture production in target by countries relative to Africa and North Africa.**



**Figure 5. The proportional contribution (%) region to African aquaculture production.**

## 1.4 Farming systems

### *Non-commercial fish farming*

The non-commercial fish farming sector is a fairly homogenous “low input-low output” activity throughout the region. Typically, a farmer owns between 1 and 3 ponds with an average size of 210 m<sup>2</sup>, range 50 to 1 000 m<sup>2</sup>. Normally aquaculture is integrated to some degree with horticulture and or animal husbandry and the products are internalized by the owners. The level of management is low and family labour is the norm. In all countries, it forms part of an agricultural diversification strategy and is not normally the main activity of its practitioners.

Cichlids (*Oreochromis* and *Tilapia* spp.) are the most commonly used species, though polyculture with *Clarias gariepinus* and *Cyprinus carpio* is practised in Cameroon, Côte d’Ivoire, Malawi, Kenya and Uganda. In most instances, mixed sex populations are used, though all male culture is advocated in several countries (Côte d’Ivoire, Ghana, Cameroon, Kenya and Malawi). *O. niloticus* has been introduced into all target countries on the assumption that this species would lead to “increased” production levels on non-commercial small-holder farms. However, several NASOs reveal that this species is prone to the same degree of stunting and poor performance as other cichlids if they are not adequately fed and ponds not adequately fertilized.

Fingerlings are obtained from ponds after harvest, from the wild or obtained free (or purchased) from Government stations (see Section 6) and stocked at 2–5/m<sup>2</sup>. Fingerling quality is a major constraint throughout the region. Low quality feeds (mainly different types of bran) are used and pond fertility is enhanced by green compost cribs or application of low levels of animal manure, though more cost effective inorganic fertilizer is now used in 10 of the 16 target countries. This is a major step forward. Final average weight rarely exceeds 100 g per fish. Mortality rates may range between 10 and 50 percent (Hecht, unpublished data). Irrespective of the species used the average reported production level by non-commercial farmers is still very low, with a mean of 1.03 tonnes/ha/year (range 0.28 tonnes to 3.2 tonnes/ha/year), which equates to around 20 kg/year for the average 210 m<sup>2</sup> pond. Under donor supported and controlled participatory research conditions and using farm made feeds, production levels of over 4 tonnes/ha/year, with various species under mono or polyculture conditions, e.g. *O. niloticus*, *O. andersonii*, *O. macrochir*, *O. karongae*, *Clarias gariepinus* and *Cyprinus carpio*, have been achieved in Cameroon, Ghana, Malawi, Sierra Leone and Zambia. However, the sustainability of such production levels depends entirely on the level of risk that the farmer is prepared to take after the “participatory event”. For example, Coche, Haight and Vincke (1994) reviewed 54 aquaculture projects and found that less than ten were rated as having “good sustainability”.

Overall, the NASOs suggest that few advances have been made and several countries report that the sector has not progressed since the 1960s (e.g. Kenya, Congo (Democratic Republic), Mozambique, Sierra Leone). There has been a sustained increase in the number of small-holder farm ponds, though in some countries fish ponds are being abandoned or not used (e.g. in Ghana 37 percent, Congo (Democratic Republic) 80 percent, Sierra Leone 41 percent and Malawi 35 percent of ponds are abandoned). In Congo (Democratic Republic) and Sierra Leone ponds were abandoned because of war. Andrew, Weyl and Andrew (2003) found that the principal reason for this in Malawi was that inputs (food, manure and labour) do not justify the returns (see Box 1 for comment on farmer motivation) or because ponds were built in unsuitable areas (soil type and or water shortage).

There is good evidence from Cameroon, Malawi and Uganda to suggest that production can be increased to >2.5 tonnes/ha/year through participative on-farm research and extension (Brummett, 2005), with emphasis on integration, the optimal use of agricultural by-products, the correct species mix and improving fingerling quality. However, it needs to be made very clear that this has only been achieved within the context of donor supported projects. If this can be achieved throughout the region then fish production by the non-commercial sector could be increased significantly. This is illustrated in the scenarios in Table 2 on the assumption that the current total pond surface area in the target

countries is entirely under non-commercial production and fully utilized. Though this is highly unlikely and very speculative, the analysis shows that at 2.5 tonnes/ha/year some 166 284 tonnes could be produced per annum.

**Table 2. Theoretical non-commercial fish production in target countries using current total pond surface area at two production levels (current, 1.5 and 2.5 tonnes/ha/year) and value calculated on the average price of fish in all target countries.**

<b>Estimated non-commercial total surface area under culture</b>	<b>Volume and value at current average production of 0.95 tonnes/ha/year and US\$2.43/kg</b>	<b>Volume and value at current average production of 1.5 tonnes/ha/year and US\$2.43/kg</b>	<b>Volume and value at 2.5 tonnes/ha/year using current surface area and US\$2.43/kg</b>
66 513 ha *	63 188 tonnes US\$153.5 million	99 770 tonnes US\$242 442	166 284 tonnes US\$404.1 million

\* = Calculated from NASOs.

#### *Commercial fish farming systems*

Depending on the product produced, commercial farming systems are characterized by higher levels of management, capital investment, higher levels of quality control and a more complex and structured market.

Fish farming systems, at various levels of intensification, include ponds, raceways, pens, cages and re-circulating systems. Ponds range from 500 m<sup>2</sup> to 2.5 ha with production levels of 3–10 tonnes/ha/year with inorganic or animal manure. Raceways are used mainly for trout and tilapia. Pens and cages (square and round) range from 15 m<sup>3</sup> to 1 600 m<sup>3</sup> and are used for farming of tilapia, trout, clariid and bagrid catfish and high-density water recirculation systems are used for fingerling and table fish production of African catfish in Nigeria and South Africa. There are about 30 re-circulating farms in southern Nigeria (mainly around Lagos) and some reportedly produce 3 tonnes of fish per week, using imported extruded pellets as a starter feed. Rice/fish culture is practised mainly in Madagascar and Nigeria. The commercial fish farming sector is best developed in Nigeria, where it comprises approximately 20 percent of fish farmers and 80 percent of production. Commercial farms are either owned by individuals, business consortia, national or foreign companies or joint venture companies and are either owner-managed or by appointed local or expatriate managers. Except for Nigeria, Zambia and South Africa, commercial fish farming is a relatively recent initiative having developed particularly during the last 5 to 8 years. Commercial fish farms use farm made feeds, locally produced pellets or imported formulated feeds. In all countries where pelleted feeds are available the quality is reported to be poor (high level of fines) and unstable in water, except South Africa.

There are now some 2 600 reported commercial farms of various sizes in Nigeria, and in Uganda the number of commercial operations has increased by over 25 percent in the last five years. Zambia has had a commercial fish farming sector since the early 1980s and currently the focus there is on the expansion of *O. niloticus* cage culture in Lake Kariba. Large-scale commercial cage culture of *O. niloticus* in the region was pioneered by Lake Harvest (Pty) Ltd in Zimbabwe, currently producing around 2 800 tonnes/year (Patrick Blow, Lake Harvest, Kariba, Zimbabwe, pers. comm.). The success of this export-orientated venture has encouraged investment on the Zambian side of the lake and has also influenced the development of large-scale cage culture in Malawi. Other countries where commercial fish farming is reported to be making rapid progress are Côte d'Ivoire, Congo (Republic of), Ghana, Kenya and Madagascar.

The majority of the emerging commercial farms, particularly in Nigeria and Uganda, are reported to be in close proximity to markets and peri-urban areas. Aquaculture in peri-urban and urban areas is also developing in Cameroon, Tanzania and South Africa (Rana *et al.*, 2005) and is developing in a similar fashion as it has elsewhere in the world (Costa Pierce *et al.*, 2005). Aquaculture in peri-urban and urban areas is practised mainly by ex-civil servants, teachers, engineers and trained unemployed youth, while women are in charge of marketing. In Nigeria, fish are raised in tanks of varying sizes ranging from 1–50 m<sup>3</sup> using “home grown” intensive technologies, with stocking densities ranging from 10–100 kg/m<sup>3</sup>. In Uganda the “peri-urban” fish farmers use earthen ponds. Of particular interest is that 43 percent of these farmers have a tertiary education, 19 percent secondary, 26 percent primary and 12 percent have vocational training (Rana *et al.*, 2005).

Dedicated commercial hatcheries are emerging in several countries and technologies range from open or closed systems, aeration, cichlid egg harvesting, controlled egg incubation, intensive catfish larval and juvenile rearing. Market forces have reduced prices, which in the past were too high, to mutually acceptable levels. Progressive fingerling producers in Kenya and Uganda have become aware of the good market for *Clarias* fingerlings as live bait in the longline fishery for Nile perch in Lake Victoria and have switched from their “traditional” forms of fish farming to becoming full-time catfish fingerling producers. Catfish hatchery technologies such as induced spawning and larval rearing are well developed. Larval feeding is achieved with egg yolk, greenwater with high densities of zooplankton and *Artemia*. The fingerling demand from the long line fishery is seasonal. Market price depends on size. Two sizes are produced (2 months and 4 month old fish), that sell at US\$0.20 and US\$0.80 per piece. Smaller 1 month old fingerlings are sold to farmers for grow-out at US\$0.05 to US\$0.08.

Fingerling supply in all countries remains problematic. Even in Nigeria and Uganda, which are the two major producing countries, fingerling supply is inadequate and limiting the expansion of the sector. For example, Nigeria has a calculated need for over 2.5 billion fingerlings per annum but only produces some 55.8 million fingerlings, a shortfall of over 4 000 percent. Some re-circulating hatcheries in southern Nigeria produce 350 000 catfish fingerlings per month. There is a clear need to support actively the establishment of commercial hatcheries. In particular, such hatcheries should be promoted in areas that have been specifically zoned for aquaculture such that they can provide the necessary quality seed at fair prices. Derelict Government stations offer the ideal opportunities to achieve a better supply of quality fingerlings as many were built in the most suitable areas for fish farming. Fingerling production in Madagascar now seems to be a completely private sector initiative and most ex-government stations now produce fingerlings commercially. Experience in many countries has shown farmers are prepared to pay for quality fingerlings (Madagascar, Uganda, Nigeria) and that production (and the enthusiasm of farmers) can be significantly increased if they have easy access to good quality seed. The requirement for quality fingerlings again highlights the need to privatize Government stations wherever possible (FAO, 2000).

In the last five years, significant advances have been made by the commercial fish farming sector throughout the region. Given the potential of the sector to supplement the growing need for fish in the region it is fair to conclude that lead agencies, their partner institutions such as FAO and donors should focus more on the emerging commercial farmers than the non-commercial sector. In particular, this support should focus on advancing and enabling platforms for development. The strategic options for these may differ between countries. Several countries are however fortunate in that the action plans to develop such platforms are outlined in their Strategic Aquaculture Development Plans. They must now be implemented.

### *Seaweed culture*

Seaweed culture in the region was pioneered on the Island of Zanzibar during the mid 1980s (Pettersson-Lofquist, 1995). The cultivation technique used in Tanzania and Mozambique is known as the “tie-tie” system, whereby fronds of seaweed are tied to ropes ( $\pm 20$  m) that is stretched between pegs. Each farmer tends 90–120 lines. The ropes are placed in the shallow inter-tidal lagoons that are



found inside the fringing reefs. Seaweed is harvested every 40 days, and in Tanzania, the growing season lasts eight months of the year. Floating long-lines, rafts and tanks are used in South Africa. Effluent water from abalone farms is used in seaweed tank culture. There is enormous room for the expansion of seaweed farming in most maritime countries and for the intensification and modernization of the technology.

#### *Prawn culture*

The technologies employed in the farming of prawns in Madagascar and Mozambique include highly sophisticated hatcheries and normal pond farming techniques for grow-out, at extensive to intensive stocking densities. Mozambique does not permit intensive prawn farming by law and all farms comply. Feeds are imported from Asian countries, Seychelles and South Africa. Most of the companies are vertically integrated and produce, process, pack and export to niche markets. Processing and packing facilities are Hazard Analysis and Critical Control Point (HACCP) compliant and product is inspected for quality by state departments and in many instances by the buyers. In all respects, the prawn farming industry in Madagascar and Mozambique is modern, highly quality conscious and practised in a responsible manner. It would be advantageous for countries with the potential for prawn farming to copy (where possible) the technologies and the approaches followed by the two leading proponents in the region. Madagascar projects that it will be producing 13 000 tonnes by 2007 and Mozambique is in the process of gearing up for 3 500 tonnes by 2009. Because of the sub-optimal climate in South Africa, farmers are developing appropriate intensive and super-intensive technologies.

#### *Abalone farming*

Abalone are only farmed in South Africa, though Namibia will soon be following suite. The industry was preceded by a very intensive high level research and development phase and the first abalone were exported in 1992. Grow out takes place in land-based pump-ashore systems, consisting of concrete or plastic tanks. Abalone are fed on a locally developed and extruded feed, harvested kelp and/or *Gracillaria* and *Ulva* grown in effluent water from the grow-out units. The highly technical hatchery technology was developed locally. All product is exported either live (80 percent) or canned (20 percent). Production in 2004/2005 was 705 tonnes and it is projected that the industry will produce over 1 000 tonnes in 2005/2006. Hatcheries have refined their technologies and because of current over capacity abalone seed is sold at around US\$0.14 per piece (Britz *et al.*, 2005).

#### *Mussel and oyster farming*

Mussel spat is collected from the wild and grow-out occurs on Spanish raft and or New Zealand long-line systems in Saldanha Bay, South Africa. For a comprehensive account of the technology see Hecht and Heasman (1999).

There is one oyster spat producer in South Africa, though the bulk of spat is imported from Chile or the United Kingdom. Various technologies for grow-out are used, including pump ashore systems for early rearing, inter-tidal racks, long-lines and rafts.

#### *Non-food aquaculture technologies*

The most important of these include the technologies developed for Nile crocodiles in South Africa and now used widely throughout the region (Nile Crocodile Farmers Association of South Africa pers. comm.) and the technologies for ornamental fish (Kaiser *et al.*, 1997).

#### *Emerging technologies*

Technologies for the farming of several species with high commercial potential are currently being developed. Technologies for the spawning and rearing of mudcrab, *Scylla serrata* have been

developed in South Africa (Davis *et al.*, 2005) and grow-out technologies using wild caught juveniles are under trial in Kenya. Rapid advances in R&D are being made in South Africa for the farming of marine fish in abalone pump-ashore facilities and in cages (Rhodes University and industry partners). Pearl culture technologies, similar to those in Seychelles, are being investigated in Kenya.

## 2. PRODUCTION, SPECIES AND VALUES

### 2.1 Production

In terms of total production by weight and value, Nigeria followed by Madagascar, South Africa, Uganda and Zambia were the five leading countries in the region in 2003 producing around 80 percent of the total production of the target countries (Figure 3). Thereafter there is considerable variation in ranking among the countries with respect to quantity and value of product (Table 3), while Table 4 shows that there have been some significant shifts in rank of the 12 most important producers over time. For example, in terms of volume Madagascar was in eighth position in 1990, and by 1995 had moved to second position, which it has maintained. Similarly, in terms of value Madagascar moved from seventh to second position between 1990 and 1995. Nigeria has maintained its leading position, by volume and value. Uganda has made the most significant and consistent upward shifts by moving from thirteenth position in 1990 to fifth position in 2003. Table 5 shows the percent changes that have occurred in the target countries over the last five years and the percent contribution by environment in each. The most notable production increases (>40 percent in volume) have occurred in Cameroon, Congo (Democratic Republic), Kenya, Madagascar, Nigeria, South Africa and the most exceptional change has occurred in Uganda, where the sector has grown by over 1 000 percent in the last five years.

**Table 3. Ranked country production for 2003 by weight (tonnes) and value (US\$'000).**

Country	Weight	Percent	Country	Value	Percent
Nigeria	30 677	42.4	Nigeria	77 253	43.8
Madagascar	9 507	13.1	Madagascar	39 035	22.1
South Africa	7 720	10.7	South Africa	29 912	17.0
Tanzania	7 002	9.7	Congo, DR	7 419	4.2
Uganda	5 500	7.6	Zambia	5 669	3.2
Zambia	4 501	6.2	Uganda	5 500	3.1
Congo, DR	2 965	4.1	Ghana	2 251	1.3
Kenya	1 012	1.4	Kenya	2 220	1.3
Ghana	938	1.3	Côte d'Ivoire	2 131	1.2
Côte d'Ivoire	866	1.2	Mozambique	1 943	1.1
Malawi	666	0.9	Tanzania	1 472	0.8
Mozambique	619	0.9	Malawi	875	0.5
Cameroon	320	0.4	Cameroon	621	0.4
Congo, Rep.	27	0.0	Congo, Rep.	46	0.0
Liberia	14	0.0	Liberia	31	0.0
<b>TOTAL</b>	<b>72 334</b>	<b>100.0</b>		<b>176 376</b>	<b>100.0</b>

Source: FAO FISHSTAT Plus

**Table 4. Country ranking by volume and value (1990–2003).**

Country	Rank by volume				Rank by value			
	1990	1995	2000	2003	1990	1995	2000	2003
Nigeria	1	1	1	1	2	1	1	1
Madagascar	8	2	2	2	7	3	2	2
South Africa	2	5	6	3	1	4	3	3
Tanzania	3	3	3	4	6	6	8	11
Uganda	13	11	9	5	14	12	10	6
Zambia	4	4	5	6	4	2	5	5
Congo, DR	6	7	7	7	5	9	6	4
Kenya	5	6	11	8	3	5	9	8
Ghana	7	8	4	9	8	7	4	7
Côte d'Ivoire	12	9	8	10	9	8	7	9
Malawi	10	10	10	11	11	11	11	12
Mozambique	15	14	16	12	13	14	16	10

Source: FAO FISHSTAT Plus

**Table 5. Changes in aquaculture production from 1998 to 2003 and contribution by environment.**

Country	Total production (tonnes) 1998	Total production (tonnes) 2003	% change last 5 years	2003 % contribution from fresh and brackish water	2003 % contribution from marine
Cameroon	67	320	+378	100	0
Congo, DR	1 993	2 965	+49	100	0
Congo, Rep.	190	27	<sup>1/</sup>	100	0
Côte d'Ivoire	1 000	866	-13	100	0
Ghana	2 900	938	<sup>1/</sup>	100	0
Kenya	300	1 012	+238	100	0
Liberia		14	<sup>2/</sup>	100	0
Madagascar	5 811	9 507	+64	26	74
Malawi	590	666	+13	100	Non maritime
Mozambique		619	<sup>2/</sup>	12	88
Nigeria	21 737	30 677	+41	100	0
Sierra Leone	30		<sup>3/</sup>	100	0
South Africa	5 208	7 720	+48	29	71
Tanzania	7 200	7 002	-3	1	99
Uganda	475	5 500 <sup>4/</sup>	+1 058	100	Non maritime
Zambia	4 180	4 501	+8	100	Non maritime

Source: FAO FISHSTAT Plus and NASOs

Notes:

<sup>1</sup> percentage change not calculated on assumption that production statistics were overestimated for 1998.<sup>2</sup> No production statistics for 1998.<sup>3</sup> No production statistics for 2003.<sup>4</sup> This figure excludes the fish produced from culture based fisheries.

Nigeria, as already mentioned, is the leading producer (by weight and value) of fish. Nigeria has doubled its production from 15 000 tonnes in 1994 to just over 30 000 tonnes in 2003. Uganda, followed by Zambia, are the next largest producers of fish. However, we need to bear in mind that

Nigeria produced some 30 000 tonnes in 2003 in comparison to the 21 600 tonnes produced by the other 16 target countries so the relative differences between Nigeria and all other countries are immense.

There is a significant difference between the price of fish in West African countries in comparison to East and Southern African countries. The average price of fish in West Africa is 56 percent higher than in East and Southern African countries, US\$3.00 (range US\$1.60–4.70) and US\$1.92/kg (range US\$0.86–4.60), respectively. In Sierra Leone the current price for farmed fish is US\$0.30/kg. This outlier was excluded from the calculation of average fish prices. The increase in fish price is no doubt the most important single factor that fuels and drives the development of the sector as a whole and in particular is driving the increases observed in Uganda (W. Mwanja, Principal Fisheries Officer, Entebbe, pers. comm. Sept. 2005). In Malawi during the period 1999 to 2003, the price of fish increased by over 350 percent (Weyl, 2003) and this also triggered the recent (2003/2004) developments in commercial fish farming.

Nigeria has the highest average urban fish price of around US\$4.10/kg. It would be interesting to relate the evolution of the Nigerian aquaculture industry to fish price. It would not be surprising if the major jump in production during the period 1988–1989 from 6 000 tonnes to 25 000 tonnes, was linked to an increase in the price of fish at that time. The increase in the price of fish after the disruption of the commercial sardine fisheries in the Nile Delta, for example, also triggered the rapid development of commercial aquaculture in Egypt (Mellac, 1995). Further increases in fish price, particularly in east and central Africa, will no doubt provide further impetus for the development of the sector. There was no correlation between farmed fish price and per capita GDP, the size of capture fisheries or whether the country is maritime or land-locked. This could however be related to the small sample size (n=16).

Using the information provided in the NASOs, or through information provided by country representatives at the Mombasa meeting (September 2005) it was possible to provide a good guesstimate of the split between commercial and non-commercial production in the target countries (Table 6). Based on this it was possible to obtain a crude estimate of the proportional contribution by volume and value from commercial and non-commercial aquaculture to total production of the target countries (Table 7). The results show that the commercial sector may contribute approximately 65 percent by volume and 69 percent by value to brackish and freshwater production in the target countries (Figure 6). All mariculture products are considered to be commercially produced commodities.<sup>3</sup>

Lead agencies need to be aware of the contributions made by the respective sectors and must recognize the different requirements of the two sectors and should be proactive in providing appropriate institutional platforms for the development of both commercial and non-commercial aquaculture.

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<sup>3</sup> Seaweed farming in the region is generally considered a subsistence activity, though the product is sold to international buyers. On this basis it was argued that seaweed should be classed as a product produced on commercial farms.

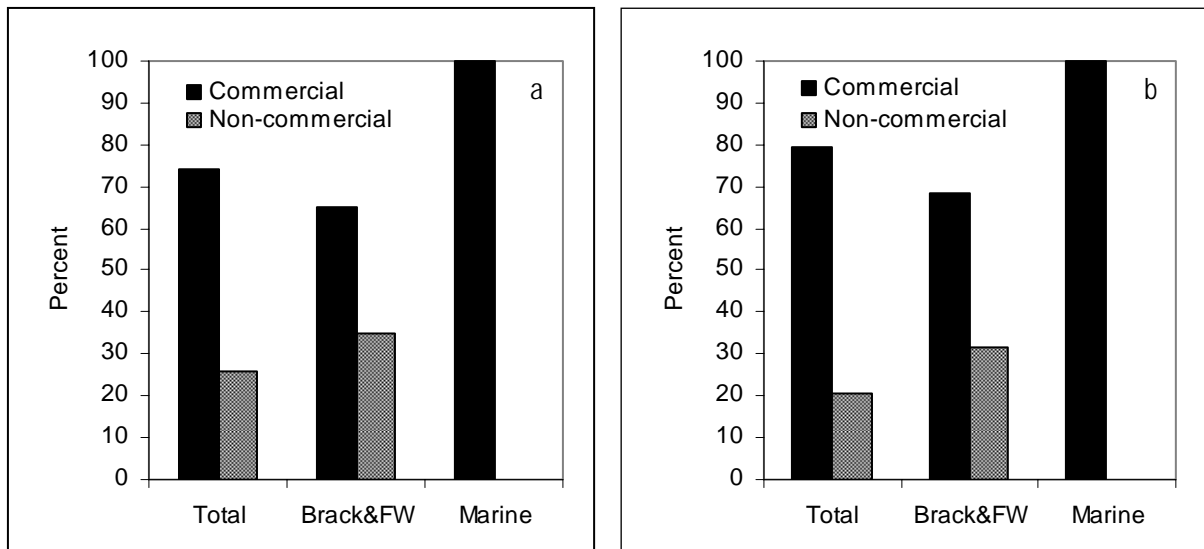
**Table 6. Estimates of the proportion of commercial production in target countries for 2003.**

<b>Country</b>	<b>Percent of fish from commercial farms</b>
Cameroon	All fish of non-commercial origin
Congo, DR	No information, all fish considered of non-commercial origin
Congo, Rep.	No information, all fish considered of non-commercial origin
Côte d'Ivoire	62 percent of fish from commercial farms
Ghana	32 percent of fish from commercial farms
Kenya	100 percent of trout, 15 percent of tilapia and 85 percent of catfish from commercial farms
Liberia	No information, all fish considered of non-commercial origin
Madagascar	36 percent of fish from commercial farms 100 percent of mariculture products from commercial farms
Malawi	100 percent of trout from commercial farm All other fish from non-commercial farms
Mozambique	2 percent of tilapia from commercial cage farm 100 percent of mariculture products from commercial farms
Nigeria	80 percent of fish from commercial farms
Sierra Leone	No information, all fish considered of non-commercial origin
South Africa	100 percent of all products from commercial farms
Tanzania	100 percent of trout from commercial farm. All other fish of non-commercial origin 100 percent of mariculture products from commercial farms
Uganda	40 percent of fish from commercial farms (and projected to be near 60 percent in 2005)
Zambia	75 percent of fish from commercial farms

Source: From NASOs and other national sources of information confirmed by country representatives.

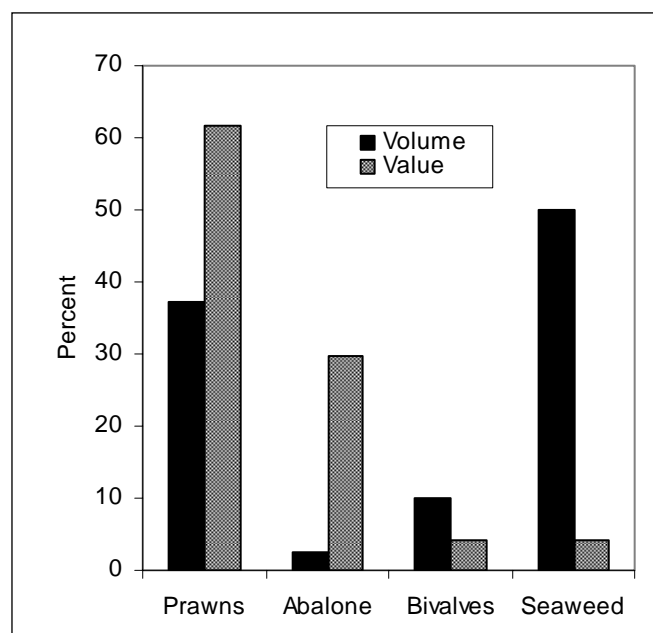
**Table 7. Calculated volume and value of aquaculture products from commercial and non-commercial aquaculture in SSA.**

<b>Environment</b>	<b>Commercial</b>	<b>Non-commercial</b>
Volume (tonnes)		
Fresh & Brackish	34 949	18 889
Marine	20 023	0
<b>Total</b>	54 972	18 889
Value (US\$'000)		
Fresh & Brackish	79 299	36 380
Marine	62 014	0
<b>Total</b>	141 313	36 380



**Figure 6. The calculated percent contribution by (a) volume and (b) value of commercial and non-commercial aquaculture to SSA target country total production in 2003.**

Just over 70 percent of the total SSA production is from the freshwater environment (Table 8). The marine environment contributes 28 percent by volume but 35 percent by value, while brackishwater aquaculture contributes negligible quantities. The main mariculture species are prawns, which contribute around 37 percent by volume and 62 percent by value. Seaweed contributes around 50 percent by volume (wet weight) and bivalves around 10 percent, and both contribute just over 4 percent by value. Abalone contribute just under 3 percent by volume but around 30 percent by value (Figure 7). Given the capital intensive nature of abalone farming it is understandable that there are no “small-scale” producers. “Small-scale” prawn grow-out is only practised on three small farms in Madagascar. Depending on profitability, further opportunities for participation by “small-scale” prawn grow-out farmers should be explored in Madagascar and Mozambique. Small-scale commercial grow-out of mussels and oysters in South Africa has recently been explored and implemented.



**Figure 7. Percent contribution by the various species groups to total mariculture production in SSA target countries (FAO FISHSTAT Plus).**

It is also interesting to note the significant impact that mariculture has on revenue streams. For instance, Madagascar only produces 31 percent of Nigeria's volume but the value of its product is 51 percent of the Nigerian value. This is simply because >70 percent of its production consists of prawns and illustrates the economic benefit of high value species.<sup>4</sup> This is even better illustrated by a comparison of the volume and value of products from Madagascar (mainly prawns) and Tanzania (mainly seaweed). Tanzania's total production is only 26 percent lower by volume than Madagascar but the value of the product is 96 percent lower than the value of prawns produced by Madagascar. Except for Madagascar, South Africa, Mozambique and Tanzania, mariculture in most SSA countries is either non-existent or nascent, though several countries (Angola, Cameroon, Côte d'Ivoire, Ghana and Nigeria on the west coast and Kenya and Tanzania on the east coast) have recognized its potential and are now promoting the development of the sub-sector. Liberia and Sierra Leone have also recognized the potential of mariculture.

**Table 8. The contribution (%) by environment to total regional production by volume and value.**

<b>Environment</b>	<b>Volume (%)</b>	<b>Value (%)</b>
Brackishwater	0.58	0.65
Freshwater	72.3	64.5
Marine	27.1	34.9

Source: FAO FISHSTAT Plus

Madagascar followed by Mozambique are the leading prawn producer countries and because of the responsible manner in which the industry has developed there, have received international recognition for the quality of its product. Over the 11-year period from 1992 Madagascar has consistently increased prawn production from ca. 30 tonnes to over 7 000 tonnes in 2003 (with a value of some US\$35 million).

Tanzania and mainly Zanzibar is now the leading seaweed producer for carageenans. Production has increased steadily from around 600 tonnes in 1989 to over 7 000 tonnes (1 500 tonnes dry weight) in 2003.<sup>5</sup> Seaweed farming is currently only practised on the African east coast in Tanzania, South Africa, Kenya, Mozambique and Madagascar. In Tanzania and Mozambique the sector is facing serious economic threats.<sup>6</sup> One of the two farms in Mozambique has recently (2005) closed down because of the low price paid to producers and Kenya also reported price related problems with the

<sup>4</sup> The farming of high value marine species is capital intensive and may require significant foreign direct investment. For example, prawn farming in Madagascar and Mozambique has attracted considerable foreign direct investment. There are certain important pre-requisites for attracting foreign direct investment and these amongst others include the following – appropriate primary infrastructure such as roads, electricity and telecommunications, an investor friendly environment, competitive investment incentives, institutional capacity and support, good political and financial governance, low or managed inflation, a stable banking system coupled with macro-economic and political stability (Hishamunda and Ridler, 2003). Mozambique (CPI, 2004) and Madagascar have put in place excellent suites of incentives for foreign direct investment with very positive results. Tanzania has now followed suite (Shipton and Hecht, 2005). Through FDI prawn culture in Madagascar has more than doubled in the last 10 years. From a zero base in 1998 prawn production in Mozambique reached around 600 tonnes in 2004 and by mid-2006 when the current farms are fully operational production will reach ca. 3 500 tonnes (Dr. F.Ribeiro, IIP, Maputo, pers. comm., Nov. 2004).

<sup>5</sup> Depending on price it is predicted that production in Tanzania will increase from 1 500 tonnes to 5 000 tonnes (dry weight) by 2007 (Shipton and Hecht, 2005).

<sup>6</sup> There are concerns that the price paid to producers in Tanzania and Mozambique is exploitative. Bryceson (2002) reported that producers were being paid as little as US\$0.09/kg, which at that stage was approximately five to six times less than that received for the same product by farmers in the Philippines. The low price would appear to be largely due to the monopoly structure of the market, which allows for the suppression of the price (Bryceson, 2002 ; Dr Anthony King, IUCN, pers. com., Nov. 2004).

activity. Tanzania has been proactive in this respect and has developed a strategic plan for the future development of its seaweed industry. The bulk of the seaweed produced in South Africa is used as abalone feed.

## 2.2 The species

The NASO data show that some 41 fresh and brackishwater species are used on farms in the target countries (Table 9), while the FAO FISHSTAT Plus data show that the number of species for which production data have been submitted has increased from 12 in 1984 to 31 in 2003. Nigeria produces the greatest variety (15) of species. Though there has been an increase in the number of species for which production figures are now recorded it is not known for certain whether this reflects taxonomic corrections in country returns or whether new species specific culture technologies have been developed in response to market demand.

**Table 9. Freshwater and brackish aquaculture species in SSA target countries.**

Family	Species	Country	Production over 200 tonnes	% contribution
Bagridae	<i>Bagrus</i> spp.	15, 17		<0.1
	<i>Chrysichthys nigrodigitatus</i>	7, 15		<0.1
	<i>Chrysichthys</i> spp.	7		<0.1
Carrasidae	<i>Carassius auratus</i> (A)	10		<0.1
Chanidae	<i>Chanos chanos</i>	11, 15, 17**	3 229	3.0
Characidae	Characid spp.	15	1 713	1.6
Citharinidae	<i>Citharinus</i> spp.	15	2 992	2.8
	<i>Distichodus</i> spp.	15	1 621	1.5
Clariidae	<i>Clarias gariepinus</i>	All except Madagascar	14 390	13.1
	<i>Clarias</i> spp.	7, 15, 18	22 171	20.5
	<i>Heterobranchus bidorsalis</i>	11		<0.1
	<i>Heterobranchus longifilis</i>	8, 11		<0.1
Cyprinidae	<i>Ctenopharyngodon idella</i> (A)	14, 19, 20		<0.1
	<i>Hypophthalmichthys molitrix</i> (A)	19, 20		<0.1
	<i>Cyprinus carpio</i> (A)	3, 10, 12, 13, 14, 18, 19, 20	4 570	4.2
Gymnarchidae	<i>Gymnarchus niloticus</i>	15	5 322	4.9
Hepsetidae	<i>Hepsetus odoe</i>	15	1 935	1.8
Osteoglossidae	<i>Heterotis niloticus</i>	8		<0.1
	<i>Heterotis</i> spp.	15	2 349	2.2
Centropomidae	<i>Lates niloticus</i>	15	4 831	4.5
Centrarchidae	<i>Micropterus salmoides</i> (A)	10, 14, 18, 20		<0.1
Cichlidae	<i>Oreochromis</i> spp.	9, 12, 13, 14, 15, 19, 20	16 144	15.0
	<i>Oreochromis andersonii</i>	19	2 839	2.6
	<i>Oreochromis aureus</i>	7	658	0.6
	<i>Oreochromis macrochir</i>	19		<0.1
	<i>Oreochromis mossambicus</i>	1, 11, 13, 14, 20	214	0.1



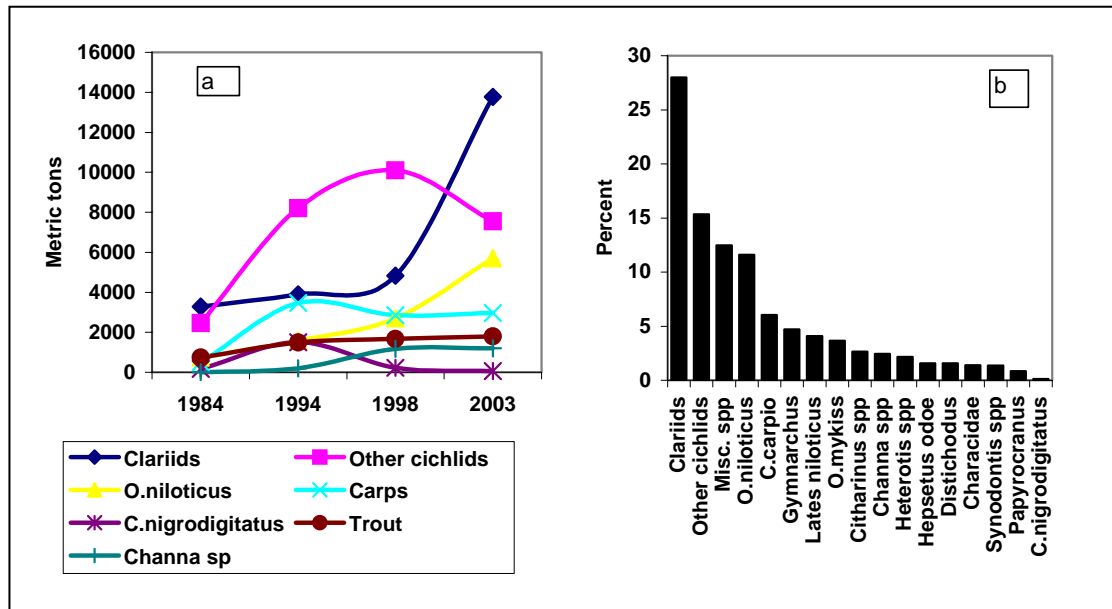
Family	Species	Country	Production over 200 tonnes	% contribution
	<i>Oreochromis niloticus</i> (T)	All except Malawi	7 667	7.0
	<i>Oreochromis shiranus</i>	13		<0.1
	<i>Oreochromis karongae</i>	13		<0.1
	<i>Oreochromis leucostictus</i>	18		
	<i>Oreochromis variabilis</i>	17		
	<i>Oreochromis esculentus</i>			
	<i>Sarotherodon galilaeus</i> (A)	11		<0.1
	<i>Tilapia rendalli</i>	13, 18, 19, 20	200	0.1
	<i>Tilapia zillii</i>	10, 11, 18	200	0.2
	<i>Hemichromis fasciatus</i>	8		
Mochokidae	<i>Synodontis</i> spp.	15	1 538	1.4
Mugilidae	<i>Mugil cephalus</i>	8**, 16*, 17**		
Notopteridae	<i>Papyrocranus afer</i>	15	750	0.7
Salmonidae	<i>Oncorhynchus mykiss</i> (A)	10, 13, 17, 18, 20	2 000	1.8
	<i>Salmo trutta</i> (A)	17, 20		
Cambaridae	<i>Procambarus clarkii</i> (A)	18, 19		<0.1
Parastacidae	<i>Cherax tenuimanus</i> (A)	19, 20		<0.1
Palaemonidae	<i>Macrobrachium rosenbergii</i>	12, 13, 18		<0.1

Asterix codes = \* Failed, \*\* Experimental. Country codes – Angola = 1; Burkina Faso = 2; Cameroon = 3; Central African Republic = 4; Congo, Democratic Republic = 5; Congo, Republic = 6; Côte d’Ivoire = 7; Ghana = 8; Guinea = 9; Kenya = 10; Liberia = 11; Madagascar = 12; Malawi = 13; Mozambique = 14; Nigeria = 15; Sierra Leone = 16; Tanzania = 17; Uganda = 18; Zambia = 19; South Africa = 20; A = Alien and T = Translocated.

Given the dominance of Nigeria in the region, it was decided to consider the production trends and contributions by species to the region as a whole and by excluding Nigeria. In 2003 for the region as a whole, five species (or groups) contributed over 70 percent by weight to total fresh and brackishwater fish production in the target countries (Figure 8b). In order of priority these are *clariid* catfish (*Clarias* species and hybrids with *Heterobranchus* spp.), other cichlids (excluding *O. niloticus*, a miscellaneous unidentified group of species, *O. niloticus*, and *Cyprinus carpio*). Nigeria and Uganda are the largest producers of catfish (10 000 and 3 000 tonnes respectively), contributing 32 and 55 percent to total country production, respectively. The Nile tilapia, *O. niloticus* contributes 12 percent by weight to total regional production but makes up 43 percent of total cichlid production in the region. In 8 out of the 17 target countries *O. niloticus* is the principal production species, viz. Cameroon, Congo (Republic), Côte d’Ivoire, Kenya, Liberia, Sierra Leone, Tanzania and Zambia. Two indigenous cichlids warrant mention. These are *O. andersonnii* and *O. karongae*. *O. andersonnii* is now as important as Nile tilapia in Zambia and about 2 000 tonnes of each is produced. The chambo, *O. karongae* has recently been shown to be an excellent indigenous species for aquaculture in Malawi.

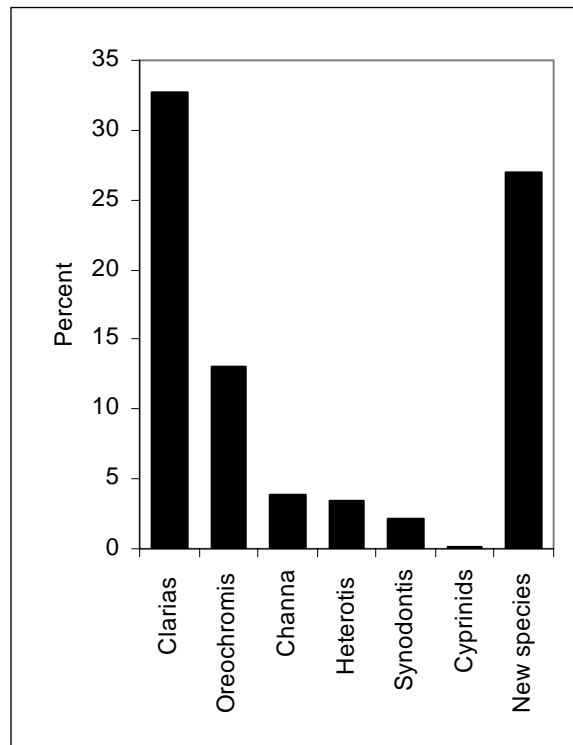
There have been some significant recent changes in the contribution by species to total fish production in the region, particularly in Nigeria and Uganda (Figure 8a). The observed shifts have been attributed to changes in market demands (G. Shimange, Director of Fisheries, Nigeria and W. Mwandja, Princ. Fisheries Officer, Uganda, pers. comm., Mombasa, September 2005). Most notable has been the change in the relative contributions by cichlids and clariids. During the last 10 years (1994–2003) the contribution by cichlids (including *O. niloticus*) fell from 42 percent of total production to 26 percent, while the contribution by *Clarias* species increased from 17 percent in 1994 to 28 percent in 2003

(Figure 8a). The data also reveal that the contribution by *O. niloticus* to total production has increased from 7 percent in 1994 to 12 percent of total production in 2003. The contribution by common carp has dropped sharply from just over 15 percent of total production in 1994 to 6 percent in 2003 (Figure 8a). The farming of Chinese grass and silver carp, though present in many countries (see Table 9), has not been successful in the region. Total regional production was less than 10 tonnes in 2003.



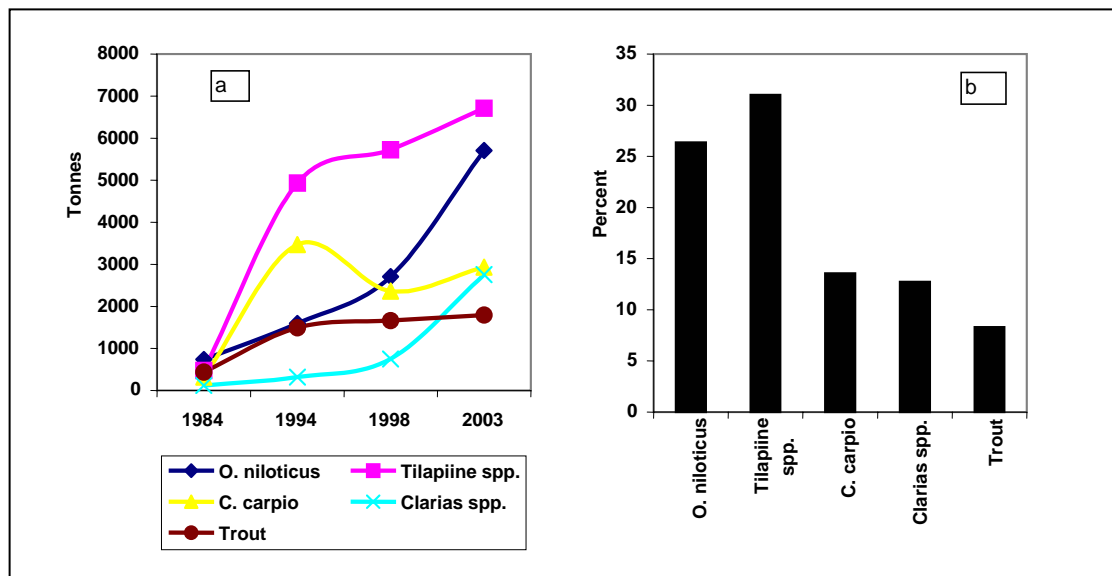
**Figure 8. Production trends of the six most important species (a) and their percent contribution in 2003 (b) to total production in target countries (FAO FISHSTAT Plus).**

These changes are mainly due to the shifts that have taken place in Nigeria in the last decade. The percent contribution in 2003 to the total Nigeria production by species or groups is illustrated in Figure 9. The farming of clariid catfish is advancing rapidly. In 2003 the production of catfish (10 000 tonnes) was more than double the production of cichlids (4 000 tonnes). Several “industries” appear to have been terminated in 1995. Mullet farming which reached a production peak of 1 500 tonnes in 1991 collapsed in 1995. Snapper (*Lutjanus* sp.) farming as well as the culture of *Bagrus* sp. and *Chrysichthys nigrodigitatus* also seem to have been terminated in 1995. The farming of common carp also appears to be on its way out. In 1996 some 7 000 tonnes of carp were produced while only 28 tonnes of production was recorded in 2003. However, in the last five years seven “new” species are being farmed and for which production figures are reported. These include *Gymnarchus niloticus*, *Lates niloticus*, a *Citharinus* species, *Hepsetus odoe*, *Papyrocranus afer*, a *Distichodus* species and a Characidae species. In 2003 these new species contributed 8 276 tonnes (27 percent) to total production.



**Figure 9. The percent contribution by species or groups to total Nigerian production in 2003 (FAO FISHSTAT Plus).**

By excluding Nigeria from the analysis the contribution by species (or groups of species) to regional production changes radically (Figures 10a and 10b). Cichlids then dominate inland aquaculture and contribute 57 percent to total production, followed by cyprinids (14 percent), clariids (13 percent) and trout 8 percent. With the exclusion of Nigeria, *O. niloticus* is the most important species in the region. In particular, the two species that have shown the most significant increases in production are *Clarias* and *O. niloticus* (Figure 10a).



**Figure 10. Production trends of the five most important species (a) and their percent contribution in 2003 (b) to total production in target countries (excluding Nigeria) (FAO FISHSTAT Plus).**

Mariculture is under-developed in the region, though the potential for the sector is enormous. Ten species are currently listed as aquaculture species in the target countries (Table 10). The species for which production figures are reported include two species of prawns (*P.monodon* and *F.indicus*), and three (or four) species of seaweed, abalone (*Haliotis midae*), mussels (*Mytilus galloprovincialis*), oysters (*Crassostrea gigas*) and one finfish species (Turbot, *Scophthalmus maximus*).

Several countries (Angola, Liberia, Mozambique, Nigeria, Tanzania, Kenya and Ghana) have attempted shellfish culture, but these initiatives for several economic, market and environmental related reasons have not been successful. The lesson learnt is that the state, in partnership with donors, should not invest in expensive R&D without the interest and backing of the private sector. Mariculture is inherently more expensive than freshwater aquaculture and its success is entirely dependent on the market and the interest of the private sector and requires comprehensive business and environmental planning.

**Table 10. Mariculture species in SSA target countries.**

Species	Country	Volume (tonnes)	Value US\$'000
Crustaceans			
<i>Penaeus monodon</i>	10, 12, 14, 17	7 173	35 860
<i>Fenneropenaeus indicus</i>	14, 20	301	2 447
<i>Artemia salina</i>	12	<1	
<i>Scylla serrata</i>	10**, 20**		
Seaweed			
<i>Eucheuma denticulatum</i> (A)	14, 17	7 200	1 470
<i>Kappaphycus alvarezii</i>	14, 17	210	205
Misc. seaweed	20	2 824	1 064
Fish			
<i>Lutjanus</i> spp.	15	<1	
<i>Scophthalmus maximus</i> (A)	20	10	77
<i>Argyrosomus japonicus</i>	20	<1	
<i>Salmo salar</i>	20	<1	
Shellfish			
<i>Perna perna</i>	1*, 14*, 20*		
<i>Mytilus galloprovinciales</i> (A)	1**, 20	1 500	997
<i>Crassostrea tulipa</i>	16*		
<i>Crassostrea gigas</i> (A)	20	500	1 598
<i>Haliotis midae</i>	20	515	18 465

Asterix code = \* Failed, \*\* Experimental

Country code: Angola = 1; Kenya = 10; Madagascar = 12; Mozambique = 14; Nigeria = 15; Sierra Leone = 16; Tanzania = 17; South Africa = 20; A = Alien or translocated

Two seaweed species are farmed (for carageenans) in Tanzania, Mozambique and Madagascar. These are *Kappaphycus alvarezii* (= *Eucheuma cottonii*), which is indigenous to Tanzania and Mozambique and *Eucheuma denticulatum* (= *E. spinosum*), which was introduced from the Philippines. *E.denticulatum* has a lower market value than *K. alvarezii*. In South Africa seaweed is farmed mainly for abalone food.

There are 14 alien and 1 widely translocated species that contribute to freshwater and mariculture in the region. Their contribution to aquaculture in the region and their impact on the environment is discussed in Section 5. The list of alien species introduced into the various target countries is by no means exhaustive and complete. For example 21 alien species were introduced into Madagascar between 1857 and 1992 (Madagascar NASO, and Rafomanana, 1994).

### 3. ECONOMICS AND TRADE

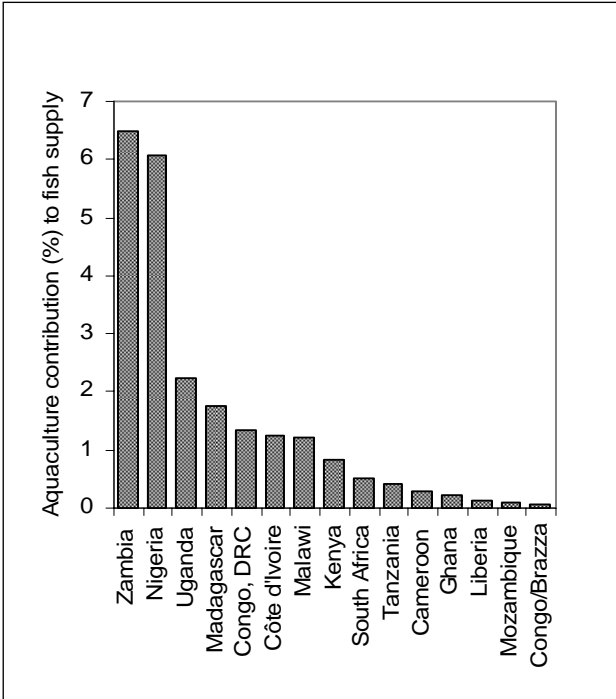
Aquaculture makes a minor contribution to overall fish and protein supply and GDP in the region. This is illustrated in the following set of figures and tables. Given the problems associated with the FAO FISHSTAT Plus statistics as well as the data contained in the NASOs and other national sources (see Box 3) the summary information presented below should be considered, at best, to provide only a very generalized picture of the developments and current status of the sector in the region.

#### **BOX 3. Data problems**

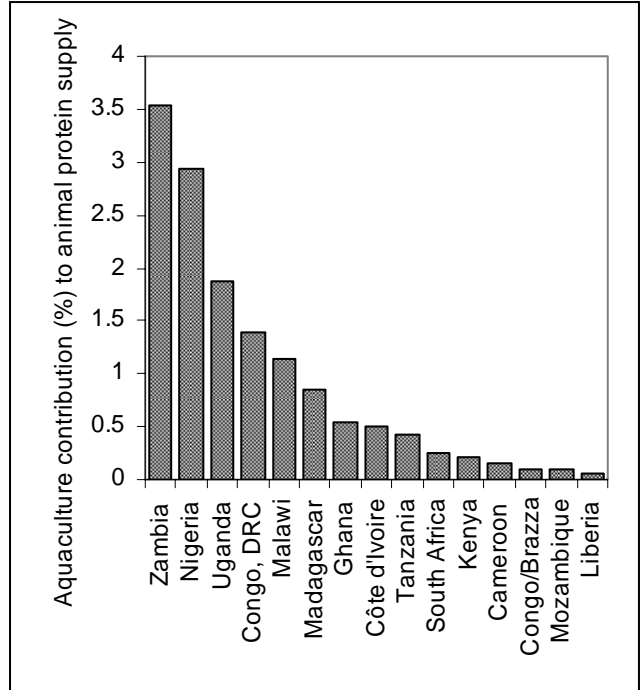
It is clear from most of the NASOs that the collection of accurate statistics is fraught with problems brought about mainly by the lack of financial and human resources. In most instances total production from non-commercial (mainly small-holder) aquaculture is calculated using an estimate of the total number of ponds per district or province, average pond size, multiplied by an “average” production figure. On the assumption that this practice is the norm rather than the exception, then the FAO statistics can at best be used to compare the relative status of aquaculture development among and between countries. The following examples illustrate the point. Firstly, in one of the NASOs annual production from 212 ha is estimated at 1 522 tonnes. This translates to 7.2 tonnes/ha/year, which for resource poor farmers in the specific country is impossible. Secondly, in a recent comprehensive survey of aquaculture in Malawi, which informed the development of the National Aquaculture Strategic Plan, Andrew, Weyl and Andrew (2003) calculated that total production in 2002 was between 50 and 117 tonnes/year. This is 93 to 85 percent lower than the official estimate of 800 tonnes for 2002. Thirdly, and conversely, the production figures from intensive catfish culture are not included in the official production figures for Nigeria and actual production may be 10 000 tonnes higher than reported. These anomalies suggest that the findings presented below should be viewed with circumspection and merely provide a general picture of the status of the sector in the region.

Agriculture and fisheries are important primary sectors in most of the target countries. By comparison, aquaculture is an emerging sector. In this section, an attempt is made to put the primary sectors into some sort of perspective, with respect to protein provision and consumption patterns within the target countries. The following suite of figures (Figures 11, 12, 13 and 14) and Table 11, based on data obtained from FAOSTAT and [www.earthrends.wri.org](http://www.earthrends.wri.org), show that;

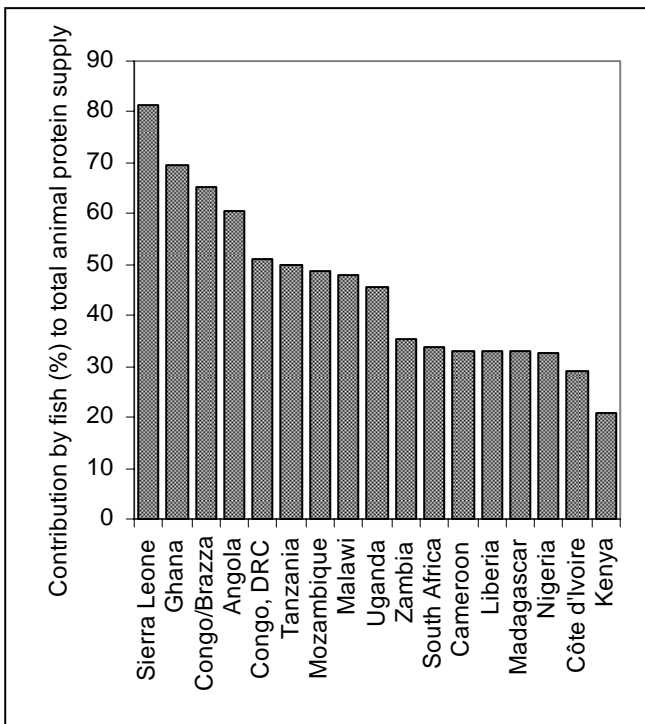
- Except for Zambia, Nigeria, Madagascar and Uganda, aquaculture makes an insignificant contribution to total fish supply (mean = 1.5 percent, range 0.05–6.47 percent) and total animal protein supply (Mean = 0.61 percent, range 0.004–2.6 percent) (Figures 11 and 12 and Table 11).
- In most countries, except Sierra Leone, Ghana, Guinea, Congo (Republic), Angola and Congo (Democratic Republic), meat production exceeds fish supply (capture fisheries plus aquaculture but excluding imports).
- Meat is the most important animal protein source in the target countries (Figure 13 and Table 11) (Meat per capita consumption = 12.4 vs. fish = 10.5 kg/person/year and see further comment in Section 4).
- Excluding Angola, Congo (Republic) and Kenya where oil, minerals and tourism, respectively, are the major contributors to GDP, the contribution by agriculture is significant. The average contribution by agriculture to GDP in the target countries is 33 percent and ranges from 22 percent in Zambia to 58 percent in Congo (Democratic Republic) (Table 11). Aquaculture, relative to agriculture, contributes an insignificant proportion to GDP (mean = 0.10 percent, range = 0.001–0.715 percent) (Figure 14).
- The contribution by aquaculture to GDP, total fisheries yield and overall animal protein supply is insignificant. However, the sector as a whole has an important social and economic impact throughout the region (see Section 4).



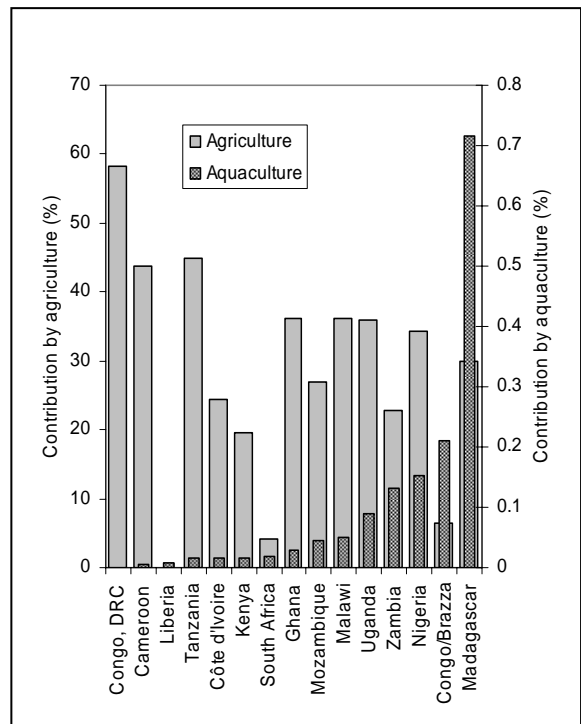
**Figure 11. Percent contribution by aquaculture to total fish supply (excluding abalone, prawns and seaweed).**



**Figure 12. Percent contribution by aquaculture to animal protein supply (excluding abalone, prawns and seaweed).**



**Figure 13. Percent contribution by fish (capture fisheries plus fish production) to total animal protein supply.**



**Figure 14. Percent contribution by agriculture and aquaculture to GDP.**

**Table 11. Summary statistics of protein supply indicators in SSA target countries (arranged in order of descending contribution by agriculture to GDP).**

Source	Agriculture contribution to GDP (%) 1999-2002 WRI & Rep	Aquaculture contribution to GDP (incl. prawns abalone & seaweed) Calc. (%)	Meat production (t) 2003 WRI & Rep	Capture fisheries (t) 2003 FAO	Aquaculture production (excl. prawns abalone & seaweed) (t) 2003 FAO & Rep.	Fish as % of total animal protein supply 2002 Calc. (%) (Excl. imports & exports)	Aquaculture contribution to fish supply Calc. (%) (Excl. imports & exports)	Aquaculture contribution to animal prot. supply (excl. abalone prawns & seaweed) Calc. (%)	Per capita meat consump. (kg/yr) 2002 WRI	Per capita fish consump. (kg/yr) 2003/4 WRI & Rep
<b>COUNTRY</b>										
Congo, DRC	58	0.001	211 909	220,000	2 965	51.3	1.33	1.4	4.8	5.9
Sierra Leone	48		22 449	96,926		81.2			6.1	15.2
Tanzania	45	0.015	360 540	356,521	1 522	49.8	0.43	0.4	10.0	7.0
Cameroon	44	0.005	218 391	107,801	320	33.1	0.30	0.1	14.4	14.0
Malawi	36	0.051	58 684	53,543	666	48.0	1.23	1.1	5.1	3.5
Ghana	36	0.029	172 018	390,756	938	69.5	0.24	0.5	9.9	29.0
Uganda	36	0.089	292 751	239,931	5 500	45.6	2.24	1.9	11.7	7.3
Nigeria	34	0.154	1 041 963	475,162	30 677	32.7	6.06	2.9	8.6	7.3
Madagascar	30	0.715	297 067	142,731	2 550	32.8	1.76	0.9	17.6	7.7
Mozambique	27	0.045	94 050	89,077	90	48.7	0.10	0.1	5.6	2.1
Côte d'Ivoire	24	0.016	170 084	68,903	866	29.1	1.24	0.5	11.3	14.6
Zambia	23	0.132	127 074	65,000	4 500	35.4	6.47	3.5	11.9	6.5
Kenya	20	0.016	455 732	119,787	1 012	21.0	0.84	0.2	14.3	4.4
Angola	7		138 610	211,539		60.4			19.0	15.0
Congo/Brazza	6	0.211	27 911	52,373	27	65.2	0.05	0.1	13.3	19.8
South Africa	4	0.019	1 686 362	854,854	4 381	34	0.5	0.3	39.00	7.6
Liberia	?	0.007	23 016	11,300	14	33.0	0.12	0.1	7.9	4.5
<b>Total</b>			<b>5 398 611</b>	<b>3 556, 04</b>	<b>56 028</b>					
<b>Mean</b>	<b>29.9</b>	<b>0.100</b>				<b>45.3</b>	<b>1.5</b>	<b>0.9</b>	<b>12.4</b>	<b>10.1</b>
<b>Range</b>	<b>4-58</b>	<b>0.001-0.715</b>				<b>5.8-69.5</b>	<b>0.05-6.47</b>	<b>0.09 - 3.54</b>	<b>4.8-39.0</b>	<b>2.1-29</b>

Source: WRI = World Resources Inst. [www.earthtrends.wri.org](http://www.earthtrends.wri.org), FAO = FISHSTAT Plus, FAOSTAT, Rep = NASOs&PAFADs, Calc=Calculated

### 3.1 Markets

As mentioned in Box 1 (Definitions), the major distinction between the two categories of farmers is that non-commercial farmers consume the bulk of their produce. However, the underlying motivation for the farming of fish by both categories is identical. All want to make money, though on aggregate non-commercial farmers do not have adequate resources to afford the necessary inputs to improve production.

On the whole, the fish produced by non-commercial farmers is for home consumption, while the remainder in all countries is sold either ex-farm gate or on nearby rural markets. The market chain is short and was most typically recorded as – farmer to consumer. Very rarely, except in Ghana, Cameroon, Nigeria, Uganda was mention made of middlemen or women (fish mummies) who buy fish from farmers and sell on village, rural or urban markets.

The lack of adequate infrastructure is most often advocated as the principal reason for the poor progress of aquaculture product marketing. The situation is perhaps best summarized by Brummett (2005) who reported that, “Market failures are posited to lie chiefly behind the failure of aquaculture to develop beyond a subsistence oriented scale. The positive impact of market incentives on the scale and intensity of fish production is clearly established through a comparative analysis of two groups of fish producers differentiated by the location of their harvest market in either the peri-urban or rural zones of southern Cameroon. In the periurban domain, prices were 48 percent higher, the number of buyers was three times greater, and the average purchase per customer was nearly double that of the rural domain. In response to these structural differences, producers in the peri-urban domain sold

300 percent more fish per harvest, were 72 percent more productive per unit area, and had 11 times the production scale of producers in the rural domain. There appears to be an urgent need to connect rural producers to urban markets in order to foster the growth of aquaculture in sub-Saharan Africa”.

The NASOs reveal that non-commercial fish farmers are widely distributed in most parts of the countries, where suitable conditions for aquaculture prevail. This does not provide the necessary concentration and economies of scale for the market (fish buyers) to become interested in the product. This emphasizes the possibly significant advantages for lead agencies to zone areas for aquaculture concentration, using bio-physical, demographic, marketing and socio-economic parameters. Such zones may provide vibrant platforms for the progressive development of aquaculture throughout the region. A good example is the proposed Namaqwaland Mariculture Park in South Africa (Britz *et al.*, 2005).

The market chain of commercial farmers in SSA differs widely and depends entirely on the product, scale of operation and the target market. The chain for fish from commercial farms sold on peri-urban or urban markets is from producer to buyer to wholesaler or retailer to consumer. The market chain for export products such as fish, prawns and abalone is more sophisticated and the chain may have the following links; producer, company marketing section to collective marketing company, foreign agents or buyers, exporting companies to wholesale or direct to retail market (Abalone Farmers Association of South Africa, pers. comm and Indian Ocean Aquaculture, Pemba, Mozambique, pers. comm.). Product labelling is applied in Madagascar, Mozambique, South Africa and Uganda, while Tanzania has developed legislation for labelling. Côte d'Ivoire and Ghana have implemented a ban on imports of aquaculture products to protect their emerging industries.

### 3.2 Exports

The principal aquaculture export products from the region are prawns from Madagascar and Mozambique, abalone from South Africa and seaweed from Tanzania, Madagascar and Mozambique. Prawns are exported frozen, seaweed is exported dry and abalone is exported live (80–85 percent of production) and the remainder is canned. Only one other aquaculture food product is known to be exported from the region. Uganda exports a small quantity of cold smoked *Clarias gariepinus* to the EU. The total volume and value of export products in 2003, and importing countries are shown in Table 12. The value of marine product exported comprises 95 percent of the total mariculture revenue of the target countries and 33 percent of the total value of aquaculture products in the region.

The most important non-food aquaculture products exported from SSA are Nile crocodile skins.<sup>7</sup> Crocodiles are produced in seven of the target countries. A total of 70 900 skins were exported from SSA in 2001 and production ranged from 500 in Mozambique to 33 300 in South Africa. The industry is growing particularly rapidly in South Africa, Zambia and Madagascar (Caldwell, 2003). Ornamental fish are also produced for the regional and international markets in Uganda, Malawi, South Africa and Zambia, though no accurate figures are available, except for South Africa. Live bait fish are exported from Uganda and Kenya to Tanzania for the Nile perch long line fishery on Lake Victoria. No figures are available on the number of fingerlings exported.

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<sup>7</sup> In terms of value crocodile skins are the most valuable export commodity, followed by ornamental fish, seaweeds and baitfish. This summary is based on South African export figures and the value of seaweeds produced in SSA.



**Table 12. Aquaculture exports from target countries.**

Country	Commodity	Volume (tonnes)	Value US\$'000	Exported to
Madagascar	Prawns	7 007	61 000	Europe (70%), Japan 25%, USA (5%).
	Seaweed	340	200	Not indicated
Malawi	Ornamental fish	Unknown	Unknown	UK, Germany, USA
Mozambique	Prawns	332	1 660	Europe, South Africa, USA
	Seaweed	210	105	Not indicated
Tanzania	Seaweed	1 500	1 470	Denmark, USA
	Trout	7	18	Not indicated
Uganda	Smoked <i>C.gariepinus</i>	81*	320*	EU * = 1.5 tonnes/week in 2004/2005
	<i>C.gariepinus</i> (live bait)	Unknown	Unknown	Tanzania
	<i>C.gariepinus</i> and <i>O. niloticus</i> fingerlings	Unknown	Unknown	Rwanda, Congo (DR), Kenya, Tanzania
	Ornamental fish	Unknown	Unknown	Regional countries
South Africa	Prawns	160	1 152	France
	Abalone	515	18 500	Japan, Singapore, Hong Kong (Special Administrative Region), Korea (Republic).
	Ornamental fish	21.6	Unknown	UK, USA, Germany.
Zambia	Ornamental fish	Unknown	Unknown	UK, Germany

(see text for export of Crocodile skins from the region)

There is very little evidence in the NASOs to suggest that there are any country specific strategies to safeguard small-scale producers from impacts of compliance to international trading standards, though at this stage there is hardly a need for this. However, Mozambique, Madagascar and South Africa have strategies to protect larger producers of export commodities.

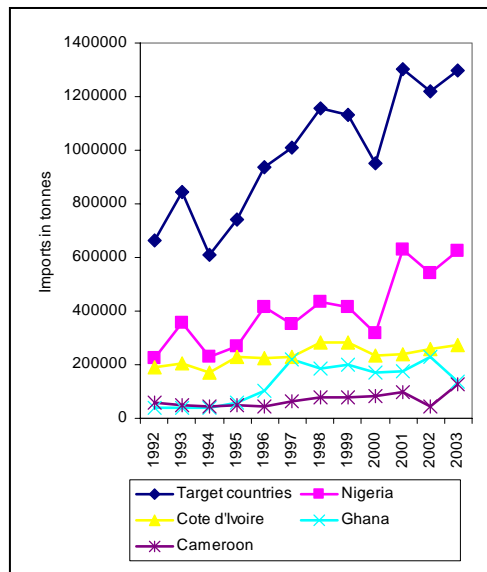
### 3.3 Access to capital

It is evident from the NASOs that access to finance by small farmers (non-commercial and commercial) throughout the region was and still is one of the major constraints to expand and intensify production, even though the farmer may have the technical ability to do so. Clearly, there is a need for the lead agencies to address this problem in a positive manner. Firstly, lending institutions must be educated such that they become aware of the business opportunities of the sector, particularly in view of the increasing price of fish and to convince them that aquaculture is no less risky than other endeavours. Secondly, there is a need for the lead agencies to obtain a comprehensive understanding of public and private sector financing opportunities in each country. Once the opportunities are known then progressive farmers, farmer associations and women's groups (in particular) need to be mobilized and educated with respect to the opportunities. Access to credit appears to have improved more in West African countries than elsewhere, though Kenya has now also established a mechanism for emerging commercial farmers. Overall, however it is concluded that access to capital remains a major constraint throughout the region.

Though no specific mention is made in the NASOs, prospective medium to large-scale commercial farms have access to capital in most countries and are provided with various investment incentives, and these vary among countries.

#### 4. CONTRIBUTION TO FOOD SECURITY

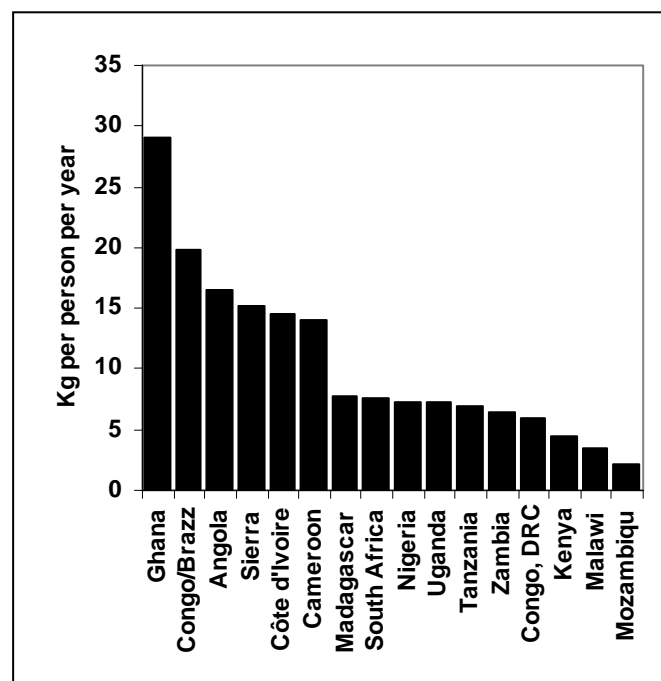
Before summarizing the information in the NASOs it is fitting to put the demand for fish and the changes that have taken place in animal protein consumption patterns over time into some sort of perspective. Several NASOs report that the demand for fish to maintain current per capita consumption is not met by supply. For example, Nigeria had a calculated shortfall of 263 547 tonnes in 2003, and Ghana had a shortfall of 257 000 tonnes. These noted shortfalls are corroborated by the increase in fish imports into target countries (Source: FAO FISHSTAT Plus - South Africa is excluded as it is a net exporter of fish). Total imports increased from 664 000 tonnes in 1992 to 1.3 million tonnes in 2003. Nigeria, Côte d'Ivoire, Ghana and Cameroon were the biggest importers (Figure 15).



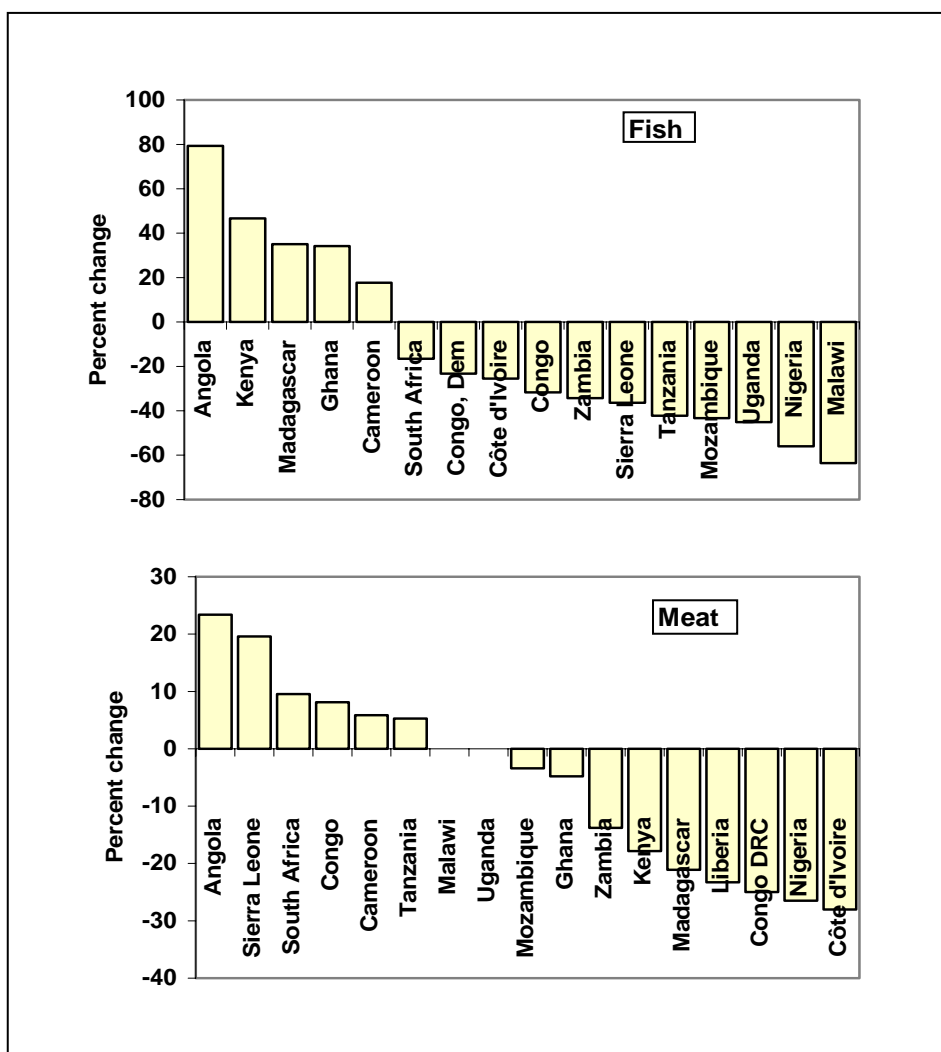
**Figure 15. Fish imports (tonnes) by target countries from 1992 to 2003 (FAO FISHSTAT Plus).**

The current per capita consumption of fish in target countries is illustrated in Figure 16, while an analysis of per capita consumption patterns of fish and meat products (Figure 17) between 1980 and 2002, reveals that only five countries recorded an increase in fish consumption, with the greatest increases occurring in Ghana and Angola. The majority of countries reported a decrease in fish consumption for the 20-year period (ranging from 16 to 64 percent) and for the region as a whole the per capita fish consumption during this period had decreased by 2.1 kg/person. Per capita meat consumption shows a similar picture of decreased consumption in most countries though the percent change for meat has been remarkably lower than for fish ranging between 3 and 28 percent.

These changes are also reflected by the proportion that fish contributes to total animal protein intake (Figure 18), which during this period had declined by 17 percent.



**Figure 16. Per capita fish consumption in SSA target countries in 2002**



(FAOSTAT and [www.earthtrends.wri.org](http://www.earthtrends.wri.org)).

Figure 17. Percent change in per capita fish (above) and meat (below) consumption (kg/person/year) between 1980 and 2002 (World Resources Institute – [www.earthtrends.wri.org](http://www.earthtrends.wri.org), FAOSTAT and NASOs).

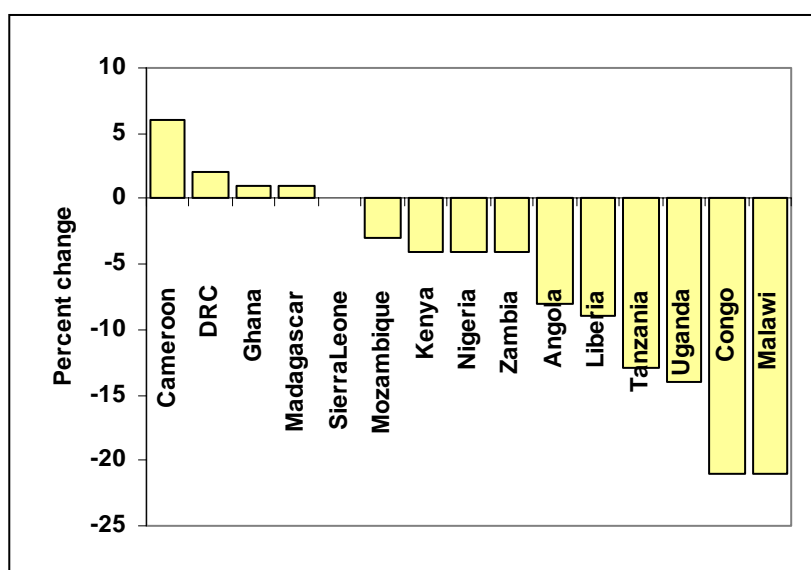


Figure 18. Change in proportion of fish protein as a percent of total animal protein supply between 1980 and 2002 (FAOSTAT).

In Section 2 it was shown that the contribution by non-commercial farmers to fresh and brackish water fish production is in the region of around 33 percent (i.e. approximately 17 776 tonnes of the total fish production of 72 334 tonnes). Moreover, most countries have significant inland or marine fisheries and fish imports have more than doubled in the last decade and animal protein intake is declining. It is within these paradigms that the contribution by aquaculture to food security and nutritional requirements is discussed. Section 3 shows that the contribution by aquaculture to total fish supply (excluding imports) in the target countries ranges from 0.12 to 2.24 percent, except for Zambia and Nigeria where it contributes more than 6 percent. The contribution by the sector to total animal protein supply ranges from 0.1 to 3.5 percent. This leads to the general conclusion that aquaculture makes a negligible contribution to national protein supply in all target countries (except Zambia and Nigeria).

Because the bulk of the fish is produced by commercial farmers it would be fair to assume that most of it is sold on urban and peri-urban markets, thereby contributing towards the supply of animal protein in these environments. The impact of the commercial aquaculture sector on the nutritional requirements of rural people (which comprise 60.5 percent of the total regional population) would therefore be negligible. On the other hand, most non-commercial farmers in all target countries are in rural areas and often do not have access to other sources of fish. This emphasizes the important role that aquaculture plays at the family level for maintaining at least a proportion of the requirement for animal protein. From the NASOs it was estimated that there are some 200 000 non-commercial fish farmers in the region and various studies suggest that the nutritional status of fish farming families is better than that of non-fish farming families in rural areas. Given that farmers sell between 20 and 60 percent (from NASOs that presented these data) of their production at farm gate or in village markets also indicates that they benefit financially.

The contribution by aquaculture to food security of rural small-holder farmers should not only be considered in relation to the quantity of fish that is produced. Several countries report that fish ponds often form an important component of the integrated farming system and are used for water storage and irrigation and therefore reduces risk of crop failure. The level of inputs and outputs are low and annual harvests in most instances are directly related to the size of pond. Therefore, if a farmer needs more fish or cash he either enlarges the pond or builds another pond. Andrew, Weyl and Andrew (2003) clearly illustrate the importance of fish ponds as “banks”, where “interest” is withdrawn for improved nutrition and cash as and when needed. The link between food security and aquaculture is well documented in Ahmed and Lorica (2002).

## **5. ENVIRONMENT AND RESOURCES**

### **5.1 Contribution and impact of alien species**

There are 9 freshwater fish species, 2 freshwater crustaceans, 1 marine finfish, 1 species of seaweed, and 2 bivalves that have been introduced and or translocated into or within the region (Tables 9 and 10).

Analysis of the FAO statistics reveal that alien and or translocated species contributed a smaller proportion to total production than indigenous species in 2003 than they did in 1995 (Table 13). For fresh and brackishwater aquaculture these findings essentially reflect the increase in clariid catfish production, the contributions made by the seven “new” species that now contribute towards Nigerian output and the decline in carp production throughout the SSA region. With respect to mariculture the figures reflect the substantial decrease in South African production of *Mytilus galloprovincialis* and the increase in production of abalone, *Haliotis midae*.

**Table 13. Percent contribution in volume and value by indigenous and alien species to total production in SSA target countries.**

	1995	1995	2003	2003
	%	%	%	%
	Indigenous	Alien	Indigenous	Alien
<b>Volume (tonnes)</b>				
Fresh and Brackish	73.4	26.6	79.5	20.5
Marine	76.1	23.9	89.0	11.0
<b>Total</b>	<b>74.1</b>	<b>25.9</b>	<b>82.1</b>	<b>17.9</b>
<b>Value (US\$'000)</b>				
Fresh and Brackish	80.0	20.0	83.8	16.2
Marine	80.4	19.6	95.6	4.4
<b>Total</b>	<b>80.1</b>	<b>19.9</b>	<b>88.0</b>	<b>12.0</b>

The Nile tilapia, common carp and rainbow trout are the three most important alien species in freshwater aquaculture. *Oreochromis niloticus* is indigenous only to catchments in Cameroon, Côte d'Ivoire, Ghana, Liberia, Nigeria, Sierra Leone, Congo (Democratic Republic) and Uganda (FishBase), but has been introduced into all other target countries except Malawi. Approximately 47 percent of total SSA Nile tilapia production is produced in countries to which it is not indigenous (Zambia, Kenya, South Africa and Tanzania) and contributes 35 percent of total fish production in these countries.

The translocation of *O. niloticus* has had serious environmental impacts. Hybridization with indigenous species has been reported in Zambia, South Africa, Kenya, Tanzania and irreversible changes in species and catch compositions of major inland fisheries in lakes, rivers and wetlands have been reported in Uganda, Zambia, Ghana, Côte d'Ivoire and Congo, Democratic Republic (Ogutu-Ohwayo, 1990; Pitcher and Hart, 1995; Pullin *et al.*, 1997; Twongo, 1995; Witte *et al.*, 1992; Zambrano, Scheffer and Martinez, 2001). In Côte d'Ivoire and Ghana *O. niloticus* has replaced indigenous species in Lake Weija and Lake Kossou, respectively and in the Kafue Swamps and in Lake Kariba it is now the dominant species. In almost all instances, it would be fair to say that the introductions were made in an irresponsible manner, did not follow internationally acceptable procedures and protocols and should be avoided in future. Malawi has been extremely vigilant and stands out as a model of how to deal with exotic species in the region.

The importance of common carp, *Cyprinus carpio* to total fish production in the region is decreasing and in 2003 only contributed 5.6 percent to total regional fish production. Approximately 2 900 tonnes of carp was produced in SSA in 2003, of which 84 percent was from Madagascar, where it is used extensively in rice/fish culture systems. Its impact, apart from local effects on water quality (turbidity) has been limited. Negligible quantities of Chinese grass, silver and bighead carps are produced in the target countries. However, their introduction has had significant environmental impacts through the introduction of parasites that have infected a multitude of cyprinid species throughout SSA (Hecht and Endemann, 1998).

Pacific oysters and *Mytilus galloprovincialis* are the only two marine species for which there is information on their environmental impact. After over 50 years of their first introduction, Pacific oysters have now formed viable breeding populations in several south east coast estuaries, and *M.galloprovincialis*, introduced via ballast water in the 1970s, has displaced the indigenous mussel *Perna perna* along the entire South African west coast and approximately 50 percent up the east coast of the country (Robinson *et al.*, 2005). Together, these two species contribute just over 70 percent to mariculture production in South African.

## 5.2 Environments and land use

Data from the NASOs suggest that the total area under freshwater and brackish water aquaculture is in the region of 66 500 ha, comprised mainly of fish ponds. Most of the ponds in the target countries are in high rainfall areas, though there are instances where farmers were encouraged by outside agencies to build ponds in unsuitable areas (Ghana, Malawi, Zambia, Côte d'Ivoire). Most NASOs reported the incidence of abandoned ponds. Pond abandonment ranged between 18 percent and 41 percent (Malawi, Ghana, Sierra Leone, Nigeria, Uganda, Tanzania) and non of the 500 odd ponds in Liberia are currently operational.

In several countries (Nigeria, Ghana, Côte d'Ivoire, Cameroon, Uganda, Zambia, Malawi, Madagascar and Kenya) cage culture in lakes and reservoirs is a rapidly emerging sector. The planned and or recently initiated operations range from medium size (6x6 m) to large circular (16–m diameter) cages. Except for Zimbabwe, none of the target countries have any expertise in monitoring the impacts of cage culture on benthic community structure and or water quality. Zambia and Malawi are being proactive in this regard and will be zoning areas for lacustrine cage farming. This will make it easier to monitor, control and manage the activities in the “new environment”.

Culture based fisheries offer major opportunities in all countries. Uganda is the most progressive with respect to culture based fisheries and produces around 4 500 tonnes/year. However, because of the high cost of stocking it is difficult to sustain such fisheries. In the last 2 years dams, smaller lakes and reservoirs have not been stocked due to shortage of funds. Nigeria is now also aggressively promoting culture based fisheries. Similarly, rice/fish culture offers vast potential. Madagascar is the leading proponent, followed by Nigeria. Many of the target countries have large rice schemes and fish farming in this environment should be aggressively promoted.

Except for Madagascar, South Africa and Mozambique, aquaculture in the marine environment is virtually unexplored in the region. The coastlines of the target countries exceed 39 000 km. Madagascar, Mozambique and Tanzania are the only countries that have so far identified and zoned suitable areas for prawn farming. The total available area for prawn farming in Madagascar is around 11 940 ha. Currently some 2 164 ha and 1 480 ha are under culture in Madagascar and Mozambique, respectively. Mozambique, on only a part of its coast, has identified and zoned 33 000 ha for future prawn farms. Tanzania, based on a recent study by Chande and Mhithu (2004), has identified 3 000 ha and a pilot scale farm has been established. Similarly, Kenya is in the early procedural stages of developing prawn farming. Given current levels of production and if 25 percent of the available area on the east coast is utilized an additional 54 000 tonnes could be produced. The South African coastline has been subjected to a full and detailed GIS for mariculture (Klotz-Shiran, 2004) and this serves as a benchmark for mariculture development in South Africa (Britz *et al.*, 2005).

Prawn culture in Mozambique is undertaken under strict environmental controls. Farms are required to treat effluent water and a large-scale and successful mangrove rehabilitation programme for those areas where water supply canals have been built through mangrove swamps has been instituted. The initiative is paid for by the industry and overseen by the relevant authorities. Producing shellfish for the export market requires strict shellfish monitoring programmes and as experienced by the South African industry, these are difficult and expensive to implement.

Current interest in mariculture includes: clams (Nigeria), mussels (Angola), mudcrab (Kenya and Tanzania), fish (South Africa, Kenya, Nigeria) and pearl culture (Kenya). This will in future lead to the use of previously unused marine and near-shore environments such as intertidal mudflats, estuaries, coral reefs and bays. All of the identified opportunities are feasible from a biotechnical perspective. However, they may not be economical. Any recommendation here would be foolhardy until comprehensive financial feasibility studies have been undertaken.

There is a need to assess the coasts for their potential and to recommend zoning suitable areas for development. This requires due consideration of financial feasibility studies, environmentally

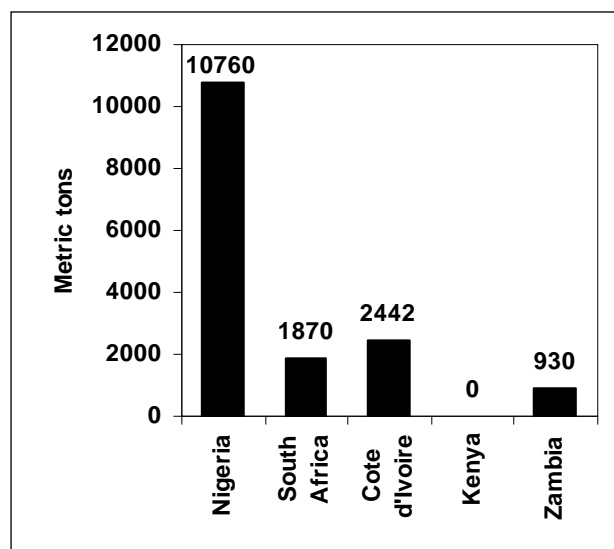
sensitive areas (mangroves, coral reefs) and potential user conflicts (tourism, conservation, mining, oil) and must be undertaken within the framework of coastal zone management policies, where these exist. Rational and environmentally responsible developments of mariculture are highly suitable investment areas for partner countries.

### 5.3 Feed and feed resources

This discussion will focus on feeds used in commercial aquaculture. Non-commercial farmers throughout the region generally use different types of brans (depending on availability), vegetable matter for *T. rendalli* and *T. zilli*, household kitchen waste, termites, various crude farm made feeds and rely heavily on natural productivity enhanced through the use of green compost cribs or the use of animal manure.

Nigeria, South Africa, Zambia, Ghana, Kenya Côte d'Ivoire, Uganda, Malawi and Madagascar are the only countries in which there are formal and informal fish feed manufacturers. Commercial farmers in several countries (Uganda and Malawi in particular) have become adept at manufacturing low-cost farm-made feeds with food conversion ratios approaching 2:1.

As experienced by Nigeria, the intensification of commercial aquaculture in all countries is clearly constrained by the availability of quality feed. The following figures and tables, as amended from Shipton and Hecht (2005), illustrate some of the issues surrounding fish feeds in selected target countries. Nigeria was the leading manufacturer of aquafeeds in the region in 2000 (Figure 19), and this is still the case.



**Figure 19. Aquafeed production in some target countries in 2000 (Shipton and Hecht, 2005).**

Despite this production capacity, Nigerian farmers are constrained by the quality of feeds that are produced and catfish farmers now import approximately 4 000 tonnes of floating, extruded pellets per annum, with which FCRs of 1:1 are obtained during the early stages of growth in catfish. Two of the 215 feed mills in Nigeria are now investing in extruders. Shipton and Hecht (2005) examined the availability of ingredients commonly used in fish feeds in five SSA countries in 2000. Except for South Africa and Nigeria all other countries would be highly dependent on imports, which would have a significant impact on feed price. For example, while some fishmeal was available in Nigeria, Côte d'Ivoire, Kenya and Zambia it was insufficient and of poor quality and the bulk was imported from Chile and South Africa. Shipton and Hecht (2005) also concluded that the current requirements, except in Nigeria, are too small for the formal animal feed sector to become interested. Even in South

Africa, with its large animal feed manufacturing capacity the aquaculture industry is served by one single niche manufacturer. Of concern was the need projections presented in Table 14. Although these projections were made in 2000 they show that at a growth rate of 10 percent to the year 2015 the total volumes of aquafeeds required are still extremely small for large feed producers. This implies that niche producers and high feed prices would still be the order of the day. These constraints also hold true for the prawn farms in Madagascar and Mozambique, where feeds are imported from several Asian countries, South Africa, Mauritius, Belgium and Seychelles. For example, Madagascar imported some 14 500 tonnes in 2003.

Clearly what is needed is a greater degree of government lobbying by commercial farmer associations together with other users of animal feeds such that import surcharges on animal feed raw materials are radically reduce or abolished.

**Table 14. Projected aquaculture production and the associated formal aquafeed requirements (2005–2015).**

2000 (tonnes)	Nigeria			Côte d'Ivoire			Zambia		
Aquaculture production	30 776			1 200			1 000		
Aquafeed production	10 760			2 442			930		
Projected growth rate	2%	5%	10%	2%	5%	10%	2%	5%	10%
2005 (tonnes)									
Aquaculture production	33 979	39 279	49 565	1 325	1 532	1 933	1 104	1 276	1 611
Aquafeed production	11 880	13 733	17 329	2 696	3 117	3 933	1 027	1 187	1 498
2010 (tonnes)									
Aquaculture production	37 516	50 131	79 825	1 463	1 955	3 112	1 219	1 629	2 594
Aquafeed production	13 116	17 527	27 909	2 977	3 978	6 334	1 134	1 515	2 412
2015 (tonnes)									
Aquaculture production	41 420	63 981	128 559	1 615	2 495	5 013	1 346	2 079	4 177
Aquafeed production	14 482	22 369	44 947	3 287	5 077	10 201	1 252	1 933	3 885

Source: Shipton and Hecht, 2005

There is very little use of trash fish and or abattoir waste for fish feed in the region and where fishmeal is produced it does not meet the needs of the animal feed industry.

#### 5.4 Non-food aquaculture

Except for the east coast seaweed industry, crocodile and ornamental fish farming very little is known about non-food aquaculture in the region. Ornamental fish are produced in Cameroon, Kenya, Malawi, South Africa, Uganda and Zambia for the domestic as well as the export market. Ornamental fish offer enormous potential in west and east Africa, particularly cichlids, cyprinids and catfishes (Kaiser *et al.*, 1997). The continent has an unparalleled bio-diversity (Daget, Gosse and Thys van den Audenaerde, 1984; Daget *et al.*, 1991) and this should be exploited. South Africa is the major producer of ornamental fish in the region. Some 21 tonnes were exported in 2003 (Fishing Industry Handbook, 2004). Crocodile farming is practised in Kenya, Madagascar, Mozambique, South Africa, Tanzania, Uganda and Zambia, while live baitfish is produced in Kenya and Uganda. Except for Seychelles there is no pearl farming in other SSA countries, though some experimental work has begun in Kenya.



## 6. LEGAL, INSTITUTIONAL AND MANAGEMENT ASPECTS

Aquaculture has an institutional home in all countries and falls under diverse Ministries, and is administered and promoted by various departments and or divisions/directorates (Table 15). In 11 out of the 17 countries for which information was available aquaculture falls under the ministries of agriculture or a ministry that deals with animal production. In one of the target countries aquaculture has “moved house” three times during the last five years, which resulted in loss of institutional memory, disruptions, and a negative effect on the development of the sector.

**Table 15. Institutional aquaculture arrangements in target countries –ministries, responsible lead organizations, number of government aquaculture stations, the number of training institutions such as universities, colleges and vocational schools and (research institutes).**

Country	Ministry	Responsible lead agency	Government stations	Training and research institutes
Angola	Fisheries	Institute of Artisanal Fisheries and Aquaculture	1	0 (2)
Cameroon	Livestock, Fisheries and Animal Industries	Directorate of Fisheries	22	3 (2)
Congo, DR	Agriculture	National Aquaculture Service Division	25	
Congo, Rep.	Agriculture and Fish Farming	Directorate of Fisheries and Aquaculture	??	0 (1)
Côte d'Ivoire	Animal Production and Aquatic Resources	Directorate of Aquaculture	2	2 (2)
Ghana	Food and Agriculture	Directorate of Fisheries	19	4 (1)
Kenya	Livestock and Fisheries Development	Department of Fisheries	2	2 (1)
Liberia	Agriculture	Bureau of Fisheries	4	
Madagascar	Agriculture and Aquaculture	Directorate Fisheries and Aquatic Resources	29	3 (7)
Malawi	Mines, Natural Resources and Environment	Department of Fisheries	13	3(2)
Mozambique	Fisheries	Aquaculture Department	2	0 (1)
Nigeria	Agriculture and Rural Development	Department of Fisheries	59	6 (2)
Sierra Leone	Fisheries and Marine Resources	Directorate of Fisheries	1	1(0)
South Africa	Environmental Affairs and Tourism (marine) and Agriculture (freshwater)	Division Marine and Coastal Management	1	3(1)
Tanzania	Natural Resources and Tourism	Fisheries Division	??	4 (1)
Uganda	Agriculture, Animal Industry and Fisheries	Dept. of Fisheries (Aquaculture Unit)	1	3 (1)
Zambia	Agriculture and Cooperatives	Dept. of Fisheries (Aquaculture Division)	19	3 (0)

In all SSA countries, except South Africa, aquaculture is promoted under the relevant Poverty Reduction Strategy papers. This indicates that governments throughout the region recognize the potential of the sector for rural development in particular. With the exception of Kenya and Uganda the aquaculture specific legislation and regulatory frameworks in almost all countries are either non-existent or weak, though in concert with other legislation is adequate from an environmental management perspective. Moreover the legislation is often disabling from a sectoral growth promotion perspective. While all countries subscribe to the responsible development of the sector not one, except Namibia, has a specific Aquaculture Act. Zambia has a draft act and South Africa and Sierra Leone are in the process of developing an act. Regulations specifically governing commercial aquaculture only exist in Uganda, Madagascar, and Mozambique (mariculture), Congo (Republic) (mariculture) and South Africa (mariculture). General regulations from other acts specifically those dealing with water, land and environmental and genetic conservation are used most often for managing the sector, while the Fisheries Acts provide the framework for the issuing of licenses/permits. It would further appear that current legislation in all countries pertains only or mainly to medium to large-scale commercial aquaculture. In all countries, commercial farms above a certain size have to go through the Environmental Impact Assessment procedure and in Mozambique, Madagascar, Tanzania and Kenya there is strict environmental legislation with respect to mangrove conservation.

It is highly likely that all countries have a policy for aquaculture development, but most lack the specific strategies to reach policy goals. However, several countries have recently developed national aquaculture development strategies or master plans (e.g. Angola, Cameroon, Zambia, Madagascar, Malawi) while plans are in preparation in Congo (Democratic Republic), Ghana and Mozambique. Nigeria has the preliminaries of a strategic plan though it has yet to be adopted by the Federal Government. These strategies and plans are critical for the development of the sector, and provide the link between development policies and objectives and form the framework within which plans are prepared and implemented, on condition that they are incorporated into appropriate legislation.

The system of institutional management throughout the region is similar. While the sector may reside under very different Ministries in the individual countries the sector falls under the direct management control of a director or deputy director and the functions are then normally split into research, monitoring and extension. In several countries, there have been major shifts in government policy with respect to the private sector. In Kenya, for example, government is gearing itself to play a purely supportive role for the private sector, by:

- promoting self regulation;
- providing basic infrastructure for aquaculture development (roads, electricity, improved telecommunications, schools, water and health services);
- providing a conducive legal and investment framework;
- providing a research platform;
- monitoring and evaluation;
- zoning for aquaculture and provision of land;
- fostering participative policy formulation, and
- establishing public/private partnerships.

Essentially Kenya is now rightly expecting the private sector to be the engine for the growth of the sector. Several other countries (Uganda, Madagascar, Mozambique, Malawi, Côte d'Ivoire, and Ghana) have adopted similar policy decisions. These shifts in government thinking will no doubt contribute to the rapid evolution of the commercial sector over the next decade. This approach has been part of the scene in Nigeria (the National Agenda for Fish Production) for a long time and, in conjunction with a very vibrant private sector, has contributed to and underpinned the development of commercial aquaculture there.

## 6.1 Associations

Aquaculture or producer associations are now common throughout the region, and have been constituted in 16 of the 19 target countries. These range from national or regional associations (e.g. Aquaculture Association of Southern Africa) to industrial associations (e.g. Groupement des Aquaculteurs et pêcheurs des crevettes de Madagascar, Abalone Farmers Association of South Africa, Nile Crocodile Farmers Association of South Africa) to informal fish farmer or seaweed associations (Table 16). The efficacy and sustainability of the smaller associations is however very tenuous.

**Table 16. Aquaculture associations in target countries.**

Country	Regional and national associations	Industrial and/or commercial associations	Small-scale marketing associations	Emerging commercial farmers associations	Informal or community fish farmers associations
Functions	1	2	3	4	5
Cameroon					X
Congo, DR					X
Côte d'Ivoire				X	X
Ghana	X			X	X
Kenya					X
Liberia					X
Madagascar		X		X	X
Malawi				X	X
Mozambique	X***	X*			
Nigeria	X	X			
Sierra Leone					X
South Africa	X**, X	X			
Tanzania		X****	X		X
Uganda		X	X	X	X
Zambia		X			X

**Functions:** 1 = Promotion of aquaculture at national or regional level, deals with government on national sector basis, dissemination of information and conferences, international links, 2 = Promoting and supporting industrial/large commercial sector (marketing, research, link to lead agency and government), 3 = Improved revenues for farmers through scheduled harvesting and cutting out middlemen, 4 = Promoting rapidly emerging sector in the region, improving economies of scale, marketing and links to lead agency, 5 = Self help associations operating at community level for improved credit and dissemination of information.

\* Industrial prawn association currently being registered.

\*\* Aquaculture Association of Southern Africa (regional association based in RSA)

\*\*\* Western Indian Ocean Aquaculture Association (regional mariculture association being constituted)

\*\*\*\* Seaweed.

Though the goals of the larger and smaller associations may differ widely there are two common denominators, and these are that they function as lobby groups to government and function as exchanges for technical and market information.

Except in Madagascar, it appears that the potential role of non-commercial fish farmer associations to promote the sector is not fully recognized and appreciated by lead agencies. There is concern about the sustainability of the non-commercial farmer associations, particularly where these were founded with donor support. The proposed function of non-commercial farmer associations is geared mainly towards accessing credit, which is still a major problem for non-commercial farmers throughout the

region and the promotion of the sector. The industrial aquaculture associations e.g. in South Africa, Madagascar and Zambia focus mainly on marketing and research development needs.

## 6.2 Government stations

All countries have or had government fish farming stations. Based on NASO information there are over 200 such facilities in the target countries (Table 15). After discussions with country representatives in Mombasa (Sept. 2005), it is fair to conclude that the majority of the stations are in a state of neglect and many have been abandoned. In Nigeria most are in a state of disrepair and neglect, 10 of the stations in Ghana and Congo (Democratic Republic) and 2 in Sierra Leone and Uganda are either non-functional or abandoned (and see Entsua-Mensah, Lomo and Koranteng, 2000). This is mainly because of the absence of adequate institutional support. A call was made in the 1999 (FAO, 2000) to privatize government facilities. There seems to have been some movement in this respect, particularly in Madagascar where significant progress has been made. Malawi has partially privatized one of its largest stations and some progress is being made in Ghana and the Republic of Congo, while Nigeria has now developed policy for the privatization of its stations. The benefits of privatizing “research or demonstration” stations for the development of the sector are immense and include amongst others, income to government, enhanced extension services as part of the lease agreement, act as real demonstration units that encourages development, investment, generation of employment and enhanced rural fish supply. Two good examples are the De Kuilen Trout Station in South Africa and the Kasinthula Station in Malawi. The former was partially privatized in 1984 and exports between 30 and 40 million eyed ova, which satisfies 20 percent of the United Kingdom’s off-season egg requirements (Hecht and Britz, 1992). The Kasinthula Station was privatized in 2002/2003, and by 2005 was producing approximately 80 tonnes of fish/year.

The designated original purpose of fisheries stations, viz. serving as hubs for extension, was clearly neither successful nor sustainable. A call should once again be made to promote the partial or total privatization of the majority of government stations in a manner such that they may serve as hatcheries and nurseries to address the shortage of fingerling throughout the region. Unfortunately, many of the stations are poorly sited, therefore have little economic value and hence are difficult to privatize. The impression that prevails from the NASOs is that the biggest obstacle is the absence of appropriate privatization policies. Care should however be taken that the process of privatization does not lead to the dissipation and or loss of research and development capacity. Ideally, each country should have one aquaculture centre, at which the limited financial and human resources are concentrated to optimize the interface with the commercial sector. Such centres should focus on research, development of appropriate technologies, monitoring and control, dissemination of information and act as service providers, but should not, as in the past, function principally and primarily as subsidized fingerling producers and extension centres.

## 6.3 Research and training

The NASO’s suggest that training opportunities to Masters and PhD level in West Africa (Nigeria and Ghana) overshadow the opportunities in East and Central Africa. In the latter two regions it is only the University of Malawi (Bunda College of Agriculture) and Moi University in Kenya that offer post graduate training in aquaculture up to MSc level and other short courses in aquaculture. Other universities in the region do not offer formal degrees in aquaculture though opportunity exists for students to obtain higher degrees in related disciplines.

Except in South Africa, most of the research that is undertaken in the region is short term in nature with severely limited budgets and in most countries that provided information is focused on feeding, pond fertility and socio-economic surveys. Access to scientific literature has been identified as the Achilles heel for research in the region (FAO, 2004b). Given the meager research and literature resources of the individual countries obviously raises the question whether research should be concentrated at the regional level. However, this question may also have been the underlying reason

for establishing the ARAT in Nigeria. For various reasons this institution could not be sustained and the same mistake should not be made again. A better option would be to identify the needs of farmers and to distill these needs into well formulated and precise research priorities and to concentrate effort and resources on a national basis.

In most countries, research priorities are unfortunately set in a top down nature by lead agency committees or scientists. Therefore, research largely meets institutional or individual objectives, but not necessarily those of the farmers. This and the lack of resources may be some of the reasons for the parlous state of aquaculture research in the SSA region and its meager contribution to sectoral advancement. However, this is changing in several countries, particularly in Zambia and Uganda and user defined aquaculture research is the norm in South Africa. Most countries recognize the need for research to develop the sector and scientists in several countries are contributing to this.<sup>8</sup>

## **7. SOCIAL IMPACTS, EMPLOYMENT AND POVERTY REDUCTION**

In 10 of the 19 target countries there are nearly 110 000 non-commercial farmers. The vast majority (>90 percent) of these operations are rural based and generally referred to as small-scale or subsistence. Most fish farms are owned by individual families. Throughout the region <10 percent of ponds are owned by communities and or farmer groups, though these are generally poorly managed. The only community-based operations that have worked in general are those where the community collectively develops the basic infrastructure (e.g., roads, canals) but production systems (ponds, cages) are individually owned and managed.

Six of the target countries provided information on the role of women in fish farming and these data show that women play a minor role in fish production and own or manage approximately 16 percent of the farms. The highest proportion of women fish farmers (30 percent) has been recorded in Zambia. However, all countries commented, though not quantified, on the important role of women in post harvest activities, and particularly in marketing of the product.

In all countries, non-commercial fish farms are reported to play an important role in contributing towards food security, improved nutrition and rural employment. Estimates of temporary and occasional employment opportunities in the non-commercial sector range from 18 000 to 30 000 jobs per country, while some 60 000 people gain temporary employment in Madagascar.

The literature supports the contention that non-commercial aquaculture plays an important role in rural livelihoods (Ahmed and Lorica, 2002), and that fish farmer families in general are better nourished than non-fish farming families (Andrew, Weyl and Andrew, 2003; Chimatiro, Hummel and Scholz, 1999). In Malawi it has been reported that fish contributes between 1 and 17 percent of fish farmer households (Andrew, Weyl and Andrew, 2003). Cash income from fish ponds contributes to general household costs and living expenses and in most countries non-commercial farmers also use fish to barter and as gifts. Given the levels of production it is highly unlikely that non-commercial aquaculture will or can make significant contributions to fish supply on a national basis in any of the countries in the short and medium term. The contribution by the sector to GDP (Table 11) is

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<sup>8</sup> It is argued in some quarters that basic research and science is no longer necessary and that the development of the sector would be best served if the experiences of the past were implemented properly. This view is myopic. It is highly unlikely that the non-commercial sector will make any significant contribution to fish supply and demand or GDP in the target countries in the short to medium term. That can only be achieved by the commercial sector, which is emerging rapidly in a number of countries. To keep pace with the needs of the sector there is a proportionally equal need for good science and research in Africa as that which is being applied worldwide. As elsewhere in the world the sector would be severely constrained by the lack or absence of good information, good science, credible scientific capacity and infrastructure. If commercial aquaculture, of whatever scale or intensity of operation, forms part of strategic development plans and policies then good scientific research is pivotal for its development and should be supported aggressively. Not to champion the support for good research would be a grave failing and a travesty.

insignificant. Non-commercial fish farming in all countries is largely an on-farm diversification strategy and in all countries has, or is considered to have, a positive effect on sustainable and improved livelihoods and poverty alleviation at the family level (see also Ahmed and Lorica, 2002).

Commercial farms offer substantial opportunity for employment. For example, seaweed farms in Tanzania, Mozambique and Madagascar are family owned businesses and the majority (>80 percent) are owned and or managed by females. In Mozambique, these farms provide some 2 000 jobs and in Tanzania the industry employs some 3 000 people. Seaweed farmers are reported to earn in the region of US\$60 per month. Commercial fish farms in the region are owned by companies and individuals. In several countries, e.g. Zambia, Nigeria, Kenya, and Uganda many of the fish farms are part of larger commercial farming operations. Prawn farms in Mozambique employ 1 492 people and in Madagascar the farms provide 4 325 direct and 30 000 indirect jobs. Of the directly employed labour force on prawn farms, approximately 30 percent are women, who are mostly employed in post harvest activities such as packing and processing or in administrative office positions. Because of high labour costs the mariculture industry in South Africa is becoming more mechanized and hence, only employs 750 people.

The education level of non-commercial fish farmers is generally low and in many cases, farmers are illiterate. The range is from around 10 percent of farmers who have some primary education in Mozambique to a high of 77 percent in Congo (Republic). The number of farmers with secondary education is much lower and ranges from 11 percent in Cameroon to 24 percent in Malawi. Farmers with tertiary qualifications are only found in the commercial sector (abalone, prawns and fish) and those who are now engaging in commercial fish farming in urban and peri-urban environments in Nigeria and Uganda (NASO's, Rana *et al.*, 2005). One should hasten to add however that higher qualifications and or literacy are not the alpha and omega for being a successful fish farmer. There are many examples of excellent and very progressive emerging farmers who are poorly educated but have a flair for business and fish farming.

From the NASO's it was also not possible to answer the question whether aquaculture has had any off-setting or alleviating effects on fishing and other sectors that are in decline. At this juncture in its development and in the absence of any hard data it is mere speculation that the sector might have off-set the increase in fishing effort in the region or that some fishermen have become fish farmers.

## **7.1 Extension**

If aquaculture is to be integrated into farming systems it is imperative to understand its interactions with the surrounding physical, socio-cultural and institutional environment. Not much information was provided in the NASOs on aquaculture extension and it is not clear whether all countries actually have extension services. However, it is evident that the standards and levels of intensity of extension in all countries is poor and it would appear that the training and visit method is still the most common (see also Moehl, Halwart and Brummett, 2005). Poor extension is ascribed mainly to a lack of resources, the wide geographic distribution of farmers, and poor infrastructure. It can be concluded that in its present form in most countries, it is generally not effective nor sustainable. It is further generally accepted that the current cadre of extension officers are adequately trained to assist the small, non-commercial farmers but they are ill equipped to deal with the requirements of the commercial sector. Uganda has taken an interesting step by privatizing the function. The effect and impact of this step on the development of the sector is yet to be assessed. Madagascar has also made advances by establishing working relationships between small-scale farmers and private sector hatcheries, to improve access to good quality fingerlings.

The new paradigm in extension is the "on-farm, participatory approach" (Lightfoot and Noble, 1993; Brummett and Noble, 1995). Its success has been demonstrated particularly in Malawi and Cameroon, but as with other methods it requires institutional (and donor) support and suitable qualified and trained personnel. The new wave of emerging/progressive farmers, specifically in Ghana, Côte

d'Ivoire, Uganda, Malawi, Kenya, may be a valuable human resource for future extension to assist other farmers to cross over from non-commercial to commercial scale farming.

It would be remiss not to mention the important role that NGOs have to play in the promotion and extension in non-commercial aquaculture throughout the region. Though not specifically mentioned in the NASOs, it was recognized by all country representatives in Mombasa that NGOs have probably played an equally important role in extension and development of rural, non-commercial aquaculture as the responsible lead agencies. However, it was agreed by all that liaison among and between the role players needs to be improved.

## 7.2 Future projections

Except for Madagascar and Mozambique that provided some reasonable estimates of future production of prawns, the other NASOs and other sources of national information did not provide any realistic future projections. Based on a number of assumptions and on the information provided in and obtained from the NASOs and information received (Box 4), it was possible to calculate two scenarios and these are illustrated in Figure 20. These scenarios should be considered nothing more than first estimates to provide some conservative, and perhaps realistic, measure of where the sector could be by 2013.<sup>9</sup> The projections made in the comprehensive GIS based study by Anguilar-Manjarrez and Nath (1998) are somewhat higher (580 000 tonnes). This excellent study should be consulted for further scenario planning.

### **BOX 4. Assumptions for projected SSA aquaculture production to 2013.**

#### **Scenario 1**

Production (all species) between 1998 and 2003 increased by 10 percent/year in target countries, cf. 12 percent for the SSA region as a whole. Projection for SSA to 2013 was made on basis of 10 percent/year.

#### **Scenario 2**

(a) Same as above for all SSA countries except for Cameroon, Congo (Democratic Republic), Kenya, Madagascar, Nigeria and South Africa and excluding mariculture.

plus

(b) Fish production from excluded countries above, at 25 percent/year for Uganda (175 percent), Cameroon (63 percent), Kenya (40 percent), at 12 percent for Madagascar (30 percent) and at the average annual rates of increase for Congo (Democratic Republic) (8 percent), Nigeria (7 percent). The figures in parenthesis are the annual percent increases as calculated from NASOs and FAO FISHSTAT Plus. The increases are therefore based on very conservative rates on the assumption that the recorded rates will not be sustainable. A growth rate of 14.6 percent was used for South Africa based on detailed projections made by Britz *et al.* (2005) in consultation with industry.

plus

(c) By 2010 there will be 3 x 3 000 tonnes/year cage farms in large lakes or reservoirs and 10 small to medium scale (250 tonnes/year) cage farms and that these numbers will have doubled by 2013.

plus

(d) Prawn farming projections were made on the basis of the Madagascar NASO, and projections made by IIP in Maputo (F. Ribeiro, IIP, Maputo, Mozambique. Nov. 2004. pers. comm.), plus the assumption that prawn farming will develop in Kenya and Tanzania within five years to 750 tonnes/year each by 2013 and to 800 tonnes/year by South Africa. Though other countries have indicated their pending interest in prawn farming they have been excluded because Kenya and Tanzania are the only countries on the threshold of prawn farming.

plus

(e) Seaweed production has been projected at 5 percent/year until 2010 and at 10 percent from 2010 to 2013.

<sup>9</sup> Given the current baseline information and for various other reasons the author is of the opinion that it is unrealistic to make projections beyond 2013.

plus

(f) Shellfish (oysters and mussels) farming will grow by 15 percent/year in South Africa and reaches 1 500 tonnes in Namibia by 2013 (E. Klingelhofer, NATMERC, Swakopmund, Namibia, pers. comm. Sept. 2005).

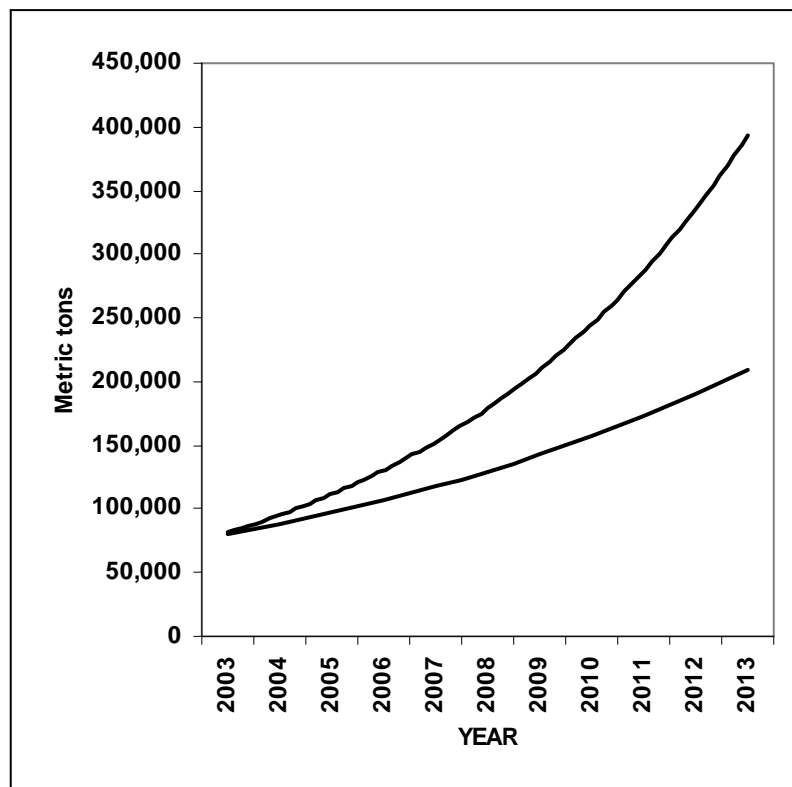
plus

(g) Contribution by non-commercial sector assuming 70 percent of existing pond area is used by 2010 and 80 percent by 2013 at production levels of 1.8 tonnes/ha/year by 2010 and 2.2 tonnes/ha/year by 2013.

This scenario excludes the potential mariculture production from other countries in SSA. They have been excluded on the basis of the current status of the sector in those countries.

The first scenario is based on the assumption that production in SSA would grow at the same average rate of increase as calculated for the preceding five years in the target countries at 10 percent/year. This is lower than the average annual percent increase of 12 percent for the SSA region as a whole and hence errs on the conservative side. This scenario predicts that production in SSA by 2013 could reach 208 600 tonnes. This implies a 2.6 fold increase over the 2003 production by 2013.

The second scenario was based on projected productions from those countries that had shown significant advances during the last five years, plus increases from the remaining SSA countries at the same rate as in the first scenario, plus projected increases in cage culture, plus production increases from the non-commercial sector, plus projected increases from prawn and seaweed production. This scenario predicts that production by 2013 could be around 380 400 tonnes, which is a 4.7 fold increase over 2003.



**Figure 20. Projected growth scenarios of SSA aquaculture production to 2013.**



## 8. SUMMARY – TRENDS AND DEVELOPMENTS

During the period 1998 to 2003 aquaculture production output in the target countries has increased by 61 percent from 44 962 tonnes to 72 334 tonnes, while for SSA as a whole production increased from 46 882 tonnes in to 80 434 tonnes. Though non-commercial aquaculture is still practised at low levels of intensity (average production in the target countries = 1.03 tonnes/ha/year), the commercial sector appears to be at the threshold of a new dawn in the region. Fish supply currently cannot meet demand. Throughout the region per capita consumption over the last two decades has decrease by an average of 2.1 kg/person/year, and marine fish imports have increased by 177 percent during the same period. The supply deficit has clearly affected the price of fish, and it is clear from the NASO's and interviews with country representatives in Mombasa that this has driven the development of the commercial sector. The average price of farmed fish (whole weight in the round), except in countries that have just emerged from civil war, is now US\$2.43/kg with a maximum of US\$4.7/kg. In general, the increase in fish imports appears to have had little effect on the price of fresh fish (which is preferred over frozen fish in many of the target countries). In most countries there has been a noticeable change to commercial farming and higher levels of intensification (such as greater use of farm-made feeds and fertilizers, controlled stocking, a greater demand for quality fingerlings and better managed and synchronized harvesting) and this is not surprising. However, it is not fully understood whether the greater degree of commercial farming in comparison to 1999 is a consequence of non-commercial farmers switching to commercial farming or whether the "new wave" of commercial farmers are progressive new entrants into the sector, spurred on by the escalating fish price. It is highly likely that the surge is a consequence of new investors because the transition from non-commercial to commercial farming is a rare occurrence. More information is required to tease apart the underlying dynamic of the evolution of commercial aquaculture in the region.<sup>10</sup>

Except in South Africa, Madagascar and Mozambique mariculture is underdeveloped and under explored in the region. However, several countries have identified the potential for the farming of prawns, fish, seaweed or shellfish and some are on the threshold of initiating the sector. Specific reasons for the under-developed nature of the sector were not provided.<sup>11</sup> The current proposal to establish a Western Indian Ocean Aquaculture Association (F. Ribeiro, IIP, Maputo, Mozambique, pers. comm.) and the development initiatives in the BCLME countries of Angola, Namibia and South Africa may serve as platforms for its development on a sub-regional basis.

Within the overall context of aquaculture in the region the commercial sector is making advances at all levels of scale and intensification. Though it could not be rigorously analysed it is suggested that the relatively small proportion of commercial farmers (Hishamunda and Ridler, 2003) in the region probably contribute 65 percent of total fresh and brackish water production. Apart from Nigeria and Madagascar, this sector now also appears to be making rapid advances in Uganda, Ghana, Kenya, Côte d'Ivoire, Zambia and Malawi. It is predicted that the development and adoption of Strategic Aquaculture Development Plans in several countries will further trigger its development.

In most countries, non-commercial aquaculture is still considered to form part of a livelihoods diversification strategy to reduce risks and provide greater food security at the family level. The non-commercial sector, as in the past is constrained by various biotechnical, institutional, infrastructural and economic factors, the most important of which are the quality and type of extension provided and the lack of quality fish seed and feed. The level of management remains low and most farmers use the pond as a "bank" for food and cash as and when needed.

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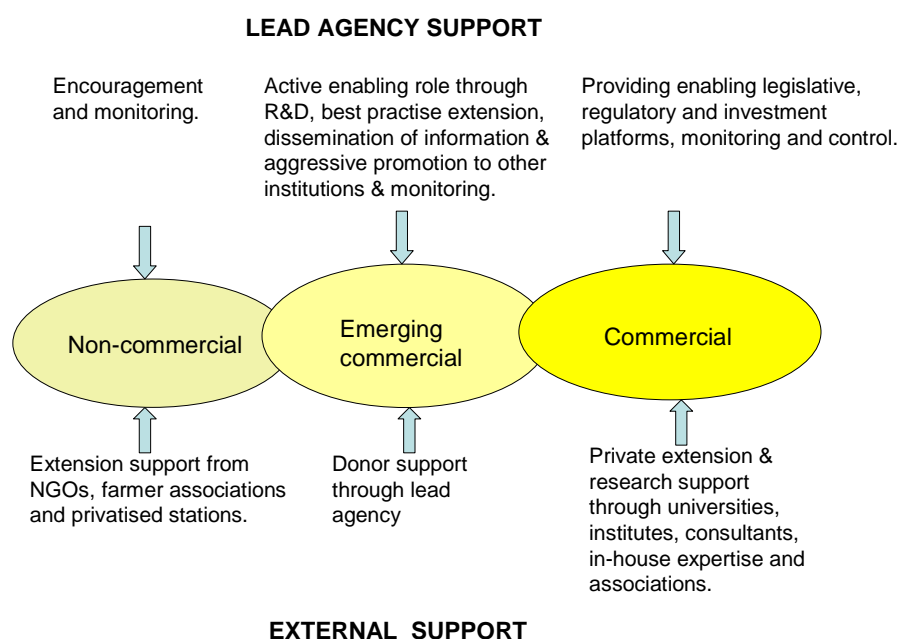
<sup>10</sup> Farmers, like there compatriots throughout the world are highly malleable to economic conditions and "know a good thing when they see one". If the price is right, farmers are more likely to invest labour and capital to profit from the opportunities.

<sup>11</sup> It was suggested by some country representatives that the main reasons probable relate to macro- and micro-economic fundamentals, the substantial FDI requirements to develop the sector and the lack of capacity for the high level R&D that is required to develop many of the technologies.

The cutback in donor support for aquaculture development, since the mid- to late-1990s, seems to have had notable institutional effects. In particular, this is evident with respect to capacity in planning, management, research, training and the quality and intensity of extension. Several countries have reported that extension either has collapsed, remained static or has seriously regressed. The most appropriate method appears to be the participatory on-farm approach. However, this method is practised mainly by donor supported projects and its long term sustainability has not been tested. Overall, it can be concluded that new and effective means of extension are required.

The conclusion reached from the NASOs is that non-commercial aquaculture will unlikely make significant contributions to national fish supply in any of the target countries. To increase national fish supply requires paradigm shifts in the support role of lead agencies and donors. The model presented below provides a summary view of how extension and lead agency support could perhaps be better apportioned in the future to realise the goal of greater self-sufficiency and improved service provision. The model proposes that direct physical extension support by lead agencies and donors should be limited to the emerging (small and medium scale) commercial sector only. Extension support to the non-commercial sector could be provided by NGOs and by the new “owners” of privatized stations as part of their lease agreement and by farmer associations, while the existing commercial sector is serviced through private means. To fulfill their mandates lead agencies should focus on active and aggressive encouragement of farmers, promotion of the sector to other institutions (e.g. finance houses), developing appropriate development platforms and monitoring and control.

### **Proposed support model for aquaculture in SSA**



To summarize, non-commercial aquaculture is reasonably well developed in most countries, except in Angola, Liberia and Sierra Leone. By contrast, the commercial sector is developing or developing rapidly in 11 of the 17 target countries. Based on the information received it was possible to develop a descriptive summary of the status of non-commercial and developments in commercial aquaculture in the target countries and this is presented in Table 17.

**Table 17. A “qualitative” summary of the state of aquaculture development in SSA target countries.**

Country	Aquaculture introduced	Non-commercial (mainly rural and small-scale)	Commercial	Notes
Angola	<1975	Nearly non-existent	Beginning	1
Cameroon	1948	Well developed	Developing	
Congo, DR	Mid–1940s	Poorly developed	Non-existent	2
Congo, Rep.	1952	Developed but regressing	Poorly developed	
Côte d’Ivoire	1955	Developed but regressing (war)	Developing but impacted by war and input delivery	3
Ghana	1953	Developed but fragmented	Developing and expanding	
Kenya	1900–1920	Developed	Developed, and expanding	
Liberia	1952	Underdeveloped	Non-existent	4
Madagascar	1950s (Prawns 1990)	Developed and intensifying	Developed and expanding	
Malawi	1906 (trout), 1954 warm water fish	Well developed	Developing	
Mozambique	1950s	Poorly developed in most regions	Developing and expanding	5
Nigeria	Mid–1940s	Developed	Well developed and expanding rapidly	
Sierra Leone	1977	Underdeveloped	Non-existent	6
South Africa	1940s	Non-existent	Mariculture and trout culture well developed and expanding rapidly.	
Tanzania	1950	Well developed (seaweeds), developed (fish)	Pilot scale level	
Uganda	1940s	Developed	Developing and expanding rapidly	
Zambia	1950s	Well developed	Developed and expanding	

Notes: 1 = Angola is in process of restructuring after civil war 1975–2002, 2 = Congo (DR) restructuring after civil war 1998–2003 and still ongoing in NE, 3 = Despite intermittent civil war 1999–2004 Côte d’Ivoire is making rapid progress, 4 = Liberia is in process of restructuring after civil war 1989–2003, 5 = Mozambique’s development after civil war 1975–1994, is mainly in prawn culture, 6 = Sierra Leone is in process of restructuring after civil war 1991–2002.

## 8.1 Recommendations

- Develop national strategies and enabling legislative and investment platforms.
- Zone aquaculture priority areas for concentration and improved economies of scale.
- Encourage private sector investment by providing competitive incentives.
- Identify and aggressively disseminate information on aquaculture opportunities
- Develop capacity for control, monitoring and environmental management of the rapidly emerging commercial sector.
- Encourage and facilitate development of quality control measures for high-value products to increase investment in African aquaculture production and processing.

- Encourage and promote adoption of integrated non-commercial aquaculture as a means of increasing rural productivity and food security.
- Privatize Government aquaculture stations wisely.

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## **PART II**

# **Report of the EXPERT WORKSHOP ON THE REGIONAL AQUACULTURE REVIEW FOR SUB-SAHARAN AFRICA**

**Sun ‘n Sand, Mombasa, 20–22 September 2005**

### **SUMMARY**

Aquaculture has made considerable progress in the Africa region since 1999. This progress is seen in production increases as well as growing investment in aquaculture. These events are stimulated by rising prices for aquatic products combined with more friendly investment environments. Over this period, there has been a noteworthy improvement in capacity of public institutions, increased awareness by the private sector, more favourable assessments by lenders, improved seed access and quality and more ready access to information; although, all these factors are still far from optimal and require continued strengthening. Positive demonstrations and experiences need to be shared and multiplied. At the intraregional level, New Partnership for Africa’s Development (NEPAD), Regional Economic Communities (RECs) or other vehicles may be efficient tools for the expanded and enhanced sharing and adoption of “what works”. But, at the national level, extension remains a serious debacle with which to deal; establishing means and methods to have effective and sustainable extension and outreach a recurring quandary. There may be economies of scale to address some issues such as research and training/education at the regional or sub-regional level. There are also economies of scale to develop stronger and more resilient links with sister national institutions and agencies such as statistics, water, environment, etc. It has been demonstrated that all of these aspects of aquaculture development can be, and should be satisfactorily attended to in the process of elaborating national aquaculture development strategies

### **1. INTRODUCTION**

The Expert Workshop on Review and Analysis of the Aquaculture Sector in Africa was held in Mombasa, Kenya, from 20–22 September 2005. The Workshop was attended by 35 participants, including participants from 13 countries in the Africa region (Appendix 1). The Workshop agenda is presented in Appendix 2.

The Workshop had twin aims: (a) to follow-up on the 1999 FAO Africa Regional Aquaculture Review, assessing progress made in developing the aquaculture sector and recommending steps/action to stimulate further growth; and, (b) to obtain relevant information from the region towards compiling two documents, as a request by the Committee on Fisheries Sub-Committee on Aquaculture (COFI-AQ); (i) Review of trends in global aquaculture development – 2005, and (ii) Prospective analysis of future aquaculture development, which will be presented to the third session of the COFI-AQ to be held in India in September 2006.

## 2. BACKGROUND

In July 1975, FAO organized the First Regional Workshop on Aquaculture. At that time, this was the primary regional colloquium to recognize the potential importance of aquaculture to the Africa region. However, thirteen years later, the FAO Expert Consultation on Planning for Aquaculture Development concluded aquaculture output from sub-Saharan Africa remained low. To assess this poor performance, five years later, FAO, assisted by other collaborators, assembled a series of twelve national aquaculture reviews from countries<sup>1</sup> responsible for 90 percent of the region's aquacultural production. These reviews identified major constraints on the continental level as: no reliable production statistics; credit availability limited for small-scale farmers; very low technical level of fish farmers; unavailability of local feed ingredients; lack of well-trained senior personnel; prohibitive transport costs; and, lack of juvenile fish for pond restocking.

Most recently, in 1999, FAO organized the Africa Regional Aquaculture Review (FAO, 2000) with the **goals** of: evaluating the past 30 years of aquaculture development efforts in sub-Saharan Africa with specific focus on extension and public sector support for aquaculture; reviewing the present status of aquaculture in the region through analysis of small-scale integrated production systems as well as medium- to large-scale systems; identifying trends in aquaculture development; and, preparing an outline of the key elements in a general aquaculture development strategy.

While the sector was stagnating, with many of the earlier constraints remaining in one form or another (Appendix 3), the 1999 Review concluded that: (a) *aquaculture was now known throughout Africa as a result of previous extension efforts* and (b) *adoption/acceptance, even if on a modest scale, had been noted in most countries*.

Between 1999 and 2005, there has been considerable growth and investment in the sector in the Africa region; albeit, production from this region continues to lag significantly behind other similarly endowed areas of the world. Nonetheless, overall aquaculture production from the region has increased by more than one-third over the period and the sector has benefited from increasingly high political visibility combined with equally high expectations as fisheries are overexploited and decision-makers look to aquaculture to fill the growing fish supply gap.

During this interim period, following the recommendations of the 1999 review, an important focus of development assistance in the region has been to help in elaborating much-needed national aquaculture strategies<sup>2</sup> which are founded on the **assumptions** that:

- Governments' roles are changing from being producers, suppliers and employers to becoming facilitators and regulators;
- Limited resources necessitate a concentration of effort in High Potential Zones (HPZs), specific aquaculture systems having specific HPZs based on a series of bio-physical and socio-economic parameters; and,
- It is necessary to specify the roles of the private and public sectors in implementation of the strategy and its plans.

Strategies address the continuing and chronic **constraints** to aquaculture development in Africa. These are; the lack of seed, feed, capital and credit, information (including extension) along with marketing and market issues.

At the same time, the FAO Fisheries Department conducts global aquaculture development trends reviews on a regular basis, the last having been done in the year 2000. The next review is scheduled for 2005.

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<sup>1</sup> Cameroon, Central African Republic, Congo (Republic of), Côte d'Ivoire, Kenya, Madagascar, Malawi, Nigeria, Rwanda, Tanzania (United Republic of), Zambia and Zimbabwe.

<sup>2</sup> An example of elements of a national strategy is provided in Appendix 7.

Further to the above, the Second Session of the COFI-AQ held in Trondheim, Norway, from 7 to 11 August 2003 agreed that the Secretariat should provide a prospective analysis of future challenges in global aquaculture as a basis for a discussion of the longer term direction of the Sub-Committee's work.

The present review and analysis of aquaculture sector in Africa, based on national aquaculture sector overviews (NASOs), structure questionnaires, thematic reviews, discussions and consultations during the workshop were envisioned as means of documenting progress made and the way forward by answering the questions: (a) was verifiable progress made; (b) if so, why, and (c) where should we go from here? and providing vital regional information for the FAO's planned global aquaculture trends review 2005 and the prospective analysis of future aquaculture development requested by COFI-AQ.

The specific **objectives of the Review** are:

- (a) To review and assess aquaculture development in Africa, including progress made in implementing the recommendations of the 1999 regional review.
- (b) To provide a forum for information exchange and sharing of experiences, specifically as relates to the information documented through the National Aquaculture Sector Overviews (NASOs) and the responses received for the questionnaire aimed at obtaining information for the preparation of prospective analysis of future aquaculture development process.
- (c) To develop recommendations for Governments and other stakeholders as to how identified constraints should be addressed and resources should be used to advance aquaculture development in the region.
- (d) To ensure regional inputs into the global aquaculture development trends review and the prospective analysis of future aquaculture development are fully met.

### **3. WORKSHOP PROCESS**

The workshop process consisted of; (a) presentation of papers and information by participants; (b) discussion at plenary; (c) working group discussions, and (d) adoption of the recommendations in plenary. The participants were divided into four Working Groups on thematic basis and were provided with specific terms of reference for each (Appendix 3). The main Working Group outputs (conclusions and recommendations) were presented to the workshop in plenary (Appendix 4). The full Working Group reports are given in Appendix 5. Working Group Conclusions and Recommendations were consolidated and synthesized and abridged into the major elements presented in Section 5 below.

### **4. ACHIEVEMENTS AND ADVANCEMENTS: 1999–2005**

As indicated in the resource paper on technology and resources, overall aquaculture production from the Africa region has increased by more than one third since 1999 (Appendix 6: Elements of 1999 Africa Regional Aquaculture Review). This increase in output only partially reflects the progress made in the region over the past six years. The majority of this production comes from profitable commercial producers of small-, medium and large-scale. These growing private sector ventures are another indication of the progress made in establishing aquaculture as a sustainable food production enterprise contributing to national food security and reducing the fish supply gap.

The increase in private sector ventures is, to a large part, as a result of the improving investment environment including better access to credit and good quality seed.

Banks and other formal lending institutions are increasingly realizing that aquaculture is a *bona fide* business in which they can have confidence. Concurrently, micro-credit schemes, credit assistance through NGOs and informal and traditional credit have also contributed to the growing availability of capital for aquaculture. Pivotal roles have been assigned to producer groups, and revolving funds put in place to facilitate the sustainable flow of resources. However, recent experiences have also

reinforced the conclusion of the 1999 review that gifts should not be given nor project-guaranteed credit offered; borrowers need to accept the direct financial responsibility for their actions.

Reliable and profitable private-sector-supplied seed is now a reality in some countries. There has been disproportionate escalation in catfish hatchery operations to keep pace with the rapid growth in catfish culture systems as, in many countries, they overtake the more established tilapia culture. Through this process, it is now appreciated that: (i) catfish is a good entry point since it requires a higher, but attainable, level of technical expertise which fosters more professional hatcheries; (ii) using catfish as an entry point also facilitates the subsequent improvement in existing poor quality tilapia hatchery technologies; (iii) hatcheries serve as effective hubs for concentrations of fish production as well as possible centres for producer associations, and (iv) distribution is as great, or greater, a challenge as production.

Although the classic constraints (feed, seed, capital, information and markets) continue to plague African aquaculture development to varying degrees, there has been considerable expansion of a wider variety of aquaculture production systems employed in the region, with viable cage, raceway, tank and other systems joining the more common pond systems (Appendix 5, Working Group 1).

While national institutions continue to be confronted with human and financial resource difficulties, the region has established a cadre of qualified and forward-thinking technicians, administrators and leaders. There has been a noticeable improvement in institutional capacity, stability and approach with an increasing awareness that development must concentrate on one's own resources and not be founded on ephemeral external aid.

Aquaculture extension is a chronic dilemma. Various methodologies have been, and are being tried across the region. Incorporation of producer associations with extension programmes is essential, albeit sustainability of these latter also seems to be problematic.

As aquaculture comes of age in the Africa region, there is now an acknowledged need to deal with such previously neglected matters as quality control and assurance, trade, specific legislation and regulation, codes of conduct, transparency and accuracy. Many countries have found that elaborating comprehensive national aquaculture development strategies or strategic frameworks, forming the bridges between existing policies and policy objectives, as well as clearly attributing roles and responsibilities to the private and public sectors, is a useful mechanism to promote broad-based and sustainable development (Appendix 7).

Regional development has also been helped by the growing attention paid to aquaculture by such organizations as NEPAD, a variety of RECS and other regional and sub-regional assemblies. Hand in hand with this recognition is the growing expectation that aquaculture can assist in a significant way to narrow the supply gap for aquatic products along with stimulating economic growth.

At its present level of development, African aquaculture can benefit from a regional approach based on collective reasoning, sharing of experiences and networking combined with a regional focus to some aspects of development such as education, training and research. There has been progress made in this area with several regional workshops and conferences on a variety of aquaculture topics promoting direct exchanges while advances in information technology have greatly increased long-distance communications and sharing.

Specific results achieved and lessons learnt during the 1999–2005 period are cited as general outputs from FAOs Field Programme as well as from field activities of other development partners (Appendix 8).

## 5. CONCLUSIONS AND RECOMMENDATIONS

In line with Workshop Objective “C”, participants formulated recommendations to governments, responsible institutions, the private sector, producer and trade associations and all other concerned stakeholders for a practical way forward for aquaculture to develop in a sustainable manner in the Africa region. Detailed conclusions and recommendations, based on the Working Group interactions, are presented in Appendix 4. These have been integrated and synthesized into the following general statements:

There was unanimity in the conclusion that aquaculture has significantly advanced in the Africa region since the First Africa Regional Review held in Accra, Ghana in 1999. This growth was attributed largely to the fact that aquaculture has proven to be a profitable enterprise. This has been demonstrated by the importance of aquaculture development to the Africa region as recognized and highlighted at various fora including the Committee for Inland Fisheries of Africa (CIFA), NEPAD Fish for All Summit and others. However, aquaculture continues to require promotion by all stakeholders in order to attract the necessary level of financial and administrative support. In this context, the importance of regional reviews was highlighted and it was recommended to hold similar reviews in 4–6 year intervals.

### **Improvement and development of aquaculture**

There is a range of existing aquaculture production systems which are being practiced in the region. To varying degrees these systems contribute to improved livelihoods through enhanced food security and poverty alleviation. Emerging production systems include *inter alia* integrated irrigation aquaculture, commercial pond, tank and cage culture. Aquaculture development efforts in the region should, therefore, target aquaculture as a business, and aquaculture should be considered, presented and promoted as a comprehensive enterprise. Focusing on optimizing the profitability of aquaculture farming systems will lead to the most sustainable use of public and private resources as well as benefit all segments of the sector including the non-commercial (subsistence) farmers with fishponds.

Aquaculture extension remains one of the major constraints confronting the region with respect to how to provide technically sound and cost-effective services. Additional constraints include limited capacities of fish seed and feed industries aggravated by weak management which are all negatively influencing culture production in the region. The situation is exacerbated by poor access to credit, seed, feed and aquaculture infrastructure, which remain constrained to varying degrees. With inputs required for the intensification of aquaculture remaining expensive and/or not readily available, measures to improve access to alternative sources of credit, cost-effective inputs and support services, as well as physical infrastructure (particularly water and electricity) should be taken up by Governments in partnership with the private sector. Among these constraints, seed is the easiest issue to address by technical services. However, the introduction of exotic and/or genetically modified organisms constitutes a potential risk to the environmental sustainability of aquaculture; thus relevant codes and agreements should be adhered to with respect to the use and introduction of culture organisms. To make the best use of available stocks, the responsible development and use of fish genetic resources including improved strains should be promoted.

Mariculture remains a largely untapped resource of the region. It should only be developed with the necessary care and precaution, using better management approaches and applying best practices. There are also considerable non-food aquaculture development opportunities (ornamental, bait, crocodile skins and eggs, aquatic plants) in all countries and it is necessary to promote diversification of food and non-food culture systems and practices.

Government support to aquaculture through favourable fiscal and procurement policies, ease of access to low cost capital and infrastructure development, particularly public investment in water and electricity, and regulatory guidelines in aquaculture management and usage (seed, feed and grow out) is critical for expansion of private sector commercial aquaculture. In addition, strategies emphasizing

organization of small-scale aquaculture around large-scale commercial producers can help to enhance the contribution of rural aquaculture to the economy as a whole. However, it is necessary to investigate the economic viability and financial profitability of various culture practices.

### **Policies, strategies and legal framework**

The aquaculture sector development in most countries is not facilitated by comprehensive and adequate legislation. Regulatory mechanisms and institutional arrangements specific to aquaculture should be improved where they exist and be developed where they don't exist. Governments should formulate aquaculture policies, strategies, plans and legislative frameworks as a priority on their national development agenda. In addition, Governments should create a conducive fiscal and public infrastructural environment that is necessary for the private sector to participate in profit oriented aquaculture.

### **Trade and safety**

The trade of aquatic products at all levels (local, national, intra- and interregional) is an increasingly important issue in aquaculture development, and should be carefully analysed to provide the best benefits for producers and consumers. Intra-African trade is of special importance and represents a large market which should be better served by aquaculture producers. Ensuring the safety and quality of aquaculture products is a must for local, national and international markets. As food safety issues are rising high in consumer demands and becoming increasingly important in improving public health, countries in Africa must take the issue of safety and quality of aquatic products seriously without further delay.

### **Promotion of aquaculture**

Governments have not adequately provided for aquaculture in their development agenda and awareness creation and promotion should be considered as important national priorities for Governments and stakeholders. NEPAD, RECs and other existing structures offer opportunities to promote and develop aquaculture further. However, aquaculture promotion should not be gratuitous. Aquaculture should be promoted when the necessary services are in place to be able to follow-through on the resulting increasing level of interest and investment.

To support the sector and its promotion, mechanisms for establishing aquaculture development funds at national, sub-regional and regional level need investigating; possibly in the form of Trusts or other legal and administrative arrangements. It is also important to promote and support research and training, with these institutions focusing on, among others, the private sector supply and distribution of suitable seed, feed and fertilisers as catalysts to sustainable development.

### **Regional networking**

African aquaculture development faces a common set of challenges which can best be met when approached regionally (Africa-wide) where experiences from one country can aid others and where resources from many can be pooled to address common issues. Networking should therefore be encouraged as an extension and communication tool for aquaculture development involving stakeholders at national and regional levels. NEPAD, RECs and other existing structures offer opportunities to promote and develop aquaculture, and links to such initiatives and institutions should be further explored with the ultimate aim of implementing a regional African aquaculture development programme.

CIFA should take an active role in African aquaculture development including establishing an aquaculture working group to facilitate networking and sustain aquaculture development while working towards development of a Network of Aquaculture Centres in Asia-Pacific (NACA)-type institution for the region. Networking should be encouraged as an extension tool which the private

sector should support and which should involve all stakeholders at national and regional levels. South-south cooperation should also be used to the advantage of regional and national development programmes.

### **Research needs**

Research should be demand-driven. Aquaculture research must address problems experienced by operators, building on the existing body of information. There is a need to promote and support research on production as well as seed and other input supply. Research should have strong socio-economic functions such that users of the results will be able to readily assess their options and determine which choice has the best fit. On-farm research is an important component of demand-driven programmes and offers opportunities for research-extension teams to address the recurrent extension delivery problems.

### **Information**

Extension of aquaculture information has not been effective under public sector administration. Systems for information gathering and dissemination need to be established where these are lacking and strengthened where they exist. Aquaculture information nodes should be established in public and private sector agencies at national, sub-regional and regional levels in sub-Saharan Africa.

Documentation centres that package aquaculture information into user-friendly forms should be established at various levels. As an immediate step, it is recommended to document and share farmer-proven case studies and technologies through “writeshop” meetings with a specific focus on sub-Saharan Africa. Attention should be given to the preparation of socio-economic studies to generate information on contributions of aquaculture to national, social and economic development, while documenting such critical areas as economic thresholds for input supply and market delivery

Information on the resources on which aquaculture production systems could be based is usually not readily available. The following countries should be recognized as having adequate resources to share experiences and knowledge on different species and practices, with the view to provide demonstration and extension to the countries in the region:

- Catfish culture -Nigeria
- Tilapia culture – Kenya
- Mariculture – Mozambique
- Cage culture – Ghana
- Small Water Bodies – Burkina Faso
- Rice-fish culture - Madagascar

### **Funding**

Existing funding mechanisms for aquaculture are expensive and inaccessible to many farmers. Farmers, extension staff and financial institutions do not have adequate capacity to formulate and review aquaculture business investment proposals. In addition, Governments have not sufficiently addressed various options and alternatives for funding aquaculture investments. There is a need for setting up aquaculture development funds and ease access to affordable sources of credit for expansion of existing farms and new investments. There is an accompanying need to actively educate farmers, entrepreneurs and other investors in how to develop and follow suitable business plans. All of these planning and funding avenues are predicated on having necessary and factual records and data available for review by those who would invest the funds.

**APPENDIX 1****List of participants****Cameroon**

KOUAM Jean  
 Chief Service of Aquaculture  
 Fisheries Department  
 DIRPEC-NINEPIA, Yaounde  
 Tel.: (237) 761 4352  
 Fax: (237) 222 1405  
 E-mail: kouamjean@ yahoo.fr

**Congo (Democratic Republic of)**

KOMBOZI Gabriel Linbeya B.  
 Directeur/Service national d'aquaculture  
 (SENAQUA)  
 Croisement Batetela et Boulevard du 30 juin  
 Ministère de l'agriculture  
 Kinshasa  
 Tel.: (243) 8951567  
 E-mail: gabykombozilb@hotmail.com

**Congo (Republic of)**

EBOUNAKA-Herve  
 Coordonnateur du Project pisciculture  
 paysanne  
 Ministère de l'agriculture, de l'élevage  
 et de la pêche  
 46 Rue Luanda Talangai  
 Brazzaville  
 Tel.: 525 47 69

**Côte d'Ivoire**

SANOOGO Mamadou  
 Chef de Service et évolution de projets  
 Ministère de la production animale  
 BP 19 rue des pêcheurs, Abidjan  
 Tel.: 05 44 04 55  
 E-mail: sanogo\_mamadou47@yahoo.fr

**Ghana**

ABBAN Eddie Kofi  
 Water Research Institute  
 PO Box M.32, Accra  
 Tel.: (233) 21 768310  
 Fax: (233) 21 761030/777170  
 E-mail: csir-wri@yahoo.com

AWITY Lionel K. A.  
 Head, Inland Fisheries and Aquaculture  
 Directorate of Fisheries, Ghana  
 Ministry of Fisheries  
 PO Box 630 Accra  
 Tel.: (233) 244 591 458  
 Fax: (233) 21 776005  
 E-mail: lawity@hotmail.com

**Kenya**

GITONGA Nancy K.  
 Director of Fisheries  
 Fisheries Department  
 PO Box 58187  
 Nairobi  
 Tel.: (254) 020 3744530  
 Fax: (254) 020 3744530  
 E-mail: samaki@saamnet.com

WAFULA Mathias  
 Deputy Director of Fisheries  
 Fisheries Department  
 PO Box 58187  
 Tel.: 020-3742320  
 Fax: 020-3744530  
 E-mail: samaki@saamnet.com

GICHURI W. Maina  
 Fisheries Department  
 PO Box 58187, Nairobi  
 Tel.: 020-3742320  
 Fax: 020-3744530  
 E-mail: samaki@saamnet.com

MBUGUA Henry M.  
 Fisheries Department  
 PO Box 58187, Nairobi  
 Tel.: 020-3742320  
 Fax: 020-3744530  
 E-mail: samaki@saamnet.com

NYANDAT Beatrice  
 Fisheries Department  
 PO Box 58187  
 Tel.: 020-3742320  
 Fax: 020-3744530  
 E-mail: samaki@saamnet.com  
 tieny30@yahoo.com



FULANDA Bernerd  
 Research Scientist – Aquaculture  
 Kenya Marine and Fisheries Research  
 Institute  
 PO Box 81651  
 Mombasa  
 Tel.: 041 475157  
 Mobile: 0721452729  
 Fax: 041 475157  
 E-mail: bernfulanda@kmfri.co.ke

MONOR Godfrey  
 Assistant Director of Fisheries  
 Fisheries Department  
 PO Box 90423  
 Mombasa  
 Tel.: 041 2229597  
 Fax: 042 2315904  
 E-mail: monorgv@gmail.com

BETHUEL Omolo  
 Senior Fisheries Officer  
 Fisheries Department  
 PO Box 1137  
 Bungoma  
 Tel.: (254) 55 30060/0722 619909  
 E-mail: bomolo@hotmail.com

THIGA Benson  
 Senior Fisheries Officer  
 Sagana Aquaculture Centre  
 PO Box 26  
 Sagana  
 Tel.: 254-060-46041  
 Fax: 254-060-46041  
 E-mail: bensonthiga@yahoo.com

YALO Maxine  
 Fisheries Officer  
 Fisheries Department  
 PO Box 90423  
 Mombasa  
 Tel.: 0735845685  
 Fax: 2315904  
 E-mail: maxyalo@yahoo.com

ATIENO ADHOLA Caroline  
 Aquaculture Officer  
 Lafarge Ecosystems  
 PO Box 81995, Mombasa  
 Tel.: (254) 11 5486601/5485901-4  
 Fax: (254) 11 5486459/60  
 E-mail:  
 caroline.Adhola@bamburi.lafarge.com  
 caroline.Adhola@yahoo.com

## **Liberia**

SEILAY J. Frederick  
 Director of Fisheries  
 Ministry of Agriculture  
 Bureau of National Fisheries  
 Tel.: (231) 06 562895

## **Malawi**

CHIMATIRO Sloans  
 Director of Fisheries  
 Department of Fisheries  
 PO Box 593, Lilongwe  
 Tel.: (265) 1 788 511  
 Fax: (265) 1 788 712  
 E-mail: Chimatiro@sdnp.org.mw

## **Mozambique**

OMAR Isabel  
 Head of Aquaculture Department  
 Ministry of Fisheries  
 PO Box 1723  
 Rua Consiglieri Pedroso 347 Maputo  
 Tel.: (258) 21 357100/309605  
 Fax: (258) 21 309605/320335  
 E-mail: iomar@mozpesca.gov.mz

## **Nigeria**

SHIMANG Gogwim Ngwa  
 Director  
 Federal Department of Fisheries  
 Federal Ministry of Agriculture and Rural  
 Development  
 Abuja, Nigeria  
 Tel.: (234) 9 3144665  
 Fax: (234) 9 3144665  
 E-mail: gshimang@yahoo.com

## **Sierra Leone**

SHERIFF Mohamed Fouad  
 Deputy Director of Fisheries  
 Ministry of Fisheries and Marine Resources  
 Brookfields Hotel Complex  
 Jomo Kenyatta Road, Freetown  
 Tel.: (233) 22 234406  
 Mobile: (232) 76 611664  
 Fax: (232) 22 235135  
 E-mail: alhaji2001@yahoo.com

**South Africa**

HECHT Thomas  
 Professor Emeritus  
 Rhodes University  
 1 Beach Rd, Kleinemonde  
 Tel.: (27) 46 6751010  
 E-mail: T.HECHT@Ru.AC.ZA

**Uganda**

MAEMBE Thomas Wanyika  
 Executive Secretary  
 Lake Victoria Fisheries Organization  
 PO Box 1625  
 Jinja  
 Tel.: (256) 43 120205/6  
 Fax: (256) 43 123123  
 E-mail: lvfo-sec@lvfo.org

MWANJA Wilson Waiswa  
 Principal Fisheries Officer – Aquaculture  
 Department of Fisheries Resources  
 PO Box 4  
 Entebbe  
 Tel.: (256) 41 320563/322026  
 Fax: (256) 41 320496  
 E-mail: wwmwanja@yahoo.com

**United Republic of Tanzania**

MUSHI Valerie Emil  
 Principal Fisheries Officer  
 Fisheries Division  
 PO Box 2462, Dar es Salaam  
 Tel.: (255) 22 2116159/2122930  
 Fax: (255) 22 2110352  
 E-mail: valerieamushi@yahoo.com

**Zambia**

MAGUSWI Charles T.  
 Deputy Director  
 Fisheries Extension and Management  
 Department of fisheries  
 PO Box 350100 Chilanga  
 Tel.: (260) 1 278418  
 Fax: (260) 1 278618  
 E-mail: piscator@zamnet.zm

MUDENDA G. Choolwe  
 Consultant-Aquaculture Economics  
 FAO/Department of Fisheries  
 PO Box 50534  
 Lusaka  
 Tel.: (260) 1 97695114  
 E-mail: cmudenda46@yahoo.com

**Food and Agriculture Organization  
of the United Nations (FAO)**

LOWTHER Alan  
 Fishery Statistician  
 Viale delle Terme di Caracalla  
 00100 Rome, Italy  
 Tel.: (39) 06 570 54029  
 Fax: (39) 06 570 52476  
 E-mail: Alan.Lowther@fao.org

HALWART Matthias  
 Fishery Resources Officer  
 Viale delle Terme di Caracalla  
 00100 Rome, Italy  
 Tel.: (39) 06 570 55080  
 Fax: (39) 06 570 53020  
 E-mail: Matthias.halwart@fao.org

HISHAMUNDA Nathanael  
 Fishery Planning Officer  
 Viale delle Terme di Caracalla  
 00100 Rome, Italy  
 Tel.: (39) 0657054122  
 Fax: (39) 06570 56500  
 E-mail: nathanael.hishamunda@fao.org

KALENDE Mulonda Boniface  
 Aquaculture Specialist  
 FAO-RAFI Ghana Accra  
 PO Box 1628  
 Tel.: (233) 780656  
 E-mail: mulonda.kalende@fao.org

SUBASINGHE Rohana P.  
 Senior Fishery Resources Officer  
 Viale delle Terme di Caracalla  
 00100 Rome, Italy  
 Tel.: (39) 06 57056473  
 Fax: (39) 06 57052030  
 E-mail: rohana.subasinghe@fao.org

MOEHL John  
Regional Aquaculture Officer  
FAO Regional Office for Africa  
PO Box 1628  
Accra, Ghana  
Tel.: (233) 21 678 000  
E-mail: john.moehl@fao.org

CRESPI Valerio  
Fishery Resources Officer  
Viale delle Terme di Caracalla  
00100 Rome, Italy  
Tel.: (39) 0657055617  
Fax: (39) 0657053020  
E-mail: valerio.crespi@fao.org

### **Secretariat**

ODERA Josephine  
Secretary  
Fisheries Department  
PO Box 90423  
Mombasa  
Tel.: (254) 041 2315904  
Fax: (254) 41 2315904  
E-mail: celyhil@yahoo.com

GICHUKI Anne  
Secretary  
Fisheries Department  
PO Box 58187  
Nairobi  
Tel.: (254) 2 3742320/49  
Fax: (254) 020 3744530  
E-mail: samaki@saamnet.com

### **Intepreters**

NASIMIYU Brenda  
Language Consultant (French)  
GAP  
PO Box 40791-80100  
Mombasa  
Tel.: 0722654052  
E-mail: gapconsult@kenyaweb.com

## APPENDIX 2

### Agenda

#### *20 September 2005*

08.00–08.30	Registration
08.30–08.45	Introduction to the workshop: structure and objectives
08.45–09.15	Evolution and lessons learnt since 1999 Review
09.15–09.35	Introduction to NASO
09.35–10.00	Aquaculture Statistics in Africa
10.00–10.20	<b>Formal Opening</b>
10.20–10.40	Coffee Break
10.40–12.30	NASO Presentations
12.30–14.00	Lunch
14.00–15.00	NASO Presentations
15.00–15.30	Introduction to PAFAD
15.30–16.00	Regional Synthesis
16.00–16.20	Coffee Break
16.20–16.40	Discussion
16.40–17.00	National Strategies
17.00–17.30	Country Strategy Up-dates: Cameroon, Zambia and Ghana
17.30–17.50	Kenya Aquaculture
17.50–18.00	Synthesis

#### *21 September 2005*

08.30–09.00	Introduction of Working Group Themes <ol style="list-style-type: none"> <li>(1) Technology, production and resources</li> <li>(2) Information and networking</li> <li>(3) Socio-Economics and finance</li> <li>(4) Policies, institutions, and legal frameworks</li> </ol>
09.00–18.00+	Working Groups
10.00–10.30	Coffee Break
12.30–14.00	Lunch
16.30–17.00	Coffee Break

#### *22 September 2005*

08.30–10.00	Drafting Group NASO/PAFAD Follow-up
10.00–10.30	Coffee Break
10.30–12.30	Discussion and concluding
12.30–15.30	Lunch
15.30–16.00	Adoption of Conclusions and Recommendations
16.00–16.15	Closing

## APPENDIX 3

### Working Group terms of reference

#### *Group I: Technology, production and resources*

**Topics** discussed should include: production systems undertaken or planned in the region with specific reference to Integrated Irrigation/Aquaculture (IIA), Small Water Bodies (SWB); cage culture and commercial pond culture, cost-effective means of producing and distributing high-quality inputs, quality control of these inputs and the use of exogenous/exotic products.

**Findings and Recommendations** should include: how production systems (technologies) should be chosen and targeted, what options are available for input supply and how choices should be made, how to address the issue of input distribution, how to provide quality control including the use of non-indigenous species, the relative roles of the private and public sectors in all of the above, infrastructure/resource requirements for major issues, advisability of targeting (e.g. geographic or demographic concentration).

#### *Group II: Information and networking*

**Topics** discussed should include: extension structure and function (as well as efforts to privatize extension), roles of farmer associations, roles for NGOs, mechanisms for feedback and feed-forward along with monitoring, the Africa Water Resource Database (AWRD), “NACA\_like” networking.

**Findings and Recommendations** should include: how aquaculture extension and outreach can be realistically provided including an assessment of methodologies currently employed, role of and issue surrounding the development of producer associations including their scope and level of structure, opportunities for computerized and GIS data systems, areas for intraregional cooperation and action, the relative roles of the private and public sectors in all of the above, infrastructure/resource requirements for major issues, advisability of targeting (e.g. geographic or demographic concentration).

#### *Group III: Socio-economics and finance*

##### **3.1 At the macrolevel**

1. Share country experiences on changes that occurred between 1999 and 2005 in terms of the contribution of aquaculture to:
  - a. Employment especially in rural areas;
  - b. Food supply (food security) and improvement of nutritional status for both fish farmers and non-fish producing consumers, especially in rural areas and urban centers;
  - c. countries' economies (welfare) in general.
2. Discuss:
  - a. **How** positive experiences in 1a, 1b and 1c, if any, came about (**i.e. enabling factors/mechanisms** which led to positive experiences in 1a, 1b and 1c);
  - b. **Why** improvements failed to occur (i.e. impeding factors to positive changes).
3. Evaluate positive changes which occurred in aquaculture financing and discuss **how** (enabling factors) they came about or **why** (impeding factors) no improvements occurred.

4. Suggest practical and feasible priority actions (solutions) to improve aquaculture socio-economics and financing (refer to 1, 2 and 3 above for definition) in the region.

### 3.2 At the microlevel

1. Share country experiences on:
  - a. Enterprises (fry production, fingerling production, a combination of both, grow out operations) and, within each enterprise, systems (species) which have proven or seem economically efficient;
  - b. Enterprises and, within each enterprise, systems which have NOT proven or DO NOT seem economically efficient.
2. For each situation discussed above (1a and 1b):
  - a. Discuss, as applicable, **how** efficiency occurred (enabling factors);
  - b. Discuss, as applicable, **why** inefficiencies occurred (constraining factors/sources of inefficiencies).
3. Share experiences on:
  - a. Financing sources and funding mechanisms for aquaculture in the region;
  - b. Progress made in improving farmers and investors in aquaculture allied sectors (feed and seed)'s access to funding.
4. Identify priority actions in increasing economic efficiency and availability of and access to funding while clearly defining the responsibility of governments, private sector and development agencies, especially FAO.

#### *Group IV: Policies, institutions and legal frameworks*

1. Evaluate the progress made between 1999 and 2005, in terms of each country having:
  - a. A policy, institutional and legal framework for aquaculture development;
  - b. Strategy for aquaculture development;
  - c. Aquaculture Development Plan(s).
2. Exchange experiences on country-specific general policies, institutions, laws regulations for aquaculture development.
3. Share experiences on issue specific policies and strategies which have been used to deal with specific issues previously identified as impeding aquaculture development in the region, namely:
  - a. Unavailability and inaccessibility to funding and loans;
  - b. Under development of allied/support industries (feed and seed);
  - c. Shortage of skilled manpower.
4. Evaluate the efficacy of each policy and derive lessons to learn. That is, after discussing whether or not:
  - a. the policy was appropriately implemented;
  - b. the policy had the intended impact and ;
  - c. the policy still reflects the best option to address the identified issue, advice whether or not it was/is a good or bad policy.
5. Make recommendations as to priority actions that need to be undertaken in order to tackle the issues.

## APPENDIX 4

### Working Group conclusions and recommendations

Detailed conclusions based on Working Group Discussions and specific recommendations prepared by each Working Group.

#### CONCLUSIONS FROM THE WORKING GROUPS

1. Governments have not adequately provided for aquaculture in their development agenda.
2. Awareness creation and promotion should be considered among important national policies.
3. Regulatory mechanisms on aquaculture development should be improved where they exist and be developed where they don't exist to make aquaculture a sustainable industry.
4. Extension of aquaculture information has not been effective under Public sector administration.
5. Networking should be encouraged as an extension and communication tool for aquaculture development.
6. Networking should involve all stakeholders at national and regional levels.
7. There was paucity of information on feed and fertilizer uses and impacts in SSA region.
8. Information on resources on which aquaculture production systems could be based is not readily available in their regime.
9. Current aquaculture research has not been largely in response of operators problems.
10. There are no active fish farmers' associations to address/articulate issues within the aquaculture industry.
11. Limited capacities in fish seed and feed industries as well as management are negatively influencing culture production in the region.
12. Inputs required for the intensification of aquaculture in SSA are expensive and not readily available.
13. It is not possible to assess progress towards improving aquaculture contribution to general economic welfare, employment and food security because of inadequate socio-economic data on aquaculture. The system for information gathering needs strengthening and in some cases should be established. There is need therefore for better information of farmed fish consumption in the region.
14. Expansion of private commercial aquaculture is critical to enabling significant contribution of aquaculture to the economy as a whole. At present, aquaculture contribution to the economy is negligible because of persistent preoccupation with subsistence production and neglect of support to the private sector. In addition, promotion of farm waste use as key driver of rural aquaculture is not beneficial to the growth of aquaculture.
15. Government involvement in aquaculture production is inefficient and generally not beneficial to the expansion of aquaculture. But, Government support to aquaculture through favourable fiscal and procurement policies, ease of access to low cost capital and infrastructure development, particularly public investment in water and electricity, regulatory guidelines in aquaculture management and usage (seed, feed and grow out) is critical for expansion of private sector commercial aquaculture. In addition, strategies emphasizing organization of small scale aquaculture around large scale commercial producers can help to enhance the contribution of rural aquaculture to the economy as a whole. However, it is necessary to investigate the economic viability and financial profitability of various culture practices.
16. There are undeveloped and untapped non-food aquaculture development opportunities (ornamental, bait, crocodile skins and eggs, aquatic plants) in all countries. It is therefore necessary to promote diversification of food and non-food culture systems and practices in the region.
17. Aquaculture research and management is dominated by biological scientists. Social economic and engineering disciplines are not usually part of aquaculture research and management.

There is therefore need for fostering multidisciplinary specialists in aquaculture research and management and including socio-economic information in aquaculture information.

18. Existing funding mechanisms for aquaculture are expensive and inaccessible to many farmers. Farmers, extension staffs and financial institutions do not have adequate capacity to formulate and review aquaculture business investment proposals. In addition, Governments have not sufficiently addressed various options and alternatives for funding aquaculture investments. There is a need for setting up aquaculture development funds and ease access to affordable sources of credit for expansion of existing farms and new investments.

## RECOMMENDATIONS OR PRIORITY AREAS

**Table 1. Recommended priority areas for action group 1**

<b>Action</b>	<b>Time frame</b>	<b>Actors</b>
Assess existing use and potential for feed and fertilizer, and promote the production of suitable pond fertilizer and fish feeds	1 year	Government, Universities, NGO's Private Sector and Development Partners (e.g. FAO)
Promote stakeholder demanded research in fish feed, seed and management	3 years	Government, Research Institutes, Private, NGO's
Establish and Strengthen farmers associations	3 years	Government, Producers, NGO's
To develop capacities in feed, seed, systems operations to all stakeholders e.g. farmers, researchers, Technicians, Extensions service providers etc.	3 years	FAO and Government
Carry out inventory of all available input resources to establish baseline data and database (fish spp., manpower, land, capital sources, feeds, seeds and human resources	2 years	FAO and governments
Provide incentives for technical equipment for production of fish feed and seed.	3 years	Government

### **Relative roles of private sector and public sectors (Group 1)**

- 1. Government**
  - Facilitation
  - Monitoring, and regulatory
  - Capacity building
- 2. Private Sector**
  - Spearhead sub-sector development
- 3. Non Governmental Organization**
  - Capacity building and advocacy
- 4. FAO**
  - Technical backup-stopping , identity sources
  - Identification sources of funds for take off
- 5. Development Partners**
  - Provide financial support



**Table 2. Priority actions and resources required – Group 2**

<b>Action</b>	<b>Time scale</b>	<b>Responsibility</b>	<b>Actors</b>
Establish National Aquaculture Development Committees (NADCs)	Immediately	Ministry responsible for aquaculture	Directorates/Departments of Fisheries and Public/Private Sector Stakeholders
Establish Aquaculture Networking Desk at Departments of Fisheries	Soon as possible	Ministry responsible for aquaculture	Directorates/Departments of fisheries
Establish National Network of Aquaculture Stakeholders	Soon as possible	Public and Private Sector Stakeholders	National Aquaculture Institutions
Develop Farmer Associations	Soon as possible	Directorates of Fisheries and Farmers	Farmers
Establishment of Network of African Aquaculture Centres within sub-Saharan Africa	Within 4 years	CIFA	National Governments
Establishment of Regional Aquaculture Working Group	2 years	CIFA	National and Sub-Regional Governments

**Table 3. Priority actions and resources required – Group 3**

<b>Action</b>	<b>Time scale</b>	<b>Responsibility</b>	<b>Actors</b>
needed to improve, expand and develop, as appropriate, information system for quantifying aquaculture contribution to employment, food security and the economy as a whole	Immediately	Government responsibility and private sector collaboration	Directorates/Departments of Private Sector Development
To foster and enable multidisciplinary research and sector management	As soon as possible	Government Ministries responsible for research	Various Directorates and Departments
To continue promoting, emphasizing, and supporting private sector participation through various incentives such as favourable fiscal and procurement policies, ease of access to and low cost capital (e.g. revenue contribution of public utilities companies to the aquaculture development fund as is the case in	Immediately	Governments, local and international agencies	Governments, local and international agencies

<b>Action</b>	<b>Time scale</b>	<b>Responsibility</b>	<b>Actors</b>
Indonesia), infrastructure development (water first, and electricity)			
To establish Aquaculture Development Funds (ADFs)	As soon as possible	Governments	Farmers
To initiate (where it does not exist), expand and strengthen (where it exists) commercial aquaculture	Immediately	Government Ministries responsible for Aquaculture	National Governments and Cooperating Partners
To mobilize and organize rural fish farmers around nucleus commercial producers and/or input suppliers for sustainable support to rural aquaculture	Immediately	Governments Ministries responsible for aquaculture	Governments, NGOs and local agencies
Governments should have clear guidelines and regulations for brood stock improvement, management and usage	As soon as possible	Government Ministries responsible for aquaculture	Directorates/Departments of fisheries
Governments should promote and/or encourage specialization (where economics permit) along the production chain (Hatchery operation, feeds production, grow out operation etc)	Immediately	Government ministries responsible for aquaculture	Directorates/Departments of Fisheries
To investigate mechanisms for setting up Aquaculture Development Funds (ADFs) and establishing same	As soon as possible	Government ministries responsible for aquaculture	FAO and National Governments
To investigate, compile and disseminate success stories in aquaculture to key funding stakeholders and partners	Immediately	Government ministries responsible for aquaculture	FAO and National Governments
To train and create capacities among funding agencies (banks, MFIs, Cooperative Societies etc) to facilitate access to funds by aquaculture producers	As soon as possible	Government Ministries responsible for aquaculture and financing	National Governments, Private Sector, and FAO
To assess alternative (all) sources of funding and funding mechanisms within the region and elsewhere	Immediately	FAO	FAO and National Governments
To assess viability and profitability of various culture practices	Immediate	Government ministries responsible for aquaculture	National Governments and FAO
To promote diversification	As soon as	Government ministries	Governments, FAO,

<b>Action</b>	<b>Time scale</b>	<b>Responsibility</b>	<b>Actors</b>
of food and non-food aquaculture systems and practices	possible	responsible for fisheries and aquaculture	Farmer Organizations
To limit the role of government s to strategic research, regulation and monitoring, and encourage and promote private sector to lead the production and culture	Immediately	Government responsible for aquaculture	National Governments
To employ social and engineering scientists in research and management	As soon as possible	Ministries responsible for aquaculture, civil works and National Research Councils	Various government ministries and Departments of Fisheries

**Table 4. Priority actions and resources required – Group 4**

<b>Action</b>	<b>Time scale</b>	<b>Responsibility</b>	<b>Stakeholders</b>
Assessment of the importance of aquaculture (socio-economic survey)	Short-term	N, S-R, R, G	National and Regional Governments; FAO; World Fish, other agencies and cooperation partners.
Formulation of regional development framework	Short-term	S-R, R	RECs; FAO; World Fish
Formulation of National development framework	Short to medium term	N	National Governments
Formulation of National Strategies and plans	Short to medium term	N	National Governments
Translate strategies and plans into legislation (Aquaculture Act)	Short to medium term	N	National Governments
Generation of scientific knowledge	Medium to long term	N, S-R, R, G	National and Regional Governments; FAO; World Fish
Mobilise funding	Short, medium and long term	N, S-R, R, G	National and Regional Governments; FAO; World Fish; NGOs
Include aquaculture in the National priorities			
Governments put regulatory mechanisms in place to regulate the aquaculture activities (i.e. feed production, seed production, etc.)	Short-term	N	National Governments, NGOs
Governments should establish separate institutions to adequately address aquaculture	Medium term	N	National Governments, Cooperating Partners
Ensure good political will	Short term	N	National Governments, NGOs
Create awareness to policy makers on the importance of aquaculture	Short term	N S-R, R, G	National and Regional Governments; FAO; World Fish; NGOs
RECs should adequately reflect aquaculture sector in their development plans.	Short to medium term	N S-R, R,	National and Regional Governments; FAO; World Fish; NGOs
National strategies on aquaculture development should be in place as a priority before it is reflected under RECs			
Countries to network to share experiences on aquaculture policy and legal framework	Short to medium term	N S-R, R,	National and Regional Governments; FAO; World Fish; NGOs

Note: \*N=National; S-R=sub-regional; R=Regional; G=Global; RECs=Regional Economic Communities (e.g. SADC, ECOWAS, EAC)

## APPENDIX 5

### Working Group reports

#### Working Group 1: Technology, Production and Resources

Members of the Group:

Facilitator:	Betty Nyandat	Fisheries, Kenya
Secretary:	Mulonda Kalend,	FAO, RAF/Ghana
Chairman:	Bethuel Omolo	Fisheries, Kenya
Members:	Mamadou Sanogo	Fisheries, Côte d' Ivoire
	Jean Kouam	Fisheries, Cameroon
	Mayembe Thomas	LVEMP, Uganda
	Fulanda Bernerd	Kenya Marine and Fisheries Institute, Kenya

**Preamble:** The group identified fish production systems or technologies in use in SSA countries and commented on the status and potential of the approaches and common critical constraints to all systems.

#### 1. Non-commercial pond culture

**Countries practicing:** - Scattered all over SSA region

**Status of practice:** - Has high potential but generally poorly managed on zero to minimum inputs with a general trend towards profit making.

**Issues of practice:** - Land tenure and availability, environmental sustainability, inputs, legal frameworks. However, it contributes to rural livelihoods and nutritional improvements.

#### 2. Integration systems: - (Integration of fish with irrigation or agriculture)

**Countries practicing:** - Burkina Faso, Madagascar, Malawi, Zambia and Zimbabwe. Ghana, Senegal and Kenya intend to adopt the system on a wide scale.

**Status of practice:** - Application generally at low level due to lack of original integration in basic physical facilities used. However, the system has high potential especially where water availability is high.

#### 3. Small water bodies

**Countries practicing:** - Burkina Faso, Ghana, Senegal, and Zimbabwe. Also firm plans exist in Angola, Guinea Conakry, Kenya, Malawi and Senegal

**Status of practice:** - Involvements and practices to enhance production under review.

**Issues of practice:** - management of resource considered as community property by individuals for higher productivity.

#### 4. Commercial pond: - Ghana, Kenya, Madagascar, Namibia, Nigeria, and Uganda. Countries with plans to engage in the practice include Angola, Cameroon, Congo (Republic of), Congo (Democratic Republic of), Côte d'Ivoire and Sierra Leone.

**Status of practice:** Mostly at commercial working towards industrial operational status. Has potential for expansion.

**Issues of practice:** - Land tenure and availability, environmental sustainability, basic inputs, training for various categories of operators.

## 5. Cage culture

Countries with Practice: Côte d'Ivoire, Ghana, Kenya, Mozambique, Zambia and Zimbabwe.

**Status of practice:** Rate of adoption relatively high, yet to attain routine industrial levels.

**Issues of practice:** Environmental implications to be studied locally. Commercial availability of basic inputs of seed, feed and locally developed and tested cage designs; access to water rights and security.

## 6. Common issues limiting all production systems

The group considered critical common issues negatively influencing all production systems and suggested strategies to enhance current status as follows:

### (i) Labour

**Status:** Mostly unskilled or inadequately trained but expensive.

**Way forward:** General need for human resources capacity building infrastructure tailored extension; identification of local and external sources of appropriate personnel and databases.

### (ii) Fish feeds

**Status:** Compounded feeds generally unavailable. Material used as feed may consist of uncompounded feed ingredients. Imported feeds are expensive and uncertified.

**Way forward:** Public sector to stimulate private sector through regulatory incentives to establish local feed industries. Networking of efforts to formulate, produce and evaluate feeds.

### (iii) Fish seed

**Status:** Local production increasing although quality and certification are mostly inexistent. Fish species for which seeds are available is very limited.

**Way forward:** Public sector to introduce appropriate regulations to certify production and quality of seeds. Studies to expand species range of seeds.

### (iv) Capital

**Status:** Not readily available.

### Way forward

- Advocacy of fish culture among financial institutions.
- Possible establishment of aquaculture development fund stimulated by public sector for lending to private sector;
- Education of farmers on requirements of financial institutions as basis of possible financial assistance.

## 7. Conclusions

- There was paucity of information on feed and fertilizer uses and impacts in SSA region.
- Information on resources on which aquaculture production systems could be based is not readily available in the region.
- Current aquaculture research has largely not been in response to operators' problems.
- There are no active fish farmers' associations to articulate issues negatively affecting the aquaculture industry.
- Limited capacities in fish seed and feed industries as well as management are negatively influencing culture production in the region.

- Inputs required for the intensification of aquaculture in SSA are expensive and not readily available.

### **Working Group 2: Information and networking**

#### **Members:**

Facilitator:	Eddie Abban	Ghana
Members:	Herve Ebounaka	Congo (Republic of)
	Wilson Maina Gichuri	Kenya
	Henry M. Mbugua	Kenya
	Frederick Seiley	Liberia
	Valerio Crespi	FAO (Rome)
	Lionel Awity	Ghana

**Preamble:** Aquaculture information which has been accepted to include proven technology packages for aquaculture stakeholders, especially farmers and input producers, extension and process of extension has apparently been unavailable. A situation which has made extension to be continuously listed as a constraint to development was discussed for improvement of the situation.

#### **1. Issues discussed**

(a) Information Availability;

##### **Status**

- generally, information generated from elsewhere has been available;
- extension has been ineffective or unavailable.

##### **Way forward**

- aquaculture extension provision should change from being mainly private sector provided by non-governmental and other non-profit making organizations.

(b) Networking of Aquaculture Stakeholders

**Status:** Virtually non-existent at all levels.

**Way forward:** Establishment of stakeholder groups and their networking at various levels as soon as possible.

(c) Establishment of National Aquaculture Development Committees (NADCs)

##### **Main functions**

The main functions are to:

- ensure the broadest spectrum of stakeholders participate in national development agenda setting and actions;
- ensure appropriate extension delivery, monitoring and evaluation;
- ensure sustainability of networking and its continuous development;
- be responsible to the Minister responsible for aquaculture sub-sector

##### **Source of funding:**

Initial funding from the public sector, later contributions by the private sector

(d) establishment of National Aquaculture Networking Desk at offices of the Department of Fisheries

**Main functions:** Desk officer to serve as Secretary to NADC.

- obtain and package aquaculture information from stakeholders or stakeholder groups and communicate them appropriately;

**Sources of funding:** Public sector

(e) Establishment of Network of Stakeholder Institutions/Groups:

**Main functions**

- ensure multidisciplinary approach to sub-sector issues;
- coordination of aquaculture activities to avoid duplications.

**2. Regional networking of aquaculture development**

**Concept:** Based on Network of Aquaculture Centres in Asia (NACA) arrangements.

(f) Opportunities for action:

- common technical and managerial backgrounds of primary stakeholders;
- common and limited species cultured;
- common constraints;
- re-awakening of Governments of the potential and relevance of fish culture to the development agenda of all countries in the region;
- regional Governmental will to support and coordinate aquaculture development by ratification of NEPAD 2005 Abuja Declaration on Fisheries and Aquaculture.

**Working Group 3: Socio-economics**

**Members:**

Facilitator:	Choolwe G. Mudenda	Zambia
Secretary:	Wilson Mwanja	Uganda
Members:	Alan Lowther	FAO
	Gabriel Kombozi	Congo (Democratic Republic)
	Caroline Adhola	Kenya
	Benson Thiga	Kenya
	Nathaniel Hishamunda	FAO

**Preamble:** The potential and actual contributions of aquaculture to socio-economics development in Africa have generally been considered positive. The group discussed this consideration with reference to three basic socio-economic parameters (employment, food security, and poverty reduction or economic welfare) at the level of the economy as a whole and at enterprise levels. The group also discussed how measurement of the benefits of aquaculture could be quantified and improved.

**1. Employment contribution**

**Status:** Actual contribution of aquaculture to employment unknown

**Evidence of contribution:** Increased private sector involvement in countries

- Increased public sector induced private sector investment in fish culture in general and non-food organisms in water – e.g. crocodiles in Kenya and Zambia.

**2. Food security contribution**

**Status:** Actual proportional contribution of aquaculture to food security status of countries undetermined.

**Evidence:** Food and nutritional improvement status of families associated to fish culture owners in rural communities freely spoken of.

**Way forward:** Studies to document employment and food security contribution of aquaculture should be undertaken together with other studies.



### 3. **Wealth creation contribution**

**Status:** Contribution of aquaculture to overall economic growth not determined but considered negligible.

#### **Evidence of wealth creation**

- farmed fish marketed in local markets in several countries;
- rural farmed fish marketed in urban centres within countries a common practice;
- farmed fish exports limited but undertaken within the region.

Commercial aquaculture expansion in at least Nigeria, Kenya, Zimbabwe, Ghana, Mozambique, Zambia and Uganda

#### **Way forward**

- Commercial aquaculture operator be encouraged to provide information on economics of their operations;
- Studies to generate information on aquaculture contributions to economic and social parameters should be supported wherever possible.
- Government to establish aquaculture development funds to support investments in aquaculture;
- Aquaculture should be presented at all levels as an economic activity;
- Economic studies to determine the viability of production systems be undertaken;
- Financial institutions to be targeted for aquaculture economic advocacy and thus their support.

### **Working Group 4: Policy and legal framework**

Facilitator: Sloans Chimatiro

Secretary: Valeria Mushi  
Gogwim Shimang  
Mohamed Sheriff  
Charles Maguswi

**Preamble:** Aquaculture in Africa has apparently started without policy and legislative instruments to guide the practice. The group discussed the situation in relation to availability of policy legislation and strategic frameworks in a very limited number of countries and considered approaches to having such legal instruments developed in all countries to the benefit of the emerging industry.

#### **1. Availability of aquaculture policy and legislative instruments**

Discussions revealed that specific aquaculture policy, legislative and strategic frameworks for guidance and development exist in a handful of African countries. Where they exist, fewer still had all the major instruments promulgated. For example, some countries have aquaculture policies without legislative frameworks. Others have developed frameworks without policies. However, efforts to develop the legal instruments were widespread.

#### **2. Justification for situation**

It was determined that aquaculture in most countries is considered an integral part of fisheries. Thus, fisheries legal instruments have been assumed to cover aquaculture. Secondly, aquaculture has not sufficiently emerged as a substantive sub sector to require separate policy and other instruments.

#### **3. Way forward**

- Aquaculture requires separate recognition to justify its policy and legislative frameworks.

- While the few available could guide countries aiming to develop legal frameworks for aquaculture expertise from countries that have them and FAO could be sought.
- Stakeholder associations should support their enterprises before they fall short of existing general legal arrangements because there are no specific ones for aquaculture.

Resources must be obtained for development of necessary legal instrument to guide aquaculture.

## APPENDIX 6

### Elements of 1999 Africa regional aquaculture review

#### PRESENT SITUATION

For the ten countries assessed, the following elements describe the present situation for at least 80 percent of the national aquaculture programmes:

- little government support for aquaculture
- government stations and hatcheries abandoned
- private fish ponds abandoned
- feed and seed shortages
- reduced aquaculture extension activity
- shortage of field staff
- loss of institutional memory
- lack of access to available aquaculture information
- lack of reliable aquaculture statistics.

Most countries are focusing on small-scale integrated systems producing tilapia and/or catfish (*Clarias* or *Heterobranchus*). As effective extension becomes more difficult, there is an orientation to rely increasingly on farmer groups (fish farmer associations). There is also a growing interest in commercial production and greater involvement of the private sector.

The Review concluded that: (a) aquaculture is now known throughout Africa as a result of previous extension efforts, and (b) adoption/acceptance, even if on a modest scale, has been noted in most countries.

#### LESSONS LEARNED

##### Policies and plans

1. An aquaculture development plan should help focus development geographically and facilitate control and evaluation (monitoring) of the programme.
2. A lack of government policy and support has led to donor-driven interventions which usually cannot be sustained at the end of projects.
3. Field activities should be decentralized on the basis of agro-ecological zones.
4. The frequent transfer of personnel has greatly hampered development plans and affected sustainability.
5. Major government fish culture stations should be given financial autonomy and put under good management.
6. Public infrastructure should ultimately be self-supporting.
7. Farming inputs should not be distributed free to farmers but should have at least a subsidized price.
8. Credit is not necessary and hence should not be provided to small-scale integrated farmers.
9. There has been a lack of coordination in development assistance.
10. Commercial aquaculture should be promoted whenever possible.
11. Farmer participation in development programmes, which has been lacking, should be encouraged.
12. Access to land is an important issue that needs careful analysis.
13. Marketing is also another issue that is often overlooked but can be critical to the establishment of aquaculture operations.

**Seed**

14. Centralized and subsidized fingerling production and supply is a disincentive to private sector involvement and creates shortage of seed.
15. Fish seed should be produced locally, in rural units involving small-scale farmers.
16. The age of stocking material (fingerlings) must be known if good results are to be obtained.

**Extension**

17. Extension duties should not be combined with law enforcement.
18. Extension efforts should be focused on small-scale model farmers operating under favourable conditions (water and soil, interest and dynamism, experience with other resources, etc.).
19. From such model farmers, the farmer to farmer extension approach should be developed through group demonstrations, field days, advice, fingerling production/sale, etc.

**Research**

20. On-station research to support small-scale aquaculture development should be based on inputs commonly available to small-scale farmers and it should be farmer-driven through joint activities.
21. Sociocultural surveys should be conducted before introducing a new technology to a region.

**Aquaculture technology**

22. Technology should not be based on imported commodities (e.g. hormones, feeds, etc.).
23. Selected culture species should be able to be reproduced by farmers themselves.
24. The integration of animal husbandry with small-scale aquaculture is often inappropriate for smallholder farmers.
25. There have been frequent pond site selection errors.
26. There has been a lack of technological flexibility.
27. There have been inappropriate methods of technology transfer.

In addition to those items listed above, the Review made the following remarks:

- (a) **Government stations:** stations often serve one or more of five common purposes: fingerling production, food fish production, demonstration centres for extension activities, training and/or research. The first three purposes should gradually be disengaged from government. During the period of disengagement, training should be provided to private sector units such as fish farmer associations and entrepreneurs, for taking over such stations in a sustainable way. Government should maintain its support for training and research.
- (b) **Regional centres of excellence:** where a centre has capacity to combine both research and training, it should carry out both functions because research activities can greatly complement training. An evaluation of existing centres should be undertaken with a view to determining their respective roles in the proposed new setting
- (c) **Advisory committees:** national committees composed of both potential and existing stakeholders should be established to guide aquaculture development. These could be decision-makers, policy-makers, academics (socio-economists, policy analysts, agriculture scientists, biologists), entrepreneurs, fish farmers and representatives of their associations, women's groups or their representatives, bankers, fishers, non-governmental organizations (NGOs), etc

- (d) **Database:** it is important nationally to identify an institution, university, etc., as a focal point for analysis and custody of statistics in a database. The database will input into the sub-regional database and in turn this will input into a regional database. Information technology hardware and peripherals must be considered as paramount when selecting the national focal point.
- (e) **Information:** there is a strong need for the promotion of information exchange throughout the region, in research, development, training and extension. This could be best done through networking. It would also contribute to reinforcing linkages between research and development at both national and regional levels.

## **THE WAY FORWARD – A STRATEGY FOR AQUACULTURE DEVELOPMENT**

Within the context of the lessons learned, the Review prepared a 37-point aquaculture development strategy to be implemented over a period of five years (see below). The strategy included elements that could be initiated immediately with existing resources as well as others that would require changes or revisions of policies and additional funding. The eight points below encompass the principal issues:

1. Establish national development policies and an aquaculture development plan in consultation with stakeholders.
2. Reduce expensive and unsustainable aquaculture infrastructure, specifically with a reduction of at least 50 percent of government fish stations within five years.
3. Promote and facilitate the private sector production of feed and seed.
4. Encourage credit for medium- and large-scale producers.
5. Revise aquaculture extension, establishing a flexible and efficient structure that can meet producers' needs.
6. Advocate farmer-friendly existing technologies that use readily available culture species and local materials.
7. Promote collaboration, coordination and information exchange between national and regional aquaculture institutions and agencies.
8. Facilitate the formation of farmers' associations.

The first step in the strategy is the elaboration of national aquaculture policies and development plans. This was a key recommendation of the Workshop 24 years ago. Yet, of the ten background country reports, eight indicated the lack of aquaculture policy as a recurrent problem while six stated there was also a lack of aquaculture planning.

To a great extent, policies and planning are a question of *political will*. If there is the political will, formulation of appropriate policies and plans is within the capacity of nearly all countries in the region.

For decades aquaculture in Africa has been vacillating between crests and troughs of various waves of development with the same constraints identified time and again: lack of seed, feed, credit and extension support. All of these constraints relate to the underlying lack of policy. If there is political will to establish workable policies, solutions to these other issues will be forthcoming.

## Strategy implementation schedule

### IMMEDIATELY

- Initiate reduction of number of government stations.
- Focus effort on selected areas.
- Promote Farmers' Associations.
- Promote farmer-to-farmer communication.
- Focus on limited number of culture organisms.
- Focus on locally available inputs and existing technology.
- Improve national coordination.
- Develop demand-driven research agendas through improved linkages with development.
- Increase involvement of universities.
- Establish informal exchanges.
- Increase use of Farmers' Associations for collecting statistics.

### WITHIN 1 YEAR

- Evaluate national training needs and capacity at all levels.
- Incorporate social, cultural and economic aspects into research agendas.
- Establish national information network.
- Initiate national research programme on brood stock management.
- Organize a regional feasibility study on credit for large-scale enterprises.
- Organize annual meeting of African Aquaculture Group together with FAO.

### WITHIN 2 YEARS

- Establish aquaculture development policy including privatization of fingerling production, focused extension and participatory approach.
- Create national Aquaculture Advisory Committee.
- Select and retain stations for research and training (government funding).
- Establish national brood stock management programme.
- Initiate regional research programme on brood stock management.
- Develop socio-economic indicators of impact.
- Promote private sector involvement and better management through long-term lease.
- Organize regional specialized training courses for commercial entrepreneurs.
- Privatize seed supply for medium- to large-scale enterprises.
- Initiate national and regional research programmes on formulated feed quality, involving government and private sector.

### WITHIN 3 YEARS

- Evaluate training regional needs and capacities (centres of excellence).
- Establish regional information network.
- Revise and improve statistics collection.

### WITHIN 5 YEARS

- Elaborate national Aquaculture Development Plan.
- Reduce by at least 50 percent the actual number of government stations.
- Revise extension structure.
- Improve understanding/knowledge of traditional systems and their potential for enhancement.
- Develop national or intraregional practical training for farmers, extensions, administrators and decision-makers.
- Establish regional specialized research network (centres of excellence).
- Establish national database.

## APPENDIX 7

### Elements of Cameroon strategic framework

#### DEFINITION OF THE STRATEGIC FRAMEWORK

##### *Identification of high potential aquaculture zones*

In most countries, the biophysical<sup>3</sup> and socio-economic<sup>4</sup> potential for aquaculture is not uniform, with some zones having greater intrinsic capacity for aquaculture growth than others. A first step in determining where resources to develop aquaculture could be efficaciously used is the identification of those areas with highest potential. This screening should be supplemented with a comparison of existing aquaculture activities, including the concentration of existing producers and the presence of government and other infrastructure.<sup>5</sup>

Zones based on biophysical and socio-economic potential may well be subdivided into areas that correspond to input supply/delivery. For example, to the extent that private seed supply comes from specialized private hatcheries, these hatcheries will operate within areas circumscribed by the economic ability to deliver seed to producers.

##### *Definition of types of aquaculture*

Categorizing fish farmers and farms according to relative sizes, degree of capitalization and profit motivation is always difficult. In the aggregate, these categories are part of a spectrum that covers the full scope of production systems.<sup>6</sup> If this spectrum reflects production intensity and investment level, individuals at the low end will likely internalise their aquaculture activities with little contribution to the public purse and little benefit from public services. Conversely, individuals at the high end of the scale may make important contributions to national aquaculture production but have relatively little need of public support.

For the purposes of this framework, producers have been divided into two categories: commercial and non-commercial. Commercial producers can be small medium or large-scale, and are active participants in the market. They purchase inputs (including capital and labour) and engage in off-farm sales of the fish produced. For these individuals, aquaculture is a principal economic activity.<sup>7</sup> Non-commercial producers may also purchase inputs, mainly seed and feed, but rely chiefly on family labour and on-farm sales of the produce. An additional feature of non-commercial aquaculture is that it is but one of the variety of enterprises comprising the farming system; it is undertaken to diversify production, improve resource use and reduce risks of such events as crop or market failure.

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<sup>3</sup> Biophysical criteria include water quantity and quality, ambient temperature, soil quality and water holding capacity, etc.

<sup>4</sup> Socio-economic criteria to evaluate include cultural aspects, availability of inputs (fingerlings, feeds, fertilizers), access to markets, range of partners, production technologies, etc.

<sup>5</sup> Aguilar-Manjarrez, J. and Nath, S.S. 1998. A strategic reassessment of fish farming potential in Africa. CIFA Technical Paper 32. FAO, Rome.

<sup>6</sup> An aquaculture system is a combination of: type of culture unit, level of intensity, culture species and scale or size of exploitation

<sup>7</sup> In addition to these characteristics, commercial aquaculture can be defined as the farming of aquatic organisms, including fish, molluscs and crustaceans and aquatic plants with the goal of maximizing profits. Thus, the distinction between commercial and non-commercial aquaculture operations relies primarily on the existence or absence of a business orientation and on how factors of production such as labour will be paid.

### ***Definition of appropriate framework for Aquaculture Outreach***

Some level of technical information dissemination is generally considered as necessary to support the aquaculture sub-sector. This is achieved through public-sector-supported outreach. Drawing upon a wide range of published experiences, a general approach to supporting the development of aquaculture can be suggested. This is based on the premises that:

- (i) Some long-term technical assistance for producers is necessary.
- (ii) Generalist/unified extension services often lack the specific technical expertise to assist aquaculture producers.
- (iii) Extension services dedicated to aquaculture assistance must be limited in scope due to corresponding limitations in human and financial resources.

In this light, high quality technical support<sup>8</sup> needs to be carefully assembled and targeted. This can best be achieved by “mobile mixed teams” providing punctual, periodic support to a relatively large geographic area. These teams, each composed of at least one technician from extension and one from research should work exclusively in high priority zones and give priority to assisting effective producer groups in partnership with Non-Governmental Organizations (NGOs) and other outreach agencies as feasible. Besides, they should be complemented by a series of private seed producers, or other service providers, who are also providing technical support to farmers.

Thus, the mode of operation of these mobile teams should be one that brings research and extension together and into direct contact with farmers.

### **ELEMENTS OF THE STRATEGIC FRAMEWORK AND THE ROLE OF PUBLIC AND PRIVATE SECTORS**

Sustainable aquaculture development relies on a number of conditions that must be met and addressed in any strategy in a flexible way. The most prominent of these are: (1) suitable production systems; (2) availability and access to inputs (feeds, seed, capital, etc.); (3) outreach; (4) research; (5) education and training; (6) marketing; (7) producer organizations; (8) regulation; (9) control, monitoring and evaluation.

For each of the two types of aquaculture defined in this document (commercial and non-commercial), the following sections define the role of the public<sup>9</sup> and private<sup>10</sup> sectors in meeting each condition. Unless otherwise specified, the role discussed applies to both commercial and non-commercial aquaculture.

In light of limited human and financial resources, Government is, in general, shifting, and should shift, from its role as a direct investor and development promoter to one as a facilitator of an independent and commercially viable aquaculture sub-sector. The private sector is composed of two general groups of actors: direct investors, including producers along with service providers, and partners, principally producer organizations and Civil Society Organizations.

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<sup>8</sup> That is, well trained and well-equipped.

<sup>9</sup> Includes the ministry in charge of aquaculture, the national research institute, and the government extension service.

<sup>10</sup> Includes producers, investors (in both fish farming and related sectors), NGOs, commercial banks, universities and development agencies.



## APPENDIX 8

### Achievements and advancements: 1999-2005

Results achieved and lessons learnt during the 1999-2005 period are general outputs from FAOs Field Programme as well as from field activities of other development partners. The 1999 review set a series of priorities which became the foundation of FAO's regional aquaculture programme. These priorities were used in articulating specific field-level objectives for national and sub-regional projects and other grassroots producer-level interventions. The major themes and how these were apportioned among projects with which FAO participated are presented below.

Theme	Project
National Strategies	TCP/ZAM/2901, TCP/ZAM/3001, TCP/ANG/3002, TCP/MAG/2901, TCP/GHA/2904, OSO/DRC/409/EC
Seed production and distribution	TCP/GUI/0066, TCP/UGA/0167, TCP/UGA/3001, TCP/GHA,2904, TCP/CMR/2903, UTF/NIR/047/NIR
Extension and farmer associations	TCP/GUI/0066, TCP/CMR/2903, TCP/MLW/0065, TCP/MAG/2901, TCP/GHA/2904, OSO/DRC/409/EC, UTF/NIR/047/NIR, GCP/RAF/361/IFA
Record keeping and data analysis	TCP/GHA/2904, TCP/ZAM/2901, TCP/ZAM/3001, UTF/NIR/047/NIR, GCP/RAF/361/IFA
Credit and business management	TCP/GHA/2904, UTF/NIR/047/NIR
Legislation and regulation	TCP/NAM/0168, TCP/CMR/2907
Technology promotion	TCP/MLW/0065, TCP/PRC/2903, TCP/ZIM/3003, UTF/NIR/047/NIR, GCP/RAF/361/IFA

### Strategic frameworks

- Frameworks and/or strategies have been drafted and endorsed but not implemented yet for Cameroon, Madagascar and Zambia.
- Frameworks are in preparation in Ghana and Angola.
- Congo (Democratic Republic), Kenya and Uganda have expressed interest in developing strategies while Malawi has recently completed a national aquaculture "Master Plan".
- Given the commonalities confronting African aquaculture development, in the aggregate, these five documents represent regional templates which can be used region-wide.
- The foundation of these strategies includes an emphasis on private sector investment and for-profit operations, a concentration on priority aquaculture production systems and high potential (geographic) zones accompanied by a retooled and streamlined level of public sector support.
- Strategies form the technical bridges between policies and policy objectives, and are the operational channels within which development plans are implemented.
- Strategies are flexible, cross-sectorial and iterative, they should be overseen and up-dated by an interdisciplinary national task force.
- Are essential precursors to efficient national programmes.

### **Privatization of public infrastructure**

- Although privatization of redundant government infrastructure was a high priority for the post-1999 review period, only Madagascar has fully privatized.
- As part of their endorsed or in-process strategies, Cameroon, Zambia and Ghana have tabled plans for privatization.
- Elsewhere, there have occasionally been “old school” intransigents seeing privatization as a loss of influence .
- Privatization has also been adversely affected by the lack of suitable private sector service providers to take over as Government changes its way of doing business.
- Although privatization has not been universal, the abandoned or dysfunction state of most Government infrastructure remains unchanged – these facilities continuing to be a drag on public resources.

### **Private sector input production/distribution**

- Real progress has been made in Nigeria, Cameroon, Zambia, Côte d’Ivoire, Ghana, Madagascar and Uganda in establishing sustainable and profitable private sector seed production and distribution mechanisms.
- Appreciating the catalytic role of private hatcheries, most countries agree in principal to the establishment of these enterprises.
- Large hatcheries can provide fry and/or fingerlings and service wide areas (some Nigerian service providers distributing nearly 400 000 fingerlings monthly).
- Medium and small hatcheries and/or nurseries can serve as hubs for “clusters” of producers in high potential zones.
- Madagascar, Ghana and Uganda have various programmes where private seed providers also have extension roles.
- Governments role can be to manage broodstock and control seed quality, perhaps through a certification programme.
- Some countries report using genetically improved seed from extra-regional sources, this underscoring the need for effective monitoring and control of seed products.
- Catfish hatcheries have greatly expanded for both baitfish and stocking.
- Artisanal production of supplemental feeds is done in most countries although the quality is variable and price often high.
- Nigeria, Ghana, Kenya, Zambia, Côte d’Ivoire have some industrial (commercial milling) of aqua feeds but quality can also be variable, quantities erratic and distribution not always effective.
- Countries such as Nigeria, Uganda and Madagascar rely heavily on imported feeds.
- Feed is more difficult to address than seed as its raw materials are dependent on the status of the overall agriculture sector.
- Few other inputs are used with the exception of on-farm organic fertilisers, locally produced inorganic fertilises and some locally available lime.

### **Credit**

- Real progress has also been made in terms of credit access in Uganda, Kenya and Ghana where medium-scale lenders now consider aquaculture as a bankable enterprise.
- Domestic investment capital elsewhere predominately comes from investors with their own resources or, for smaller enterprises, from traditional lending mechanisms.
- In Cameroon, Ghana, Madagascar, Uganda and Kenya, NGOs are increasingly involved in credit assistance.
- Recent experiences continue to reinforce existing recommendations that GIFTS, including capital, are counterproductive and must be avoided.

- Although the negative stigma of aquaculture seems to be slowly eroding, high interest rates still limit the accessibility of capital.

### **Record keeping/business planning**

- Access to credit is predicated on good record keeping and business planning.
- Practical assistance to producers in developing suitable business plans and keeping needed records has been provided in Uganda, Kenya, Ghana, Nigeria and Zambia.
- Generic manuals on record keeping and business planning are under preparation by FAO.

### **Producer groups**

- An important milestone has been the incorporation of aquaculture into the array of enterprises covered by the Zambia National Farmers Union, providing the organizational and political force of a respected and established producer group for aquaculturists.
- Ghana has worked toward the strengthening of local formal producer groups with varied results.
- Nigeria has two semi-functional national associations.
- Most countries have, or have had, informal and ephemeral fish farmer groups that nearly spontaneously arise to gain access to certain advantages and then dissipate with equal rapidity.
- Cameroon, Uganda, Madagascar and Côte d'Ivoire have experiences with producer groups taking an active part in aquaculture extension.
- Groups continue to be a key and universally accepted concept in national aquaculture development although the creation of sustainable and effective groups continues to be challenging.

### **Markets and market products**

- There has been a noticeable increase in the marketing of aquatic products produced in Africa.
- Increasing prices for aquatic products and expanding markets have been major factors attributing to the growth of aquaculture over the period.
- There has been a relatively greater increase in catfish production than its nearest rival, tilapia.
- Nigerian catfish production (food fish and seed) is rapidly expanding with the domestic market far from saturated.
- Farm-raised catfish production has also expanded in Ghana, Cameroon, Kenya, Uganda and Congo (Democratic Republic).
- Tilapia remains the major culture organism for Zambia, Angola, Mozambique, Liberia, Sierra Leone and Congo (Democratic Republic of) as well as being an important product in the other countries.
- Madagascar and Mozambique have large shrimp farms while the former also produces significant quantities of carp.
- With the exception of shrimp which is principally an export product, most aquatic products are for local markets.
- Lacustrine countries of East Africa plan on raising fish to complement (declining) wild catches for processing and export.
- There are important and severely under-served intraregional markets.
- Marketing has proven to be a very critical element in the development of the sector which much be scrupulously studied and monitored.

## **Communications and information exchange**

- Communications and information exchange remain oft-cited constraints.
- Extension is a producer-level information exchange channel which remains one of the major unresolved issues in the region, the methods to ensure technically and economically effective outreach services still to be assured.
- With the establishment of private seed producers in Madagascar, Uganda and Ghana, these entrepreneurs as seen as de facto extensionists with vested interests in increasing the number of their customers by improving their information base.
- Uganda, Madagascar, Nigeria and Côte d'Ivoire are promoting various levels of private extension while other countries use variations of generalist or dedicated government extension services.
- FAO and Member Countries, through CIFA, have initiated activities to promote the establishment of a region-wide aquaculture network.
- Technology has made major advancements in information technology with all countries now accessible via e-mail and most national partners having access to the necessary information services.
- FAO initiated a pilot information (documentation) exchange network with demonstrated that, while an acknowledged constraint, many concerned individuals and agencies are not proactive in facilitating information flow.
- Information, at all levels and for a wide constituency, is necessary and its distribution channels need to be organized at regional level with fully functioning sub-regional, national and sub-national nodes.

## **Training and education**

- Public and private sector stakeholder groups have noteworthy human capital deficits which need to be reduced through appropriate training and education.
- Inter-country exchanges (study tours) using well-functioning private farms as hands-on demonstrations and fostering farmer-to-farmer contacts has proven to be most important, with farmers and staff from Nigeria, Ghana, Uganda, Zambia, Côte d'Ivoire and Madagascar taking part in these exercises.
- More formal reputed regional training centres are operational to a greater or lesser degree in Zambia, Malawi, Nigeria, Cameroon, South Africa and Côte d'Ivoire while universities in Kenya, Nigeria, Ghana, Uganda, South Africa, Côte d'Ivoire and Malawi have aquaculture curricula.
- Although training and education is pivotal, numerous intraregional for a have called for a regional approach similar to the Africa Regional Aquaculture Centre(s) set up under the FAO/UNDP Aquaculture Development Programme.

## **Appropriate technology**

- In line with the recommendations of the 1999 review, all countries and most producers are employing appropriate technology.
- Appropriate technology usually optimises the regional comparative advantages of (most often) relatively cheap and available land, water and labour, with production increases from expansion as opposed to intensification.
- But, poor management remains to be one of the major weaknesses noted in all countries.
- The aforementioned shift to catfish has had positive effects in terms of seed technology producing high quality fry and fingerlings as well as educating farmers as to the value of high quality seed, increasing their willingness to pay for seed.
- Technology needs to include distribution (transport) as well as production technologies.
- South-south (TCDC) exchanges have proven most valuable to introduce and/or reinforce the adoption and use of appropriate technologies.

### **Commercial aquaculture**

- There have been significant increases in commercial aquaculture production as well as a re-assessment of how to view “commercial” aquaculture (current approach defined in Annex 4).
- Commercial is for-profit production of any scale, using any system.
- Large firms, often with international investment, may best be considered as “industrial”.
- Overall, for-profit operations have greatly expanded with cage culture operations in Zambia, Malawi, Mozambique, Côte d’Ivoire, Ghana, Uganda and Kenya, intensive tank (including recirculation) systems in Nigeria and pond-based systems in Malawi, Uganda, Cameroon, Nigeria, Ghana, Côte d’Ivoire, Zambia, Madagascar, Mozambique, Angola and Congo (Democratic Republic), however,
- While seed availability has considerably improved, access to cost-effective feeds of suitable quality remains a key issue.

### **Legislation and regulation**

- Specific aquaculture legislation has been developed in Mozambique, Madagascar and Uganda while it is in preparation in Cameroon, Kenya, Zambia, Malawi and Ghana.
- Legislation is most applicable when based on an existing national aquaculture development strategy.
- Most countries elaborating relevant legislation are establishing “one stop shops” to facilitate investment in aquaculture. but,
- Enforcement is a problem with few countries having the resources to be able to effectively implement and enforce, including the control of the use of exotic species.

### **Evaluation and monitoring**

- Effective evaluation and monitoring is another key weak point in all countries.
- While the tools for effective monitoring of production/produces by central government through computerized systems with GIS are available, few are in operation.
- Monitoring and evaluation by development partners is completely inadequate, with little or no follow-up of activities aimed at promoting the sector’s development.
- Monitoring and evaluation require valid data at all levels, but this is most often lacking and, when available, is of questionable accuracy.
- Several countries have considered linking with national statistic or census services to facilitate and harmonise producer-level data collection.

## **REPORT**

***Special Session to propose the ad hoc Aquaculture Working Group  
of Committee for Inland Fisheries of Africa (CIFA)  
Mombasa, Kenya  
23 September 2005***

### **Introduction**

In conjunction with the *FAO Expert Workshop on Regional Aquaculture Review: Africa* (20-22 September 2005 in Mombasa, Kenya), a Special Session of aquaculturists from CIFA-Member countries was held to examine modalities of establishing an ad hoc Aquaculture Working Group as a follow-up to the recommendations of the 13<sup>th</sup> Session of CIFA held in Entebbe, Uganda in October 2004. The Prospectus of the Special Session is in Annex 1, the List of Participants in Annex 2 and the Agenda in Annex 3.

Annex 4 provides additional background to the subject, explaining why it was difficult to implement the exact recommendation of CIFA 13 and establish an Aquaculture Sub-Committee; in lieu of a Sub-Committee, an ad hoc Working Group being administratively the most expeditious mechanism.

### **Results**

At the onset, as seen in the Annexes, the expectation was to propose the establishment of an *ad hoc* Aquaculture Working Group (AqWG) to serve for a period of two to three years and assist with the establishment of the proposed regional (NACA-like) aquaculture network; this assignment perhaps being facilitated by a regional TCP as proposed by CIFA 13. The possible membership and mandate of this group are proposed in Annex 4.

However, discussions during the Special Session concentrated on the sustainability of action initiated by the AqWG, participants underscoring the importance of obtaining a commitment from governments for longer-term support before undertaking major activities. To this end, it was proposed and supported by participants that a Memorandum of Understanding (MOU) be prepared on this subject; countries signing the MOU affirming their commitment to collaborate and their willingness to continue to support the efforts at the end of the term of the AqWG and/or the completion of the recommended regional TCP. With this tactic, countries signing the MOU would be considered as the core group for participation in the AqWG and, if approved, the regional TCP; their participation justified by their pledge to provide their own resources for these activities in the short- and medium-term.

On the other hand, the proposed MOU would need to be approved by CIFA before it could be distributed. Hence, if the MOU is a prerequisite for establishing the broader AqWG, this cannot be done before presenting this matter to the fourteenth session of CIFA next year.

In this light, it was determined that some action was immediately required and that an Interim ad hoc Working Group should be formed at once. This group would have the responsibilities of drafting the MOU as well as the Terms of Reference of the broader AqWG which would be formed by experts from some or all of those countries signing the MOU. At the same time, the Interim Working Group should also review the design of the regional TCP proposal to be formulated next month. The Terms of Reference of the Interim Working Group are in Annex 5.

It was also noted that the legal and institutional arrangements for NACA should serve as references for the proposed African Network. These matters should be explored when formulating the regional TCP. In terms of process, it was stated that NACAs experiences in growing from an original core of three countries to its present membership of 17 countries would be equally useful to examine.

Given the links between the AqWG and the proposed TCP, it is important to assess how these inter-relate. The TCP should facilitate the ultimate objective of establishing the regional network. The network, as an Inter-Governmental Organization (IGO) would need to operate at a political level. Thus, the TCP should focus on this level and facilitate a series of regional technical and legal meetings leading to Ministers or other senior officers and decision-makers committing to the IGO. The TCP should also provide country-level assistance in working with core countries (i.e. those signatories to the MOU) in setting up the necessary legal, institutional and administrative frameworks such that the country in question can become an official and contributing member of the network.

Finally, it was noted that the current session did not adequately represent Francophone countries from the region. Efforts would be made to discuss membership in the Interim Working Group with Francophone experts and to ensure that the AqWG has a large and representative membership.

### **Conclusion**

The TOR for the Interim Group (Annex 5) was approved by participants. It was further concluded that these be included in a letter from the CIFA Secretariat to the CIFA Chairperson, explaining, as stated above, why the original Sub-Committee recommendation needed to be transformed into an ad hoc AqWG and this, in turn, initially considered as an Interim Working Group. This letter would be discussed with the Chairperson and then a similar document sent to CIFA members by the Chair to inform them of action taken and planned as well as incorporating the approved TOR for the Interim group.

## Prospectus

### *Special Session to propose the ad hoc Aquaculture Working Group of Committee for Inland Fisheries of Africa (CIFA)*

Mombasa, Kenya  
23 September 2005

In 1999 *Africa Regional Aquaculture Review* (CIFA/OP24) concluded there was a strong need for the support of information exchanges throughout the region in research, development, training and extension. This position was reinforced by the Second Session of the COFI Sub-Committee on Aquaculture (Trondheim, Norway, 7-11 August 2003) which recommended that one of the top priority areas of work was the promotion of regional network and cooperation (e.g. through NACA-like<sup>11</sup> organizations).

As a follow-up to the Sub-Committee's statement, in December, 2003, FAO sponsored a Mission to prepare a Report on *Africa Intergovernmental Aquaculture Networking Opportunities and Options*. The Mission concluded:

- The chronic constraints of seed, feed and extension remain.
- These are exacerbated by lacks of (a) institutional arrangements to foster national fish culture development, (b) clear-cut aquaculture legislation and (c) framework on which strategic aquaculture development can be formulated.
- The principal constraints can cost-effectively be addressed through regional collaboration and networking in Africa as NACA has done for Asian countries.

The Mission further concluded that lessons learnt from the Asian experience indicate that networking in Africa can:

- Eliminate duplication of efforts.
- Facilitate technical information generation, packaging and dissemination together with technology transfer.
- Pool together national resources and strengthen national systems.
- Hasten widespread and coordinated aquaculture development.
- Ensure effective use of scarce resources and the sharing of benefits between members.
- Better attract funding from development partners.
- Maximize utilization of all resources especially available training/research facilities and human expertise to achieve faster aquaculture growth.
- Promote Technical Cooperation Among Developing Countries (TCDC).
- The Mission summarized:
- There is an overwhelming support from within the region for the concept of establishing a Regional Intergovernmental Aquaculture Network Organization for Africa similar to NACA to facilitate and hasten aquaculture development which would be an effective vehicle for coordinating information exchange, technology transfer, training and collaborative research – consequently there is a need for initiatives to establish an African Regional Aquaculture Development Network.

Given this support, the Mission on Intergovernmental Networking recommended three possible options for starting an interim African network:

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<sup>11</sup> NACA is the Network of Aquaculture Centres of Asia and the Pacific which has evolved from a regional project into a stand-alone regional service provider actively supporting aquaculture development in Asia.



1. Establishing a CIFA Subcommittee for Aquaculture with the FAO Regional Office for Africa providing the Secretariat. Membership would be open to all CIFA members. Funding would come from extra budgetary funds including member country or donor contributions.
2. Formation of a Committee for the Development of a Regional Aquaculture Network Organization for Africa. Membership will be open to the first ten or more member countries, which sign a Memorandum of Understanding (MOU) to establish the Committee. Member countries would agree on a host country and a Secretariat. Funding of the Secretariat should come from extrabudgetary funds including member country or donor contributions, or,
3. Establishment of Aquaculture units (Secretariat) within the existing sub-regional Organizations (COMESA, ECOWAS, UEMOA, SADC). Funding for such units would be provided in the budget of the sub-regional organizations. The sub-regional aquaculture units will collaborate with CIFA and the single Intergovernmental Organization once finally established.

The proposed Intergovernmental Aquaculture Organization for Africa (IGO) is for the whole of Africa and is to consist of a Secretariat and network centres to be selected from member countries. The IGO Secretariat will act as a clearinghouse for information collection and exchange and coordinate the network centres' agreed priority activities.

The establishment of an Aquaculture Intergovernmental Organization for Africa has administrative and financial implications for the Secretariat and for the governments participating in the work of such a structure. Under the option of establishing a CIFA Sub-Committee, it is estimated this would require three months of professional and general service time annually in addition to approximately US\$35 000 for each meeting of the Sub-Committee. Funding would come from extra budgetary funds including member country or donor contributions.

In October 2004, the Mission's report and recommendations were presented to the 13<sup>th</sup> Session of CIFA. The Session discussed the three options listed above and **endorsed the first option:** establishing a CIFA Sub-Committee for Aquaculture, which will also serve as the first step leading eventually to establishment of an intergovernmental organization similar to NACA in Africa.

However, procedures preclude establishing a Sub-committee in a spontaneous manner; procedurally the best option being to encase these responsibilities in an ad hoc Aquaculture Working Group.

In this light, the first step in the process of establishing the ad hoc Working Group is drafting its Terms of Reference (TORs.) These TORs will be prepared by participants attending a meeting *following the FAO Expert Workshop on Regional Aquaculture Review: Africa (Mombasa, Kenya, 20-22 September 2005)*. The draft TORs will be prepared for submission to the 14<sup>th</sup> Session of CIFA (2006) for comment and endorsement.

*The Objective of this one-day Special Session is to draft the Working Group's TOR*

The participants will be composed of at least one member from each of the four principal geo-political zones of the Africa region: West Africa, Central Africa, East Africa and Southern Africa (list attached).

The Meeting will:

- Review relevant background and reference documents to determine the optimal role and function of the proposed Sub-Committee.
- Review the statutory and administrative requirements.

- Evaluate the human and financial resources necessary and make recommendations as to how these could be best provided, including, as appropriate, the general framework of a regional project designed for this purpose.
- Draft the Working Group's Terms of Reference for submission to the 14th Session of CIFA.

**List of participants****Cameroon**

KOUAM Jean  
 Chief Service of Aquaculture  
 Fisheries Department  
 DIRPEC-NINEPIA  
 Yaounde  
 Tel.: (237) 761 4352  
 Fax: (237) 222 1405  
 E-mail: kouamjean@ yahoo.fr

**Ghana**

AWITY Lionel K.A.  
 Head, Inland Fisheries and Aquaculture  
 Directorate of Fisheries, Ghana  
 Ministry of Fisheries  
 PO Box 630  
 Accra  
 Tel.: (233) 244 591 458  
 Fax: (233) 21 776005  
 E-mail: lawity@hotmail.com

**Kenya**

NYANDAT Beatrice  
 Fisheries Department  
 PO Box 58187  
 Tel.: 020-3742320  
 Fax: 020-3744530  
 E-mail: samaki@saamnet.com  
 tieny30@yahoo.com

**Malawi**

CHIMATIRO Sloans (excused)  
 Director of Fisheries  
 Department of Fisheries  
 PO Box 593  
 Lilongwe  
 Tel.: (265) 1 788 511  
 Fax: (265) 1 788 712  
 E-mail: Chimatiro@sdpn.org.mw

**Uganda**

MWANJA Wilson Waiswa  
 Principal Fisheries Officer – Aquaculture  
 Department of Fisheries Resources  
 PO Box 4  
 Entebbe  
 Tel.: (256) 41 320563/322026  
 Fax: (256) 41 320496  
 E-mail: wwmwanja@yahoo.com

**United Republic of Tanzania**

MUSHI Valerie Emil  
 Principal Fisheries Officer  
 Fisheries Division  
 PO Box 2462  
 Dar es Salaam  
 Tel.: (255) 22 2116159/2122930  
 Fax: (255) 22 2110352  
 E-mail: valerieamushi@yahoo.com

**Zambia**

MAGUSWI Charles T.  
 Deputy Director  
 Fisheries Extension and Management  
 Department of Fisheries  
 PO Box 350100  
 Chilanga  
 Tel.: (260) 1 278418  
 Fax: (260) 1 278618  
 E-mail: piscator@zamnet.zm

**Lake Victoria Fisheries Organization**

MAEMBE Thomas Wanyika  
 Executive Secretary  
 Lake Victoria Fisheries Organization  
 PO Box 1625  
 Jinja  
 Tel.: (256) 43 120205/6  
 Fax: (256) 43 123123  
 E-mail: lvfo-sec@lvfo.org

**Food and Agriculture Organization of the  
United Nations (FAO)**

HALWART Matthias  
Fishery Resources Officer  
FAO Fisheries Department  
Viale delle Terme di Caracalla  
00100 Rome, Italy  
Tel.: (+39) 06 570 55080  
Fax: (+39) 06 570 53020  
E-mail: Matthias.halwart@fao.org

HISHAMUNDA Nathanael  
Fishery Planning Officer  
FAO Fisheries Department  
Viale delle Terme di Caracalla  
00100 Rome, Italy  
Tel.: (39) 0657054122  
Fax: (39) 06570 56500  
E-mail: nathanael.hishamunda@fao.org

SUBASINGHE Rohana P.  
Senior Fishery Resources Officer  
FAO Fisheries Department  
Viale delle Terme di Caracalla  
00100 Rome, Italy  
Tel.: (39) 06 57056473  
Fax: (39) 06 57052030  
E-mail: rohana.subasinghe@fao.org

MOEHL John  
Regional Aquaculture Officer  
FAO Regional Office for Africa  
PO Box 1628  
Accra, Ghana  
Tel.: (233) 21 678 000  
E-mail: john.moehl@fao.org

**Agenda**

**Conference Hall  
Sun 'n Sand Hotel  
Mombasa, Kenya  
23 September 2005**

0830–0845	Review of the Session's Objectives
0845–1030	Discussion as to the roles and functions of an ad hoc Aquaculture Working Group
1030–1045	Coffee Break
1045–1130	Discussion as to methods and requirements
1130–1230	Drafting of TOR
1230–1300	Approval of draft and closing

## Proposal

ad hoc Aquaculture Working Group  
Committee on Inland Fisheries of Africa (CIFA)  
September 2005

1. CIFA 13 proposed the establishment of a CIFA Sub-Committee for Aquaculture with the Regional Office for Africa (RAFI) serving as Secretariat, with membership open to all CIFA members and with funding to come from extra-budgetary sources as well as Member Country contributions. These activities were to be interim steps toward the ultimate goal of establishing a formal intergovernmental organization for promoting aquaculture development and networking across the Africa region (para 38(i) and 40). The Committee further requested assistance through a regional TCP to put in place the foundations of such a regional structure (para 41).
2. FAO Manual Section 135 (13 December 2004), page 3 (para 1.11) states "...statutory bodies [including Sub-Committees] should be established only where strictly necessary and where the work to be undertaken cannot be carried out by ad hoc groups...". Further, the requirement for establishing a new body is that "the conference of Council must have before it a document, prepared by the Director-General, setting forth in detail: the objectives that are to be achieved through the establishment of the body; the manner in which the body will carry out its functions and any impact that its creation may have on current or future programmes; and the financial implications of the establishment of the body.....".
3. Within the aforementioned operational environment, it is proposed that the initial steps aimed at establishing a regional network be accomplished through the mechanism of an ad hoc working group; the **CIFA ad hoc Aquaculture Working Group**.
4. It is further proposed that the CIFA ad hoc Aquaculture Working Group (AqWG) have a maximum of **12 members** representing the following: (a) one person representing public sector technical agencies (e.g. research, extension, education, etc.) from East, West, Central and Southern Africa (i.e. 4 members); (b) three members representing the private sector (including service providers); (c) two members representing national aquaculture administrations (i.e. central management); (d) one person representing relevant African Regional Economic Communities; (e) a representative from funding agencies (e.g. donor, bank, etc.), and (f) a representative from specialized assistance organization (e.g. World Fish Centre, NGOs, CSOs).
5. **FAO** would serve as the **Secretariat** through the relevant African office and provide **technical assistance** in terms of advisory staff to AqWG Meetings.
6. Meetings of the AqWG would be facilitated through a **regional TCP** if same can expediently be funded. The objective of the TCP would be to implement the CIFA 13 recommendation and expedite the establishment of the nascent regional network. It is suggested that the TCP proposal use the results of the 23 September meeting and be submitted before the end of 2005.
7. In the event the regional TCP option is not available, the FAO Africa Office will explore **other funding options** to be submitted to the 14<sup>th</sup> CIFA in 2006 along with the Terms of Reference of the AqWG.

8. **Provisional Terms of Reference for the AqWG** could include:
  - (a) Review the information needs of the region.
  - (b) Evaluate the information channels available for enhanced information flow.
  - (c) Select specific priority theme(s) for developing prototype network including selecting the key institutions at national and regional levels to be included in same.
  - (d) Prepare a design proposal for implementing the prototype network including resource requirements.
  - (e) Identify focal point for overseeing the implementation of the prototype network.
  - (f) Serve as steering committee and monitoring unit during implementation of prototype activities.
  - (g) Liaise with other regional networks (e.g. NACA).
  - (h) Based on results of prototype network, design a wider-reaching (technically and geographically) network.
  - (i) Prepare proposal for implementing larger network.
  - (j) Prepare TORs for AqWG within the context of this wider network.
  - (k) Maintain regular (quarterly) contact with Secretariat.
  - (l) Report to CIFA.
9. FAO Africa Office will provide CIFA Member Countries with the draft report of the 23 September Meeting, including the endorsed details, and asked to propose candidates for the AqWG pending its review and approval by CIFA 14.
10. The AqWG should, once approved, **meet on a bi-annual basis**; when feasible, meetings combined with other related activities in the region to reduce costs. Meetings should be limited to **two days**. Indicative costs would be US\$50 000 per meeting.

**Terms of Reference  
Interim CIFA ad hoc Aquaculture Working Group**

The proposed Terms of Reference of the Interim CIFA Ad hoc Aquaculture Working Group, based on the recommendations of the Expert Meeting (Special Session) held in Mombassa, Kenya on 23 September 2005, would be as follows:

The Interim Ad hoc Working Group consists of the following membership:

1. Jean Kouam: Cameroon (Central Africa)
2. Lionel Awity: Ghana (West Africa)
3. Wilson Mwanja: Uganda (East Africa)
4. Sloans Chimatiro: Malawi (Southern Africa)
5. Beatrice Nyandat: Kenya (East Africa)
6. Valeria Mushi: Tanzania (United Republic of) (East Africa)
7. Charles Magusui: Zambia (Southern Africa)
8. Thomas Maembe: Lake Victoria Fisheries Organization

The convener of the Interim Ad hoc Working Group is Mr Lionell Awity

The Interim Ad hoc Working Group shall provide assistance and advice to CIFA during the inter-sessional period between the 13<sup>th</sup> and 14<sup>th</sup> Sessions on its work towards establishing NACA-type organization in Africa, as called by its members during the 13<sup>th</sup> Session (paras 39-41 of the Report of CIFA 13).

The advice and assistance will include:

- (a) Develop Terms of Reference for the CIFA Ad hoc Working Group on Aquaculture.
- (b) Assist CIFA in developing a Memorandum of Understanding for securing resources from member countries for establishing a NACA-type organization in Africa.
- (c) Assist FAO and the CIFA Secretariat in developing a Technical Cooperation Project proposal for obtaining technical assistance in establishing an inter-governmental mechanism for improving aquaculture in the region.
- (d) Report to CIFA regularly during the interim period.



