CCARDESA

Centre for Coordination of Agricultural Research & Development for Southern Africa
Centre De Coordination De La Recherche Et Du Développement Agricole De L'afrique Australe
Do Centro De Coordenacão Da Investigacão E Desenvolvimento Agrário Da África Austral

SADC

SOUTHERN AFRICAN DEVELOPMENT COMMUNITY
TOWARDS A COMMON FUTURE

The role of fisheries in food and nutrition security in the SADC region

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Acronyms and abbreviations

ARNS	African Regional Nutrition Strategy
AU	African Union
CAADP	Comprehensive Africa Agriculture Development Programme
CCARDESA	Centre for Coordination of Agricultural Research and Development for Southern Africa
COMESA	Common Market for Eastern and Southern Africa
FAO	Food and Agricultural Organization
GDP	gross domestic product
ICN2	Second International Conference on Nutrition
IFSS	The Integrated Food Security Strategy
LIFDC's	Low income food deficient counties
MDGs	Millennium Development Goals
NDP	National Development Plan
NEPAD	The New Partnership for Africa's Development
NPCA	The NEPAD Planning and Coordinating Agency
PoU	prevalence of undernourishment
SADC	Southern African Development Community
SID	Small Island Developing country
SUN	Scaling- Up Nutrition
SRO	Sub-Regional Organization
t	Tonnes
WFS	World Food Summit
UN	United Nations
USD	Unites States Dollars

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Tim Bostock, former senior fisheries specialist at the World Bank, speaking at the Global Oceans Action Summit for Food Security, said:
"***For some 200 million people — about 30 percent of the African continent's population — fish is the main and lowest-cost source of animal protein.'*** He then added that ***'For almost all African coastal states, fisheries are major contributors to rural livelihoods, income and food security."*** [1]

Highlighting the need for an integral approach to promote food security in Africa, FAO Director-General Jose Graziano da Silva, said ***"To achieve food security in a sustainable way, we must work with small-scale producers, helping them increase production and productivity, but we also need to look at access to food, and ensure that poor families have the means to produce the food they need or earn the income needed to buy their food."*** [2]

When asked about how the interrelated issues of food security, population growth, climate change and foreign policy are playing out in Africa, Nobel Peace Prize winner Kofi Annan said ***"We have to understand that nutrition is critical for people's health and development. We therefore must adopt policies that improve access to nutritious food, and promote healthy and sustainable diets, particularly for children and caregivers."*** [3]

[1] Source: AFK insider, Article: Empowering Africa's coasts for a Blue Economy, dated 25th April 2014 http://afkinsider.com/53304/empowering-africas-coasts-blue-economy/#sthash.IQptgGi6.dpuf

[2] Source: FAO, Article: 2025, United behind the African agenda to eradicate hunger, dates 1st July 2013 http://www.fao.org/news/story/en/item/179303/icode/

[3] Source: Africa progress panel, Article: Launch Remarks – Kofi Annan, dated 8th May 2014 http://www.africaprogresspanel.org/launch-remarks-kofi-annan/

1 Introduction

1.1 Background

Fish and fish products are a primary source of protein and essential nutrients in human diets. Various fish and other aquatic species are available from both salt and fresh water in every country of the Southern African Development Community (SADC) region and these fish are making a significant contribution to the food and nutrition security of people in Southern Africa. However, the role of fisheries in food and nutritional security has not been well documented in the region due to a range of reasons including the difficulties in acquiring adequate and appropriate data and information. For this reason the Centre for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA) in collaboration with New Partnership for Africa's Development (NEPAD), the SADC, Common Market for East and Southern Africa (COMESA), and the WorldFish Center have commissioned this study to establish the role of fisheries in food and nutrition security in the Southern Africa region. CCARDESA is a Sub-Regional Organisation (SRO) mandated to implement Pillar four of the Comprehensive Africa Agriculture Development Programme (CAADP) of the NEPAD, which is a cross-cutting Pillar that supports and reinforces the other three pillars of the CAADP.

The report provides information for a wide stakeholder base on the role of fisheries in food and nutrition security, as well as assisting CCARDESA to develop collaborations with strategic partners to develop and implement initiatives targeted at ensuring that the region realises the benefits that can be derived from fisheries.

1.2 Key issues underpinning the study

Despite numerous strides being made in achieving the goal of eradicating hunger in all countries and the goal of halving the number of undernourished people by 2015[4], more than 800 million people suffer from chronic malnourishment and one in nine people around the world (795 million) go hungry every day[5]. These food related deficiencies can be devastating. If a child does not receive sufficient nutrition in the first 1,000 days of life they are at risk of mental impairment, poor health, low productivity and even death. The economic costs of micronutrient deficiencies caused by food insecurity are also considerable, reducing gross domestic product (GDP) by 0.7-2% in most developing countries, and the SADC region is one of the worst affected areas.

The main benefits that fisheries provide are the basis of a vital source of food, employment, recreation, trade and economic well-being for millions of people around the world. Fishing and related activities provide employment and livelihoods for 60 million people, 90% of these are in developing countries, thus contributing to their overall security and ability to produce or purchase food. Fish directly accounts for about 17 % of the global population's intake of animal protein, and 6 % of all proteins consumed.

A major challenge to food and nutrition security is the increasing human population, particularly in developing countries, and the resultant increase in demand this will generate on already stretched food resources. The global population is expected to grow by another two billion to reach 9.6 billion people by 2050[6], with more than half of this global population growth expected to occur in Africa

[4] Rome Declaration on World Food Security, adopted at the World Food Summit, Rome, 13–17 November 1996.

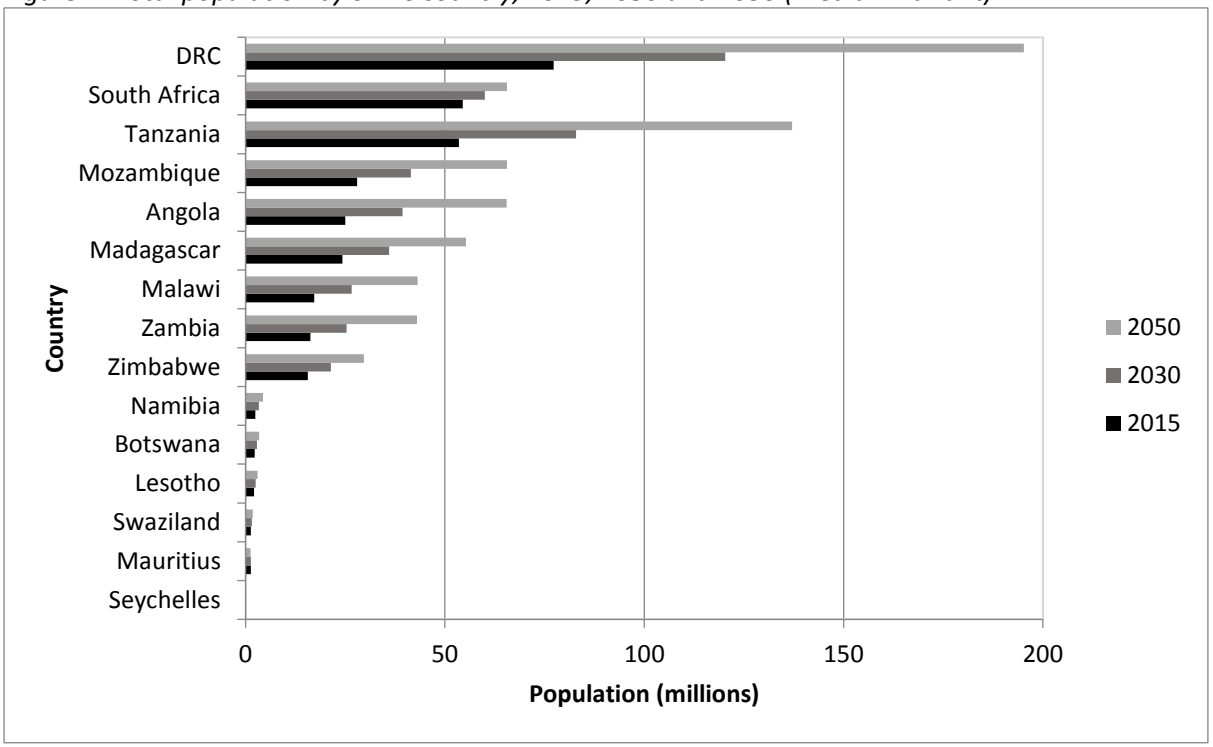
[5] FAO, IFAD and World Food Programme, 2015. The State of Food Insecurity in the World

[6] FAO State of Food Insecurity. 2015 - http://www.fao.org/3/a-i4646e.pdf

which grew at a pace of 2.55 % annually in 2010-2015[7]. Between 2015 and 2050, the populations of 28 African countries are projected to more than double. By 2100, the populations of five SADC countries are projected to increase by at least five-fold: Angola, Democratic Republic of Congo (DRC), Malawi, United Republic of Tanzania (Tanzania) and Zambia. During 2015-2050, half of the world's population growth is expected to be concentrated in nine countries and two of these are SADC countries: the DRC and Tanzania (see Figure 1 for current and predicted population growth to 2030 and 2050).

It is perhaps the greatest challenge that we face – to feed the people of the SADC region – while safeguarding our natural resources for future generations.

Figure 1: Total population by SADC country, 2015, 2030 and 2050 (Medium variant)



Source: United Nations, Department of Economic and Social Affairs, Population Division (2015). World Population Prospects: The 2015 Revision, Key Findings and Advance Tables. Working Paper No. ESA/P/WP.241.
See Annex one for figures.

1.3 Report structure

The finding of this study are presented in seven chapters:

1. This introductory chapter;
2. An overview of food and security nutrition on the continent and in the SADC region, with a specific focus on the role played by fisheries in food security;
3. A summary of global fish production and consumption, and a detailed look at the fish production and consumption in SADC countries, with a regional comparative summary;
4. A special chapter on the issue of small scale fish farming and fish consumption;
5. An analysis of the strengths, weakness, opportunities and threats of increasing the contribution of fisheries to food and nutritional consumption
6. Recommendations for research into fisheries and fish farming in order to increase the contribution of fisheries to food and nutritional security

[7] United Nations, Department of Economic and Social Affairs, Population Division (2015). World Population Prospects: The 2015 Revision, Key Findings and Advance Tables. Working Paper No. ESA/P/WP.241.

7. Annexes, containing more detailed statistics and other relevant information.

2 Food and nutrition security

2.1 What is food and nutrition security?

The definition of food and nutrition security has evolved from the starting point of 'food security' being when food was available to the rapid realisation that availability is not sufficient for food security, because food may be physically existent but inaccessible for those most in need. Today the accepted definition of food and nutrition security by the United Nations (UN) Food and Agriculture Organization (FAO) is '*a condition when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.'*

This definition includes four dimensions[8]:

- Consistent availability of sufficient quantities of food – the *categorical* dimension;
- Physical, social and economic access to sufficient food – the *socio-organizational* dimension;
- Ability to utilize available food; access to clean water, sanitation and health care for nutritional wellbeing – the *managerial* dimension; and
- Stability of food supply to national markets to maintain a regular supply of food at all times – the *situation-related* dimension.

Food availability means there is a consistent supply of appropriate food types, either imported or produced locally. Food access means that the local population have the means to purchase or barter for the food necessary for appropriate dietary and nutritional requirements. Available and accessible food must also be of sufficient nutritional value and be safe to consume if food security is to be attained. There should also be a stable supply of and access to food for adequate periods. This can be achieved with appropriate food production, handling and storage.

2.2 Global overview of food and nutrition security

Despite the progress made in the fight against hunger, a large number of people still lack the food they need for an active and healthy life. The latest available estimates indicate that about 795 million people in the world were undernourished in 2014–15[5].

Progress towards improved food security also continues to be uneven across regions. While some regions have made considerable progress in reducing hunger, others have done so at a slower pace, with significant pockets of food insecurity in a number of countries in these regions[5]. The different rates of progress across regions have brought about changes in the regional distribution of hunger since the early 1990s with Southern Asia and sub-Saharan Africa now accounting for substantially larger shares of global undernourishment. The share of sub-Saharan Africa in particular has increased from 45% to over 60 %[5].

2.3 Food security and nutrition in Africa

Overall food availability in Sub-Saharan Africa has increased by about 12% over the past two decades, with the prevalence of undernourishment in Sub-Saharan Africa having declined from 33% to 23% between 1990-92 and 2014-16. However, the total number of undernourished people continues to increase with an estimated 227 million in between 2012 and 2014 compared to 176 million in 1990-92[5] (see Table 1).

[8] FAO, IFAD and World Food Programme, 2015. The State of Food Insecurity in the World

Table 1: Undernourishment globally and in Africa (2012-2014)

Region	Number of people undernourished (millions)	Percent of population undernourished
World	805	11.3 %
Africa	227	20.5 %
Sub-Saharan Africa	214	23.8 %

Source: FAO, IFAD and World Food Programme, 2015. The State of Food Insecurity in the World

Recognising the food security needs of the continent, a number of complementary and comprehensive food security and nutrition policies and programs have been adopted across Africa with the aim of making an impact on hunger, food insecurity and malnutrition in Sub-Saharan Africa.

Continental Initiatives addressing food security include:

- The Malabo Declaration on "*Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods*" adopted in June 2014 and aimed at building on the achievements and lessons of the CAADP's first ten years and the implementation of earlier African Union (AU) Decisions and Declarations[9].
- African Regional Nutrition Strategy (ARNS) 2015-2025 for a shared consensus and commitment to effective multi-stakeholder approaches and governance mechanisms for nutrition. Developed by the AU and its partners, the ARNS proposes a series of institutional provisions to ensure governance mechanisms for ending child hunger and malnutrition by 2025[10].
- The NEPAD CAADP Nutrition Capacity Initiative, commenced collaboration with countries in 2011 to develop and implement nutrition-sensitive agricultural policies, programmes and investment plans. This initiative is supported by the follow up actions of the Second International Conference on Nutrition (ICN2)[11].

Initiatives such as these show the growing efforts being adopted across Africa to meet the challenges of providing adequate food for the continent.

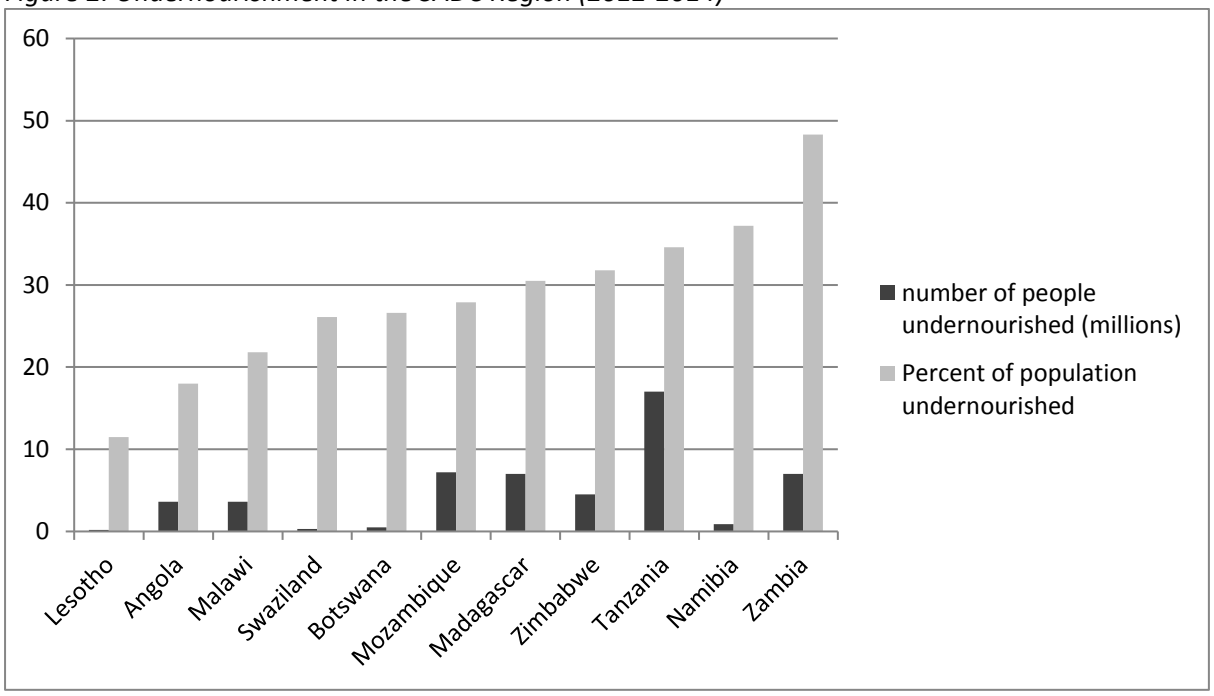
2.4 Food and nutrition security in SADC

As with many parts of Sub-Saharan Africa, the SADC States face numerous challenges ranging from food scarcity to unpredictable changes in food availability due to factors such as weather and climate, labour-intensive or outdated agricultural methods, and HIV and AIDS, as well as other health issues affecting agricultural production levels[12].

The SADC States, have prioritised the need to improve the lives of their people by removing the serious obstacle of inadequate access to food, recognizing that a healthy, well-fed population will be better equipped to build a better future. The core focus of food security in Southern Africa is sustainable access to safe and adequate food at all times. The many food challenges faced by the region have made food security a top priority within SADC.

[9] Document: Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods, dated June 2014
Web Link: http://pages.au.int/sites/default/files/Malabo%20Declaration%202014_11%2026-.pdf
[10] Document: African Regional Nutrition Strategy 2015-2025, dated April 2015
Web Link: http://sa.au.int/en/sites/default/files/Africa%20Regional%20Nutrition%20Strategy%202015-2025%2013.3.2015%20-%20English_0.pdf
[11] Article: Integrating Nutrition in CAADP investments plans, dated 2011
Web link: http://www.fao.org/nutrition/policies-programmes/capacity-development/caadp/en/
[12]http://www.sadc.int/themes/agriculture-food-security/food-security/

Figure 2: Undernourishment in the SADC Region (2012-2014)



Source: FAO, IFAD and World Food Programme, 2015. The State of Food Insecurity in the World
Note: For Seychelles, Mauritius, South Africa and DRC inadequate information was available.

Regional initiatives to tackle food insecurity include:

- The SADC Food and Nutrition Strategy (2015-2025)[13], which was approved by the respective Ministers in July 2014 and subsequently endorsed and adopted by the Council and the Summit in August 2014. The strategy aims to promote availability of food through improved production, productivity and competitiveness; to improve access to adequate and appropriate food in terms of quality and quantity; to improve the utilization of nutritious, healthy, diverse and safe foods for consumption under adequate biological and social environments with proper health care; and to ensure stable and sustainable availability, access and utilization of food[14].
- The NEPAD/SADC Food and Nutrition Security Knowledge-Sharing and Monitoring Platform, whose objectives are to improve food and nutrition security and resilience. The intention is to do this through risk management, and support to regional mechanisms, building on on-going efforts to strengthen access to information and capacities of governments and stakeholders for an informed decision-making within the CAADP framework and the Scaling-Up Nutrition (SUN) movement[15].
- The Common Market for Eastern and Southern Africa (COMESA) Regional CAADP Compact is also designed to harmonize, align and standardize agricultural investment programmes in the region within the framework of the strategic priorities: i) increasing food output and productivity throughout the regional value chain: on farms, in processing industries, and in marketing, ii) developing priority regional trade and development corridors and iii) developing human and institutional capacity in support of an enhanced policy environment.[16]

[13] Document: Food and Nutrition Security Strategy 2015 – 2025, dated September 2014, Web link: http://www.nepadsanbio.org/sites/default/files/SADC_Food_%26_Nutrition_Strategy_(Final)_for_Publication_12_Sep_2014.pdf

[14] FAO Regional Overview of Food Insecurity: Africa - http://www.fao.org/3/a-i4635e.pdf

[15] Regional Overview of Food Insecurity: Africa - http://www.fao.org/3/a-i4635e.pdf

[16] COMESA has some overlapping membership to the SADC.

Box 1: South Africa and Angola case studies of national approaches to support of food and nutrition security
Source: FAO, IFAD and World Food Programme, 2015. The State of Food Insecurity in the World

South Africa is presently able to improve national food sufficiency through a combination of local production and food imports. The South African Government places a high priority on several national policies and programmes, which contribute to the common goal of raising nutritional levels, especially for the more vulnerable sections of the population. The set of policies include:

- *The Integrated Food Security Strategy (IFSS), which was developed in 2000 to streamline, harmonise and integrate diverse food security programmes into one comprehensive strategy to improve food security and nutrition in South Africa.*
- *The National Development Plan (NDP) sets out various methods and targets to eradicate poverty, reduce unemployment, and eliminate inequality by 2030.*
- *The Food Security Production Intervention Programme was introduced in 2012 to provide smallholder farmers, communities and households the opportunity to increase production of basic food.*
- *Fetsa Tlala ("Defeat Hunger"), South Africa's Zero Hunger Programme, derives its mandate from various policies and documents, including the Constitution, the IFSS and the NDP, and Vision 2030.*
- *The Integrated Food Production Programme aims to produce enough food to meet the population's needs. In 2013 the South African Government made available ZAR 2 billion to deal with structural problems of food insecurity.*

Angola has been able to make significant progress towards economic growth and reducing poverty, food insecurity and undernourishment in less than 13 years, following more than 30 years of civil war which led to the almost complete destruction of the country's productive and economic infrastructure. This has been made possible by the following factors.

- *First, the implementation of successive national development plans supported by massive investment in priority productive and social sectors (agriculture, health, education, water and sanitation, etc.).*
- *Second, through the implementation of the National Strategy for Food Security and Nutrition, and through the Integrated Programme of Rural Development and Fight against Poverty, Angola promoted decentralization and devolution of decision making and transfer of budgetary resources to local governments.*
- *Third, Angola has set up and operationalized formal inter-sectoral coordination structures to monitor plans and programs. These are Inter-Departmental Committees which were appointed by Presidential Decree.*

Box 2: Madagascar case study – Challenges to food and nutrient security are multiple
Source: FAO, IFAD and World Food Programme, 2015. The State of Food Insecurity in the World

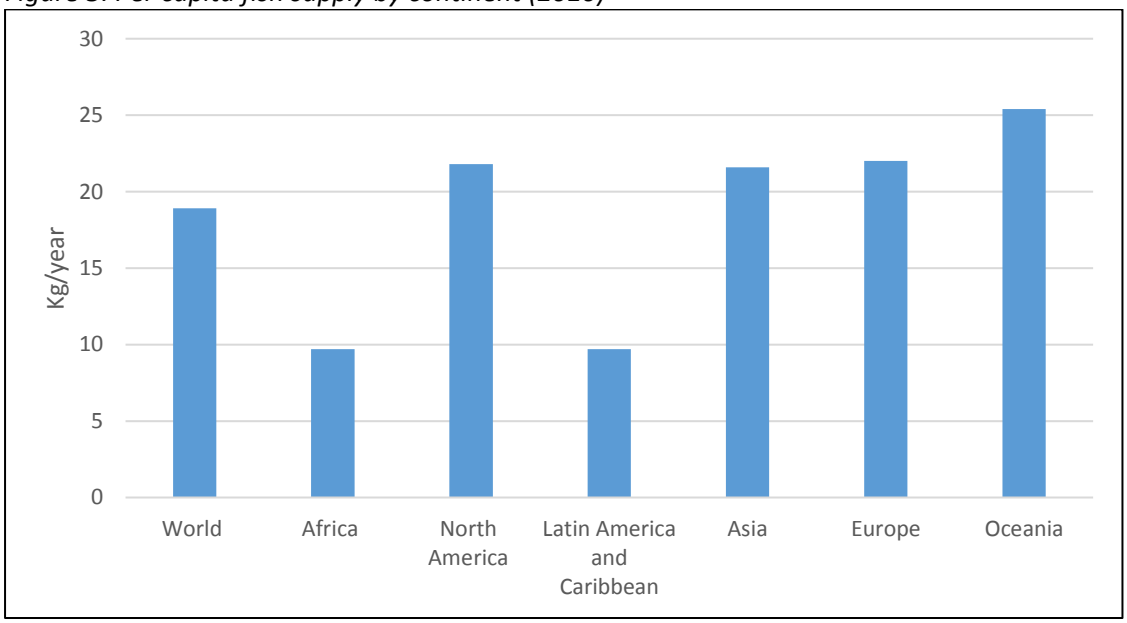
Madagascar is one of the poorest countries in the world, ranking 151 of the 187 countries in the 2012 Human Development Index. The island is highly exposed to climate hazards – in recent decades, it has faced cyclones, droughts, floods and locust invasions. Such natural disasters have led to and exacerbated poverty and food insecurity. More than 70 percent of the population lives on less than one USD per day, and poverty rates in rural areas are even higher. Approximately 73% of the rural population is engaged in agricultural activities, livestock and fisheries, and most rural households practise subsistence farming. Six out of ten farming households cultivate less than 1.5 hectares of land each. Because of large family size and low agricultural productivity, most rural households are net food buyers. About 31% of the population was undernourished in 2012–14, up from 27 percent in 1990–92 see Figure 3). About 84% of the population obtain most of their calories (more than 75%) from staples, indicating that diets are of poor quality. Malnutrition is widespread, and about 47 percent of children under five years of age are chronically malnourished or stunted. Political instability has thwarted economic growth and strained relations with international donors. Average annual GDP growth fell from an average of 5.6% in the five years before the political crisis of 2009, to just 1.8% in the three years following. After a successful election in 2013, and the country's reinstatement in the African Union, Madagascar is resuming relationships with bilateral and multilateral partners.

2.5 Role of fisheries in food and nutrition security

Fish and fisheries products have the potential to have a significant impact on food security and good nutrition worldwide[17] [18] [19]. Currently fish is said to provide more than 4.5 billion people with at least 16.7% of their average per capita intake of animal protein worldwide[20]. In addition, the fishery and aquaculture sectors are a source of income for millions of women and men in low income families[21], thus contributing directly and indirectly to their food security[22].

Figure 3 summarises per capita fish supply by continent. Of the 130 t million available for human consumption in 2010, fish supply was lowest in Africa (as 9.7 kg/year).

Figure 3: Per capita fish supply by continent (2010)



Source: FAO SOFIA 2014

Fish are a particularly important source of protein for many African countries, and especially for poorer segments of the population and therefore plays an important role in improving Africa's food security and nutrition status. In small island developing states (SIDS), such as the Seychelles and Mauritius, per capita fish supply is among the highest in the world[23] (see Chapter 3 for more detail on SADC countries).

[17] Allison, E. H., 2011. Aquaculture, fisheries, poverty and food security. Working Paper 2011–65. Penang: WorldFish Center.

[18] Thilsted, S. H., 2012. The potential of nutrient-rich small fish species in aquaculture to improve human nutrition and health.

[19] Beveridge, M. C. M., Thilsted, S. H., Phillips, M. J., Metian, M., Troell, M., & Hall, S. J., 2013. Meeting the food and nutrition needs of the poor: the role of fish and the opportunities and challenges emerging from the rise of aquaculture. Journal of Fish Biology, 83, 10671084.

[20] Christophe Béné & Manuel Barange & Rohana Subasinghe & Per Pinstrup-Andersen & Gorka Merino & Gro-Ingunn Hemre & Meryl Williams, 2015. Feeding 9 billion by 2050 – Putting fish back on the menu

[21] Béné, C. (2006). Small-scale fisheries: assessing their contribution to rural livelihoods in developing countries. FAO Fisheries Circular,
No. 1008. Rome: Food and Agriculture Organization (FAO).

[22] World Bank/FAO/WorldFish. (2012). hidden harvest: The global contribution of capture fisheries. World Bank Report, No. 66469-GLB. Washington: World Bank

[23] http://www.globefish.org/total-fish-consumption-per-capita-kg-and-fish-contribution-to-total-proteins-percent.html

Although humans cannot live on fish alone, small quantities of fish in human diets can make a decisive difference to a variety of health concerns including, among others, brain, bone, and muscle tissue development, prevention of blindness, heart attacks, cancer, and mitigating the effects of HIV/AIDS[24]. Fish are highly nutritious, rich in essential micronutrients, minerals, essential fatty acids and proteins, and represent an excellent supplement to nutritionally deficient cereal-based diets. Fish also provide livelihoods for about 800 million individuals or 10 to 12 % of the world's population as summarised in Table 2.

Table 2: The role of fish as food and source of employment

Fisheries & aquaculture sector			
Proteins	**Employment & Livelihood**		
• 16.7% of world total animal protein intake. • 19% of Africa's total animal protein intake.	• 58 million people employed worldwide, 15% of which are women. • 12.3 million employed in fisheries in Africa.	• Assures livelihood for 10% - 12% of world's population (About 800 million people)	• Value added by fisheries to GDP in Africa is USD 24 billion (1.26 % of total GDP)

Source: State of World Fisheries FAO, 2014 & Value of African Fisheries 2104

Based on the four pillars of food security – utilisation and nutritional value, availability, access, and stability – fish has the potential to provide an important albeit under-recognised role in global food security. In terms of utilisation and nutritional value, fish are a key source for protein and micronutrients. In terms of availability, the total world production in 2013 was 160 t million[25], with Africa accounting for nine t million. Global trade in fisheries products are worth around USD 130 billion of which Africa holds USD 11 billion[26]. Rising demand for fish and fishery products has been supplemented with a robust increase in aquaculture, with the World Bank predicting that aquaculture production will be about 93 t million by mid-century[27].

Despite its recognised potential beneficial contribution to food security and nutrition, a recent review of international development and research agencies working on food security and nutrition revealed that fish is strikingly missing from strategies for reduction of micronutrient deficiency, precisely where it could potentially have the largest impact[28]. More than 400 million Africans, meanwhile depend on fish as a vital source of food and nutrition security[29].

[24] http://www.ictsd.org/bridges-news/biores/news/identifying-policy-synergies-on-aid-for-trade-fisheries-and-food-security

[25] FAO, 2013. Yearbook of Fisheries Statistics, Summary Tables: World Fisheries Production, by capture and aquaculture, by country. Rome, FAO. Retrieved from ftp://ftp.fao.org/FI/STAT/summary/default.htm on 9/9/2015

[26] FAO, 2012. ftp://ftp.fao.org/FI/STAT/summary/a6ybc.pdf

[27] http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2014/01/31/000461832_20140131135525/Rendered/PDF/831770WP0P11260ES003000Fish0to02030.pdf

[28] Allison, E. H., Delaporte, A., & Hellebrandt de Silva, D. (2013). Integrating fisheries management and aquaculture development with food security and livelihoods for the poor. Report submitted to the Rockefeller Foundation. Norwich: School of International Development, University of East Anglia

[29] http://pubs.iclarm.net/resource_centre/WF_2466.pdf

2.5.1 Nutritional elements of fish

FAO estimates are that about 60% of people in developing countries depend on fish for over 30% of their animal protein. The protein content of fish averages 15-20%, and it contains significant amounts of all essential amino acids. Fish is an excellent source of lysine and/or the sulphur-containing amino acids, which are lacking in cereal grains, and is a good source of A, B and D vitamins, calcium, phosphorous, iron, copper and selenium[30].

Research suggests that small fish species consumed whole with bones, heads and internal organs, play a critical role in providing micronutrients, as this is where most micronutrients are concentrated. Small fish are also more affordable, can be bought in smaller quantities, and can be processed and stored for longer periods. Protein from fish is said to be 5-15% more digestible than that from plants, and fish protein improves the digestion of plant protein[31].

Table 3 shows that 100g of tilapia (indigenous to the SADC region) provides 20.8g of protein, more than all plant-source foods, and all the other animal-source foods except for chicken eggs. Fish also contains varying levels of eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), both important for foetal development improved learning ability in infants[32]. Fish is important for brain development in infants but also brain preservation in the aging population. It is associated with decreased risk of dementia and Alzheimer's disease, promoting and preserving mental development[33].

Speaking at a gathering on ways in which malnutrition can be eliminated by changing the agricultural and food systems, African Development Bank (AfDB) President, Akinwumi Adesina, said ***"Poorly fed people lead to poorly performing economies. UNICEF has estimated the annual cost of undernutrition in sub-Saharan Africa at USD 25 billion. Africa and Asia lose 11% of their GNP every year due to poor nutrition. The evidence is clear: boosting nutrition boosts the economy."[34]***

[30] FAO, 2015. Nutritional elements of fish. http://www.fao.org/fishery/topic/12319/en

[31] Bene, C. and Nozomi, K., 2011. The potential role of small fish species in improving micronutrient deficiencies in developing countries

[32] Ibid

[33] Uauy, R., Dangour, A. D., 2006. Nutrition in Brain Development and Aging: Role of Essential Fatty Acids.

[34] Source: All Africa.com, Article: AfDB President Says Good Nutrition Is a Boon to Economic Growth, dated 18th November 2015, http://allafrica.com/stories/201511190575.html

Table 3: The nutrient content of fish and other foods (per 100 g)[35]

Group	Common name	Protein (g)	Total Polyunsaturated fatty acids (PUFA) (g)	EPA (g)[36]	DHA (g)[37]
Large freshwater fish	Carp	17.83	1.43	0.238	0.114
	Catfish	15.60	1.568	0.067	0.207
	Tilapia	20.80	0.476	0.007	0.113
Marine fish	Anchovy	20.35	1.637	0.538	0.911
	Herring	16.93	2.423	0.969	0.689
	Mackerel	18.60	3.350	0.898	1.401
	Milkfish	20.53	1.840		
	Sardine	24.60	5.148	0.470	0.509
Other animal-source foods	Ground beef	14.30	0.696		
	Chicken breast	14.70	3.340		
	Chicken egg	35.60	7.555	0.004	0.037
	Chicken liver	16.90	1.306		
	Cow's milk	3.28	0.136		
Plant-source foods	Cassava	1.40	0.048		
	Rice	2.69	0.323		
	Kidney beans	8.67	0.278		
	Carrot	0.93	0.117		
	Kale	3.30	0.338		
	Spinach	2.86	0.165		

Source: The potential role of small fish species in improving micronutrient deficiencies in developing countries.

[35] Ibid.

[36] EPA and DHA have been associated with foetal development, cardiovascular function, and Alzheimer's disease. Studies have shown that EPA and DHA are important for proper foetal development, including neuronal, retinal, and immune function. EPA and DHA may affect many aspects of cardiovascular function including inflammation, peripheral artery disease, major coronary events, and anticoagulation. http://advances.nutrition.org/content/3/1/1.full

[37] Docosahexaenoic acid (DHA) is essential for the growth and functional development of the brain in infants. DHA is also required for maintenance of normal brain function in adults. The inclusion of plentiful DHA in the diet improves learning ability, whereas deficiencies of DHA are associated with deficits in learning. http://www.ncbi.nlm.nih.gov/pubmed/10479465

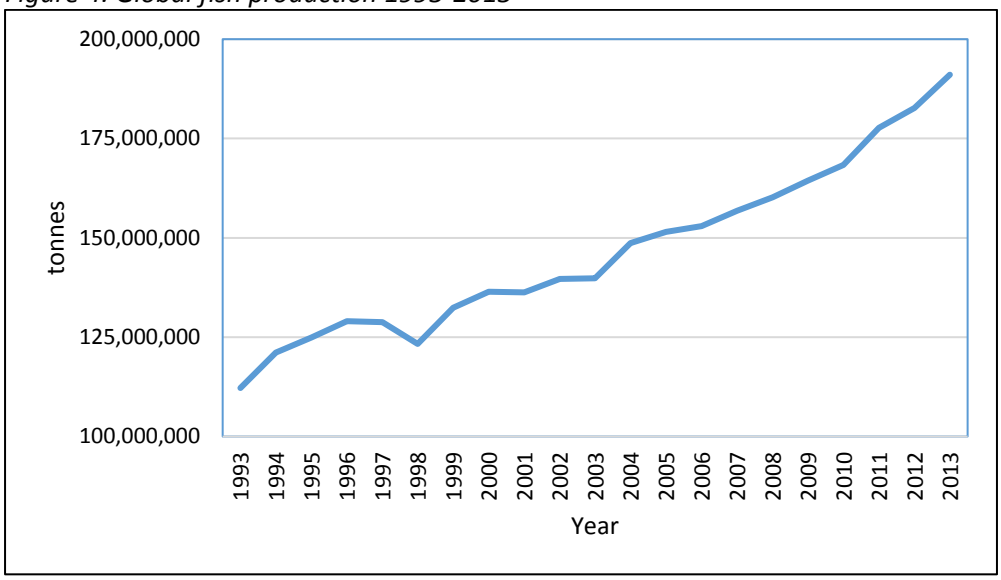
3 Fisheries production and consumption

3.1 Global overview

Although often not fully recognized as a major productive activity in many countries, the contribution of capture fisheries and aquaculture production to national economies is multifaceted. In addition to supplying food, capture and aquaculture production contributes to GDP, provides livelihoods for fishers and processors, is a source of hard currency (from exports of fishery products), and boosts government revenues through fisheries agreements and taxes[38].

Figure 4 highlights the steady growth in global fish production in the last two decades. The annual average growth of fish production of 3.2% outpaces the world population growth of 1.6 %. While Figures 5 and 6 provide a recent overview of world capture and aquaculture production.

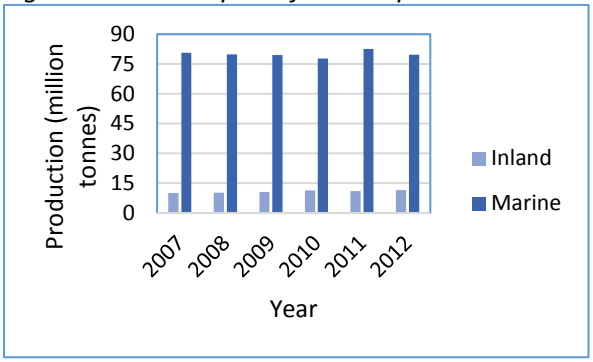
Figure 4: Global fish production 1993-2013



Source: FAOSTAT

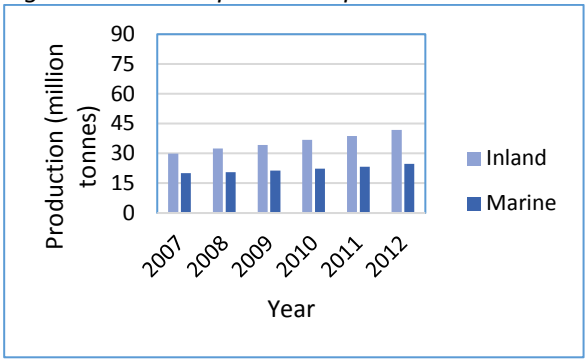
[38] de Graaf, G. & Garibaldi, L. 2014. The value of African fisheries. FAO Fisheries and Aquaculture Circular. No. 1093. Rome, FAO. 76 pp.

Figure 5: World capture fisheries production



Source: FAO State of World Fisheries and Aquaculture 2014

Figure 6: World aquaculture production



Source: FAO State of World Fisheries and Aquaculture 2014

A combination of population growth, rising incomes and urbanization, and the strong expansion of fish production, mainly attributed to China's dramatic expansion in fish production (aquaculture), have resulted in global per capita fish consumption increasing to 19.2 kg (2012) from an average 9.9 kg in the 1960's.

Per capita fish consumption in developing regions and low-income food-deficit countries (LIFDCs) has also risen in the last 50 years, going from 5.3kg and 4.9kg respectively in 1961 to 17.8kg and 10.9kg respectively in 2010. The gap in consumption levels between developed and developing or LIFDCs is decreasing, and the proportion of fish consumed that is imported has increased[39].

[39] FAO, 2014. The State of World Fisheries and Aquaculture 2014

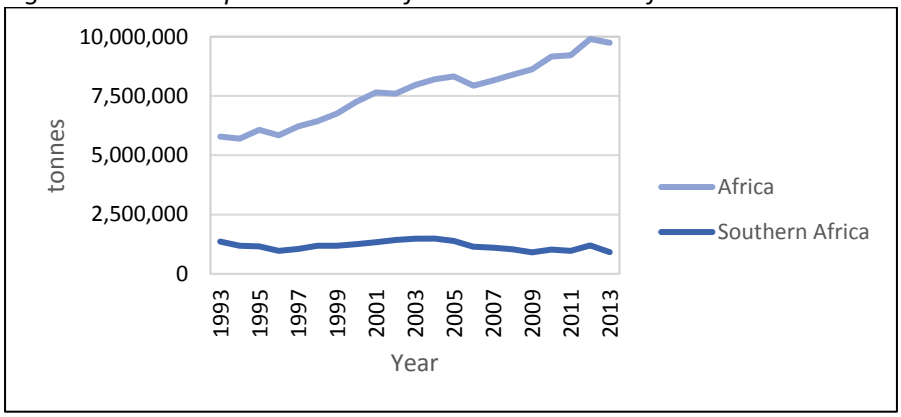
3.2 Fisheries in Africa

Fisheries in Africa are characterized by the contribution of small-scale fisheries to employment. However, while fishing itself is clearly an important source of employment, the sector also generates exports and foreign currency and conservation and biodiversity values that are of global significance[40]. A 2012 study by the World Bank[41] highlighted that the bulk of fisheries employment in Africa is in the post-harvest economic activities, which includes fish processing and marketing.[42] Most AU Member States have a fishery sector consisting of both capture fisheries and aquaculture, generating a variety of benefits including food and nutrition security[43].

The value of fisheries and aquaculture on the continent was estimated at USD 24 billion (2011), 1.26 % of the GDP of all African countries. Marine artisanal fisheries accounted for the largest proportion (0.43 %) with marine industrial fisheries and inland fisheries contributing 0.36 % and 0.33 % respectively.[44]

In 2010 the estimated total fishery production on the continent was 9.4 million tonnes, with 4.9 million tonnes, 2.7 million tonnes and 1.4 million tonnes coming from the marine capture, inland capture and aquaculture fisheries respectively. In the same year, per capita fish consumption in Africa was 9.1 kg, less than half the global average of 18.4 kg. Fish constitutes 36 % of the protein intake in Africa, making it the most important animal protein on the continent, with a majority (21 %) coming from the marine fishery.[45]

Figure 7: Fisheries production in Africa and Southern Africa 1993-2013



Source: FAOSTAT

3.3 Country summaries of fisheries and their role in food and nutrition

3.3.1 Angola[46]

Figure 8: Map of Angola

Physical

Angola has an exclusive economic zone (EZZ) of 491,991 km^2 and the second largest land area amongst SADC countries, 1,246,700 km^2. In relation to its land mass, the area covered by inland water is low.

[40] AUC-NEPAD (2014). The Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa
[41] World Bank, 2012. Hidden harvest: the global contribution of capture fisheries. Washington DC. 92 pp.
[42] Ibid
[43] AUC-NEPAD (2014). The Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa
[44] Ibid
[45] AUC-NEPAD (2014). The Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa
[46] Statistics and sources for all information are provided in the Annexes.

Socio-economic

Angola's GDP is around USD 130 billion, the second highest in the region. The population is 24 million, with a life expectancy of 52. 37% of the population live below the national poverty line.

Fisheries production

Angola produces around 275,000 t of fish, 99% of which come from capture fisheries. This contributes 2% to the country's GDP. The fisheries sector employs 150,000 people, with about 800 being employed in the aquaculture sub-sector. The value of fish imported is USD 252 million, more than double the regional average of USD 100 million, while the value of fish exported is USD 12 million, far below the regional average of USD 152 million.

Source: Maps of World http://www.mapsofworld.com/

Food and nutritional security and the contribution of fisheries

The percentage of Angolans undernourished is 14%, which is below the regional average of 24%, while the percentage of children under five moderately or severely underweight is 16%. The per capita fish consumption is 16 kg per person, this constitutes 7% of the total protein intake, and 22% of the total animal protein intake. Per capita fish supply is 14 kg/per person.

Figure 10: Contribution of fish to total animal protein intake – Angola

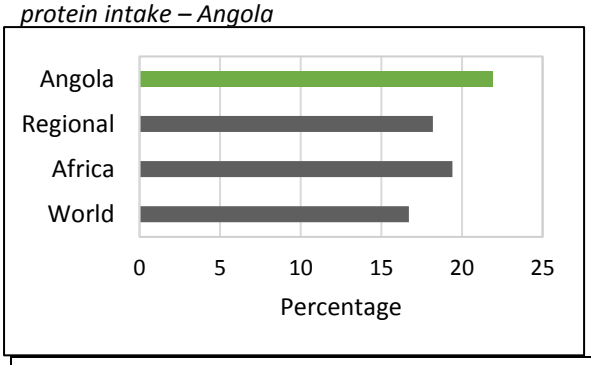
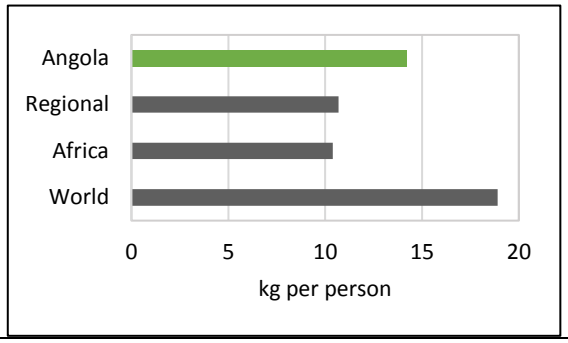


Figure 9: Per capita fish supply – Angola



Angola's fisheries - Marine fisheries target small pelagic species, demersal species, and deep-water shrimps mainly by industrialised vessels. Around 20% of artisanal boats are motorised, and artisanal fishers catch demersal species, groupers, snappers, sea breams, croakers and spiny lobster. Semi-industrial and industrial fishers mainly target pelagic species, shrimp and deep-sea red crab. All semi-industrial and industrial fishing are based at the four main ports, while artisanal craft are scattered about the coastline in around 100 landing sites. Unsuccessful attempts to start commercial aquaculture have been made, but these have all faced difficulties, mostly market-related and therefore the contribution of aquaculture to fish production is less than 1%.

Source: FAO Food Balance Sheets, 2011

3.3.2 Botswana

Figure 11: Map of Botswana

Physical

Botswana's land area is 566,730 km^2, with rivers along its borders and the Okavango Delta in the north. The country is covered in large part by desert.

Socio-economic

Botswana has a GDP of USD 16 billion, below the regional average, but has a population of only 2 million, 19% of whom live below the national poverty line, less than half the regional average. The life expectancy is relatively low at 47, largely due to HIV/AIDS.

Fisheries production

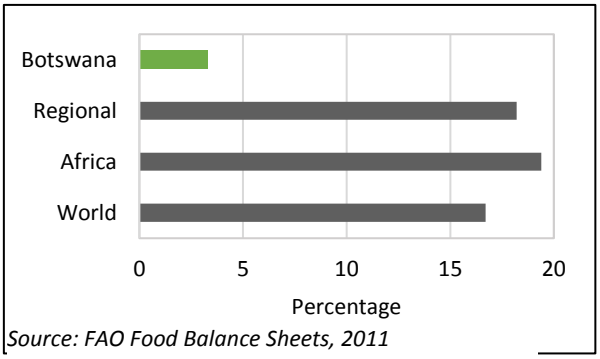
Botswana produces about 400 t of fish, from capture fisheries, and the contribution of fisheries to GDP is below 1%. The value of fish imports is USD 12 million, and only Lesotho, Malawi and Swaziland export less fish than Botswana's USD 500,000.

Source: Maps of World http://www.mapsofworld.com/

Food and nutritional security and the contribution of fisheries

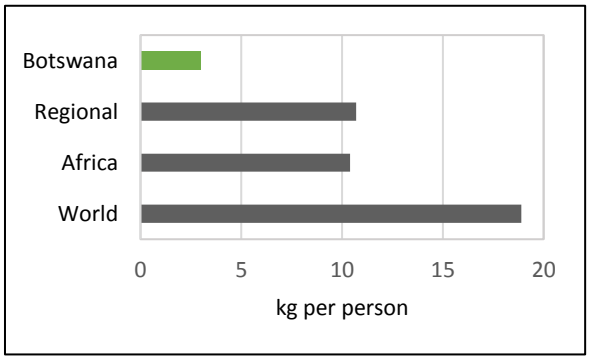
Botswana per capita fish consumption is 3 kg per person, and the contribution of fish to total protein and total animal protein intake is 1% and 3% respectively, well below the regional averages. 24% of Batswana are undernourished.

Figure 12: Contribution of fish to total animal protein intake – Botswana



Source: FAO Food Balance Sheets, 2011

Figure 13: Per Capita fish supply – Botswana



Botswana's fisheries - All fishing activity in Botswana occurs in rivers, lakes and waterways. The Okavango Delta supports a multi-species fishery exploited by five principal fishing methods; hook and line, gillnet fishermen, baskets, spears and traps. The resource is exploited by three principal fisher groups, the artisanal or subsistence fishers, the commercial, and the recreational fishers. Surveys suggest that the number of fishers has decreased; however, there's an increase in motorised vessels, a reduction in the number of gillnets and a slight reduction in the size of gillnets used.

3.3.3 Democratic Republic of Congo

Figure 14: Map of DRC

Source: Maps of World http://www.mapsofworld.com

Physical

DRC has the largest land area and the largest area covered by water amongst SADC countries, 2,267,048 km^2 and 77,810 km^2 respectively. DRC has several rivers and a few lakes, however its EEZ is the smallest of all the SADC coastal countries, 13,894km^2.

Socio-economic

DRC's population, 75 million, is the highest in SADC, although it's GDP of USD 32 billion is below the regional average. 64% of the population live below the poverty line, almost double the regional average, and life expectancy is one of the regions lowest.

Fishery production

Total fish production of about 230,000 t, mostly from capture fisheries, contributes 4% to the country's GDP. DRC imports USD 175 million worth of fish, well above the regional average, and exports only USD 700,000. DRC has the second highest number of people employed in the fisheries in SADC, estimated at 376 000.

Food and nutritional security and the contribution of fisheries

Per capita fish supply is 6 kg/per person. Although contribution of fish to total protein is low at 6%, fish constitutes 39% to total animal protein intake, amongst the highest in SADC. 42% of DRC's population is undernourished, while 23.4% of children under five are moderately or severely underweight, both above regional averages.

Figure 15: Contribution of fish to total animal protein intake - DRC

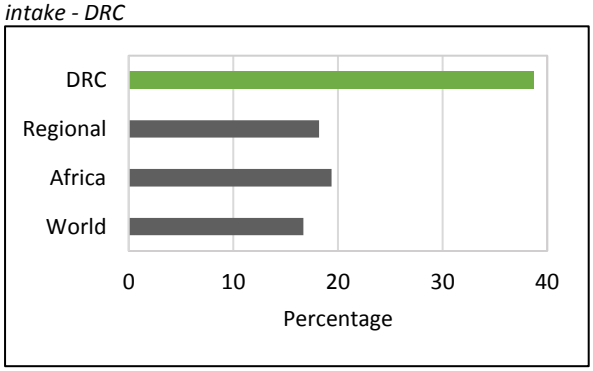
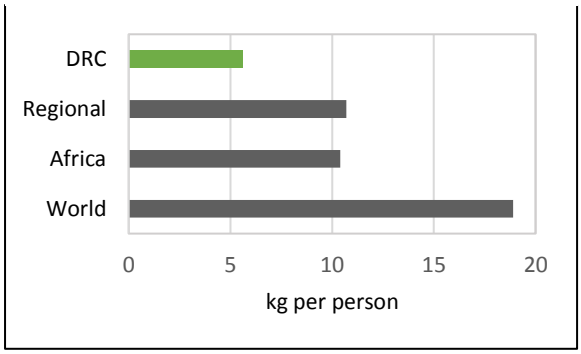


Figure 16: Per capita fish supply - DRC



Source: FAO Food Balance Sheets, 2011

DRC's fisheries - DRC has a very small coastline; and marine production is modest, almost all derived from artisanal units using canoes and beach seines and there are no dedicated fish ports. The majority of fishing activity in the DRC occurs in the large inland lakes. Most of the marine catch is marketed as chilled or fresh fish in Kinshasa markets. Inland catches are marketed in cured form, either as smoked, sun-dried or salt-dried product, except for markets in the immediate vicinity of landing sites, where fresh product is available. Fish is a very popular food item in most areas and demand is exceedingly high. However, the isolated location of many of the water bodies and non-existent or extremely disintegrated infrastructure impose severe limitations on distribution and marketing possibilities.

3.3.4 Lesotho

Figure 17: Map of Lesotho

Source: Maps of World http://www.mapsofworld.com/

Physical

Lesotho is one of the smallest SADC countries with a land area of 30,355 km^2. It contains rivers and man-made dams, but relative to its size the area covered by inland water is low.

Socio-economic

Lesotho's GDP is USD 2 billion, low for the region. The population is 2 million, 61% of which lives below the poverty line, and the life expectancy is 49, largely due to HIV and AIDS.

Fishery production

Lesotho produces about 500 t of fish, 90% of which are from capture fisheries. Though contribution of fisheries to GDP is negligible, 150 people are employed in the sector and USD 3 million worth of fish is imported.

Food and nutritional security and the contribution of fisheries

Lesotho's per capita fish consumption, the contribution of fish to total protein intake and the contribution of fish to total animal protein intake are all the lowest in the region. 11% of the population is undernourished, only South Africa and the Seychelles have lesser proportion of people undernourished.

Figure 19: Contribution of fish to total animal protein intake – Lesotho

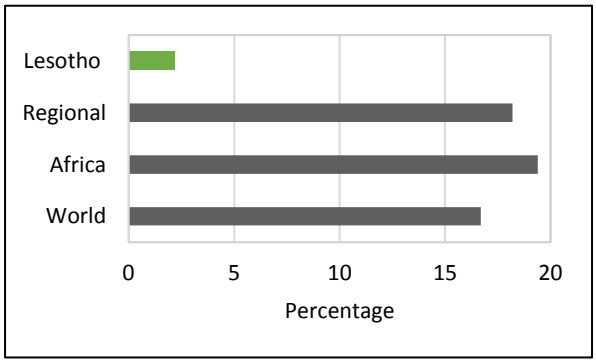
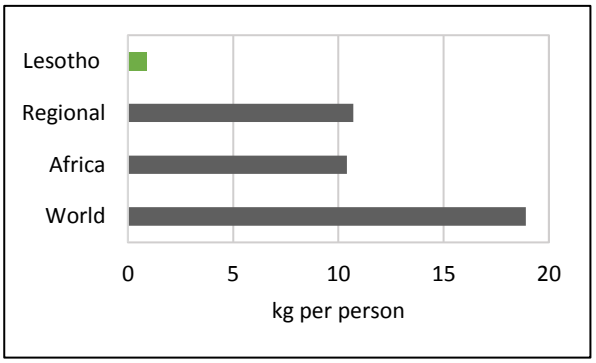


Figure 18: Per capita fish consumption – Lesotho



Lesotho's fisheries - Lesotho's water resources are mainly in the form of rivers but also a few medium-sized reservoirs. Fishing is exclusively subsistence, focusing on both indigenous and exotic species. Recreational fishing takes place in mountain streams, focused on rainbow trout and yellow fish. There is also limited trophy fishing taking place in lowlands reservoirs. No specialized fishing communities exist although some individuals living near rivers and reservoirs continuously fish and use the fish for household food supply and other needs, but do not entirely depend on fishing.

Source: FAO Food Balance Sheets, 2011

3.3.5 Madagascar

Figure 20: Map of Madagascar

Physical

Madagascar has one of the largest EEZ's in the region, 1,201,732 km^2, and a land area of 585,540 km^2. There are rivers and small water bodies inland which make up the 5,501 km^2 covered by water.

Socio-economic

88% of Madagascar's 24 million population lives below the poverty line, the highest in the region. The GDP is USD 11 billion, below average in the region, and the life expectancy is 65.

Fishery production

Madagascar produces about 112,000 t of fish, mostly from capture fisheries. Fisheries contributes 3% to the GDP and the sector employs about 166,000 people. Madagascar has 12,000 people employed by aquaculture, and the third highest aquaculture production in the region, more than double the regional average.

Source: Maps of World http://www.mapsofworld.com/

Food and nutritional security and the contribution of fisheries

Madagascar has the highest proportion of moderately or severely underweight children under five in the region, 37%, and a third of the population is undernourished. The per capita fish supply and consumption, and the contribution of fish to protein intake are all below the regional average.

Figure 22: Contribution of fish to total animal protein intake – Madagascar

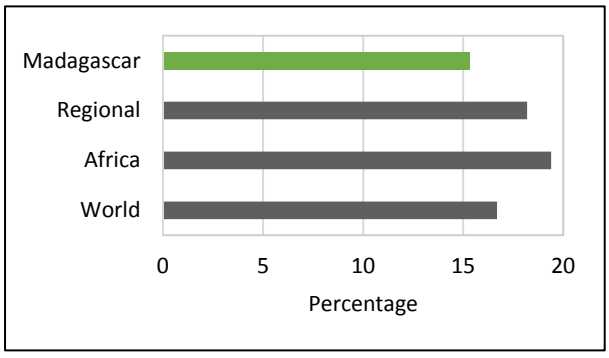
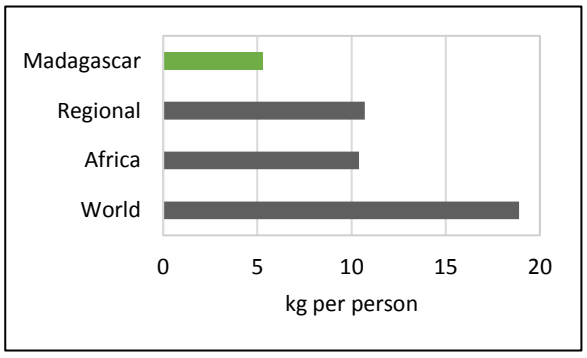


Figure 21: Per capita fish supply - Madagascar



Madagascar's fisheries - On the east coast of the country, fishing is restricted mainly to the coastal lagoons. In the north-west, sardines and tuna are caught. Others species caught include lobster, prawn, octopus and shrimp.

The marine fisheries sector is structured in three main segments: traditional fisheries, artisanal fisheries and industrial fisheries. Traditional fishing is done on foot or in a dugout canoe, while artisanal fishing is characterised by the use of motorised boats using engines of not more than 50 horsepower. The industrial fishing fleet is made up of boats powered by engines of more than 50 hp. There are five important ports in Madagascar. The artisanal fishery operates along the entire coast.

Source: FAO Food Balance Sheets, 2011

3.3.6 Malawi

Figure 23: Map of Malawi

Physical

Malawi is a small landlocked densely populated country with over 20% of its 94,280 km^2 land area covered by water.

Socio-economic

The GDP of Malawi is the fourth smallest in the region, while its population is the sixth largest. More than half of the population lives below the national poverty line and the life expectancy is 55 years.

Fisheries production

The annual fish production is 115,953 t, contributing 3% to the GDP. 3,705 t of this production comes from aquaculture. 173,328 people are employed in the fisheries sector, 8,334 of which are fish farmers. The value of exported fish is less than that of imported fish.

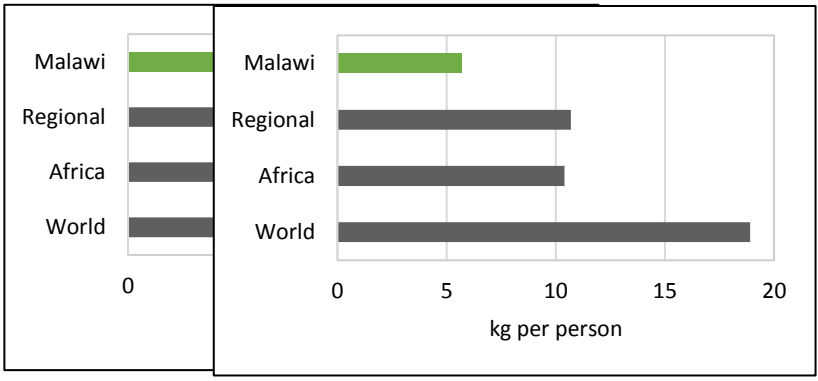
Food and national security and the fisheries

The per capita fish consumption is 6 kg/per person, which accounts for 3% of total protein intake. 21% of Malawians are undernourished, with 17% of children under the age of five moderately or severely underweight.

Source: Maps of World http://www.mapsofworld.com/

Figure 24: Contributi

Figure 25: Per capita fish supply – Malawi intake – Malawi

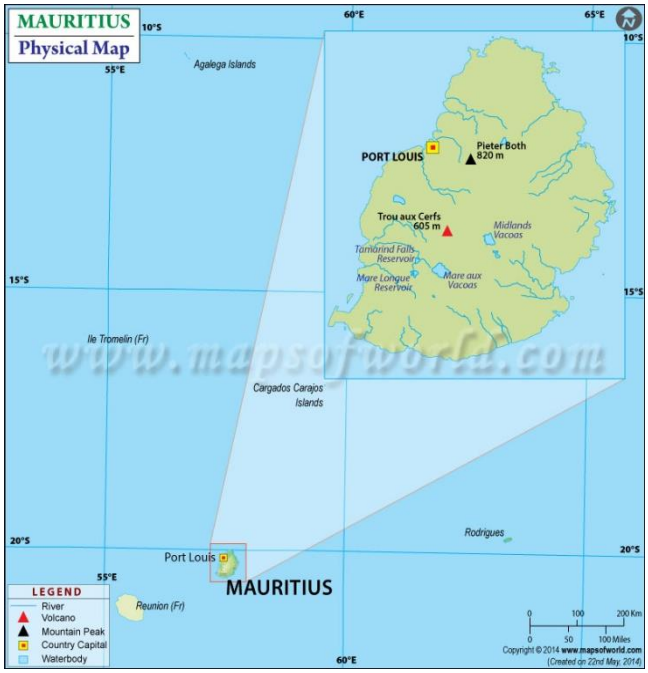


Fisheries in Malawi – 87% of fish landings come from small-scale fishers which use a variety of gear including beach seines, open water seines, gill-nets, fish traps and hooks. The vast majority is brought onto the beaches. Commercial catches are landed at Monkey bay and Madeco's fish landing quays. Tilapia and haplochromines are important species captured.

Source: FAO Food Balance Sheets, 2011

3.3.7 Mauritius

Figure 26: Map of Mauritius



Physical

Mauritius has a total land area of 4,030 km^2, which is much smaller than its 1,276,958 km^2 EEZ. 10 km^2 of its land area is covered by water.

Socio-economic

Mauritius has a GDP of about USD 13 billion with a population of 1.3 million inhabitants. The life expectancy in Mauritius is 74 years, which along with Seychelles is the highest in the region. 9.8% of the population lives below the national poverty line.

Fisheries Production

The annual production of fish is 7,794 t, with 485 t coming from aquaculture. The fisheries sector contributes 0.17% to the GDP, with the value of fish exported outweighing that of imported fish by approximately USD 30million. 6,838 people are employed by the fisheries sector with 346 employed by aquaculture.

Source: Maps of World http://www.mapsofworld.com/

Food and Nutritional Security and the Contribution of Fisheries

5% of people in Mauritius are undernourished, this is jointly (with South Africa) the second lowest percentage in the region. The per capita fish consumption is 23 kg per person, which accounts for 7.7% of total protein intake and about 17% of the total animal protein intake, per capita fish supply is 23 kg per person.

Figure 28: Contribution of fish to total animal protein intake – Mauritius

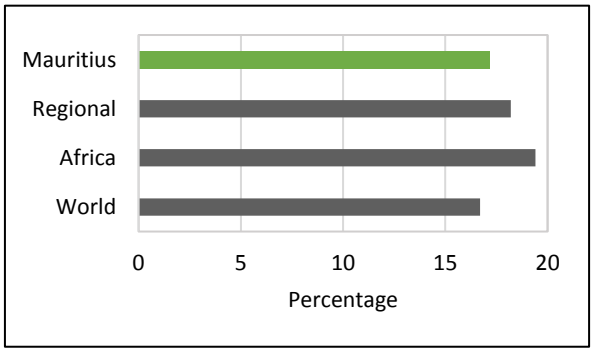
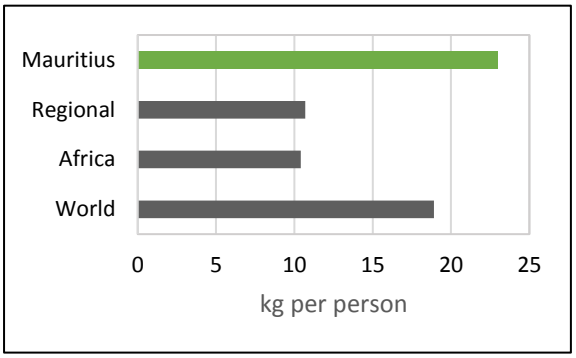


Figure 27: Per capita fish supply - Mauritius



Source: FAO Food Balance Sheets, 2011

Mauritius fisheries - Mauritius has a combination of industrial, semi-industrial and artisanal fisheries. The most industrialised of all is the tuna fishery. There are 61 landing stations used by artisanal fishermen. Commercial aquaculture consists of the production of giant freshwater prawn, red tilapia and marine red drum fish. Mauritius also has fishery processing with the tuna cannery business being the most important.

3.3.8 Mozambique

Figure 29: Map of Mozambique

under the age of five are moderately or severely underweight.

Physical

Mozambique has a total land area of 786,380 km^2, 13,000 km^2 of which is covered by water, and an EEZ of 573,577 km^2.

Socio-economic

Mozambique has a GDP of USD 16 billion and a population of 27 million people. 55% of its population living below the national poverty line. The life expectancy is 50 years.

Fisheries Production

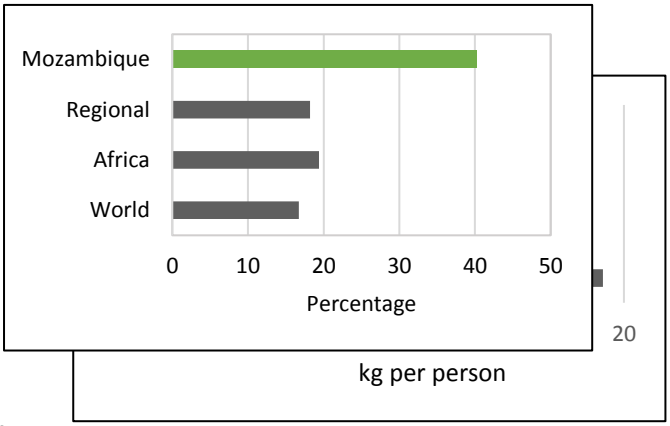
Production is 222,822 t annually, with 721 t coming from aquaculture. The value of imported fish was almost twice that of exported fish. The fisheries sector employs over 374,000 people. The value of fish imported exceeds that of fish exported. 4% of the GDP come from the fisheries.

Food and Nutritional Security and the Contribution of the Fisheries

The per capita fish consumption is 9 kg per person, which makes up 40% of total animal protein intake and 5% of total protein intake. 25% of the population is undernourished and 16% of children

Source: Maps of World http://www.mapsofworld.com/

Figure 30: Contribution *Figure 31: Per capita fish Supply - Mozambique intake - Mozambique*



Mozambique's fisheries - The main fishery sector in Mozambique is industrial and semi-industrial, with over 70% of the active fleet targeting shrimp. The artisanal fishery has been growing as a result of substantial investment in the sector. The recreational/sport fishery is also an important fisheries sector for eco-tourism in Mozambique. In general, artisanal fishing extends along the entire. The country has three main fishing ports. Aquaculture practices range from extensive farming (tilapia and seaweeds) with few inputs and modest output, to semi-intensive farming (shrimp) with high inputs and high output.

Source: FAO Food Balance Sheets, 2011

3.3.9 Namibia

Figure 32: Map of Namibia

Physical

Namibia has a total land area of 823,290 km^2, with 1,002 km^2 covered by water, and an EEZ of 560,905km^2.

Socio-economic

With a life expectancy of 64 years, the Namibian population is 2.4 million, 25% of which lives below the national poverty line. The GDP is about USD 13 billion.

Fisheries Production

Namibia produces the largest quantity of fish in the SADC region at 486,208 t, contributing 3% to the national GDP. The value of fish exported is approximately USD 717 million, greater than that of imported fish. Over 13,000 people are employed by the fisheries sector with 1,640 employed by the aquaculture sub-sector.

Source: Maps of World http://www.mapsofworld.com/

Food and Nutritional Security and the Contribution of the Fisheries

Per capita consumption of fish is 12 kg per person, which constitutes, 6% of total protein intake and 16% of total animal protein intake. 42% of the population is undernourished with 13% of children under the age of 5 moderately or severely underweight.

Figure 34: Contribution of fish to total animal protein - Namibia

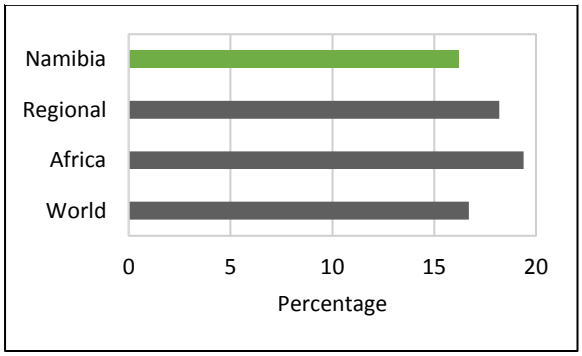
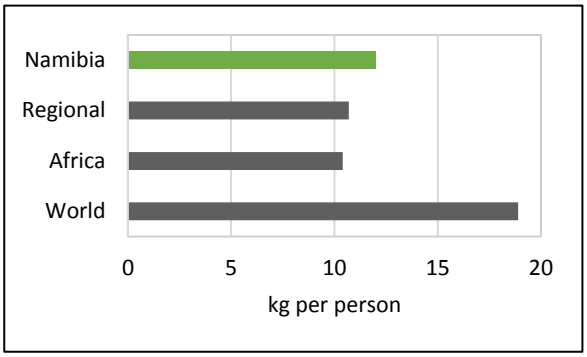


Figure 33: Per capita fish supply - Namibia



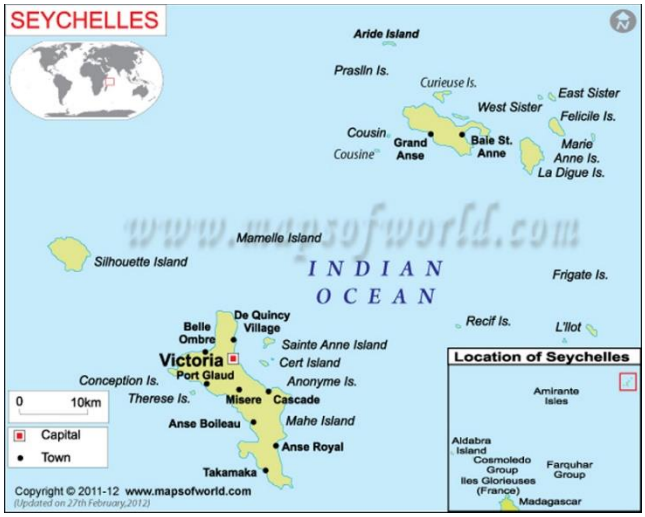
Source: FAO Food Balance Sheets, 2011

Namibia's fisheries - Namibia's fisheries are almost entirely industrial, and the two most important economic fisheries are facing serious challenges. Horse mackerel is the most abundant species in terms of volume. Walvis Bay and Lüderitz are the only two ports with the majority of processing happening at Walvis Bay. 90% of fish products are exported. Commercial marine aquaculture is currently dominated by oyster production in Walvis Bay, Swakopmund and Lüderitz. Freshwater aquaculture is in its infancy though excellent development potential exists along rivers such as the Okavango, Kunene, Orange and Zambezi, as well as lakes and dams.[47]

[47] Namibia's aquaculture strategic plan

3.3.10 Seychelles

Figure 35: Map of Seychelles



Physical

Seychelles has a land area of 455 km2 and an EEZ of 1338039, which is the largest in SADC.

Socio-economic

With only 90,000 inhabitants, the least in SADC, Seychelles has a very small 0.3% (also the lowest in SADC) of its population below the national poverty line. The GDP is 1,400 million and the life expectancy is 74.

Fisheries Production

Seychelles produces 74,128 t of fish annually, and fisheries contributes 2% to the national GDP. Fish exports are approximately twice the value of fish imports. The sector employs 2,000 people.

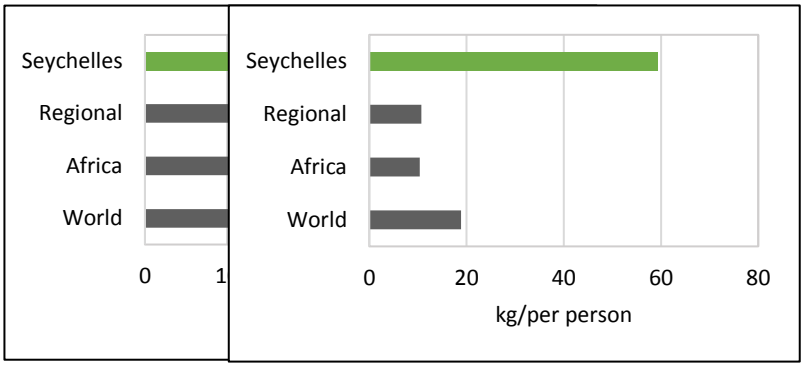
Source: Maps of World http://www.mapsofworld.com/

Food and Nutritional Security and the Contribution of Fisheries

The per capita fish consumption is 59 kg per person, the largest in SADC region, this constitutes 22% of total protein intake and 48% of total animal protein. 4% of children under the age of 5 are moderately or severely underweight.

Figure 37: Contribution of fish to total animal protein intake – Seychelles

Figure 36: Per capita fish supply - Seychelles



Source: FAO Food Balance Sheets, 2011

Seychelles fisheries - Industrial fisheries are entirely foreign run, while there are some semi-industrial local vessels. These fisheries target tuna and tuna like species, however there are 12 locally owned vessels involved in the semi-industrial fishery using long line methods targeting swordfish and other tuna species. The aquaculture sector in Seychelles is quite small in terms of importance and has been most exclusively centred on three projects: prawn farm, pearl oyster farm and giant clam farm.[48]

[48] FAO National Aquaculture Legislation Overview Seychelles

3.3.11 South Africa

Figure 38: Map of South Africa

Physical

Socio Economic

South Africa has an EEZ of 1,066,538 km^2, the fourth largest in the region. Its inland area is 1,214,470 km^2, 0.3% of which is covered by water.

South Africa has a GDP over USD 350 billion the largest in the region. Its population is 54 million, with a life expectancy of 57 years. 9% of the population live below the national poverty.

Fisheries Production

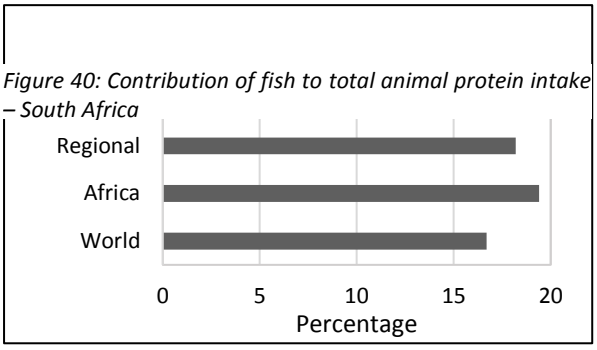
South Africa produces about 417,000 t of fish, this contributes 0.1% to the country's GDP. The value of fish imported is around USD 362 million, while the value of fish exported is around USD 572 million. 27,000 people are employed in the fisheries sector

Food and nutritional security status and the contribution of fisheries

Source: Maps of World http://www.mapsofworld.com

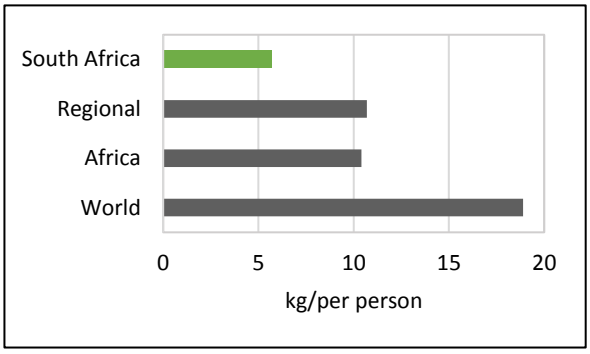
South Africa's per capita fish consumption is about 6kg person, constituting 2.1% of the total protein intake and 5% of the total animal protein Intake. Per capita fish supply is about 6 kg person, which is below the regional, continental and global average. It has the lowest percentage of people undernourished in the SADC region at 5%, with 8.7% of children under five moderately or severely underweight.

Figure 40: Contribution of fish to total animal protein intake – South Africa



Source: FAO Food Balance Sheets, 2011

Figure 39: Per capita fish supply – South Africa



South Africa's fisheries - The west coast of South Africa consists mostly of industrial fisheries, while the east coast is less Industrialised, with more artisanal and subsistence fishers. The most important fisheries ports in South Africa are Saldanha, Cape Town, Mossel Bay, Port Elizabeth and Durban. The main pelagic species targeted are anchovy, pilchard, round herring and horse mackerel. Hake is the main demersal species harvested. Aquaculture in South Africa is divided into freshwater

and marine aquaculture. Freshwater aquaculture is severely limited by the supply of suitable water while marine aquaculture is a fast developing sector.[49]

[49] A profile of the south African aquaculture market value chain, 2012 - http://www.nda.agric.za/docs/AMCP/Aquacult2012.pdf

3.3.12 Swaziland

Figure 41: Map of Swaziland

Source: Maps of World http://www.mapsofworld.com/

Physical

Swaziland is landlocked with a land area of just over 17,000 km^2, 160 km^2 of which is covered by water.

Socio-Economic

Swaziland has a GDP of about 3.5 billion and one the smallest populations in the region of about 1.3 million people. Its life expectance is 49 years, below the regional average, with 39.3 % of the population living below the national poverty line.

Fisheries production

Swaziland produces only 100 t of fish all of which is from aquaculture fisheries. The fisheries contribution to GDP is minimal, with no employment data available on number of fishers or fish farmers. Its value of fish imported USD four million, while the value of fish exports is USD 150,000 the second lowest in the region.

Food and nutritional security status and the contribution of fisheries

Swaziland's per capita fish consumption is 2kg person, which constitutes about 1% of the total protein intake, and 3.0% of the total animal protein intake. Its per capita fish supply is about 2kg per person, well below the regional, continental and world averages. About 27 % of Swaziland's population is undernourished, with an estimated 6 % of children under five moderately or severely underweight.

Figure 43: Contribution of fish to total animal protein intake – Swaziland

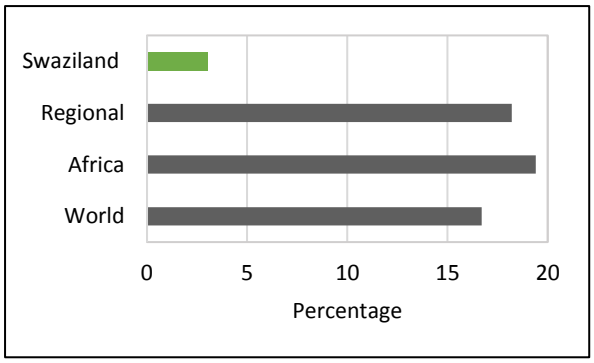


Figure 42: Per capita fish supply – Swaziland

Swaziland's fisheries - Swaziland's fisheries sector is relatively small and not well developed. In both aquaculture and capture fishery the exploitation is at a subsistence level at present although of the two fisheries sub-sectors, fish farming has the highest potential for further development. There is an aim in Swaziland to enhance production from small water bodies and reservoirs whilst promoting small-scale fish farming in rural areas to cater for an additional source of protein as well as income for the rural population.

Source: FAO Food Balance Sheets, 2011

3.3.13 Tanzania

Figure 44: Map of Tanzania

Physical

Tanzania has an EEZ of 242,889 km^2 and an inland are of 885,800 km^2. It has the second largest inland area covered by water at 61,500 km^2.

Socio-economic

Tanzania has a GDP of about USD 50 billion, the third largest in the region, with a population of about 52 million people. The countries life expectancy is 61 years and about 44% of the population living below the national poverty line.

Fisheries production

Tanzania produces just over 400,000 t of fish, 99% of which is from its capture fisheries. This contributes about 10% to the country's GDP, the highest in the region. The fisheries sector employs over 580,000 people, with about 35,000 employed in the aquaculture sub-sector. The value of fish imported is about USD four million, while fish exports are valued at USD 122 million.

Source: Maps of World http://www.mapsofworld.com/

Food and nutritional security status and the contribution of fisheries

Per capita fish consumption in Tanzania is 6kg person, which constitutes 4% of the total protein intake and 22% of the total animal protein intake which. Per capita fish supply is 6kg person. About 32% of the Tanzanian population is undernourished, with 13% of children under the age of five moderately or severely underweight.

Figure 46: Contribution of fish to total animal protein intake - Tanzania

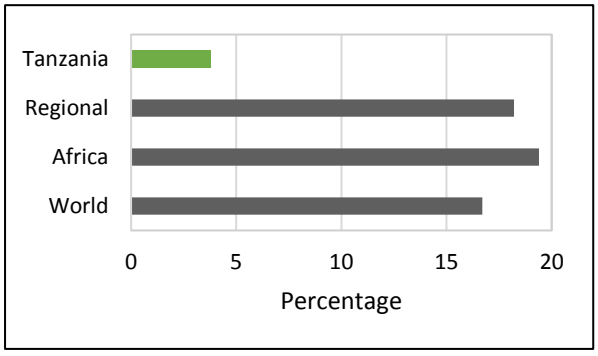
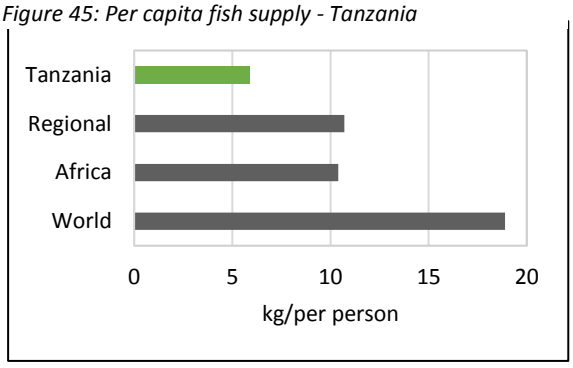


Figure 45: Per capita fish supply - Tanzania



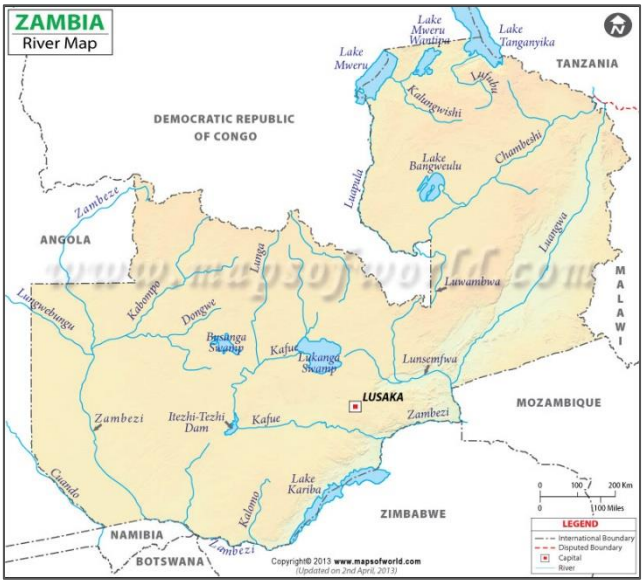
Source: FAO Food Balance Sheets, 2011

Tanzania's Fisheries - Tanzania's marine fishing activity is generally concentrated inshore and around the islands of Zanzibar, Pemba and Mafia. The inland fisheries is made up of artisanal and subsistence operators, who deploy gillnets, lift nets, beach seines, long lines, traps, and pole-and-line for a wide range of species, including Nile perch, tilapias, small pelagic dagaa, and catfish. An estimated 25 000 small craft – make up the national inland fishery fleet. Aquaculture is mainly freshwater fish farming in which small-scale farmers practice both extensive and semi-intensive fish farming.[50]

[50]FAO Country profile - http://www.fao.org/fishery/countrysector/naso_tanzania/en

3.3.14 Zambia

Figure 47: Map of Zambia



aquaculture subsector. The value of fish imports is about USD 23 million, while exports are valued at around USD two million.

Physical

Zambia is landlocked and has a land are of 743,398km^2, 9,220 km^2 of which is covered by water.

Socio-economic

Zambia has a GDP of about USD 27 billion and a population of just under 16 million people with a life expectancy of 58 years. About 61% of the population live below the national poverty line.

Fisheries production

Zambia produces about 107,000t of fish, 81% of which is from capture fisheries. The fisheries sector contributes 0.5% to the country's GDP and employs about 300,000 people, with 6,860 employed in the

Source: Maps of World http://www.mapsofworld.com/

Food and nutritional security status and the contribution of fisheries

Per capita fish consumption in Zambia is 7 kg person, which constitutes 4% of the total protein intake and 20.2% of the total animal protein intake. Per capita fish supply is about 7 kg person. About 48% of the Zambian population is undernourished, the highest percentage in the region, while 15% of children under the age of five are moderately or severely underweight.

Figure 49: Contribution of fish to total animal protein intake - Zambia

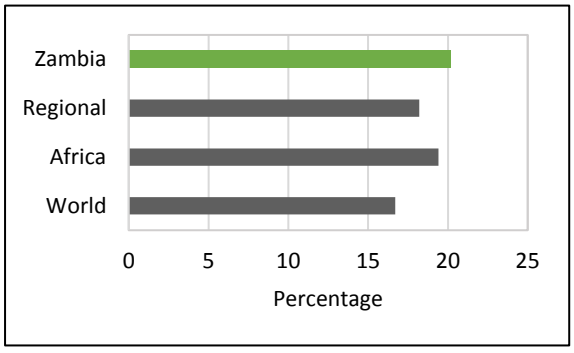
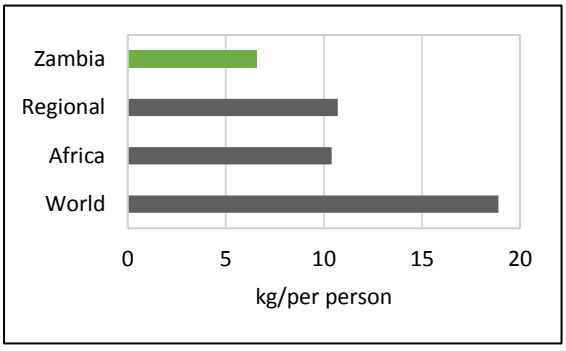


Figure 48: Per capita fish supply - Zambia



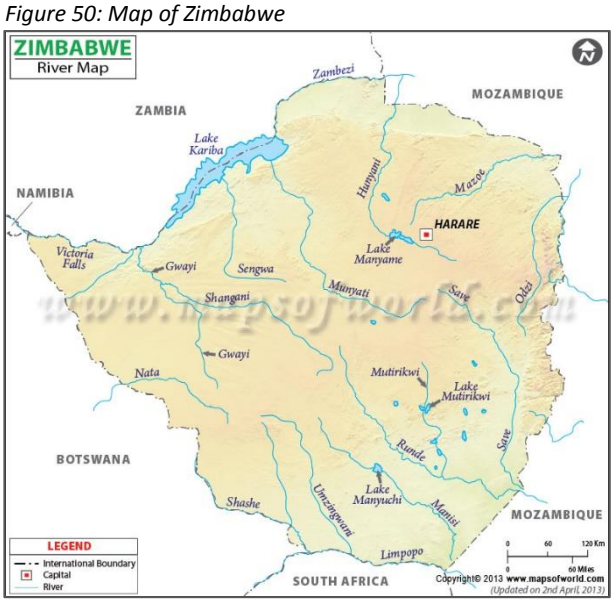
Source: FAO Food Balance Sheets, 2011

Zambia's Fisheries – The three major fishing areas are: Lake Kariba, Lake Mweru-Luapula, and Lake Tanganyika. The Zambian fisheries are classified in two groups – the inshore fishery which mainly exploits the bream fishery, and the pelagic fishery which targets Kapenta. All fishing activities are classified as being commercial, although separated into artisanal and recreation for management purposes. The artisanal fishery is characterised by extensive usage of canoes and plank boats. Aquaculture is in its infant stage of development. There has been a number of donor supported aquaculture development programmes targeting small-scale farmers, this has led to increased and adoption of the practice in various parts of the country.[51]

[51] FAO country profile ,Zambia - http://www.fao.org/fishery/countrysector/naso_zambia/en

3.3.15 Zimbabwe

Figure 50: Map of Zimbabwe



employs about 4,700 people, 264 of which are in the aquaculture subsector.

Physical

Zimbabwe is landlocked with a land area of 386,847 km^2, 10% of which is covered by water.

Socio-economic

Zimbabwe has a GDP of about USD 14 billion and a population of about 15 million people, with a life expectancy of 60 years. Just over 72% of the population live below the national poverty line, the third highest percentage in the region.

Fisheries production

Zimbabwe produces about 21,000 t of fish of which 51% and 49% is from capture fisheries and aquaculture respectively. Fisheries contributes 0.2% to the country's GDP and

Source: Maps of World http://www.mapsofworld.com/

Food and nutritional security status and the contribution of fisheries

Per capita fish consumption in Zimbabwe is 3kg person, constituting about 2% of the total protein intake and 7% of the total animal protein intake. Per capita fish supply is 3kg person which is below the regional, continental and world average. 33% of Zimbabweans are undernourished, with about 11% of children under the age of five moderately or severely underweight.

Figure 51: Contribution of fish to total animal protein intake - Zimbabwe

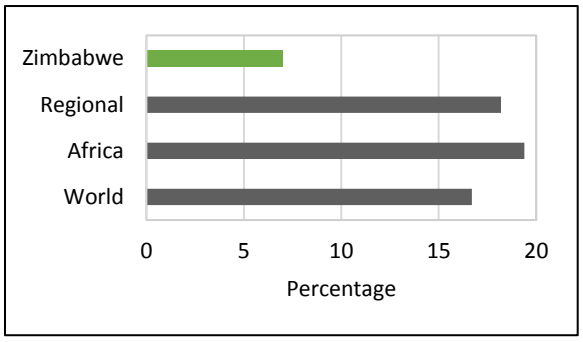


Figure 52: Per capita fish supply - Zimbabwe

Source: FAO Food Balance Sheets, 2011

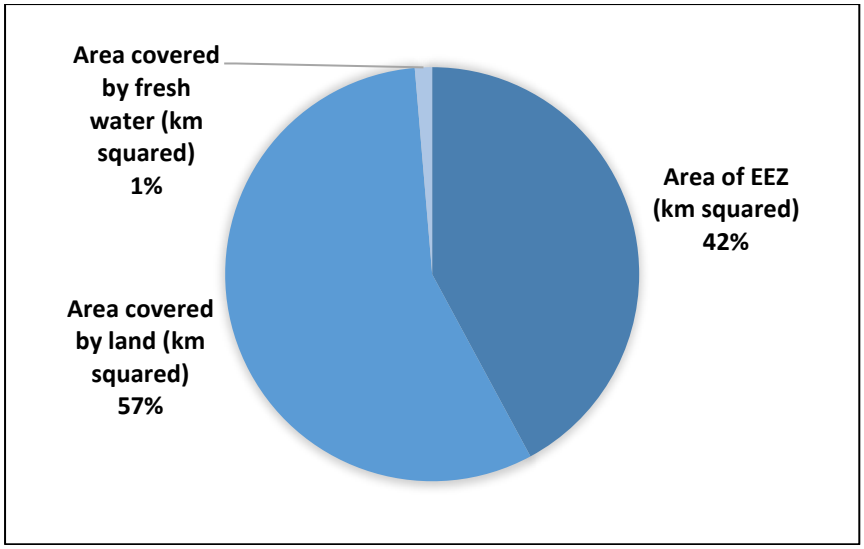
Zimbabwe's fisheries - Zimbabwe's fishery sector comprises capture fishery, aquaculture and recreational fishery, exploiting about 114 indigenous fish species and an additional 30 exotic species. Commercial fishing occurs mainly on Lake Kariba, Lake Chivero, Lake Mutirikwi, Manyame and Mazvikadei Dam. Smaller dams, rivers and ponds provide fish for subsistence purposes. Capture fisheries from Lake Kariba is the mainstay of the fishery sector, with a large aquaculture farm on the Kariba contributing significantly to fish production.

3.4 Regional comparison and overview[52]

3.4.1 Physical

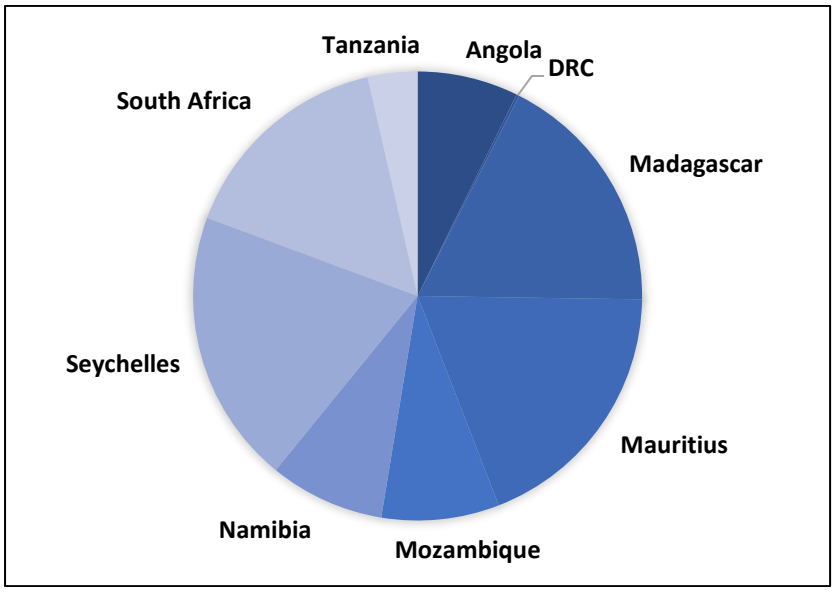
The total surface areas of the SADC Region is 9,079,597 km², with 216,137 km²covered in fresh water and 6,765,923 km² being marine water (see Figure 53). This demonstrates the importance of especially, marine oceans and coastal areas to the region.

Figure 53: Proportion of total water and land area of the SADC region



Nine of the SADC countries have EEZ's totalling 6,765,923 km², Figure 54 demonstrates these by proportion. For the Indian Ocean islands the total area under their jurisdiction is approximately equal to the mainland countries.

Figure 54: Proportion of total EEZ per country for the SADC region



Source: Marine Regions, 2015.

[52] All statistics and information is compiled based on the tables in the Annexes where sources are included.

3.4.2 Socio-economic

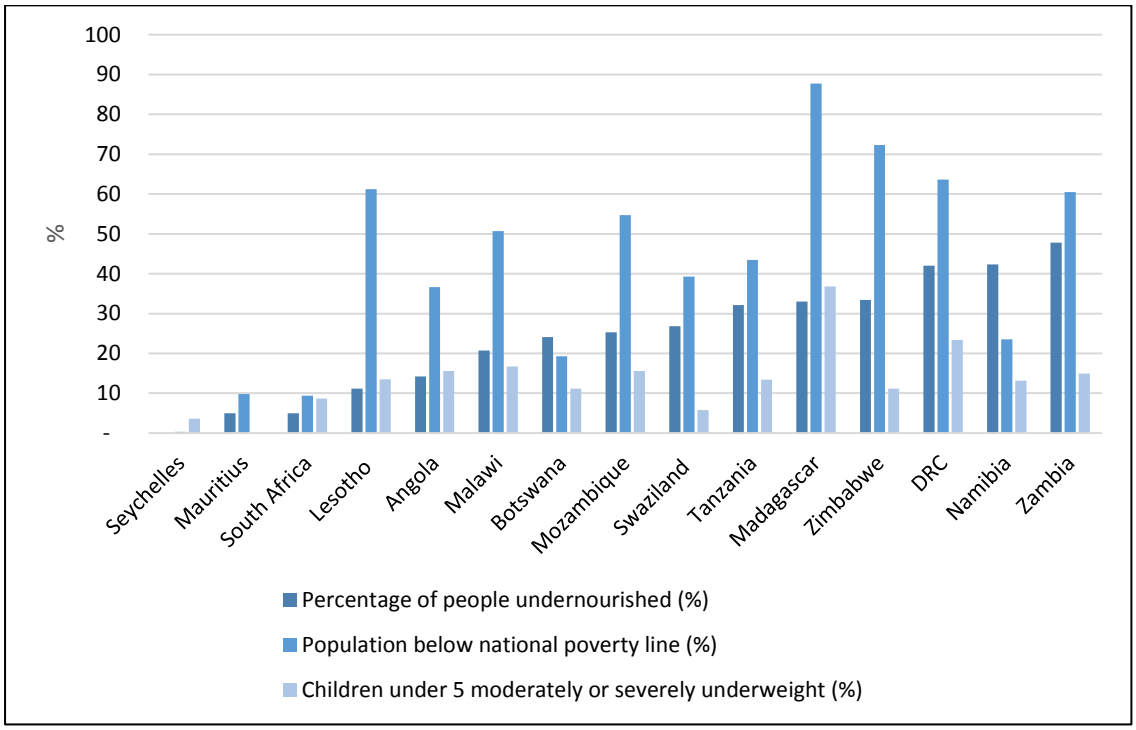
As discussed above the region has had extensive population growth and this growth is predicted to continue in the foreseeable future. Table 4 shows the figures in millions of the combined total populations, or predicted populations, of the current 15 SADC countries from 1950 to 2100.

Table 4: Population estimates and predictions (1950 to 2100)

Year	1950	2015	2030	2050	2100
Combined population of the current SADC countries in that year	59	321	465	714	1,374

The key social-economic indicators are given in Figure 55 for the countries of the region, they are ranked according to the percentage of people under-nourished.

Figure 55: Social-economic indicators for the SADC region



3.4.3 Fisheries and aquaculture production

The capture fisheries in the region can be separated into the marine capture fisheries and the inland capture fisheries. Marine industrial fisheries was the largest contributor to GDP in Southern Africa.[53] Africa's marine fisheries are exploited by foreign commercial fleets and only a small portion contributes to the continents, and the sub-regions', food needs. The small scale coastal inshore, and inland freshwater fisheries provide most of the fish consumed across the continent[54].

Southern Africa is comprised of several large water systems including the Zambezi system, Lakes Kariba and Cahora Bassa, and the Okavango[55].

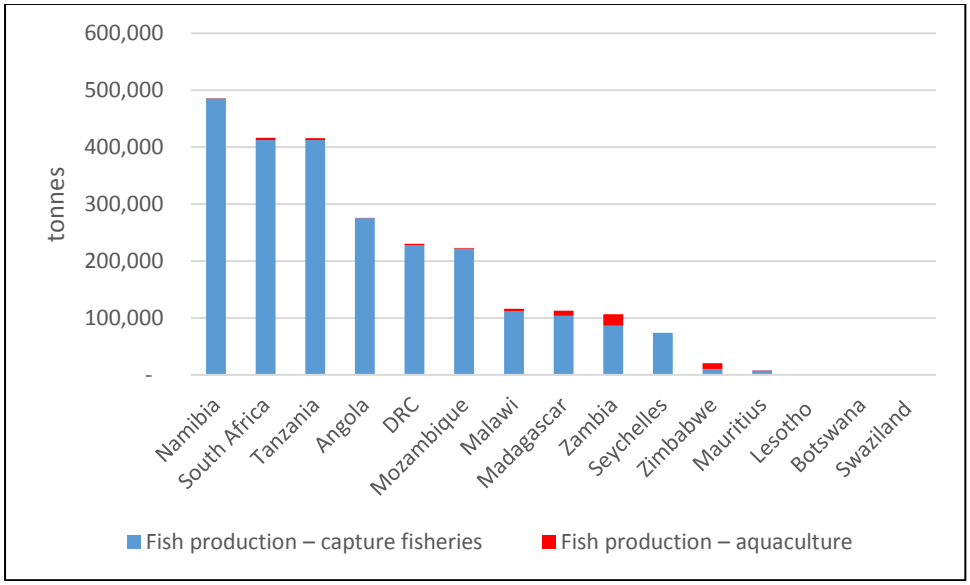
[53] de Graaf, G. & Garibaldi, L. 2014. The value of African fisheries. FAO Fisheries and Aquaculture Circular. No. 1093. Rome, FAO. 76 pp.

[54] WorldFish Center, 2009. Fish Supply and Food Security for Africa

[55] Welcomme, R., Lymer, D. An audit of inland capture fishery statistics – Africa FAO Fisheries and Aquaculture Circular No. 1051. Rome, FAO. 2012. 61 pp.

Aquaculture – the SADC Protocol on Fisheries states that State Parties should take the necessary steps to optimise the economic contribution of aquaculture to the Region.[56] There is currently little fish farming activity in the SADC region, and much of the tilapia consumed in the region originates from Asian aquaculture farms, even though tilapia is a species native to the region. Although lagging behind that seen in other continents, the growth of aquaculture in certain African countries has been commendable. From 2004-2006 aquaculture grew by 62 % and 43 % in Mozambique and Malawi respectively with more impressive growth further afield in countries like Egypt and Uganda[57].

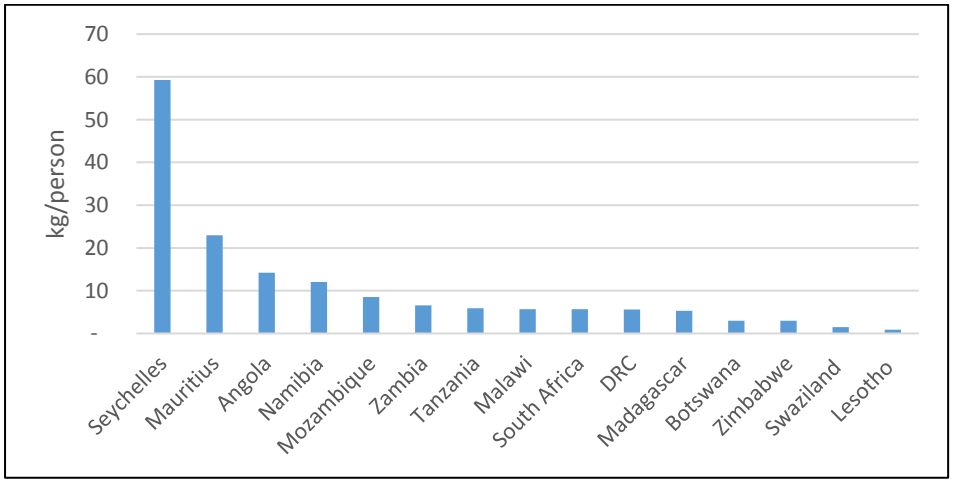
Figure 56: Fish production from capture and aquaculture by country (2013)



3.4.4 Food and nutrition security status and the contribution of fisheries

The per capita fish supply in the region, is greatest in the two islands of Seychelles and Mauritius, interesting Madagascar's per capita supply is, on average much lover due to the considerable land mass, and therefore land-locked percentage of the population.

Figure 57: Per capita fish supply by country (2011)



[56] SADC, 2011. SADC Protocol on Fisheries.
[57] Ibid

The contribution of fish to total animal protein is in many SADC countries considerably high, indicating the importance of fish in the diet of the people.

Figure 58: Contribution of fish to total animal protein intake (2011)

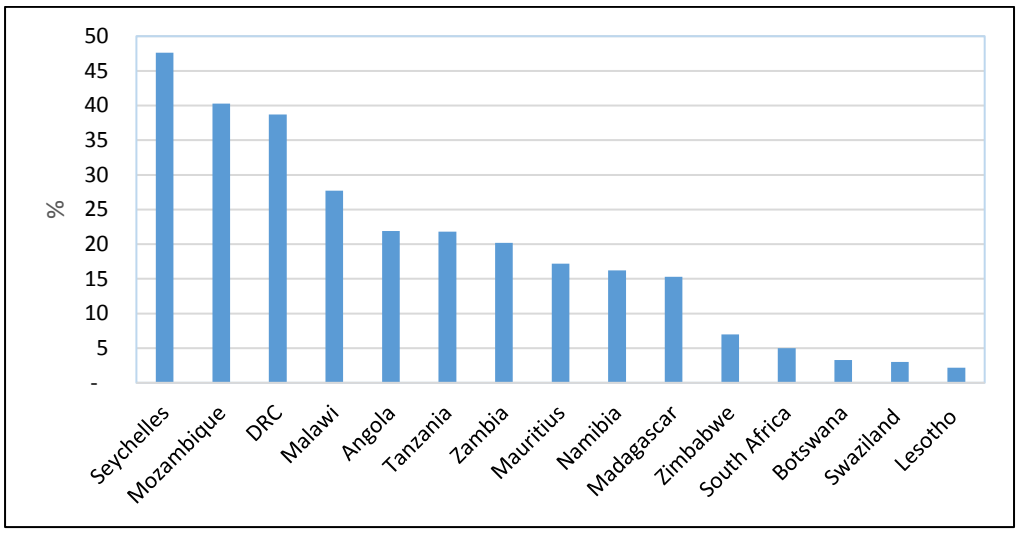
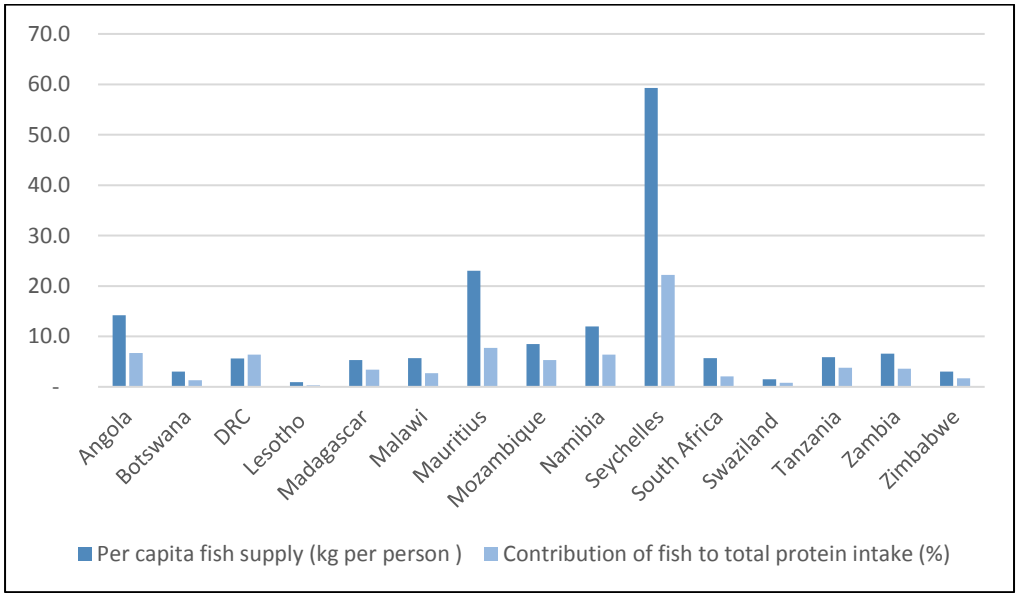


Figure 59 compares the per capita fish supply to the contribution of fish to the total protein intake and it can be seen that there is, as expected, a good correlation between supply and intake.

Figure 59: Contribution of fish to total protein intake (2011) and per capita fish supply (2011)



The value of fish and fish products imported into the SADC region is higher than the value of fish and fish products exported, despite the abundance of fisheries resources and great potential for aquaculture production in the region (the value of imported fish and fishery products were USD 1,505 million in 2012 and the value of exports of fish and fishery products was USD 2,282 million in the same year).

4 Challenges and opportunities in small-scale fish farming and consumption

This chapter addresses a particular issue in the terms of reference for this study to assess why small scale fish farming is not contributing more to improve food and nutritional security in the SADC region and how it could.

The political commitment for developing fish farming or aquaculture exists for example, the Namibian fisheries and marine resources Minister Bernhard Esau said aquaculture is the way forward to ensure food security in the face of adverse climate change. "We need to promote it aggressively". Hon Esau further stressed that communities need to understand that government is investing in aquaculture development for them to benefit[58]. While the Zambian president Edger Lungu, when launching a privately-owned fish farm located on the shores of Lake Kariba said "Increasing domestic fish production, especially aquaculture fish production will lead to increased job creation, improved access to protein as well as increased exports to neighbouring countries. The challenge that I have given my minister responsible for agriculture development is to ensure that significant investment is channelled towards increasing the country's fish production"[59].

4.1 Continental policies

This political commitment is also demonstrated in policies. For example the following continental policies directly address the need to invest more in fisheries and aquaculture development:

- The Policy Framework and Reform Strategy for Fisheries and Aquaculture in Africa was developed by the AU in collaboration with several partners and institutions, and endorsed In June 2014 at the Summit of African Heads of States and Governments held in Malabo, Equatorial Guinea. Its purpose is to "*facilitate transformation of Africa's fisheries and aquaculture for food, livelihoods and wealth and provides appropriate guidance on how to implement reforms for sustainable fisheries and aquaculture development*."[60] One of the guiding principles of the AU's Policy Framework and Reform Strategy for African fisheries and aquaculture (2014) is enhancing social welfare, nutrition and food security.[61]
- The CAADP is Africa's policy framework for agricultural transformation, wealth creation, food security and nutrition, economic growth and prosperity for all.[62] Fisheries and aquaculture are an integral part of the CAADP, developed by NEPAD in 2003, and endorsed by AU Member States. This is the agricultural programme of the NEPAD, which in turn is a programme of the AU.[63]

[58] Source: The Namibian, Article: Aquaculture the way to go for Namibia – Esau, dated 10th August 2015, http://www.namibian.com.na/index.php?id=140500&page=archive-read

[59] Source: Zambia Daily mail, Article: Increase fish farming – Lungu, dated 21st August 2015, https://www.daily-mail.co.zm/?p=41017

[60] AU-IBAR, 2015. Expert consultative workshop on indicators and criteria for alignment of national and regional fisheries and aquaculture policies with the policy framework and reform strategy for fisheries and aquaculture in Africa. http://www.au-ibar.org/component/rseventspro/print/75-expert-consultative-workshop-on-indicators-and-criteria-for-alignment-of-national-and-regional-fisheries-and-aquaculture-policies-with-the-policy-framework-and-reform-strategy-for-fisheries-and-aquaculture-in-africa

[61] Ibid.

[62] CAADP, 2015. http://www.caadp.net/about-us

[63] de Graaf, G. & Garibaldi, L. 2014. The value of African fisheries. FAO Fisheries and Aquaculture Circular. No. 1093. Rome, FAO. 76 pp.

4.2 SADC Policies

SADC has also given clear policy support to the development of fish farming such as in the 2001 Protocol on Fisheries was drafted specifically to recognize the value of fisheries and to support member states actions to bolster it.[64] Of particular interest for this chapter are Articles 12 and 13 of SADC's 2001 Protocol on Fisheries which addresses small scale fisheries and aquaculture, stating the need for policies and measures that will benefit the two sectors[65], (see Annex 7.3 for text of the Protocol).

The 2004 SADC Dar-Es-Salaam Declaration on agriculture and food security in the SADC region was also an important commitment by countries to strengthen agriculture, including fisheries and aquaculture and their commitment to what was then called food security. A more recent policy the SADC Reginal agricultural policy of 2013, covers, albeit briefly fisheries and aquaculture in Article 12.

The reason for SADCs recognition of aquaculture and small scale fisheries in the 2001 Protocol on Fisheries is the sectors potential of lifting millions out of food insecurity, a point highlighted when SADC conducted a food security review in 2009. This review emphasized the role of these two fisheries sectors in ensuring food security in the SADC region.

4.2.1 Overview of fish farming by country

The following summaries have been extracted from the Regional Agricultural Policy Review Report 2011 with slight modifications, if omitted this is because the country was not covered in the review report.

Angola has pointed to marine aquaculture as a development, poverty alleviation and food security priority. The artisanal fishing institute was to establish experimental centers for aquaculture of prawns, blue mussels and tilapia. "However, the efforts towards the materialization of this objective are hampered by the lack of technical expertise and personnel and the assistance of the private sector is highly recommended."[66]

Botswana intends to establish hatcheries and encourage participation in aquaculture.[67]

Lesotho gains almost all its fish produce from aquaculture.

Madagascar has both marine and freshwater aquaculture operations. "Aquaculture plays an important economic role in Madagascar. It provides fish for consumption, generates well-paid employment and represents a source of significant foreign currency earnings. However, this sub-sector is confronted with many problems including inadequate control of appropriate farming techniques, poor performance of production systems, high production costs, lack of technical and financial resources, need to professionalize the sector, lack of stakeholder coordination, and absence of local feed manufacturers."[68] "Marine aquaculture includes the culture of shrimp, seaweed and collection of sea cucumber. Freshwater aquaculture is dominated by the culture of Tilapia and Carp."[69] A master plan was set up from 2004-2007 to increase freshwater fish production which included aquaculture.[70] The five measures of the 5 year plan to improve fisheries management

[64] http://www.sadc.int/documents-publications/show/801
[65] 2001 Protocol on Fisheries
[66] SADC Regional Agricultural Policy (RAP) Country Summary Agricultural Policy Review Reports January 2011, pp 20.
[67] Ibid, pp 47
[68] Ibid, pp 112
[69] Ibid, pp 111
[70] Ibid, pp 117

included: “establish a service to coordinate fisheries and aquaculture research in order to produce tools for decision making.”[71]

Malawi aims to “promote investment in the fishing industry, rural fish farming units and exploit all opportunities to expand existing and develop new aquatic resources”[72] as part of its National Fisheries and Aquaculture Policy (NFAP). “The NFAP is supported by the (i) Department of Fisheries Strategic Plan 2002-2007 (2003), currently being reviewed; (ii) Presidential Initiative on Aquaculture Development (PIAD) 2006 – 2011 (2006); (iii) National Aquaculture Strategic Plan (NASP) 2006 – 2015 (2005); (iv) Chambo Restoration Policy (CRP) (July 2003); (v) Chambo Restoration Strategic Plan (CRSP) 2003-2015 (September 2003); and (vi) Fisheries HIV and AIDS Strategy 2007 – 2011. Under aquaculture, the policy promotes the growing of fish by implementing PIAD which aims at boosting aquaculture through adoption of modern fish farming technologies, initiating a credit scheme, and developing fish marketing and business development services. Through the NASP, aquaculture extension is being revamped by promoting farmer-to-farmer exchange of technology and integrating farmer associations into the extension service.”[73]

Mauritius “is supporting aquaculture development to complement the seafood hub activities and as a means to increase total fish production. In this context, the Government has produced an Aquaculture Master Plan for the promotion on aquaculture development in Mauritius. The Fisheries and Marine Resources Act (2007) was amended to make provision for marine aquaculture development in Mauritius.”[74] Under the land based Oceanic Industry, Mauritius plans to use the nutrient rich water from the deep sea to aid in aquaculture development.[75]

Namibia has large oyster cultures which dominate the mariculture sector. “Freshwater aquaculture in Namibia is practiced to enhance food security by facilitating the provision of fingerling production to rural communities for fish farming. Freshwater aquaculture production in Namibia is dominated by Tilapia and Catfish fish species.”[76] “Freshwater aquaculture is being vigorously promoted by the Ministry. The model adopted is one of community ownership of the productive assets on behalf of the State and production for non-commercial purposes.”

South Africa has implemented that Policy for the Development of a Sustainable Marine Aquaculture which aims to promote “the development of an economically sustainable and globally competitive marine aquaculture industry in South Africa” (Government Gazette, 2007). [77] The policy covers, among others, areas of research and development (R&D), environmental protection, aquaculture awareness, transformation and broadening participation, availability and access to services, and technical advice (Semoli, 2010).[78] One of the obstacles faced by South Africa in terms of implementing regional rules as that it does not have one policy to cover all aquaculture.

Zambia has a National Aquaculture Association Zambia, which is affiliated with the Zambia National Farmers Union. The department of fisheries overseas the implementation of the national fisheries programs for aquaculture development with the goal of achieving a sustainable fisheries industry and realizing economic benefits. There is also progress being made on a standalone fisheries policy.[79]

[71] Ibid, pp 118
[72] Ibid, pp 140
[73] Ibid.
[74] Ibid, pp 179
[75] Ibid.
[76] Ibid, pp 217
[77] Ibid, pp 280
[78] Ibid.
[79] Ibid, pp 359

4.3 Case studies of the role of small scale inland aquaculture and consumption

To examine the role of small scale inland aquaculture in food security and nutrition, three case studies in Malawi, Namibia and Zambia will be discussed. Closely examined will be the challenges and opportunities in shaping policy to increase consumption through inland small scale aquaculture and applicable lessons for the rest of the SADC region.

Box 3: Zambia bringing tilapia home

The fisheries sector of Zambia has always been an important and undervalued contributor to food security and overall nutrition in Zambia[80]. For example, fish contributed 20.2% of the animal protein supply in 2011, which is more than the average 19.4% in the rest of Africa, and 16.7% for the rest of the world[81].

Small scale aquaculture dates back to Zambia's independence and now employs over 6000 people, with over 13 000 fish ponds created[143]. Up to 75% of aquaculture production is produced by small scale farming, making small scale aquaculture an extremely important sector in Zambia[143]. However despite the importance of the fisheries sector to food security in Zambia, production from aquaculture remains low[143] and fails to meet demand. For example in 2012, the aquaculture sector produced around 20 000 tons of fish products, yet Zambia imported over 45 000 tonnes of fish products[82]. Additionally Zambia's fish per capita supply (6.6 kg in 2011) is also well below the average for the African continent (10.4 kg in 2011)[144]. This is despite the vast water resources that can be utilized for aquaculture[83].

The lack of production from the aquaculture sector is partly because of cheap farmed imports from Asia outcompeting the domestic sector. For example commonly farmed species by small scale aquaculture in Zambia are all of the tilapia family, which are indigenous to the area[143]. However the majority of tilapia consumed in Zambia is imported from East Asia[84].

In order to ensure that Zambia can meet its own fish consumption demands, the government of Zambia secured a USD 50 million loan from the African Development Bank to revamp the sector[147]. The goal of the loan would be to improve aquaculture production to the point that Zambia could not only produce enough fish for its own consumption, but also become a tilapia exporter after three years[147]. Small scale aquaculture, both current and future, has been identified as a key recipient of funding from the loan by the current government[147]. Considering that small scale aquaculture contributes 75% of aquaculture production[143], such level of government support has the potential to dramatically improve the food security situation in Zambia alongside meeting development and trade goals.

Nutrition experts say that fish farming has added nutritional value to many poor people's diets. ***"Fish farming helps poor African communities to add high-value protein to their diet since Africa often suffer challenges of malnutrition,"*** *Agness Mwansa, an independent nutritionist based in Lusaka, the Zambian capital, told IPS news.[85]*

[80] Musumali, M.M., Heck, S., Husken, S.M.C., Wishart, M. 2009. Fisheries in Zambia: An undervalued contributor to poverty reduction. The WorldFish Center/The World Bank. Policy Brief 1913.

[81] FAO, 2011. ftp://ftp.fao.org/FI/STAT/summary/FBS_bycontinent.pdf

[82] FAO, 2012. ftp://ftp.fao.org/FI/STAT/summary/a6ybc.pdf

[83] SmartFish, 2014. Workshop Brief: Fisheries and Food Security in Zambia. SmartFish Program.

[84] LusakaTimes.com, August 2015. Zambia Shouldn't be importing so much Fish-President Lungu. Retrieved from: https://www.lusakatimes.com/2015/08/05/zambia-shouldnt-be-importing-so-much-fish-president-lungu/ . Accessed 10/30/2015

[85] Source: Inter Press Services news, Article: Fish Farming Now a Big Hit in Africa, dated 5th August 2015. http://www.ipsnews.net/2015/08/fish-farming-now-a-big-hit-in-africa/

Box 4: Malawi and fish farming

Malawi's effort to promote aquaculture have been regarded as a success[86]. The industry now employs over 30 000 people[135] and production has tripled since 2005[87]. By 2013 Malawi produced 3,705 tonnes of fish from aquaculture[88]. Responses from fish farmers have also been positive, for example one farmer from Malawi's second city Blantyre reported that "fish breeding is a less demanding economic venture, which anyone willing can undertake to do, and fish sell faster because they are cheaper"[135].

However despite the increases in production, fish produced from aquaculture is still less than 5% of that produced from capture fisheries [137]. This is despite the fact that although Malawi has less fish per capita supply than the rest of the African continent (only 5.7 kg vs the African continental average of 10 kg) it comprises 27.7% of the animal protein consumed in the country. This is significantly higher than the rest of Africa (19.4%) [137]. With fish being the most popular form of protein[89] there is clearly more room for growth and consumption of fish produced by small scale fish farmers.

Malawi has introduced several policies that target aquaculture although not specifically small scale fish farmers. These include Malawi's fisheries policy 2012-2017 which acknowledges the decline in fish consumption in Malawi, and aims to address this through increasing aquaculture in rural areas, and creating a conducive environment for small scale, gender equal fishing communities. Additional food security documents that also covers small scale aquaculture includes the Malawi Agriculture Sector Wide Approach, the Agriculture Sector Gender, HIV, and AIDS Strategy, the Food Security Policy of 2006, and the Poverty Reduction Strategy. All of these policies focus on encouraging fish farming among vulnerable peoples and focusing on village initiatives. Although none of the policies specifically addressed small scale fish farming the demographics addressed by the policies, for example village level, women, and vulnerable peoples, tend to favour small scale aquaculture.[138]

Box 5: Namibia a master plan to feed the nation

Namibia has a well-developed fisheries industry earning over USD 750 million in exports in 2012, the highest of any SADC nation[90]. However despite the importance of the fisheries industry to Namibia's GDP, only a small portion of production is gained from aquaculture. In 2013 aquaculture produced only around 475 tonnes of fisheries products compared to over 485 000 tonnes of fisheries products produced by the capture fisheries sector[91].

To address this, Namibia has instituted a master plan to promote aquaculture. The focus of which is to raise freshwater aquaculture production to 4 000 tonnes per year by 2023. The ultimate goal of the plan though is to develop an aquaculture sector that helps alleviate poverty. Although mainly focusing on marine aquaculture for export, freshwater aquaculture was also highlighted for its potential to provide local employment, food security, and reduce poverty for vulnerable peoples.[92]

An example of Namibia's efforts to alleviate poverty through small scale aquaculture is the funding of a community run aquaculture pilot project by the Ministry of Fisheries and Marine Resources in the Fonteintjie community at Keetmanshoop. The fish farm will be manned by community volunteers with the ministry funding the renovation of necessary infrastructure such as septic tanks, ponds, and fences. The project is scheduled for completion in 2016 with the aim of alleviating poverty for people living in the South of Namibia[93].

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[86] Moyo, Jeffery, August 2015. Fish Farming now a Big Hit in Africa. Inter Press Service News Agency. Retrieved from http://www.ipsnews.net/2015/08/fish-farming-now-a-big-hit-in-africa/. Accessed 10/30/2015

[87] NFDS Africa. 2014. Malawi fish consumption survey report. Report/Rapport: SF-FAO/2013/xx. March 2014. FAO-SmartFish Programme of the Indian Ocean Commission, Ebene, Mauritius. 53 pp.

[88] FAO, 2013. Yearbook of Fisheries Statistics, Summary Tables: World Fisheries Production, by capture and aquaculture, by country. Rome, FAO. Retrieved from ftp://ftp.fao.org/FI/STAT/summary/default.htm. Accessed 9/9/

[89] SmartFish, 2014. Workshop Brief: Fisheries and Food Security in Malawi. SmartFish Program.

[90] FAO, 2012. ftp://ftp.fao.org/FI/STAT/summary/a6ybc.pdf

[91] FAO, 2013. Yearbook of Fisheries Statistics, Summary Tables: World Fisheries Production, by capture and aquaculture, by country. Rome, FAO. Retrieved from ftp://ftp.fao.org/FI/STAT/summary/default.htm. Accessed 9/9/2015

[92] The Fish Site, August 2015. Namibia Unveils Aquaculture Master Plan. 5m Publishing, Sheffield, England. Retrieved from http://www.thefishsite.com/fishnews/26273/namibia-unveils-aquaculture-master-plan/ . Accessed 10/30/2015

[93] Cloete, Luqman, August 2015. Aquaculture the Way to go for Namibia – Esau. The Namibian. Retrieved from http://www.namibian.com.na/index.php?id=140500&page=archive-read . Accessed 10/30/2015

The efforts by Malawi, Namibia, and Zambia to boost small scale aquaculture show separate approaches. In the case of Malawi, small scale aquaculture was promoted through the incorporation of aquaculture into policies favouring small scale fish farming. In Zambia, it is through an effort to address a trade imbalance to ensure that Zambia can meet its own food demands and become a major player in the aquaculture sector. Finally in Namibia, the focus has been using small scale inland aquaculture alongside large scale marine aquaculture to alleviate poverty. These approaches bring both challenges and opportunities in achieving food security and boosting fish consumption through small scale fisheries.

In the case of Malawi, it is important to note that none of the policies address small scale aquaculture directly. Instead policies addresses the sections of society participating in small scale inland aquaculture, including rural level, women led initiatives, and small fishing communities. However a lack of policy documents specifically addressing small scale aquaculture may be problematic in the future. For example favouring large scale aquaculture for export rather than smaller scale aquaculture which is more suited to satisfying and meeting local needs. Specific legislature promoting small scale fish farming may therefore be required. With many policies coming up to their closure or review within a couple of years, an opportunity to specifically address small scale inland aquaculture in future policies presents itself.

Zambia, in this case study, sees small scale fish farming as an avenue to achieve development and export success. However as small scale fish farming often directly benefits the local community through employment and provision of food for owners and their families, the communities also stand to benefit. As long as the Zambian government maintains its commitment through policy and funding, the future of small scale aquaculture in securing both food security, and export remains bright. However challenges remain, ranging from implementation to illegal smuggling of fish products from abroad. The smuggling of fish products from abroad in particular has hampered investments in indigenous small scale aquaculture[94]. Thus it is important that both policy and financial support continue to single out small scale fisheries as a path towards development.

In Namibia, efforts to promote small scale aquaculture are still in their infancy. The industry remains dwarfed by the marine capture industry. As the marine capture industry is geared primarily towards exports, small scale fish farming has the potential to fulfil the niche of providing both employment and food security at a more local level. Thus promoting small scale fish farming in Namibia has the potential to diversify the fisheries sector and provide nutrition to local communities as well as jobs and development. However it is still too early to determine the impact of Namibia's initiative to promote small scale fish farming.

All three countries are aligning to SADC recommendations of promoting small scale fisheries and aquaculture. In the case of Malawi, there has already been signs of success, and Zambia and Namibia have both initiated proposals and policies to promote these sectors as recommended by SADC Protocol on Fisheries. Additionally all three countries recognize the ability of small scale aquaculture to alleviate poverty as recommended by SADC's food security review. The challenge will be continued government investment in policies that promote small scale aquaculture as the low increase in per capita supply of fish in all three countries indicates that small scale fish farming and the policies that support it have yet to fully address current fish consumption issues.

[94] Lisulo, Stewart, Ed., June 2015. Zambia Losing Revenue through Tilapia Smuggling-Kukula Capital. The Post. Retrieved from: http://postzambia.com/news.php?id=8654 . Accessed 10/30/2014

4.4 Obstacles to aquaculture development in the SADC Region

The following factors have been identified as being issues which prevented the growth and success of aquaculture in the SADC region:[95]

- There is a lack of well-defined policy, public sector interventions, legal frameworks and institutional capacity for the development of aquaculture in general. South Africa, Botswana, Angola and Zimbabwe are specific examples of this issue.

- Secondly, there is a lack of finance and start-up capital for developing aquaculture and financial institutions are still reluctant to lend money for aquaculture projects due to the high risk involved. These challenges are, however, slowly being tackled in Southern Africa. In Namibia, for example, the government has invested over USD 1 million to date in aquaculture development, with more funds allocated in its annual fiscal budget. The government is also encouraging financial institutions to recognize aquaculture as a potential business and to assist in its expansion.

- A third issue is the lack of interest by the private sector in investing in aquaculture in desert and arid lands because of the potential risks involved. Including the high costs associated with constructing and managing the production facilities, taking into consideration the returns on investment envisaged. The private sector is the driving force behind aquaculture development in Southern Africa.

- There is a lack of important infrastructure such as hatcheries, fish feed factories and the like, as well as the lack of basic infrastructure such as roads, electricity, communication and so forth, especially in remote areas.

- The scarcity of water resources in some areas makes it difficult to plan for large-scale expansions as groundwater resource replenishment is based on annual rainfall. Additionally, surface water may be insufficient in drought years. Unfortunately, in some places the quality of the groundwater is not satisfactory for some freshwater aquaculture species. For example, salinity can hamper the growth of some species.

- The fact that fish seed and raw materials must be imported acts as an obstacle as these important resources become expensive and at times are beyond the reach of many small-scale and even some large-scale farmers.

- There is no biosecurity framework in Southern Africa, which increases the risk of stock loss due to disease spread. Fish disease outbreaks have been recorded recently in Southern Africa where the region is battling with the spread of epizootic ulcerative syndrome (FAO, 2009b).

- With no clear-cut marketing feasibility studies, the private commercial sector has nothing to base their business plans on prior to project implementation. Additionally, a lack of adequate skills for aquaculture development is a strong limiting factor to aquaculture development. Thus, training and capacity building programs are important for the development of a vibrant aquaculture sector.

[95] All the information from this section comes from B. Mapfumo, An overview on desert aquaculture in Southern Africa, FAO Fisheries and Aquaculture Proceedings No. 20. Rome, FAO. 2011. pp. 136 and 137.

5 SWOT analysis of the role of fisheries in food and nutrition in SADC

The following table provides an analysis of the strengths, weaknesses, opportunities and threats that fisheries face as a means to improve the food and nutrition security in Africa.

Strengths	Weaknesses
- Water availability - Fish resources availability - Instruments, policies and agreements are in place for trade - Legally binding documents/agreements exist - Economic and political stability - Indigenous species are suited to aquaculture (tilapia is the most commonly used species in aquaculture) - Wide variety of species present (high biodiversity positively impacts ecosystem resilience. Possibility of exploiting a wide range of fish in order to allow overexploited species to recover) - Basic infrastructure is present (road networks, railways and ports assist trade of fish and fish products within the SADC region)	- Poor capacity in general (including lack of human capacity and financial capacity on the individual level) - Lack of aquaculture infrastructure - Weak management of shared resources - Lack of harmonization in policies and management measures (challenges in the Zambezi's management may have resulted from the lack of coherence of national management measures) - Institutional inadequacy (inability to implement policies, lack of funding or poor use of funding etc.) - Poor implementation of legal agreements/poor adherence to legal obligations - Overexploitation of stocks - Lack of economic resources on a government level to develop fisheries though implementation of policies, innovation and support provision to farmers and fishers. - High demand for current supply (the catch supply is stagnant or reducing) - Huge exportation out of the SADC region (the benefits of fish as a food are lost. Only a few benefit economically) - IUU fishing and illegal trade (poor monitoring and enforcement of management measures) - Inability to exploit certain stocks (deep sea stocks fished by foreign vessels) - Raw materials must be imported which creates high operation costs (fish feed) - Poor management (water management, corruption in licensing, bycatch etc.) - Insufficient and outdated information regarding stocks, effort etc.
Opportunities	**Threats**
- Value addition enterprises (development of processing sites. Would increase economic value and reduce post-harvest losses) - Aid as a possibility to develop much needed capacity among other things - Improved production technologies (GIFT project, aquaponics and bio-filtration) - Reducing post-harvest losses to increase value and benefits	- Climate change (Lower rainfall, temperature increase above global average etc. Poor infrastructure exacerbates disasters such as drought and floods.) - El Nino (currently causing prolonged drought conditions) - Huge population growth predicted (wild stocks may be in serious danger if aquaculture is not increased to relieve the pressure)

6 Recommendations for research

Based on the findings of the analysis above the following areas of interest for further research are proposed. Some are general and would benefit from being made more specific to certain countries or to be narrowed to certain situations:

6.1 Aquaculture focus possible research areas

- Water efficiency in aquaculture (large areas of SADC region are arid. These are the very areas where fish and fish products are less likely to be available due to a lack of wild fisheries).

- Local fish food production using household organic waste, vermiculture and recycled products from abattoirs. Where tilapia species are reared (and other species which are omnivorous), growing aquatic plants as part of the diet should also be explored. "Here in Africa, Nigeria in particular, the prospects of vermiculture has not been duly explored, particularly as regarding indigenous species."[96]

- Bio-filtration as a means to control water quality and therefore increase the production possible in the same amount of water.

- Assessing and compiling current research and then filling gaps in understanding the nutritional value (under different preparation methods) for the main species of the SADC region that are important for local consumption, so that these can be assessed against availability and means to promote fish consumption.

- Aquaponics as a means of providing a locally ground, full rounded diet. There are limitations to aquaponics such as the inability to grow large trees such as orange and apple trees (see Annex 7.4).

- Species which will be suited to aquaculture given the ramifications (specifically to Sub-Saharan Africa) of global climate change.

- The possibility of a SADC level policy regarding aquaculture. (such as the EU has regarding a great deal of issues)

- Explore options for decreasing the cost and increasing the availability of fish such as through increasing domestic aquaculture production, improving distribution and expanding methods of preservation.

- Design of hatchery systems that can best ensure high quality seed and sufficient production – private or public run for example

- Stocking of dams in order to increase the fishery value and potential to promoted fisheries on a larger scale on, consideration of impacts on water quality when dams are for human consumption.

[96] A. Aladesida et al., Prospects and Challenges of Vermiculture Practices in Southwest Nigeria, African Journal of Environmental Science and Technology, Vol 8(3), 2014, pp 186.

6.2 Fisheries and general research areas

- To update research regarding stocks, fishing effort etc. for the future management of wild fisheries.

- The potential for management measures based on the Flood Pulse Concept in areas which are subject to a flood pulse cycle should be explored in line with the preceding research area.

- Research into which areas have the least infrastructure and are therefore the high risk areas for exacerbation of floods and droughts should be carried out. Additionally these areas will be those which are most hindered with regards to adaptation to climate change.

- The impacts of increased training (teach a group of people and then allow them to run a pilot project. Evaluate how it goes)

- Having identified vulnerable communities, research into empowering these communities (most food deficient) through cost effective small scale aquaculture.

- Conduct a further study more deeply analysing economic vulnerability, gender, food security and fish consumption in rural and urban areas.

- Conduct a study on ways to diversify the population's fish consumption, looking into local production of alternative fish species, improved distribution, or importation.

- Assess national and local policies governing over food security and nutrition to promote fish consumption.

- Improve inter-agency and stakeholder cooperation in order to strengthen integrated fisheries management in aim of increasing fisheries and aquaculture production and their contribution towards food and nutrition security.

- Hold awareness events and produce educational materials to promote increased fish consumption, specifically the development of aquaculture and the health benefits of eating fish.

- A study analysing the supply of fish in certain countries, including domestic production from capture-based fisheries, aquaculture, as well as imports. The findings should be used to design a strategy for ensuring that supply meets the current and future demand, based on sustainable management of capture-based fisheries as well as aquaculture development.

7 Annexes

7.1 Population of the SADC countries

Table 5: Total population of the SADC countries (actual and predicted) 2015 to 2050

Location	2015	2030	2050
Seychelles	0.10	0.10	0.10
Mauritius	1.27	1.31	1.25
Swaziland	1.29	1.51	1.79
Lesotho	2.14	2.49	2.99
Botswana	2.26	2.82	3.39
Namibia	2.46	3.27	4.32
Zimbabwe	15.60	21.35	29.62
Zambia	16.21	25.31	42.98
Malawi	17.22	26.58	43.16
Madagascar	24.24	35.96	55.29
Angola	25.02	39.35	65.47
Mozambique	27.98	41.44	65.54
Tanzania	53.47	82.93	137.14
South Africa	54.49	60.03	65.54
DRC	77.27	120.30	195.28
Africa	1 186.00	1 679.00	2 478.00

Source: United Nations, Department of Economic and Social Affairs, Population Division (2015). World Population Prospects: The 2015 Revision, Key Findings and Advance Tables. Working Paper No. ESA/P/WP.241.

7.2 Country Tables

7.2.1 Angola

Parameter	Source	Year	Figure
Population[97]	World bank	2014	24.23 million
Area of EEZ[98]	Marine Regions	2015	491 991 km^2
Area covered by land (km squared)	CIA World Fact Book	Retrieved 13-11-15	1 246 700
Area covered by water (km squared)[99]	CIA World Fact Book	Retrieved 13-11-15	-
Fish production (Total)[100]	FAO	2013	275 450 tonnes
Fish production – Capture fisheries[100]	FAO	2013	275 000 tonnes
Fish production – Aquaculture[100]	FAO	2013	450 tonnes
GDP[97]	World Bank	2014	USD 131.4 billion
Contribution of Fisheries to GDP[101]	FAO country profiles	2012	1.7%
Value of fish imported[102]	FAO	2012	USD 252 million
Value of fish exported[102]	FAO	2012	USD 12 million
Total number employed in fisheries sector[103]	FAO Country profile	2012	150 000
Number of fishermen employed by aquaculture[101]	FAO Country profile	2012	800
Per capita fish supply[104]	FAO	2010	14.2 kg
Per capita fish Consumption[105]	Globe Fish	2011	16.3 kg
Contribution of fish to total protein intake[104]	FAO	2011	6.7 %
Contribution of fish to total animal protein intake [105]	FAO	2011	21.9 %
Percentage of people undernourished[106]	United Nations MDG Indicators	2015	14.2 %
Population below national poverty line[106]	United Nations MDG Indicators	2008	36.6 %
Children under 5 moderately or severely underweight[106]	United Nations MDG Indicators	2007	15.6 %
Life expectancy[97]	World Bank	2013	52

[97] World Bank, 2014. Country Summary: Angola. Retrieved from http://www.worldbank.org/en/country/angola on 28/09/2015

[98] Marine Regions, 2015. Retrieved from http://www.marineregions.org/eezdetails.php?eez_id=200 on 9/9/2015.

[99] CIA World Fact Book - https://www.cia.gov/library/publications/the-world-factbook/fields/2147.html

[100] FAO, 2013. Yearbook of Fisheries Statistics, Summary Tables: World Fisheries Production, by capture and aquaculture, by country. Rome, FAO. Retrieved from ftp://ftp.fao.org/FI/STAT/summary/default.htm on 9/9/2015

[101] FAO Country profile Angola - http://www.fao.org/fishery/facp/AGO/en

[102] FAO, 2012. ftp://ftp.fao.org/FI/STAT/summary/a6ybc.pdf

[103] http://www.fao.org/fishery/facp/AGO/en#CountrySector-SectorSocioEcoContribution

[104] FAO, 2011. Food balance sheet of fish and fishery products in live weight and fish contribution to protein supply

[105] http://www.globefish.org/total-fish-consumption-per-capita-kg-and-fish-contribution-to-total-proteins-percent.html

[106] MDGI, 2015. http://mdgs.un.org/unsd/mdg/Data.aspx

7.2.2 Botswana

Parameter	Source	Year	Figure
Population[107]	World Bank	2014	2.22 million
Area of EEZ			N\A
Area covered by land (km squared)	CIA World Fact Book	Retrieved 13-11-15	566 730
Area covered by water (km squared)	CIA World Fact Book	Retrieved 13-11-15	15 000
Fish production (Total)	FAO	2013	431 tonnes
Fish production – Capture fisheries	FAO	2013	431 tonnes
Fish production – Aquaculture	FAO	2013	-
GDP [107]	World Bank	2014	USD 15.81 billion
Contribution of Fisheries to GDP	FAO Country profiles	2007 (latest available)	0.002 %[108]
Value of fish imported	FAO	2012	USD 12.03 million
Value of fish exported	FAO	2012	USD 460 000
Total number employed in fisheries sector	FAO country profile	2007	3 000
Number of fishermen employed by aquaculture	FAO country profile	2007	50
Per capita fish supply	FAO	2011	3 kg
Per capita fish consumption	Globe Fish	2011	3 kg
Contribution of fish to total protein intake	FAO	2011	1.3 %
Contribution of fish to total animal protein intake	FAO	2011	3.3 %
Percentage of people undernourished	United Nations MDG Indicators	2015	24.1 &
Population below national poverty line	United Nations MDG Indicators	2009	19.3 %
Children under 5 moderately or severely underweight	United Nations MDG Indicators	2007	11.2 %
Life expectancy	World Bank	2013	47

[107] World Bank, 2014. Country Summary: Botswana. Retrieved from http://data.worldbank.org/country/botswana on 28/09/2015

[108] ftp://ftp.fao.org/FI/DOCUMENT/fcp/en/FI_CP_BW.pdf

7.2.3 DRC

Parameter	Source	Year	Figure
Population [109]	World bank	2014	74.8 million
Area of EEZ	Marine Regions	2014	13 894.2 km^2
Area covered by land (km squared)	CIA World Fact Book	Retrieved 13-11-15	2 267 048
Area covered by water (km squared)	CIA World Fact Book	Retrieved 13-11-15	77 810
Fish production (Total)	FAO	2013	230 283 tonnes
Fish production – Capture fisheries	FAO	2013	227 414 tonnes
Fish production – Aquaculture	FAO	2013	2 869 tonnes
GDP[109]	World Bank	2014	USD 32.96 billion
Contribution of Fisheries to GDP[110]	FAO – Value of African Fisheries	2013	3.81%
Value of fish imported	FAO	2012	USD 175.2 million
Value of fish exported	FAO	2012	USD 650 000
Total number employed in fisheries sector[111]	FAO country profile	2007(latest available)	153 432
Number of fishermen employed by aquaculture	FAO country profile	2007 (latest available)	500 000
Per capita fish supply	FAO	2011	5.6 kg
Per capita fish consumption	Globe Fish	2011	5.6 kg
Contribution of fish to protein intake	FAO	2011	6.4 %
Contribution of fish to total animal protein intake	FAO	2011	38.7 %
Percentage of people undernourished[112]	FAO - BEFS Country Brief	2013	42 %
Population living national poverty line[109]	World Bank	2012	63.6%
Children under 5 moderately or severely underweight [106]	United Nations MDG Indicators	2013	23.4 %
Life expectancy [109]	World bank	2013	50

[109] World Bank, 2014. Country Summary: Congo Dem. Rep. Retrieved from http://data.worldbank.org/country/congo-dem-rep on 05/11/2015

[110] FAO, 2014 – The Value of African fisheries

[111] http://www.fao.org/fishery/facp/COD/fr

[112] FAO - BEFS Country Brief http://www.fao.org/energy/36342-0d2a826525757566a86e626cfa3de1fb0.pdf

7.2.4 Lesotho

Parameter	Source	Year	Figure
Population [113]	World Bank	2014	2.109 million
Area of EEZ			N\A
Area covered by land (km squared)	CIA World Fact Book	Retrieved 13-11-15	30 355
Area covered by water (km squared)	CIA World Fact Book	Retrieved 13-11-15	-
Fish production (Total)	FAO	2013	550 tonnes
Fish production – Capture fisheries[100]	FAO	2013	500 tonnes
Fish production – Aquaculture	FAO	2013	50 tonnes
GDP[113]	World Bank	2014	2.088 billion
Contribution of Fisheries to GDP			No data available [114]
Value of fish imported	FAO	2012	USD 3.1 million
Value of fish exported	FAO	2012	USD 100 000
Total number employed in fisheries sector[115]	FAO country profile	2007	150
Number of fishermen employed by aquaculture			No data available
Per capita fish supply	FAO	2011	0.9 kg
Per capita fish consumption	Globe Fish	2011	0.9 kg
Contribution of fish to total protein intake	FAO	2011	0.3 %
Contribution of fish to animal protein intake	FAO	2011	2.2 %
Percentage of people undernourished	United Nations MDG Indicators	2015	11.2 %
Population living below national poverty line	United Nations MDG Indicators	2010	61.2 %
Children under 5 moderately or severely underweight	United Nations MDG Indicators	2009	13.5 %
Life expectancy[113]	World Bank	2013	49 years

[113] World Bank, 2014. Country Summary: Lesotho. Rep. Retrieved from http://data.worldbank.org/country/lesotho on 05/11/2015

[114] http://acpfish2-eu.org/index.php?page=lesotho

[115] http://www.fao.org/fishery/facp/LSO/en#CountrySector-SectorSocioEcoContribution

7.2.5 Madagascar

Parameter	Source	Year	Figure
Population [116]	World Bank	2014	23.57 million
Area of EEZ	Marine Regions	2015	1 201 732 km^2
Area covered by land (km squared)	CIA World Fact Book	Retrieved 13-11-15	581 540
Area covered by water (km squared)	CIA World Fact Book	Retrieved 13-11-15	-
Fish production (Total)	FAO	2013	112 771 tonnes
Fish production – Capture fisheries	FAO	2013	103 797 tonnes
Fish production – Aquaculture	FAO	2013	8,974 tonnes
GDP	World Bank	2014	USD 10.59 Billion
Contribution of Fisheries to GDP	FAO – Value of African Fisheries	2013	2.76%
Value of fish imported	FAO	2012	USD 35.1 million
Value of fish exported	FAO	2012	USD 112.3 million
Total number employed in fisheries sector	FAO – Value of African Fisheries	2014	166 013
Number of fishermen employed by aquaculture	FAO – Value of African Fisheries	2014	12 210
Per capita fish supply	FAO	2011	5.3 kg
Per capita fish consumption	Globe Fish	2011	4.9 kg
Contribution of fish to total protein intake	FAO	2011	3.4 %
Contribution of fish to animal protein intake	FAO	2011	15.3 %
Percentage of people undernourished	United Nations MDG Indicators	2015	33.0 %
Population living below national poverty line	United Nations MDG Indicators	2010	87.7 %
Children under 5 moderately or severely underweight	United Nations MDG Indicators	2004	36.8 %
Life expectancy	World Bank	2013	65 years

[116] World Bank, 2014. Country Summary: Madagascar. Rep. Retrieved from http://data.worldbank.org/country/madagascar on 05/11/2015

7.2.6 Malawi

Parameter	Source	Year	Figure
Population [117]	World Bank	2014	16.70 million
Area of EEZ			N\A
Area covered by land (km squared)	CIA World Fact Book	Retrieved 13-11-15	94 080
Area covered by water (km squared)	CIA World Fact Book	Retrieved 13-11-15	24 404
Fish production (Total)	FAO	2013	115 953 tonnes
Fish production – Capture fisheries	FAO	2013	112 248 tonnes
Fish production – Aquaculture	FAO	2013	3 705 tonnes
GDP	World Bank	2014	USD 4.258 Billion
Contribution of Fisheries to GDP	FAO – Value of African Fisheries	2014	3.3%
Value of fish imported	FAO	2012	USD 1.5 million
Value of fish exported	FAO	2012	USD 320,000
Total number employed in fisheries sector	FAO – Value of African Fisheries	2014	173,328
Number of fishermen employed by aquaculture	FAO – Value of African Fisheries	2013	8,334
Per capita fish supply	FAO	2011	5.7 kg
Per capita fish consumption	Globe Fish	2011	5.7 kg
Contribution of fish to total protein intake	FAO	2011	2.7 %
Contribution of fish to animal protein intake	FAO	2011	27.7 %
Percentage of people undernourished	United Nations MDG Indicators	2015	20.7 %
Population living below national poverty line	United Nations MDG Indicators	2010	50.7 %
Children under 5 moderately or severely underweight	United Nations MDG Indicators	2014	16.7 %
Life expectancy	World Bank	2013	55 years

[117] World Bank, 2014. Country Summary: Malawi. Rep. Retrieved from http://data.worldbank.org/country/malawi on 05/11/2015

7.2.7 Mauritius

Parameter	Source	Year	Figure
Population [118]	World Bank	2014	1.26 million
Area of EEZ	Marine Regions	2015	1 276 958 km^2
Area covered by land (km squared)	CIA World Fact Book	Retrieved 13-11-15	2 030
Area covered by water (km squared)	CIA World Fact Book	Retrieved 13-11-15	10
Fish production (Total)	FAO	2013	7 794 tonnes
Fish production – Capture fisheries	FAO	2013	7 309 tonnes
Fish production – Aquaculture	FAO	2013	485 tonnes
GDP	World Bank	2014	USD 12.62 Billion
Contribution of Fisheries to GDP	FAO – Value of African Fisheries	2013	0.17%
Value of fish imported	FAO	2012	USD 388 million
Value of fish exported	FAO	2012	USD 419 million
Total number employed in fisheries sector	FAO – Value of African Fisheries	2014	6 838
Number of fishermen employed by aquaculture	FAO – Value of African Fisheries	2014	346 persons
Per capita fish supply	FAO	2011	23 kg
Per capita fish consumption	Globe Fish	2011	23 kg
Contribution of fish to total protein intake	FAO	2011	7.7 %
Contribution of fish to animal protein intake	FAO	2011	17.2 %
Percentage of people undernourished	United Nations MDG Indicators	2015	5.0 %
Population below national poverty line	United Nations MDG Indicators	2010	9.8 %
Children under 5 moderately or severely underweight	United Nations MDG Indicators	2014	Latest Data Unavailable
Life expectancy	World Bank	2013	74 years

[118]World Bank, 2014. Country Summary: Mauritius. Rep. Retrieved from http://data.worldbank.org/country/mauritius on 05/11/2015

7.2.8 Mozambique

Parameter	Source	Year	Figure
Population [119]	World bank	2014	27.22 million
Area of EEZ	Marine Regions	2015	573 577
Area covered by land (km squared)	CIA World Fact Book	Retrieved 13-11-15	786 360
Area covered by water (km squared)	CIA World Fact Book	Retrieved 13-11-15	13 000
Fish production (Total)	FAO	2013	222 822 tonnes
Fish production – Capture fisheries	FAO	2013	222 101 tonnes
Fish production – Aquaculture	FAO	2013	721 tonnes
GDP	World bank	2014	USD 16.39 billion
Contribution of Fisheries to GDP	FAO – Value of African Fisheries	2013	3.73%
Value of fish imported	FAO	2012	USD 50.4 Million
Value of fish exported	FAO	2012	USD 27.4 Million
Total number employed in fisheries sector	FAO – Value of African Fisheries	2013	374 027 persons
Number of fishermen employed by aquaculture	FAO – Value of African Fisheries	2013	922 persons
Per capita fish supply	FAO	2011	8.5 kg/per person
Per capita fish consumption	Globe Fish	2011	8.5 kg
Contribution of fish to total protein intake	FAO	2011	5.3 %
Contribution of fish to animal protein intake	FAO	2011	40.3 %
Percentage of people undernourished	United Nations MDG Indicators	2015	25.3 %
Population below national poverty line	United Nations MDG Indicators	2009	54.7 %
Children under 5 moderately or severely underweight	United Nations MDG Indicators	2011	15.6%
Life expectancy	World bank	2013	50 years

[119] World Bank, 2014. Country Summary: Mozambique. Rep. Retrieved from http://data.worldbank.org/country/mozambique on 05/11/2015

7.2.9 Namibia

Parameter	Source	Year	Figure
Population [120]	Word Bank	2014	2.40 million
Area of EEZ	Marine Regions	2015	560, 905 km^2
Area covered by land (km squared	CIA World Fact Book	Retrieved 13-11-15	823 290
Area covered by water (km squared)	CIA World Fact Book	Retrieved 13-11-15	1 002
Fish production (Total)	FAO	2013	486,208 tonnes
Fish production – Capture fisheries	FAO	2013	485,738 tonnes
Fish production – Aquaculture	FAO	2013	470 tonnes
GDP	Word Bank	2014	USD 13.4 billion
Contribution of Fisheries to GDP[121]	AFDB – African economic outlook	2013	3.1%
Value of fish imported	FAO	2012	USD 40.2 Million
Value of fish exported	FAO	2012	USD 757 Million
Total number employed in fisheries sector[122]	Ministry of fisheries & Marine Resources	2013	13 380
Number of fishermen employed by aquaculture[123]	Ministry of fisheries & Marine Resources	2009	1 640
Per capita fish supply	FAO	2011	12.0 kg
Per capita fish consumption	Globe Fish	2011	12.0 kg
Contribution of fish to protein intake	FAO	2011	6.4%
Contribution of fish to animal protein intake	FAO	2011	16.2 %
Percentage of people undernourished	United Nations MDG Indicators	2015	42.3%
Population below national poverty line	United Nations MDG Indicators	2009	23.5%
Children under 5 moderately or severely underweight	United Nations MDG Indicators	2013	13.2%
Life expectancy	Word Bank	2013	64 years

[120] World Bank, 2014. Country Summary: Namibia. Rep. Retrieved from http://data.worldbank.org/country/namibia on 05/11/2015

[121] African economic outlook 2015 , retrieved 05/11/2015 http://www.africaneconomicoutlook.org/fileadmin/uploads/aeo/2015/CN_data/CN_Long_EN/Namibia_GB_2015.pdf

[122] http://www.mfmr.gov.na/documents/53305/832050/Hon++Minister%27s+Speech+to+the+Fishing+Industry+13+March+2014+%283%29.pdf/ad1046b0-6891-4720-8616-1de0fe752289

[123] http://www.mfmr.gov.na/aquaculture-marketing-employment

7.2.10 Seychelles

Parameter	Source	Year	Figure
Population[124]	World Bank	2014	91,530 people
Area of EEZ	Marine Regions	2015	1 338 039 km^2
Area covered by land (km squared	CIA World Fact Book	Retrieved 13-11-15	455
Area covered by water (km squared)	CIA World Fact Book	Retrieved 13-11-15	-
Fish production (Total)	FAO	2013	74,128 tonnes
Fish production – Capture fisheries	FAO	2013	74,128 tonnes
Fish production – Aquaculture	FAO	2013	-
GDP	World Bank	2014	USD 1.4 Billion
Contribution of Fisheries to GDP[125]	AFDB – African economic outlook	2013	1.5 %
Value of fish imported	FAO	2012	USD 128 million
Value of fish exported	FAO	2012	USD 250 million
Total number employed in fisheries sector[126]	FAO country profile	2005 (latest verifiable)	2000
Number of fishermen employed by aquaculture			No data available
Per capita fish supply	FAO	2011	59.3 kg
Per capita fish consumption	Globe Fish	2011	59.3 kg
Contribution of fish to total protein intake	FAO	2011	22.2 %
Contribution of fish to animal protein intake	FAO	2011	47.6 %
Percentage of people undernourished	United Nations MDG Indicators	2015	Unavailable
Population below national poverty line	United Nations MDG Indicators	2010	37.8 %
Children under 5 moderately or severely underweight	United Nations MDG Indicators	2012	3.6 %
Life expectancy	World Bank	2013	74 years

[124] World Bank, 2014. Country Summary: Seychelles. http://data.worldbank.org/country/seychelles
[125] African economic outlook 2015 , retrieved 05/11/2015 http://www.africaneconomicoutlook.org/fileadmin/uploads/aeo/2015/CN_data/CN_Long_EN/Seychelles_GB_2015.pdf
[126] ftp://ftp.fao.org/FI/DOCUMENT/fcp/en/FI_CP_SC.pdf

7.2.11 South Africa

Parameter	Source	Year	Figure
Population[127]	World Bank	2014	54 million people
Area of EEZ	Marine Regions	2015	1 066 538km^2
Area covered by land (km squared	CIA World Fact Book	Retrieved 13-11-15	1 214 470
Area covered by water (km squared)	CIA World Fact Book	Retrieved 13-11-15	4 620
Fish production (Total)	FAO	2013	416 520 tonnes
Fish production – Capture fisheries	FAO	2013	412 510 tonnes
Fish production – Aquaculture	FAO	2013	4 010 tonnes
GDP	World Bank	2014	USD 349.8 Billion
Contribution of Fisheries to GDP[128]	AFDB – African economic outlook	2013	0.1%
Value of fish imported	FAO	2012	USD 361.8 million
Value of fish exported	FAO	2012	USD 572.2 million
Total number employed in fisheries sector[129]	DAFF	2014	27 000
Number of fishermen employed by aquaculture[130]	DAFF	2012	1 600
Per capita fish supply	FAO	2011	5.7 kg/per person
Per capita fish consumption	Globe Fish	2011	5.7 kg
Contribution of fish to total protein intake	FAO	2011	2.1 %
Contribution of fish to animal protein intake	FAO	2011	5.0 %
Percentage of people undernourished	United Nations MDG Indicators	2015	5.0 %
Population below national poverty line	United Nations MDG Indicators	2011	53.8 %
Children under 5 moderately or severely underweight	United Nations MDG Indicators	2008	8.7 %
Life expectancy	World Bank	2013	57 years

[127] World Bank, 2014. Country Summary: South Africa. http://data.worldbank.org/country/south-africa
[128] http://www.africaneconomicoutlook.org/fileadmin/uploads/aeo/2015/CN_data/CN_Long_EN/South_Africa_GB_2015.pdf
[129] http://www.gov.za/about-SA/fisheries
[130] http://www.nda.agric.za/docs/AMCP/Aquacult2012.pdf

7.2.12 Swaziland

Parameter	Source	Year	Figure
Population [131]	World Bank	2014	1.27 million
Area of EEZ			N\A
Area covered by land (km squared	CIA World Fact Book	Retrieved 13-11-15	17 204
Area covered by water (km squared)	CIA World Fact Book	Retrieved 13-11-15	160
Fish production (Total)	FAO	2011	100 tonnes
Fish production – Capture fisheries)	FAO	2013	-
Fish production – Aquaculture	FAO	2013	100 tonnes
GDP	World Bank	2014	USD 3.4 Billion
Contribution of Fisheries to GDP (%)			No Data provided
Value of fish imported	FAO	2012	USD 3.9 million
Value of fish exported	FAO	2012	USD 150 000
Total number employed in fisheries sector			No available data as mostly informal
Number of fishermen employed by aquaculture			No available data as mostly informal
Per capita fish supply	FAO	2011	1.5 kg
Per capita fish consumption	Globe Fish	2011	1.5 kg
Contribution of fish to total protein intake	FAO	2011	0.8 %
Contribution of fish to animal protein intake	FAO	2011	3.0 %
Percentage of people undernourished	United Nations MDG Indicators	2015	26.8 %
Population below national poverty line	United Nations MDG Indicators	2009	39.3 %
Children under 5 moderately or severely underweight	United Nations MDG Indicators	2010	5.8 %
Life expectancy	World Bank	2013	49 Years

[131] World Bank, 2014. Country Summary: Swaziland. http://data.worldbank.org/country/swaziland

7.2.13 Tanzania

Parameter	Source	Year	Figure
Population [132]	World Bank	2014	51.82 million
Area of EEZ	Marine Regions	2015	242 289.2 km^2
Area covered by land (km squared	CIA World Fact Book	Retrieved 13-11-15	885 800
Area covered by water (km squared)	CIA World Fact Book	Retrieved 13-11-15	61 500
Fish production (Total) (Mainland)	FAO	2013	384 397 tonnes
Fish production (Total) (Zanzibar)	FAO	2013	30 722
Fish production – Capture fisheries (Mainland)	FAO	2013	381 510 tonnes
Fish production – Capture fisheries (Zanzibar)	FAO	2013	30 712 tonnes
Fish production – Aquaculture (Mainland)	FAO	2013	3 477 tonnes
Fish production – Aquaculture (Zanzibar)	FAO	2013	10 tonnes
GDP	World Bank	2014	USD 49.18 Billion
Contribution of Fisheries to GDP (Mainland) (%)	FAO – Value of African Fisheries	2014	3.07 %
Contribution of Fisheries to GDP (Zanzibar) (%)	FAO – Value of African Fisheries	2014	6.64 %
Value of fish imported	FAO	2012	USD 3.5 million
Value of fish exported	FAO	2012	USD 122 million
Total number employed in fisheries sector (Mainland)	FAO – Value of African Fisheries	2014	517 126
Total number employed in fisheries sector (Zanzibar)	FAO – Value of African Fisheries	2014	63 750
Number of fishermen employed by aquaculture (Mainland)	FAO – Value of African Fisheries	2013	10 802
Number of fishermen employed by aquaculture (Zanzibar)	FAO – Value of African Fisheries	2013	23 839
Per capita fish supply	FAO	2011	5.9 kg
Per capita fish consumption	Globe Fish	2011	5.9 kg
Contribution of fish to total protein intake	FAO	2011	21.8 %
Contribution of fish to animal protein intake	FAO	2011	3.8 %
Percentage of people undernourished	United Nations MDG Indicators	2015	32.1%
Population below national poverty line	United Nations MDG Indicators	2012	43.5 %
Children under 5 moderately or severely underweight	United Nations MDG Indicators	2014	13.4 %
Life expectancy	World Bank	2013	61 years

[132] World Bank, 2014. Country Summary: Tanzania. http://data.worldbank.org/country/tanzania

7.2.14 Zambia

Parameter	Source	Year	Figure
Population[133]	World Bank	2014	15.72 million
Area of EEZ			N\A
Area covered by land (km squared	CIA World Fact Book	Retrieved 14-11-2015	743 398
Area covered by water (km squared)	CIA world Fact book	Retrieved 14-11-2015	9 220
Fish production (Total)	FAO	2013	106 798
Fish production – Capture fisheries	FAO	2013	86 527 tonnes
Fish production – Aquaculture	FAO	2013	20 271 tonnes
GDP	World Bank	2014	USD 27.1 Billion
Contribution of Fisheries to GDP (%)[134]	AFDB – African economic outlook	2014	0.5%
Value of fish imported	FAO	2012	USD 23.2 million
Value of fish exported	FAO	2012	USD 1.5 million
Total number employed in fisheries sector [135]	ACP II	2008(latest verifiable)	300 000
Number of fishermen employed by aquaculture[136]	FAO country profile	2003 (latest verifiable)	6 860
Per capita fish supply	FAO	2011	6.6 kg
Per capita consumption	Globe Fish	2011	6.6 kg
Contribution of fish to total protein intake	FAO	2011	3.6 %
Contribution of fish to animal protein intake	FAO	2011	20.2 %
Percentage of people undernourished	United Nations MDG Indicators	2015	47.8%
Population below national poverty line	United Nations MDG Indicators	2010	60.5%
Children under 5 moderately or severely underweight	United Nations MDG Indicators	2007	14.9 %
Life expectancy	World Bank	2013	58 years

[133] World Bank, 2014. Country Summary: Zambia. http://data.worldbank.org/country/zambia

[134] http://www.africaneconomicoutlook.org/fileadmin/uploads/aeo/2015/CN_data/CN_Long_EN/Zambia_GB_2015.pdf

[135] http://acpfish2-eu.org/index.php?page=zambia

[136] National Aquaculture Sector Overview. Zambia. National Aquaculture Sector Overview Fact Sheets. Text by Maguswi, C. T. In: *FAO Fisheries and Aquaculture Department* [online]. Rome. Updated 1 January 2003. [Cited 14 November 2015]. http://www.fao.org/fishery/countrysector/naso_zambia/en#tcN700D3

7.2.15 Zimbabwe

Parameter	Source	Year	Figure
Population [137]	World Bank	2014	15.25 million
Area of EEZ			N\A
Area covered by land (km squared)	CIA World Fact Book	Retrieved 14-11-15	386 847
Area covered by water (km squared)	CIA World Fact book	Retrieved 13-11-14	3 910
Fish production (Total)	FAO	2011	20 590 tonnes
Fish production – Capture fisheries	FAO	2013	10 500 tons
Fish production – Aquaculture	FAO	2013	10 090 tonnes
GDP	World Bank	2014	USD 13.66 Billion
Contribution of Fisheries to GDP (%)[138]	FAO country profile	2006	0.026% (latest available estimate)
Value of fish imported	FAO	2012	USD 27.4 million
Value of fish exported	FAO	2012	USD 6.6 million
Total number employed in fisheries sector[139]	FAO country profile	2007(last verifiable)	4 700
Number of fishermen employed by aquaculture[140]	FAO -Improving governance of aquaculture employment : A global assessment	2014	264 (figure based on major aquaculture producers in the country)
Per capita fish supply	FAO	2011	3.0 kg
Per capita fish consumption	Globe Fish	2011	3.0 kg
Contribution of fish to total protein intake	FAO	2011	1.7 %
Contribution of fish to animal protein intake	FAO	2011	7.0 %
Percentage of people undernourished	United Nations MDG Indicators	2015	33.4%
Population below national poverty line	United Nations MDG Indicators	2011	72.3 %
Children under 5 moderately or severely underweight	United Nations MDG Indicators	2014	11.2 %
Life expectancy	World Bank	2013	60 years

[137] World Bank, 2014. Country Summary: Zimbabwe. http://data.worldbank.org/country/zimbabwe
[138] ftp://ftp.fao.org/FI/DOCUMENT/fcp/en/FI_CP_ZM.pdf
[139] ftp://ftp.fao.org/FI/DOCUMENT/fcp/en/FI_CP_ZW.pdf
[140] FAO- Improving aquaculture a global assessment, 2014 - http://www.fao.org/3/a-i3128e.pdf

7.3 Extracts from key regional policies

7.3.1 SADC Protocol on Fisheries

1. MANAGEMENT OF SHARED STOCKS

7. State Parties shall develop, implement and enforce management plans, towards the development and management of shared inland water bodies, by balancing the needs of industrial enterprises, artisanal fishers, subsistence fishers, recreational fishers, and aquaculture practitioners, in a politically, environmentally and economically sustainable manner.

8. ARTISANAL, SUBSISTENCE FISHERIES AND SMALL-SCALE COMMERCIAL FISHERIES

2. State Parties agree to develop and nurture small-scale commercial fisheries taking particular account of the need to optimise the economic and social benefits of such fisheries.
3. State Parties shall take measures to facilitate the provision of physical and social infrastructure and support services for the development of artisanal, subsistence and small-scale commercial fisheries.

8. State Parties shall, subject to Article 16[141] of this Protocol, adopt equitable arrangements whereby artisanal, subsistence and small scale commercial fishers who are traditionally part of a transboundary fishery may continue to fish and trade in goods and services.

9. AQUACULTURE

1. State Parties shall take the necessary steps to optimise the economic contribution of aquaculture to the Region.

2. State Parties shall review policies, legislation, plans and institutions to address the characteristics and needs of aquaculture in recognition of the fact that aquaculture is a distinct enterprise.

3. State Parties shall promote on-site research, demonstrations and increased practitioner-to-practitioner extension as ways to increase economic and social benefits from aquaculture.

4. State Parties shall promote private sector participation in aquaculture through access arrangements to designated areas and provide or facilitate the necessary support services and access to finance.

5. State Parties shall co-operate, where necessary, in the promotion of inland and marine ranching and stock enhancement.

6. State Parties shall undertake research and technological development, particularly in identifying new sources of locally available raw materials for fish feed.

7. PROTECTION OF THE AQUATIC ENVIRONEMENT

10. State Parties shall promote the use of energy efficient and clean technologies in the fishing and aquaculture sectors.

8. HUMAN RESOURCE DEVELOPMENT

3. State Parties shall actively work towards the enhancement of training in fisheries.

[141] Trade and Investment

7.3.2 Dar-Es-Salaam Declaration on agriculture and food security in the SADC region – 2004

Commit to:

IN THE SHORT TERM (2004 – 2006):

4. Crop, Livestock and Fisheries Production

(b) establish and develop proper storage and preservation facilities at the household, national and regional levels;

(d) increase aquaculture and marine farming, and improve fish stock management and fish product quality through pre and post-harvest handling, processing and storage, in accordance with the SADC Protocol on Fisheries.

IN THE MEDIUM TO LONG TERM (2004 – 2010) ENSURE:

9. Sustainable Use and Management of Natural Resources

a) promote conservation, management and sustainable utilisation of plants and animals, including fisheries, forestry and wildlife;

10. Research, Technology Development and Dissemination

a) strengthen research and extension services in order to facilitate the development and transfer of technologies;

b) revamp extension services through recruitment, re-training and retention of extension workers and development of farmer skills; and

c) enhance development of crop varieties and animal breeds that are tolerant to and perform better under prevailing physical environmental conditions.

11. Market Access

e) support voluntary farmer organisations and create opportunities for them to get into the value adding chain;

12. Agricultural Financing and Investment

a) progressively increase budgetary allocations for agriculture to at least 10% of the national total budgets as recommended in the African Union Declaration on Agriculture and Food Security in Africa July 2003;

b) increase the establishment and use of rural financial intermediaries; and

c) investigate the establishment of an Agricultural Development Bank/Fund.

7.3.3 SADC REGIONAL AGRICULTURAL POLICY – 2013

11. FARM SUPPORT SYSTEMS AND SERVICES

11.1. Policy Statement: SADC shall complement and support Member States' measures designed to promote agricultural research and development in crops, livestock, fisheries and forestry

11.2 Policy Statement: SADC shall complement and support Member States' measures designed to enhance regional and national agricultural, forestry and fisheries information systems

49) An effective agricultural information management system (AIMS) provides policy makers, planners and relevant economic actors including smallholder farmers, access to reliable and timely information necessary for policy development, emergency preparedness, planning, and decision making. The timely collection, analysis and communication of information and monitoring of vulnerability, food security and weather patterns in the region contribute significantly to timely interventions by relevant actors thereby enhancing food security and rural development.

12 FORESTRY AND FISHERIES

54) With regards to fisheries, consumption and therefore demand for fish products, particularly from aquaculture, has grown significantly in many parts of the world including Southern Africa. With an exclusive economic zone of over 6 million square kilometres and a continental shelf of 503,646 sq. km, the region has large fishing areas. Furthermore, it has a high potential for aquaculture production. However, key challenges affecting the region's fisheries sector include degradation of aquatic environments particularly from land based activities such as discharge of sewage, industrial effluent and agro-chemicals; weak management systems; overfishing; illegal, unreported and unregulated (IUU) fishing; limited development of aquaculture which only contributes less than 1% of the region's total fish production; and limited intra-regional trade and investment in fisheries. Promoting responsible and sustainable use of the living aquatic resources and aquatic ecosystems has been formalised as a priority objective of SADC under the Protocol on Fisheries (2001).

12.1. Policy Statement: SADC shall stimulate and support Member States' efforts to improve production, processing, trade, conservation and sustainable management of forest and fisheries resources

55) Therefore, the proposed interventions will include:

a. Facilitating the implementation of the SADC Protocol on Forestry and on Fisheries to achieve their stated objectives;

c. Facilitating the development of aquaculture to optimise its economic contribution as a distinct enterprise and to release pressure on natural fisheries resources;

d. Promoting the increased, sustainable production and productivity of fisheries resources particularly aquaculture;

f. Promoting (R&D) in relevant areas of forestry and fisheries including the spread of diseases of relevance to cultured aquatic species and in identifying new sources of raw materials for fish feed;;

g. Promoting trade and investment in forestry and fisheries products;

h. Facilitating the development of cross-border value-chains particularly of forestry products; and developing strategies on invasive forest and fisheries species.

PART 3C: IMPROVE PRIVATE AND PUBLIC SECTOR ENGAGEMENT AND INVESTMENT IN THE AGRICULTURAL VALUE-CHAINS

76) Despite growing international demand for manufactured products from agro-industry, forestry and fisheries, most Southern African countries are yet to make significant progress towards adding value to agricultural, forestry and fisheries products. Agro-processing development can provide positive impacts on rural and urban employment; offer market access, create business linkages with small to medium enterprises (SME); enhance food security; contribute to the much needed industrialisation and exploitation of underutilized natural resources and agro-processing capacity in the region; and improve overall competitiveness and trade balance.

7.4 Case study of the option for bio filtration and its ramifications for fish production rates

Stocking density constraints

One of the major constraints on the stocking density of an aquaculture system is ammonia (also referred to as total ammonia nitrate or TAN). Fish which are exposed to a prolonged high ammonia level are more susceptible to diseases, experience stunted growth and can be killed by damage to gills and other tissues caused directly by high ammonia levels.[142] This issue is relentless for aquaculture practitioners as ammonia is continually released by fish as a result of their metabolizing of food. Furthermore, uneaten feed also releases ammonia. With water scarcity becoming an ever larger issue in Sub-Saharan Africa, aquaculture's ability to produce more fish may be at serious risk. The IPCC's fourth Assessment Report of 2007 pointed to Sub-Saharan Africa as being among the hardest hit of regions with regards to prolonged droughts and flood events.

Thus it is in the best interests of fish production, and therefore food and nutrition security in the SADC region, to investigate techniques which can increase stocking densities of small scale fish farming. One such example is presented here, based on the success of innovations in China and Australia among others. The technology works based on the mimicry of nature: plants require nutrients to survive. These nutrients can be provided by ammonia, through the natural nitrification of ammonia into nitrites and then nitrates. Plants absorb nitrates and thus filter the water, preventing the fish from being harmed (nitrates are less harmful that ammonia, but must still be controlled). This nitrification process is performed by naturally occurring bacteria.

Bio filtration in action

The third largest aquaculture lake in China - Lake Taihu - was treated using this technology after high ammonia levels and eutrophication due to run off lead to the devastation of the fish stocks. A company named Aqua Biofilter installed rafts which housed plants in order to combat these issues. The roots of the plants are under the raft, allowing them access to the nutrient rich water. A similar case occurred is Australia where algae blooms causing loss of aquatic life.[143]

This technology can also be implemented on smaller scales. This is based on research done in Bangladesh using very basic, readily available materials to build rafts.[144] With ammonia levels controlled, stocking density can be increased (within reason). Thus, future growth in the aquaculture sector need not be impeded by water scarcity, if managed correctly. Therefore the use of indigenous aquatic plants, housed in rafts, as a filtration device in the SADC region's small scale aquaculture systems should be a research priority for the future increase in fish production and consumption.

Application

A rather substantial amount of aquaculture research has concluded that juvenile fish in the same conditions, of the same cohort and fed the same diet can still exhibit significantly different growth rates depending on whether they are reared in a tank or an earthen pond. This is because in their juvenile stage, fish feed on phytoplankton, zooplankton and other invertebrates[145]. The best

[142] R. Francis-Floyd et al, Ammonia in Aquatic Systems, University of Florida IFAS Extension. Retrieved from https://edis.ifas.ufl.edu/pdffiles/FA/FA03100.pdf

[143] See Aqua Biofilter website at http://www.aquabiofilter.com/guidecasestudies.html

[144] See M.A. Salam et al, Aquaponics for Improving High Density Fish Pond Water Quality Through Raft and Rack Vegetable Production, World Journal of Fish and Marine Science 5(3), 2013.

[145] Abou et al. Growth and fatty acid composition of Nile tilapia Oreochromis niloticus L. fed Azolla-diets, in tanks and in earthen ponds: A comparative study, Discussion, 2013.

available evidence suggests that the switch from live food to feeds is due to a developmental change in the fish[146].

A recent study indicated that it is very unlikely that a nursery pond will contain too little nutrients to support sufficient phytoplankton, zooplankton and other invertebrate populations. It was further concluded that supply of food is greater than consumption.[147] This would indicate that the removal of some nutrients in order to increase stocking density may not have adverse effects on fish seed quality (juvenile growth and development).

However, it is recommended that it become a research priority to investigating whether the use of bio filtration decreases available natural feed in hatchery ponds. This must be done in order to ensure that quality of fish seed is not being jeopardized by efforts to increase stocking densities of adult fish. Secondly, it will be instrumental in ensuring that fish feed is not used wastefully. This is based on the fact that the above mentioned investigation concluded that zooplankton and insects continue to be an important food source for fish, even once they begin consuming dry pellets.[148]

[146] Culver and Filbrun Stable isotopes reveal live prey support growth of juvenile channel catfish reared under intensive feeding regimens in ponds, Discussion, 2014.
[147] Ibid.
[148] Ibid.